



**Request for Tender
RFT 22-079**

**HVAC & Controls Upgrades at
Montclair Public School**

Closing Date: March 15, 2022

Closing Time: 2:00 p.m.

Sealed RFTs will be received **via email to arrudamaa@hdsb.ca**
on or before 2:00 p.m., Eastern Daylight Time

Late or Facsimile Bids will not be considered

February 22, 2022

Mario Arruda, CPPB
Officer – Purchasing

Communications Notice

To obtain documents online please visit: <https://hdsb.bidsandtenders.ca>

If you subscribe to bids & tenders you can login to your account to download the document(s) without the preview watermark. You may also opt to purchase a one-time download for this opportunity. Documents are not provided in any other manner.

All proponents shall be registered as a Plan Taker for this opportunity, which will enable the proponent to download the Request for Proposal (RFP) without the watermark preview, to receive addenda email notifications, and to download addenda.

Should the HDSB receive a proposal that is subsequently found to be from a bidder that is not registered with bids & tenders and the bidder did not obtain the proposal document from <https://hdsb.bidsandtenders.ca> the HDSB reserves the right to remove the proposal from further consideration.

To ensure receipt of the latest information and updates via email regarding this opportunity, the onus is on the proponent to register as a Plan Taker for this opportunity at <https://hdsb.bidsandtenders.ca>.

The following documents form part of all HDSB competitive proposal documents:

HDSB Procurement Administrative Procedure:

<https://www.hdsb.ca/our-board/Policy/Procurement.pdf>

HDSB Asbestos Management in Facilities Administrative Procedure:

<https://www.hdsb.ca/our-board/Policy/AsbestosManagementInFacilities.pdf>

HDSB Vendor Performance Management Administrative Procedure:

<https://www.hdsb.ca/our-board/Policy/VendorPerformanceManagement.pdf>

Broader Public Sector Procurement Directive

[https://www.doingbusiness.mgs.gov.on.ca/mbs/psb/psb.nsf/Attachments/001-BPS_Procurement_Directive/\\$FILE/BPS_Procurement_Directive.pdf](https://www.doingbusiness.mgs.gov.on.ca/mbs/psb/psb.nsf/Attachments/001-BPS_Procurement_Directive/$FILE/BPS_Procurement_Directive.pdf)

Contents

Part A – Outline and Instructions

1. Introduction and Board Profile
2. General Terms of the RFT
3. Bid Security and Bonding Requirements
4. RFT Closing Information
5. Accuracy of Information/Liability for Errors or Omissions
6. Communication after RFT Issuance
7. Addenda
8. Planned Schedule of Events
9. Bidder's Costs
10. Bidding Format
11. Pricing
12. Subcontractors
13. Mandatory Pre-Bid Site Meeting

Part B – Standard Terms and Conditions

14. Scope
15. Definitions
16. Reserved Rights of the Board
17. Litigation with the Board
18. Accessibility for Ontarians with Disabilities (AODA)
19. Ability to Negotiate/Contract Negotiations
20. Agree to Abide by the Established Process
21. Assignment
22. Award
23. Breaking a Tie
24. Change Orders
25. Conflict of Interest
26. Board Confidential Information
27. Criminal Background Checks
28. Debrief
29. Dispute Resolution
30. Environmental Statement
31. Force Majeure
32. Guarantees and Warranties
33. Health & Safety/WHMIS
34. Indemnification and Liability
35. Insurance and Liability
36. Invoicing/Payment/EFT
37. Irrevocability
38. Municipal Freedom of Information and Protection of Privacy Act (MFIPPA)
39. No Guarantee of Work or Exclusivity Contract

40. Non-Performance/Termination of Contract
41. Ownership
42. Permits, Licenses and Approvals
43. Co-operative Purchasing Provisions
44. Proof of WSIB Coverage
45. Right to Withdraw
46. Smoking on Board Property
47. Vehicle Operation on Board Property
48. Bidder Conduct

Form of Tender (2 pages)

Appendix A – Declaration Signature Sheet (1 page)

Appendix B – HDSB Approved List of Sub-Contractors (2 pages)

Scope of Work (5 pages)

Specifications (407 pages)

Drawings (33 pages)

Part A – Outline and Instructions

1. Introduction and Board Profile

The Halton District School Board is composed of approximately 104 school locations (86 elementary and 18 secondary schools). These locations service approximately 65,000 regular day school students (Junior Kindergarten to Grade 12). The Board employs approximately 10,860 employees. Please visit our website <http://www.hdsb.ca> for additional information.

2. General Terms of the RFT

The Halton District School Board, hereinafter referred to as HDSB, is seeking qualified Contractors to complete HVAC & Control Upgrades at Montclair Public School located at 1285 Montclair Dr, Oakville, ON L6H 1Z3, as outlined herein. Specific details of the RFT are to be found in the attached Scope of Work.

3. Bid Security and Bonding Requirements

Any bid submission equal to or greater than \$500,000, must be submitted with a Bid Bond in the value of ten percent (10%) of the Total Cost and a Surety Consent in favour of the Halton District School Board. The Surety Consent shall cover a Performance Bond and a Labour & Materials Payment bond, each in the amount of fifty percent (50%) of the contract price as a guarantee that the Bidder shall execute the contract upon award.

The Bid Security so submitted shall be irrevocable and valid for 90 from closing date set for the submission of tender.

In order to be considered for award of a contract equal to or over \$500,000, the Bidder shall submit as part of their Submission, a Surety Consent, completed by a Bonding Company. Any others will not be accepted.

Upon receipt of written notice from the Halton District School Board that it has been awarded the Contract, the successful Bidder shall provide, within five (5) working days of such notice, an original Performance Bond and a Labour and Material Payment Bond, each for the amount of fifty per cent (50%) of the total lump sum price, to guarantee the performance of all obligations of the Contract.

4. RFT Closing Information

Bidders must submit their Submission via email on or before 2:00 p.m., Eastern Daylight Time on **March 15, 2022** (the “Closing Time”) to the following address:

arrudama@hdsb.ca
Attention: Mario Arruda

Submissions will be deemed to be officially received by the time stamp issued by the HDSB’s email server. Submissions received after the official closing time will be declared non-compliant and shall not be considered during the selection process. Electronic

submission shall be no larger than 25MB. Proponents are responsible for confirming that their submission has been successfully received.

5. Accuracy of Information/Liability for Errors or Omissions

While the HDSB has used considerable efforts to ensure an accurate representation of information in this document, the information contained in it is supplied solely as a guideline for Bidders. Any data contained in this RFT or provided by way of Addenda are estimates only and are for the sole purpose of indicating to the Bidder the general size of what is being requested hereunder. The information is not guaranteed or warranted to be accurate by the HDSB, nor is it necessarily comprehensive or exhaustive. Nothing in this document is intended to relieve Bidders from forming their own opinions and conclusions with respect to the matters addressed in this RFT. It is the Bidder's responsibility to avail itself of all the necessary information to prepare a Submission in response to this RFT.

6. Communication After RFT Issuance

All Communications regarding any aspect of this RFT must be submitted via Bids and Tenders.

Bidders that fail to comply with the requirement to direct all communications to the RFT Authority via Bids and Tenders may be disqualified from this RFT process. Without limiting the generality of this provision, Bidders shall not communicate with or attempt to communicate with the following as it relates to this RFT:

- any employee or agent of the HDSB, other than the RFT Purchasing contact;
- any member of the HDSB governing body including, without limitation, the director, officers, trustees, superintendents, and any advisors thereto;

Bidders shall promptly examine this RFT and all Appendices, including the Form of Tender, and:

- shall report any errors, omissions or ambiguities; and
- may direct questions or seek additional information on or before the Deadline for Questions to the RFT Purchasing contact.

It is the responsibility of the Bidder to seek clarification, by submitting questions to the RFT Authority via Bids and Tenders, on any matter it considers to be unclear. The HDSB shall not be responsible for any misunderstanding on the part of the Bidder concerning this RFT or its process.

In the event a Bidder has any reason to believe that an error, omission or ambiguity exists, the Bidder must notify the RFT Authority via Bids and Tenders prior to submitting a Proposal.

If appropriate, the RFT Authority will then clarify the matter for the benefit of all Bidders by publication on the same public platform, its website or by notice to Bidders who have requested a copy of this RFT in the same manner as set out in section 6 below.

In answering a Bidder's questions, the HDSB will set out the question, without identifying the Bidder that submitted the question, and the HDSB may in its sole discretion:

- edit the question for clarity;
- answer similar questions from various Bidders only once.

Where an answer results in any change to the RFT, such answer will be formally evidenced through the issue of a separate addendum for this purpose.

7. Addenda

If the HDSB for any reason, determines that it is necessary to provide additional information relating to this RFT, such information will be communicated to all Bidders by addendum in the same manner the RFT was communicated. Each Addendum shall form an integral part of this RFT. This RFT may only be amended in accordance with this section.

All questions related to this Tender must be submitted in writing via bids and tenders prior to 2 p.m. on March 4, 2022. Any addendum will be posted no later than March 8, 2022.

Any amendment or supplement to this RFT made in any other manner will not be binding on the HDSB.

All Addenda shall become an integral part of this RFT and shall be incorporated into any content. Each Bidder shall be responsible for verifying before depositing its Proposal that it has received all Addenda that have been issued.

8. Planned Schedule of Events – Project Schedule

Event	Date
Release of RFT	February 22, 2022
Non-Mandatory Site Meeting	February 28, 2022
Question Deadline	March 4, 2022
Issuance of Final Addendum	March 8, 2022
Project Timelines for Completion	July 6, 2021 – August 26, 2022
RFT Closing	March 15, 2022

9. Bidder's Costs

Bidders shall bear all costs and expenses incurred relating to any aspect of its participation in this RFT process, including all costs and expenses relating to the Bidder's participation in:

- the preparation, presentation and receipt of its Submission;
- the Bidders attendance at any meeting in relation to the RFT process, including any presentation or interview;
- the conduct of any due diligence on its part, including any information-gathering activity;
- the preparation of the Bidder's own questions prior to the Deadline for Questions; and
- any discussion and/or finalization, if any, in respect of the Form of Agreement.

10. Bidding Format

Unless otherwise specified in these RFT documents or the final contract entered into between the HDSB and the successful Bidder, responses shall be for a stipulated sum without escalator clauses or other qualifications (when applicable). Bidders submitting a bid with escalator clauses or other qualifications that are not in accordance with the terms and conditions of this RFT may have their bid rejected.

All information entered on this RFT document must be type written or entered in ink. No pencil entries will be accepted.

Erasure(s), overwriting or strike-out(s) must be initialed in ink by the person signing this Submission.

Respondents will use the following format for their submission:

- Form of Tender (complete form must be included with your submission, including bonds and any other information as may be required herein)
- Appendix A - Signed Declaration Sheet (must be included with your submission)

11. Pricing

Please do not add tax to base (unit) price. (when applicable). Early payment discounts may be considered part of the Submission. Credit Card payment acceptance may be considered part of the Submission.

12. Subcontractors

The General Contractor must select a sub-contractor from the HDSB pre-qualified list of sub-contractors attached in Appendix B.

The General Contractor agrees to preserve and protect the rights of the parties under the contract with respect to work performed under subcontract, and shall:

- enter into contracts or written agreements with their sub-contractors to require them to perform their work in accordance with and subject to the terms and conditions of the contract. Further, the General Contractor shall be fully responsible to the Owner for acts and omissions of their sub-contractors and of any persons directly or indirectly employed by them as for acts and omissions of persons directly employed by them.
- therefore, agree that they will incorporate the terms and conditions of the Contract Documents into all Sub-Contractor Agreements they enter into with their sub-contractor.

The HDSB reserves the right, at its discretion to waive the requirement to utilize the mandatory list of pre-qualified sub-trades at any time during the tendering process based on market conditions.

13. Pre-Bid Site Meeting

There will be a **Non-Mandatory Site Meeting** on February 28, 2022 at the main office of Montclair Public School located at 1285 Montclair Dr, Oakville, ON L6H 1Z3. The Non-Mandatory Site Meeting will start at 2:45 p.m.

Bidders shall follow Public Health and HDSB Covid-19 protocols while on site.

Part B – Standard Terms and Conditions

14. Scope

Unless otherwise expressly stated these Standard Terms and Conditions form a part of this document and apply in like force to contracts for the purchase of commodities as stated in this document. All Bidders will be bound by the terms and conditions set forth, except as specifically qualified in Special Terms and Conditions issued in connection with this document or any Addenda issued relating to this document.

15. Definitions

As used herein as well as in all RFSQ, RFQ, RFP, RFI, Tender or contract documents issued by the Halton District School Board, the following definitions will apply.

Addenda/Addendum	an addition/change made to this document, subsequent to its printing or publication.
Applicable Law and Applicable Laws	means any common law requirement and all applicable and enforceable statutes, regulations, directives, policies, administrative interpretations, orders, by-laws, rules, guidelines, approvals and other legal requirements of any government and/or regulatory authority in effect from time to time.
Bid/Submission/Proposal	an offer from a Bidder in response to a Proposal/Tender which is subject to acceptance or rejection.
Proponent	a legal entity, being a company, partnership or individual who submits a Bid, Proposal, or Submission in response to a formal request for Bid, Proposal, or Submission.
Board/HDSB	means the Halton District School Board.
Contract	means the agreement, in writing, governing the performance of the Work and/or the purchase and sale of commodities and includes, without limitation, the document (including standard terms and conditions), Bidder Submission and the written document accepting the Bidder Submission (including any notice of acceptance or award).
Document	means the document describing the Goods and/or Services to be purchased and the terms upon which the Goods and/or Services are to be purchased and

	includes, without limitation, those documents referenced on the index of the document and such Addenda as may be issued by the HDSB.
Goods or Services	product and/or any and all labour, vehicles or equipment used by a Bidder in fulfilling a Contract.
HST	means Harmonized Sales Tax.
Intellectual Property	means any trademark, copyright, moral right, patent, industrial design, trade name, domain name, trade secret, know how, integrated circuit topography or other intellectual property, industrial property or proprietary right owned by, licensed to, or used by any third person.
Mandatory Requirement	a minimum requirement – where the words “mandatory”, “must”, “required”, “shall” and/or “will” are referenced in this document and such requirement is identified as a Mandatory Requirement. Failure to comply will deem the submission non-compliant and the bid/submission will be disqualified.
Proposal/RFP	a sealed written offer to supply Goods and/or Services of any value, acceptance of which may be subject to negotiation.
Quotation/RFQ	a written offer to supply Goods and/or Services with a value that is less than \$100,000.
Response	the package submitted by a Bidder in response to an RFP or RFT.
Specifications	those stated requirements for the Goods and/or Services set out in the document.
Subcontractor	a person, firm or corporation having a direct contract with the contractor to perform a part or parts of the Work, or to supply Goods worked to a special design according to the contract documents, but does not include one who merely supplies Goods not so worked.
Tender/RFT	a sealed written offer to supply Goods and/or Services with a value that is greater than \$100,000.
Bidder Submission	means the document as completed by the Bidder for the purpose of offering to sell to the HDSB the services

	and/or goods specified in the document, and includes but is not limited to Quotations, Tenders and Proposals.
Work	means the Work to be undertaken by the Bidder pursuant to the provisions of the Contract.

16. Reserved Rights of the HDSB

The HDSB reserves the right to:

- (a) make public the names of any or all Bidders;
- (b) request written clarification or the submission of supplementary written information in relation to the clarification request from any Bidder and incorporate a Bidder's response to that request for clarification into the Bidder's Submission;
- (c) assess a Bidder's Submission on the basis of:
 - (i) a financial analysis determining the actual cost of the Submission when considering factors including quality, service, price and transition costs arising from the replacement of existing goods, services, practices, methodologies and infrastructure (howsoever originally established);
 - (ii) information provided by references;
 - (iii) the Bidder's past performance on previous contracts awarded by the HDSB;
 - (iv) the information provided by a Bidder pursuant to the HDSB exercising its clarification rights under this RFT process; or
 - (v) other relevant information that arises during this RFT process;
- (d) waive formalities and accept Submissions that substantially comply with the requirements of this RFT;
- (e) verify with any Bidder or with a third party any information set out in a Submission;
- (f) check references other than those provided by any Bidder;
- (g) disqualify any Bidder whose Submission contains misrepresentations or any other inaccurate or misleading information;
- (h) disqualify any Bidder or the Submission of any Bidder who has engaged in conduct prohibited by this RFT;

- (i) disqualify a Bidder for any conduct, situation or circumstance that constitutes a Conflict of Interest, as solely determined by the HDSB and at any time.
- (j) make changes, including substantial changes, to this RFT, provided that those changes are issued by way of addenda in the manner set out in this RFT;
- (k) select any Bidder other than the Bidder whose bid reflects the lowest cost to the HDSB;
- (l) review all Bidders utilizing the HDSB Vendor Performance Management Administrative Procedure, which can include suspension of Bidders who fail to meet the HDSB's expectations or who are involved in litigation or threatened litigation against HDSB. The HDSB Vendor Performance Management Administrative Procedure is found at the attached link

(www.hdsb.ca/our-board/Policy/VendorPerformanceManagement.pdf)
- (m) award to one or more bidders according to their requirements;
- (n) cancel this RFT process at any time and for any or no reason;
- (o) cancel this RFT process at any stage and issue a new RFT for the same or similar deliverables;
- (p) accept any Submission in whole or in part; or
- (q) award to multiple bidders if circumstances are warranted;
- (r) reject any or all Submissions;
- (s) to limit the number of pre-qualified Bidders eligible to submit proposals for any future projects. HDSB shall not be obligated to provide all pre-qualified Bidders with the same opportunity to bid on all future projects within each stated category. By participating in this RFT, Bidders acknowledge that there is no guarantee that a Bidder will receive any assignments, work or projects and that there is no expectation that any specified number of projects will be made available during the pre-qualification term;

and these reserved rights are in addition to any other express rights or any other rights that may be implied in the circumstances.

In addition, the HDSB reserves the right at any time during normal business hours, and as often as the HDSB may deem necessary, to examine, the successful Bidder's records with respect to the successful Bidder's services under the Bidder's purchase order and/or Submission and any Contract. The successful Bidder shall permit the HDSB to audit, examine, and make copies, excerpts or transcripts from such records, and to make audits

of data relating to matters covered by a Submission, any purchase order and/or any Contract. The successful Bidder shall maintain and retain all records and other documents related to a Submission, any purchase order, and/or any Contract for a period of seven (7) years from the date of final payment, except in cases where unresolved audit questions require a longer period of time for resolution, as determined by the HDSB.

17. *Litigation with the HDSB*

The HDSB may, in its absolute discretion, reject a Submission submitted by a Bidder **prior to or after a Submission opening, if the Bidder:**

- (a) is or has in the past 10 years been a party to litigation with the HDSB; or
- (b) directly or indirectly, including by common ownership or control or otherwise, is related to a party currently in litigation with the HDSB or a party that has in the past 10 years been in litigation with the HDSB; or
- (c) intends to use a subcontractor in respect of a specific project who is, or has in the past 10 years been a party to litigation with the HDSB, or who is related to a party currently in litigation with the HDSB or a party that has in the past 10 years been in litigation with the HDSB.

For the purposes hereof, the phrase “litigation with the HDSB” includes cases in which the Bidder or prospective Bidder or any of the parties named above, has advised the HDSB in writing of their intention to commence litigation, or have commenced or have advised the HDSB of their intention to commence an arbitral proceeding against the HDSB (excepting only construction lien demands, notices or proceedings or arbitrations under O. Reg 444/98 of the Education Act).

In determining whether or not to exercise its discretion as set out herein, the HDSB will consider whether the litigation (past or current) is likely to affect a Bidder’s ability to work with the HDSB, its consultants and representatives, and whether the HDSB’s experience with the Bidder, the related party or subcontractor, as the case may be, in the matter giving rise to the litigation, indicates that the HDSB is likely to incur increased staff and legal costs in the administration of the Contract if it is awarded to the Bidder.

18. *Accessibility for Ontarians with Disabilities (AODA)*

The HDSB is committed to accessibility and preventing and removing barriers for persons with disabilities. Where practicable, the HDSB will incorporate accessibility features and criteria when procuring or acquiring goods, services and facilities, in which case, a Bidder must be capable of recommending and delivering same in an inclusive and accessible manner, consistent with the Ontario Human Rights Code (“OHRC”), the Ontarians with Disabilities Act, 2005 (“AODA”) and its Regulations, in order to achieve accessibility for Ontarians with disabilities. If the HDSB determines that it is impractical to do so an explanation will be provided upon request.

In accordance with Ontario Regulation 429-07 made under the AODA, the HDSB has established policies, practices and procedures governing the provisions of its services to persons with disabilities, which may be found at:

<https://www.hdsb.ca/our-board/Pages/Accessibility.aspx>

19. Ability to Negotiate/Contract Negotiations

The HDSB reserves the right to enter into negotiations with any Bidder as it sees fit, or with another Bidder concurrently. The HDSB will not incur liability to any Bidder as a result of these negotiations.

The HDSB may, prior to and after Contract award, negotiate changes to the specifications, the type of materials or any conditions with the successful or preferred Bidder or one or more of the Bidders without having any duty or obligation to advise any other Bidder or to allow them to vary their bid prices as a result of such changes, and the HDSB shall have no liability to any other Bidder as a result of such negotiations or modifications.

20. Agree to Abide by the Established Process

It is vital to the HDSB that the process leading to the recommendation of a bidder(s) and the conclusion of an agreement for the provision of these services be, and be seen to be, open and fair and that each of the respondents is treated equally.

No respondent can be seen to be deriving, intentionally or otherwise, an advantage or information, which is not equally available to all other respondents. Nor is it acceptable that any advantage or information be sought or obtained from any unauthorized staff or representative of the HDSB, or any benefit derived from any special or personal relationships or contacts.

All communications, including requests for information, between respondents to this RFT and the HDSB should be between only the representative(s) of the HDSB who has been authorized and designated for that particular purpose. Bidders must not rely on information from any other source.

21. Assignment

Unless otherwise stated in this document, it is mutually agreed and understood that the successful Bidder will not assign, transfer, convey, sublet or otherwise dispose of the Contract (in whole or in part) or the right, title or interest therein, or the Bidder's power to execute such contract to any other person, firm, company or corporation without the previous written consent of the HDSB. Any act in derogation of the foregoing shall be null and void. For the purposes hereof, the transfer or issuance of shares by a Bidder of more than fifty (50%) percent of the voting securities of a Bidder to any third party other than to an affiliate (as such term is defined in the Business Corporations Act (Ontario)) or the

shareholder or shareholders of the Bidder as of the Closing Date, whether or not such transfer or issuance of voting securities takes place in one or more transactions, shall, for the purposes of this Agreement, be deemed to be an assignment of the Contract requiring the consent of the HDSB, unless such transfer or issuance of shares is made pursuant to an initial public offering of common shares under the Securities Act (Ontario).

22. Award

The final award will be based on (but not limited to) the best value for money and quality service delivery from a Bidder who complies with the provisions of this Submission solicitation, including specifications, contractual terms and conditions, who can reasonably be expected to provide satisfactory performance on the proposed Contract based on reputation, references, performance on previous contracts, and sufficiency of financial and other resources, and provides a solution that is a fit with the HDSB's requirements. The lowest price or bid shall not be the sole, determinative factor.

23. Breaking a Tie

In the event of a tie score, the HDSB will resolve same based on the earlier date/time stamp of when the bid was received by HDSB in accordance with this RFT.

24. Change Orders

A change order results when unforeseen conditions are identified from the original scope of work (Contract or Purchase Order) and is inextricably tied to the original scope.

The following steps should occur prior to issuance of a change order that does not originate from HDSB senior management:

- appropriate HDSB approval must be acquired prior to modifying any Contract or Purchase Order
- appropriate written HDSB approval must be obtained prior to commencing the work.

All requests or recommendations for Change Orders shall include the impact to both price and schedule for the work to be performed. HDSB shall have the right to retain consultants or experts to help identify the need or to verify the impact of the change order on the project.

No change in the work shall proceed without the written approval of the Owner. Any change shall be initiated by Owners "WORK ORDERS" which shall bear the change cost and the Contractor's and Owner's representative's signatures as an instruction to proceed. All changes shall be restricted to five percent (5%) overhead and five percent (5%) profit applied to the labour and material cost.

25. Conflict of Interest

For the purposes hereof, "Conflict of Interest" includes:

- (a) in relation to the Submission process, the Bidder has an unfair advantage or engaged in conduct, directly or indirectly, that may give the Bidder an unfair advantage, including:
 - (i) having or having access to information in the preparation of the Submission that is confidential to the HDSB and not available to other Bidders;
 - (ii) communicating with any person with a view to influencing preferred treatment in the Submission process; or
 - (iii) engaging in conduct that compromises or could be seen to compromise the integrity of the open and competitive process and render that process non-competitive and unfair; or
- (b) in relation to the performance of the Work, services or contractual obligations, the Bidder's other commitments, relationships or financial interests:
 - (i) could or could be perceived to exercise an improper influence over the objective, unbiased and impartial exercise of the Bidder's independent judgments; or
 - (ii) could or could be perceived to compromise or impair or be incompatible with the effective performance of the Bidder's work, services or contractual obligations.

The Bidder shall:

- (a) avoid any Conflict of Interest in the Submission process and in the performance of its contractual obligations;
- (b) disclose to the HDSB without delay any actual or potential Conflict of Interest that arises during the Submission process or during the performance of its contractual obligations; and
- (c) comply with any requirements prescribed by the HDSB to resolve any Conflict of Interest.

In addition to all other contractual rights or rights available at law or in equity, the HDSB may immediately disqualify a Submission or terminate the Contract upon giving notice to the Bidder where:

- i. the Bidder fails to disclose an actual or potential Conflict of Interest;
- ii. the Bidder fails to comply with any requirements prescribed by the HDSB to resolve a Conflict of Interest; or
- iii. the Bidder's Conflict of Interest cannot be resolved.

This paragraph shall survive any termination or expiry of the Contract.

26. HDSB Confidential Information

For the purposes hereof, "HDSB Confidential Information" means all information of the HDSB that is of a confidential nature, including all confidential information in the custody or control of the HDSB, regardless of whether it is identified as confidential or not, and whether recorded or not, and however fixed, stored, expressed or embodied, which comes into the knowledge, possession or control of the Bidder in connection with the Contract. For greater certainty, HDSB Confidential Information shall:

- (a) include:
 - (i) all new information derived at any time from any such information whether created by the HDSB, the Bidder or any third party;
 - (ii) all information (including Personal Information) that the HDSB is obliged or has the discretion not to disclose under provincial or federal legislation or otherwise at law; but
- (b) not include information that:
 - (i) is or becomes generally available to the public without fault or breach on the part of the Bidder of any duty of confidentiality owed by the Bidder to the HDSB or to any third party;
 - (ii) the Bidder can demonstrate to have been rightfully obtained by Bidder without any obligation of confidence, from a third party who had the right to transfer or disclose it to the Bidder free of any obligation of confidence;
 - (iii) the Bidder can demonstrate to have been rightfully known to or in the possession of the Bidder at the time of disclosure, free of any obligation of confidence when disclosed; or
 - (iv) is independently developed by the Bidder;

but the exclusions in this subparagraph shall in no way limit the meaning of Personal Information or the obligations attaching thereto under the Contract or at law.

During and following the term of the Contract, the Bidder shall:

- (a) keep all HDSB Confidential Information confidential and secure;
- (b) limit the disclosure of HDSB Confidential Information to only those of its directors, officer, employees, agents, partners, affiliates, volunteers or subcontractors who have a need to know it for the purpose of carrying out its obligations under the Contract and who have been specifically authorized to have such disclosure;
- (c) not directly or indirectly disclose, destroy, exploit or use any HDSB Confidential Information (except for the purpose of carrying out its obligations under the Contract or except if required by order of a court or tribunal), without first obtaining:
 - (i) the written consent of the HDSB; and
 - (ii) in respect of any HDSB Confidential Information about any third party, the written consent of such third party;
- (d) provide HDSB Confidential Information to the HDSB on demand; and
- (e) return all HDSB Confidential Information to the HDSB before the end of the Term, with no copy or portion kept by the Bidder.

27. Criminal Background Checks

The Bidder acknowledges that the HDSB must be in compliance with Regulation 521/01 of the Education Act (Ontario) - Collection of Personal Information with respect to criminal background checks and offence declarations. The Bidder covenants and agrees to assist the HDSB in complying with same by providing the HDSB, or such other entity as the HDSB may designate, with a criminal background check covering offences under the Criminal Code, the Narcotics Control Act, and any other offences which would be revealed by a search of the automated Criminal Records Retrieval System maintained by the RCMP or, in instances where the Bidder will have access to or is responsible for minors or vulnerable persons, a Vulnerable Persons Clearance certificate in addition to the above ("Criminal Background Check"), together with an Offence Declaration in HDSB approved form, for every individual or employee of the Bidder who may come into direct contact with students on a regular basis at a school site of the HDSB, or who may have access to student information.

For the purposes of this document, the HDSB shall determine in its sole and unfettered discretion whether an individual or employee of the Bidder may come into direct contact with students on a regular basis or may have access to student information. The Bidder agrees to indemnify and save harmless the HDSB from all claims, liabilities, expenses, and penalties to which it may be subjected on account of the Bidder's failure to provide a Criminal Background Check and an Offence Declaration, as aforesaid. This indemnity shall survive the expiration or sooner termination of the Contract. In addition, and

notwithstanding anything else herein contained, if the Bidder fails to provide a Criminal Background Check and an Offence Declaration for an individual or employee of the Bidder who may come into direct contact with students on a regular basis at a school site of the HDSB or who may have access to student information, then the HDSB shall have the right to forthwith terminate the Contract without prejudice to any other rights which it may have in the Contract, in law or in equity.

28. Debrief

The HDSB, at the written request of a Bidder will conduct a debriefing. Bidders must submit their request within sixty (60) days of Contract award notification. The HDSB will only identify any weaknesses or strengths in the Bidder's submission. No information regarding other Bidders' submissions will be disclosed. The intent of the debriefing information session is to assist a Bidder in presenting a better Submission in subsequent procurement opportunities. Any debriefing provided is not for the purpose of providing any opportunity to challenge the procurement process.

29. Dispute Resolution

In the event that a Bidder wishes to review the decision of the HDSB in respect of any material aspect of the RFT process, and subject to having attended a debriefing, the Bidder shall submit a protest in writing to the RFT Authority within ten (10) days from such a debriefing.

Any request that is not received in a timely manner will not be considered, and the Bidder will be notified in writing.

A protest in writing shall include the following:

- (a) a specific identification of the provision and/or procurement procedure that is alleged to have been breached;
- (b) a specific description of each act alleged to have breached the procurement process;
- (c) a precise statement of the relevant facts;
- (d) an identification of the issues to be resolved; and
- (e) the Bidder's requested remedy.

For the purpose of a protest, the HDSB will review and address any protest in a timely and appropriate manner. HDSB's decision in this regard is final.

30. Environmental Statement

The Board, when practically and financially feasible, will consider the acquisition of goods and services that will reduce the environmental footprint of the Board.

31. Force Majeure

Delays in or failure of performance by either party under the Contract shall not constitute default thereunder or give rise to any claim for damages if caused by occurrences beyond the control of the party affected, including but not limited to, decrees of Governments, acts of God, fires, floods, riots, wars, rebellion, sabotage, and atomic or nuclear incidents. Lack of finances, strikes, lockouts or other concerted acts by workers shall not be deemed to be a cause beyond a party's control.

In the event that performance of the Contract in the reasonable opinion of either party is made impossible by an occurrence beyond the control of the party affected, then either party shall notify the other in writing. The HDSB shall either terminate the Contract forthwith and without any further payments being made, or authorize the Bidder to continue the performance of the Contract with such adjustments as may be required by the occurrence in question and agreed upon by both parties. In the event that the parties cannot agree upon the aforementioned adjustment, it is agreed by the parties that the Contract shall be terminated.

32. Guarantees and Warranties

All Work shall be done in a good and workmanship like manner. All materials, goods and services must meet the applicable specifications, either by the HDSB, its consultant on the project or the manufacturer. The Bidder warrants and guarantees that all materials, Goods; Services and workmanship will be free from defects and fit for the purpose intended by the HDSB. All Goods delivered by the Bidder must be new, in good working order and of the latest model possessing all accessories standard to the manufacturer's stock model. The Goods and/or Services must be covered by written guarantees and warranties acceptable to the HDSB.

33. Health & Safety / WHMIS

Bidders and/or contractors must comply with the Occupational Health and Safety Act and its regulations. All Bidder's contractors and sub-contractors and their respective employees will have received health and safety training appropriate to their trade, and will be able to provide proof thereof to the HDSB upon request. Contractors shall be held responsible for any sub-contractors where such are permissible by the HDSB. The HDSB may request and suppliers/contractors/sub-contractors will provide evidence of such training at any time.

Suppliers/contractors/sub-contractors shall comply with the HDSB policies, programs and procedures at all times while on site. All suppliers/contractors/sub-contractors are

required to sign in upon arrival/exit at a HDSB location prior to beginning and at completion of Work.

Suppliers and/or contractors/sub-contractors shall be held responsible for all fines and/or contraventions of legislation which have been incurred by the HDSB.

As per Ontario regulation 278/05 section 10 (5) the HDSB will provide contractors/sub-contractors performing work in HDSB buildings access to the site-specific asbestos inventory. Site specific asbestos inventories are available at each HDSB site. Contractors/sub-contractors shall review the site-specific asbestos inventory in relation to the scope of work they are undertaking, prior to the commencement of work. The requirements of the HDSB's Asbestos Management Administrative Procedure are to be adhered to at all times. A copy of the HDSB's Asbestos Management Administrative Procedure can be found at:

<http://www.hdsb.ca/our-board/Policy/AsbestosManagementInFacilities.pdf>.

All Work is subject to prior approval by the appropriate HDSB department.

Contractors shall examine carefully the HDSB's Asbestos Register for the Work site, in addition to examining existing conditions for suspected Asbestos Containing Materials (ACM), on which completion of Work is dependent.

Upon discovery of unforeseen suspected ACM affecting completion of the Work, the Contractor shall cease any operations that may disturb said materials and notify the Owner immediately.

The Contractor shall arrange for removal of ACM affecting completion of Work through a HDSB-approved ACM abatement contractor, and arrange for coordination of testing through HDSB Facility Services, if required.

Contractors shall be responsible for any sub-contractors in their employ with respect to the aforementioned requirements.

34. Indemnification and Liability

The Bidder hereby agrees to indemnify and hold harmless the HDSB, its directors, officers, trustees, employees and agents from and against all liability, loss, costs, damages and expenses (including legal, expert and consultant fees), causes of actions, actions, claims, demands, lawsuits or other proceedings, by whomever made, sustained, incurred, brought or prosecuted if:

- (a) resulting from the Bidder's failure to observe and conform to the standards established by law or by any other association which has established standards recognized by the Province of Ontario;
- (b) relating to labour and equipment furnished for the Work; and

- (c) involving inventions, copyrights, trademarks or patents, and rights thereto, used in doing the Work and in the subsequent use and operation of the Work or any part thereof upon completion.

35. Insurance and Liability

The successful bidder must indemnify the HDSB from any and all manner of damage or injury, risk, claims, demands, actions, penalties, causes of action, damages and any and all costs arising out of, or incurred by reason of provision of goods and/or services by the bidder. The cost of such insurance will be the responsibility of the Bidder.

The successful bidder(s) will obtain and provide current proof of insurance upon the award, that the successful Bidder will be covered by:

at least Two Million Canadian Dollars (C\$2,000,000.00) of comprehensive commercial general liability insurance for bodily injury, property damage, operations liability, contractual liability and tenant's legal liability, including umbrella liability insurance covering liability arising from premises, operations, independent contractors, products-completed operations, personal injury and liability assumed under the Contract;

at least One Million Canadian Dollars (C\$1,000,000.00) of business automobile liability insurance and, if necessary, umbrella liability insurance for owned, hired and non-owned vehicles covering bodily injury and property damage: and with an insurer licensed to carry on business in the Province of Ontario.

In the case of multi-year contracts, a copy of a valid certificate must be provided to the Halton District School HDSB annually thereafter, at least thirty (30) days prior to the anniversary date of the contract commencement date. At commencement of the Contract and throughout the Contract duration, certification shall be submitted on a Certificate of Insurance form with the above-mentioned coverage, thereby protecting the Halton District School Board against claims for property damage and bodily injuries, including accidental death, caused by the successful Bidder(s) or its employees and/or Sub-contractors during the performance of its obligations under the Contract.

The Halton District School Board must be named as additional insured, and the policy must contain a cross liability clause, and thirty (30) day prior notice clause of any cancellation, non-renewal or product change in coverage, terms or conditions.

As a condition precedent to contract award, Certificates of all such insurance policies shall be filed with the HDSB by the successful Bidder and shall be subject to the HDSB's approval as to the adequacy of protection.

All the above-mentioned insurance shall be maintained until the HDSB certifies that the work is complete.

36. Invoicing/Payment/EFT

To ensure that payment is not deferred, the following information shall be on all invoices:

- Bidder's Name or Business Number, Address, Telephone Number and HST registration number
- Invoice Date
- Invoice Number
- Purchase Order Number, Name of Requester, Shipment Destination
- Name of Halton District School Board staff that issued this order
- Complete Good/Service Description (including hourly rates, service/delivery dates, service location)
- Attach Copy of Service Report/Work Order Completed
- Terms of payment
- Total of HST where applicable
- Total Amount Payable

The HDSB's method of payment is by Electronic Funds Transfer (EFT). If the Bidder is a new vendor or current vendor who has not previously utilized the EFT payment service or has banking information which has changed, then an "Application of Vendor Direct Deposit" form is required to be completed, which is available through the Purchasing contact for this document. This form along with a voided cheque or letter from the Bidder's bank should be sent to:

Halton District School Board
Attention: Accounts Payable Department
J.W. Singleton Centre,
PO Box 5005 Stn LCD 1,
Burlington ON L7R 3Z2 or

electronically to: apeft@hdsb.ca before any invoices are submitted to the HDSB for payment.

Payment terms are Net 28. Early payment discounts may be considered.

37. Irrevocability

The Submission will be open for acceptance by the HDSB and irrevocable by the Bidder for a period of one hundred and twenty (120) calendar days from the Closing Date.

38. Municipal Freedom of Information and Protection of Privacy Act ("MFIPPA")

- (a) The Bidder acknowledges and agrees that the HDSB is subject to MFIPPA. The Bidder further expressly acknowledges and agrees that, upon the acceptance of a successful Submission and conclusion of this process (including execution and

delivery of the Contract between the HDSB and the successful Bidder), subject to subsection (b) below, the Submission shall not be considered confidential for the purposes of Section 10 of MFIPPA and, in the event of an access request or at the discretion of HDSB, shall be subject to release in its entirety without redaction.

- (b) Notwithstanding paragraph (a) above, the Bidder and the HDSB acknowledge and agree that the information listed below is considered to be supplied by the Bidder to the HDSB in confidence:
1. For Services: Hourly rates/fees and information from which such rates/fees could be reasonably deduced.
 2. For Goods: Unit costs and information from which such unit costs could be reasonably deduced.
- (c) Notwithstanding the foregoing, the Bidder acknowledges and agrees that, because the HDSB is subject to MFIPPA, all or part of any Submission, including information supplied in confidence, may be subject to release in response to an access request submitted pursuant to MFIPPA. In the event that the HDSB receives a request for access to all or part of a Submission supplied in confidence, the HDSB shall deliver the relevant notice to the Bidder, who shall bare all costs, legal or otherwise, with respect to any objection the Bidder may have in respect of the release of any or all parts of the Submission pursuant to MFIPPA.

39. No Guarantee of Work or Exclusivity of Contract

The HDSB makes no guarantee of the value or quality of goods or services or volume of work to be assigned to the successful Bidder. Any Contract executed with a successful Bidder may not be an exclusive Contract for the provision of the requested Goods or Services. Quantity where specified more or less, are estimates of previous consumption and are furnished without liability to the HDSB.

40. Non-Performance/Termination of Contract

If the Bidder delivers substandard, unapproved or defective items, which are rejected by the HDSB, the Bidder agrees to replace these items at the Bidder's expense with items of a quality deemed acceptable to the HDSB within a 48-hour period of the mutual satisfactory agreement being reached. If the Bidder fails to replace the items within this 48-hour period, the parties agree that the HDSB may purchase substitutes for the rejected items in the open market at no additional cost or liability to the HDSB.

Where at any time the quality of the Goods or Service supplied by the successful Bidder is not of a satisfactory standard, the HDSB may issue a verbal warning outlining the deficiency in supply or other aspects of performance and requiring the successful Bidder to correct those deficiencies within such period of time as stated. If the deficiency is not corrected within the time specified, or having been corrected, there is a further instance

of deficient performance, the HDSB may issue a written notice to the successful Bidder, identifying the deficiency in performance and setting a final date or time period for its correction, and advising that if corrective steps are not taken by that date or within that time, the HDSB may terminate the Contract and take corrective action itself.

Until the HDSB is satisfied that the unsatisfactory performance has been corrected, the HDSB may hold back from any payment an amount sufficient to rectify the unsatisfactory performance until its requirements have been met.

The HDSB reserves the right, in its absolute discretion, to terminate a Contract immediately without penalty, costs or damages of any kind whatsoever, where the Bidder has violated any laws or performed any of the following acts while performing work with the HDSB and further reserves the right to take that failure into account with respect to the award of any future contract.

- a) over-billing or duplicate billing;
- b) splitting of invoices;
- c) charging for items not supplied;
- d) charging for items not approved prior to invoicing;
- e) charging for items of one grade, while supplying items of an inferior grade;
- f) Misrepresentation as to the quality or origin of goods, their functionality or suitability for a purpose, or their performance characteristics;
- g) not responding to the HDSB or, failure to complete contract.

41. Ownership

The Submission, along with all correspondence, documentation and information provided to the HDSB by any Bidder in connection with or arising out of the Submission, once received by the HDSB, shall become the property of the HDSB and may be appended to any Contract and/or purchase order with the successful Bidder.

42. Permits, Licenses and Approvals

Bidders shall obtain all permits, licences and approvals required in connection with the supply of the Goods and/or Services. The costs of obtaining such permits, licences and approvals shall be the responsibility of, and shall be paid for by the Bidder.

Where a Bidder is required by any Applicable Law to hold or obtain any such licence, permit, or approval to carry on an activity contemplated in its Submission or in the Contract, neither the acceptance of the Submission nor the execution of the Contract by

the HDSB shall be considered an approval by the HDSB for the Bidder to carry on such activity without the requisite licence, permit, consent or authorization.

Without in any way limiting the generality of the foregoing, any electrical Goods being proposed for consideration pursuant to this RFT must be authorized or approved in accordance with the Electrical Safety Code or by a certification organization accredited with the Standards Council of Canada Act (Canada), and shall bear the certification organization's mark identifying the Goods certified for use in Canada. Certification shall be to the standard that is appropriate for the intended use of the electrical Goods at any of the HDSB's schools or facilities.

43. Co-operative Purchasing Provisions

This document is being issued by the HDSB to meet the HDSB's requirements. The successful Bidder acknowledges that the Provincial Government encourages cooperative procurement initiatives by School HDSBs. Bidders shall indicate on the Form of Quotation if they are willing to extend pricing and submission terms to other District School Boards in the province of Ontario where the scope of work is deemed similar or the same and where both parties are in agreement, in which case they shall be deemed to have granted consent to the HDSB to share the Submission with such HDSBs, subject to such HDSBs agreeing to receive the Submission in confidence on the understanding that the Submission contains financial, commercial, technical and other sensitive information of the Bidder. The Bidder will not be penalized if it does not agree to this provision. The HDSB will not incur any financial responsibility in connection with any purchase by another School Board. Each School Board shall accept sole responsibility for its own contract management such as placing orders and making payments to the successful Bidder.

44. Proof of WSIB Coverage

If the Bidder is subject to the Workplace Safety and Insurance Act ("WSIA") or the Workplace Safety and Insurance Amendment Act, 2008 ("WSIAA"), the Bidder shall submit a valid clearance certificate of Workplace Safety and Insurance Board ("WSIB") coverage to the HDSB before commencing the performance of any work or services. In addition, the Bidder shall, from time to time during the term of the Contract and at the request of the HDSB, provide additional WSIB clearance certificates. The Bidder covenants and agrees to pay when due, and to ensure that each of its subcontractors pays when due, all amounts required to be paid by it or its subcontractors, from time to time during the term of the Contract, under the WSIA and/or the WSIAA, failing which the HDSB shall have the right, in addition to and not in substitution for any other right it may have pursuant to the Contract or otherwise at law or in equity, to pay to the WSIB any amount due pursuant to the WSIA or the WSIAA unpaid by the Bidder or its subcontractors and to deduct such amount from any amount due and owing from time to time to the Bidder pursuant to the Contract together with all costs incurred by the HDSB in connection therewith.

45. Right to Withdraw

Submissions may be withdrawn prior to the Closing Time. Following Closing, no Submission may be withdrawn. Any Bidder who attempts to do so may have a negative Performance Evaluation placed on record with the HDSB in accordance with the Vendor Performance Management Administrative Procedure

www.hdsb.ca/our-board/Policy/VendorPerformanceManagement.pdf

46. Smoking on HDSB Property

Smoking of any substance and in any manner is prohibited in all HDSB buildings and on all HDSB property. This includes, without limitation, tobacco, cannabis in any form and vaping.

47. Vehicle Operation on HDSB Property

The successful Bidder shall use due care and caution when motorized vehicles are in operation on school property while students are expected to enter or exit the school building and/or are visible outside the school building on school property or adjacent property, particularly during recess, lunch period and preceding and following the end of the school day. Vehicles operated in parking lot and driveway areas shall not be driven at a speed in excess of 8-kilometers/per hour.

Further, on school property drivers must turn off vehicles and remove the keys during any stop. At no time are vehicles to be left running while unattended. It is recommended that the vehicle be locked when left unsupervised. The HDSB will not be responsible for any theft of, or any theft from, vehicles operated by the successful Bidder.

Asphalt play areas around the exterior of the school building are not constructed to handle heavy vehicles. Bidders will be held responsible for any damage to HDSB property including but not limited to asphalt or natural surfaces as a result of using them for access of heavy vehicles. Making good of natural surfaces or asphalt areas that are damaged in the course of the work shall be to the original (new) condition irrespective of their condition prior to commencement of the work, or the condition of the adjacent unaffected areas. Vehicles are only permitted to access, stand or be parked in areas designated by administrative staff of HDSB, which for the purposes of this provision does not include principals of schools.

48. Bidder Conduct

When on HDSB property, the Bidder and its employees must:

- have proper identification (name badge, uniform with logo, photo I.D. etc).
- be dressed appropriately (the following are not appropriate: clothing that fails to contain the anatomy when the person is carrying out normal duties; clothing with

printed slogans, advertising or designs that are obscene or could have a double meaning).

- use appropriate language.
- refrain from wearing scented products or fragrances such as perfume, cologne, after shave, shampoos (as required).
- work with dignity, courtesy and respect for self and others.
- not make noise or move in corridors during morning announcements, and playing of the national anthem.
- observe procedures during fire evacuation and lockdowns, whether they are actual or test (drills).
- park in spots designated by the Principal.

The Bidder must observe all HDSB policies and procedures including but not limited to: Smoke-Free Environment; Sexual, Racial and Ethno Cultural Harassment, etc.

The Bidder will ensure that the education program is not interrupted and that the health and safety of the students and staff is not compromised.

No person who is impaired by alcohol or drugs will enter and/or remain on HDSB property.

The Bidder agrees that its employees and sub-contractors will observe and comply with all standards, procedures, policies, rules and regulations of the HDSB, including but not limited to privacy, use of facilities, equipment, building security and computer technology.



FORM OF TENDER

Project: HVAC & Control Upgrades – Montclair Public School

Project Reference #: RFT 22-079

From (Bidder): _____
Company Name

Street Address

City, Province and postal code

Phone Number Email Address

To (Owner): Halton District School Board
 2050 Guelph Line
 Burlington, Ontario L7P 5A8

We, the undersigned, having examined the Tender Documents for the above-named Project, including Addenda, hereby offer to perform the Work in accordance with the Tender Documents, for the Stipulated Price of:

Base Bid Amounts:

A - Base Bid Amount	\$
B - Cash Allowance – Subgrade, Concrete, Envelope Testing outside of scope	\$ 25,000
C – Contingency 15% - (A+B) X 15%	\$
Sub-Total A+B+C (Exclusive of Taxes)	\$

FORM OF TENDER CONTINUED
RFT 22-079 HVAC & Control Upgrades – Montclair Public School
Page 2 of 2

Prime Sub-Contractor

Electrical: _____

Mechanical: _____

Abatement: _____

Roofing: _____

Controls: _____

We, the undersigned, declare that:

- a. We agree to perform the Work within the required completion time specified in the Tender Documents,
- b. We have arrived at the Tender without collusion with any competitor,
- c. This Tender is open to acceptance by the Owner for a period of 90 days from the date of Tender Closing,
- d. All Form of Tender supplements called for by the Tender Documents from an integral part of this Tender.

Signature: _____
LEGAL NAME OF BIDDER

DATE

AUTHORIZED SIGNATURE OF BIDDER
I have the authority to bind the Bidder

& TITLE

PRINTED NAME



APPENDIX A - DECLARATION SIGNATURE SHEET

1. I/WE DECLARE that this Submission is made without collusion, knowledge, and comparison of figures or arrangement with any other company, firm or person submitting a Submission for the same work.
2. I/WE DECLARE that to our knowledge no member of Halton District School Board is, will be or has become financially interested, directly or indirectly, in any aspect of the Contract other than in the appropriate discharge of his/her obligations as an employee/officer of Halton District School Board.
3. I/WE HAVE READ, Understood and agree to abide by the Agreement to Abide by the Established Process.
4. I/WE HAVE CAREFULLY examined the RFT documents, and have a clear and comprehensive knowledge of what is being requested hereunder. By submitting the Submission, the Bidder agrees and consents to the administrative procedures of the Board, as well as the procedures, terms, conditions and provisions of the RFT, including the Form of Tender.
5. I/WE have carefully examined all of the Proposal Documents, and that we have thoroughly reviewed all proposal documentation and addenda number ____ to ____, and hereby accept and agree to same as forming part and parcel of the proposed Contract.
6. I/WE ARE AUTHORIZED BY and have the authority to bind the Bidder.

DATE: _____

NAME: _____

Please Print

SIGNATURE: _____

TITLE: _____

COMPANY NAME: _____

ADDRESS: _____

PHONE NUMBER: _____

E-MAIL ADDRESS: _____

E-MAIL to Send PO: _____

Appendix B – HDSB Approved List of Sub-Contractors

Electrical

Vendor Name	Contact Name	Email Address	Telephone Number
Arc Electrical	Brian Leiper	office@arcelectrical.ca	905-816-0234
Atlas Electric Corp.	Emre Ates	atlaselectricgta@gmail.com	289-386-3601
B-Safe Electric	Dan More	dan@b-safe.cabrian@b-safe.ca	905-872-7233
Best Electric	Gurmukh Sehmbi	gsehmbi@bestelectric.ca	416-677-3851
Black & McDonald Limited	Brian Mino	swatson@blackandmcdonald.com	905-560-3100
Brant Electric Limited	John Phelps	johnphelps@brantelectriclimited.ca	905-634-5577
Cahill Electr Inc.	Chris Cahill	chris@cahillelectric.ca	905-388-0515
CEC Services Ltd.	Kyle Feinstein	estimating@beswickgroup.com	905-716-3711
Current Technologies Ltd.	Don Frederickson	donfred@currenttechnologies.ca	416-240-7691
Dorval Electric Inc.	Pat Folino	dorvalelectric@bellnet.ca	905-845-4341
EEL Line Corporation	Majeed Wraich	majeed@eelline.ca	416-540-8894
Electrobauer Systems Limited	Michael Bauer	michaelbauer@rogers.com	416-389-6804
Elite Electrical Solutions	Amar Taneja	estimate@eliteelectrical.ca	905-789-5511
Gremar Electric Ltd.	Gennaro Di Gregorio	gennaro@gremar.ca	905-652-2641
Indcon Inc.	Nitesh Patel	indcon74@gmail.com	416-677-3303
JD Electrical Services	Dave De CiantisMatthew De	dave@jdelectric.com	416-803-7689416-896-6393
LJ Barton Mechanical Inc.	Mike Van den Heuvel	estimating@ljbarton.com	905-304-1976
McCleary Electric Limited	Ron Vandermeulan	mcclearyelectric@bellnet.ca	905-634-7634
Nadelec Contracting Inc.	John Nadalin	john.nadelec@gmail.com	905-875-5239
North Star Electric	Greg Harris	gharris@northstarelectric.ca	905-845-9063
Ozz Electric	Dave Burlo	estimating@ozzelectric.com	416-637-7237
PRL - Guite Electric Ltd.	Kyle Leaker	estimating@prlguite.ca	905-549-6711
R.A. Hillmer Electric Corp.	Robert Hillmer	rahillmerelectric@outlook.com	289-736-1000
Smith & Long	Vince Ambrico	vambrico@smithandlong.com	416-391-0443
Star Electrical Services Inc.	Harvinder Kahlon	info@starelectrical.ca	905-799-3883

Mechanical

Vendor Name	Contact Name	Email Address	Telephone Number
BAS Mechanical Inc.	Riaz Ahmad	estimator@basmechanical.ca	905-669-1126
Black & McDonald Limited	Jordan Anderson	swatson@blackandmcdonald.com	289-919-1166
Black Creek Mechanical Ltd.	Nelson Pedreira	estimating@blackcreekmechanical.ca	416-604-7558
Brenner Mechanical Inc.	Michael Brenner	mbrenner@brenner.ca	519-746-0439
CEC Mechanical Ltd.	Devin Brown	dbrown@beswickgroup.com	905-266-1500
Chamberlain Building Systems Inc.	Alex Skaljac	a.skaljac@chbs.ca	905-329-8936
Glenn Richardson Plumbing & Heating Ltd.	Kyle Richardson	kyle@glenrichardsonplumbing.com	905-335-2945
Kirk Mechanical Limited			

LJ Barton Mechanical Inc.	Bruce Hunter	estimating@ljbarton.com	905-304-1976
Mattina Mechanical Limited	Domenic Mattina	dmattina@mattina.ca	905-544-6380
Mekcon Ltd.	Inaam Cheema	ashir@mekcon.ca	905-918-1899
Modern Niagara Southwestern Ontario Inc.	Rachel McGowan	rmcgowan@modernniagara.com rfqswo@modernniagara.com	289-768-1951
Nutemp Mechanical Systems Ltd.	Matthew Soyka	msoyka@nutemp.ca	905-338-5603
SFB Plumbgin and Heating Inc.	Stan Bliszczuk	stan@sfbplumbing.com	289-527-1499
Superior Boiler Works & Welding Ltd.	Domenic Settimi	info@sbww.com	(905) 643-6628
Velocity Mechanical Inc.	Peter Linseman	quotes@velocitymechanical.com	519-896-1119

Abatement

I&I Construction Services Limited 70 Newkirk Road, Unit 6 Richmond Hill, Ontario L4C 3G3 905-884-1290 Contact: John Watters (jwatters@landl.ca)	Biggs and Narciso Construction Services Inc. 181 Bentley Street, Unit 14 Markham, Ontario L3R 3X1 1-866-771-0859 Contact: James Graham (james@biggsandnarciso.com)
QM Environmental 345 Horner Avenue, Suite 300 Toronto, Ontario M8W 1Z6 416-253-6000 Contact: Mark Reinhardt (mark.reinhardt@qmenv.com)	Alliance Environmental & Abatement Contractors Inc. 589 Middlefield Road, Unit 14 Scarborough, Ontario M1V 4Y6 416-298-4500 Contact: Dean Power (info@allianceenvironmental.com)
Inflector Environmental Services. 2325 Hurontario Street, Suite 298 Mississauga, Ontario L5A 4K4 416-726-2817 Contact: Robert Miedema (rmiedema@inflector.ca)	JMX Environmental Inc. 1885 Clements Road, Unit 252 Pickering, Ontario L1W 3V4 905-426-8315 Contact: Peter Bensley (peter.bensley@jmxenvironmental.com)
Caliber Environmental Construction Services Inc. 636 Edward Avenue Richmond Hill, Ontario L4C 0V4 905-884-5500 Contact: Jimmy Ball (jimball@caliberenv.com)	Ferro Canada Inc. 14685 Woodbine Avenue Gormley, Ontario L0H 1G0 905-841-8108 Contact: Peter Ferrante (peter@ferrocanada.com)
McGowan Insulations Ltd. 345 Barton Street Stoney Creek, Ontario L8E 2K9 905-549-1844 Contact: Dan Foley (dfoley@mcgowan.on.ca)	

Roofing

Atlas-Apex Roofing Inc	John McDowell	inquiries@atlas-apex.com	416-421-6244
Atlantic Roofers Ontario Ltd	Tony Pocobene	tpocobene@on.aibn.com	905-573-6202
Caswell Maintenance Roofing & Sheet Metal	Jason Johnny	jason@caswellmaintenance.ca	905-574-1940
CM Whiteside Ltd	Daryl A.C. Whiteside	daryl@whiteside-fm.com	905-389-6000
The Consilium Group	Gary Ostermeier	consiliumgroup@on.aibn.com	905-825-3599
Crawford Roofing Corporation	Nelson Rites	nelson.rites@crawfordroofing.ca	416-787-0649
Flynn Canada Ltd	Joseph Raposo	Joseph.Raposo@flynncompanies.com	905-643-9515
Pollard Enterprises Ltd	Jamie Pedra	jamiypedra@pollardroofing.com	305-332-6660
Roque Roofing Inc	Scott Wager	scott@roqueroofing.com	905-525-9689
Schrieber Brothers Limited Roofing & Sheet Metal	Marinos Barlas	marinos@schrieberroofing.com	905-561-7780
Semple Gooder Roofing Corporation	Derek Wansbrough	dwansbrough@semplegooder.com	416-743-5370
Top-Line Roofing & Sheet Metal Inc	Leandro Pedra	info@top-lineroofing.com	905-602-0760
Triumph Roofing & Sheet Metal Inc	Mario Ribeiro	info@triumphinc.ca	416-534-8877

Scope of Work

GENERAL

The Scope of Work, to be completed in accordance with the drawings and specification detailed herein includes, but is not limited to the following:

- Replacement of HVAC equipment
 - Coordinate and complete a Building Automation System upgrade, in accordance with Section 23 09 23, for entire school including but not limited to:
 - Boilers, pumps, and accessories
 - Replacement and/or upgrade of all pneumatic valves, dampers, and actuators
 - Unit Ventilators
 - All remaining fans (exhaust, supply, and return)
 - Air Handling equipment
 - Rooftop HVAC equipment
 - Perimeter radiation equipment (electric and hydronic)
 - Fan powered heaters
 - Duct heaters
 - Unit Heaters
1. The Scope of work detailed above shall be completed no later than August 26th, 2022.
 2. Equipment and goods including all HVAC equipment shall be ordered within 5 business days of Shop Drawing Approvals. Shop Drawings shall be requested from suppliers within 10 days calendar days from Award of Contract.
 3. All work, **MUST** be completed outside of school operating hours. Work can be completed during daytime hours on PA Days, Summer Break, Holidays, or March Break.

1. GENERAL PROVISIONS

1.1 WORK INCLUDED

1. Provide complete, fully tested, balanced, and operational mechanical and electrical systems to meet requirements described herein, in complete accordance with applicable Codes and ordinances.
2. "Provide" shall mean "Supply and Install" products and services specified.
3. Provide materials, equipment and plant, of specified performance and quality, with current models with published, certified ratings for which replacement parts are readily available.
4. Provide project management and on-site supervision to undertake administration, meet schedules, ensure performances, coordination, and establish orderly completion and delivery of fully commissioned installation.
5. Contractor shall act as General Constructor of record for the site, for all projects by other trades on the same site.
6. The Contractor, appointed to perform the work detailed herein, is wholly responsible for ensuring the health and safety as a result of the work, for all individuals on-site during work activities, and taking all necessary actions and precautions to protect the community and property outside of work activities.
7. Contractors must have a safety program and ensure they are hiring competent workers and sub-contractors that follow all applicable health and safety legislation and standards, are trained and qualified in the work they perform, are instructed in the safety procedures to be followed, and are working safely.

8. Follow manufacturer's recommendations for installation, safety, access for inspection, maintenance and repairs. Provide access and Install equipment to permit maintenance and disassembly with minimum disturbance.
9. Work shall be in accordance with the Drawings and Specifications and their intent, complete with necessary components, including those not shown or specified, but required for complete installation which meets all obligatory requirements.
10. Connect mechanical services to equipment furnished by Owner or other trades, including start-up and test.

1.2 ADDITIONAL WORK AND/OR SCOPE TO BE UNDERTAKEN UPON OWNER REQUEST

1. The Board reserves the right to negotiate additional services of a similar functional or technological nature from the successful Proponent without further competitive procurements.

1.3 SEQUENCE OF WORK

1. Before interrupting major services, notify Owner and arrange acceptable schedule for interruptions.
2. Before interrupting services, complete preparatory work as far as possible and have materials on site and prefabricated (where practical) and work continuously to keep length of interruption to minimum.
3. Include for cost of work that may be required out of regular hours, to minimize period of service interruption when connecting into existing systems.

1.4 BUILDING OPERATION DURING CONSTRUCTION

1. In order to minimize operation difficulties for building staff, trades must cooperate with Owner and Owner's Representatives throughout construction period and particularly ensure that noise is minimized.
2. Convenient access for staff and students to building must be maintained. Minor inconveniences and interruption of services will be tolerated, provided advance notice is given, but Contractor shall to coordinate his Work, in consultation with Owner's Representatives, so operation of facility can be maintained as nearly normal as possible.

1.5 PERFORMANCE

1. Upon completion of each site and/or project a review of performance, based on the requirements detailed herein will be completed by the Board's project lead.
2. A Performance Review considered poor will be reviewed with the contractor. Areas which require improvement will be documented and a mutually agreed upon procedure for improvement will be detailed and applied to subsequent projects.
3. Subsequent Reviews deemed poor may result in the Contractor no longer approved to complete work on the Board's sites.
4. The project will be evaluated as a whole, the Contractor is responsible for all of his employees, sub-trades and, sub-contractors.

1.6 PRE-QUALIFIED SUBCONTRACTORS

1. At the discretion of the Owner, subcontracted forces shall be pre-qualified by, and in good standing with, the HDSB, and identified on the HDSB's Vendor of Record (VOR). Subcontractors and trades retained to provide Work or services not specifically identified by the HDSB, shall be at the discretion of the prime contractor.
2. A list of pre-qualified contractors in the disciplines identified, and required to complete the Scope of Work, will be provided by the Owner.

3. All roofing shall be undertaken exclusively by pre-qualified roofing contractors identified by the HDSB, and in accordance with the most current edition of the "Halton District School Board Mechanical Upgrade Handbook for Roofing Contractors".

1.7 ACCESS TO SITE

1. There will be no interior access to the site during the Tender period.
2. For the purposes of this Contract, "Regular Hours" are considered to be between 8:00 A.M. and 4:00 P.M., Monday to Friday.
3. Schedule must be coordinated with the Contractor, School Administration Staff, and the appropriate Area Field Supervisor and/or Head Caretaker.
4. The Contractor shall include in the total stipulated tender price, all costs for overtime work which may be necessary to complete the various portions of Work, in accordance with the completion dates specified on the Form of Tender. Any additional payments requested in connection with overtime work that have not been authorized by the Owner or Owners Representative in writing, will be rejected.
5. In all cases, Contractors working on school board premises are required to inform either the Caretaker and/or the main office, of their presence on site, and sign-in on the appropriate log book.

1.8 RESPONSIBILITIES

1. Responsibility for provision of equipment or materials rests solely with the Contractor. Extras shall not be considered based on difference in interpretation of Specifications as to which trade provides certain equipment or materials.
2. In consideration of the present COVID-19 circumstances, Provincial requirements for physical distancing and the health and safety of all project stakeholders, the Project Site Visit will not be held and is substituted with digital photographs and videos provided. Each Bidder is required to carefully review the digital photographs and videos as provided. While physical review of the interior of school will not be possible, each Bidder is required to attend at the school during the Tender Period to review the site and to familiarize with the exterior scope of Work and logistical matters of the Work. Please note exterior review of the school will be without Board or Consultant escort and may be done at each Bidders' convenience. It remains the responsibility of each Bidder to satisfy themselves of existing visual conditions of the project. Any questions regarding the Work and clarification as required regarding the videos or photographs as provided are to be submitted during the Tender Period in accordance with the details contained herein. No consideration will be granted for any misunderstanding of Work to be done resulting from failure of the Contractor or the Contractor's Agents to review information or request information and/or clarification.
3. Ensure equipment does not transmit noise and/or vibration to other parts of building, as a result of poor installation practice.
4. Where Contract Documents do not contain sufficient information for proper selection of equipment for bidding, notify Owner during tendering period.
5. Conflicts or additional Work not covered by Drawings and Specifications shall be brought to attention of the HDSB before start of Work.
6. On completion of Work, tools and surplus waste materials shall be removed and work left in clean and operating correctly.
7. Advise HDSB of specified equipment, material or installation, which violates laws, ordinances or regulations.
8. Contractor shall be responsible to remove any access materials and debris from the site. School waste bins shall not be used. Environmental disposal (recycling) shall be the responsibility of the contractor. Do not use existing school dumpsters.

1.9 COORDINATION AND SUPERVISION

1. Coordinate Work with trades and make changes to facilitate satisfactory installation.
2. Install distribution systems and equipment close to building structure and parallel to building lines, avoiding interference with other services or free space.
3. Work out interference problems on site with other trades and coordinate work before fabricating, or installing any material or equipment. Where necessary, produce interference drawings. Ensure materials and equipment fit into allotted spaces and equipment can be properly serviced and replaced. Extras for improper coordination and removal of equipment to permit remedial work shall not be considered.
4. The Contractor shall provide following services:
 1. Coordinate all supply, installation, delivery, removal, electrical, controls, builder's work, and all additional services, as described in the Contract Documents.
 2. Follow up on material and equipment deliveries, review shop drawings and produce interference drawings.
 3. Ensure sub-trades are installing Work properly.
 4. Resolve and direct responsibility for warranty.
5. Supply and locate refuse bins in areas approved by the Owner or Owner's Representative. Bins shall not interfere with playground areas, parking, fire access or vehicle circulation.

1.10 CODES AND STANDARDS

1. In this document, all references to Codes shall mean "Latest Edition"

1.11 PERMITS AND INSPECTIONS

1. Obtain required permits and pay fees and comply with Provincial, Municipal and other legal regulations and bylaws applicable to work.
2. **The contractor identified as the prime Electrical Contractor must have an Electrical Contractor's / ESA License in good standing, and shall be the Electrical Permit (Application for Inspection) Holder.**
3. **The contractor identified as the prime Mechanical Contractor must have a valid TSSA Fuels Certificate in good standing and shall be the Contractor of record responsible to ensure appliances installed under the scope of work detailed herein, are done so in accordance with the O. Reg 212/01, 215/01 and B149.1.15 Code.**
4. Arrange for all required inspections of Work by Authorities Having Jurisdiction. On completion of Work, furnish final unconditional certificates of approval by inspecting Authorities.
5. This contractor shall make application, arrange, and pay for inspection of all piping and equipment systems, including, but not limited to refrigeration, fuel piping, heating and cooling plant, and associated equipment installed under this Contract. Provide a copy of the report(s) and certificates in the Operation & Maintenance manuals for each system inspected.
6. The Contractor shall notify the Chief Building Official or the registered code agency where applicable, of the readiness, substantial completion and completion of the stages of construction set out in the Ontario Building Code 2012 O.Reg. 332/12 Division C Article 1.3.5.1.(2) and 1.3.5.2 as amended. The Contractor shall be present at each site inspection by an inspector or registered code agency as applicable under Sentence 1.3.5.3 of the Building Code and shall provide to the Consultant any documents provided by the inspector, and a written report on matters discussed and reviewed during the inspection(s).

1.12 WORKMANSHIP

1. Tradesmen engaged in installation of Work covered herein shall be qualified in accordance with the Ontario College of Trades and Apprenticeship Act, 2009.
2. Workmanship shall be in accordance with the respective Regulations, Code(s), local, provincial or federal authorities, and, established practice and standards accepted and recognized by Owner, Owner's Representative and Contractor.

1.13 INSPECTION OF WORK

1. Owner, or Owner's Representative, shall be permitted to inspect Work prior to being concealed upon request.
2. Prior to any concealment, Authorities Having Jurisdiction shall approve Work.

1.14 SUBSTANTIAL COMPLETION REQUIREMENTS

1. Contractor shall provide checklist for completion before Substantial Completion Field Review. Provide written declaration that work is complete. The following items shall be complete before Substantial Completion Field Review:
 1. Mechanical and Electrical systems capable of operation with Building Automation System, in operation with alarms functional.
 2. Tests on systems and equipment completed and certificates of approval obtained from regulating Authorities.
 3. Fire stopping completed, if required.
 4. Valve tagging completed and equipment, ductwork and piping identified.
 5. Escutcheons installed.
 6. Equipment lubricated in accordance with manufacturer's data.
 7. Extended warranty form mailed to manufacturer and copy provided to Owner.
 8. Systems chemically cleaned and flushed, strainers cleaned and water treatment initiated.
 9. Equipment drains installed.
 10. Manufacturer's report on acceptability of treatment obtained.
 11. Submit Operating and Maintenance Manuals.
 12. Submit Record Drawings.
 13. Ensure access doors suitable located and equipment accessible.
 14. Ensure electrical connections to mechanical equipment are complete and motor rotation correct.
 15. All testing, balancing, chemical treatments, and start-up reports.

MONTCLAIR PUBLIC SCHOOL RENOVATIONS

**1285 Montclair Dr, Oakville,
Ontario L6H 1Z3
Halton District School Board**



Unit 100 –706 Euclid Avenue
Toronto, Ontario, Canada M6G 2T9
Tel: 416-591-6575 Fax: 416-591-1010

Project No.: 20144
Date: APRIL 2021
Set No.:
Issued:

Specifications

<u>Section Title</u>	<u>Pages</u>
00001 List of Consultants	1
00002 List of Drawings	3
 <u>Division 00 - Procurement and Contracting Requirements</u>	
00226 Designated Substances Report	1
00710 General Conditions	1
00830 Supplementary Conditions	33
 <u>Division 01 - General Requirements</u>	
01011 Summary of Work Single Contract	3
01021 Allowances	2
01040 Coordination	4
01300 Submittals	3
01310 Construction Schedule	3
01400 Quality Control	4
01510 Temporary Utilities	3
01535 Temporary Facilities	3
01560 Temporary Controls	4
01601 Material and Equipment	10
01655 Facility Start-Up	4
01711 Cleaning	3
01721 Project Record Documents	7
01730 Operation and Maintenance Manual	2
01750 Spare Parts + Maintenance Materials	3
01770 Take-Over Procedures	3
01780 Closeout Submittals	9
 <u>Division 02 - Sitework</u>	
02070 Sitework Demolition and Removal	2
02080 Asbestos Abatement Specifications	26
 <u>Division 03 - Concrete</u>	
03345 Concrete Floor Finishes	2
 <u>Division 04 - Masonry</u>	
04050 Masonry Procedures	6
04100 Mortar & Grout for Masonry	4
04150 Masonry Accessories	3
04160 Masonry Reinforcing and Connections	4
04220 Concrete Masonry Unit	2
 <u>Division 05 – Metals</u>	

05500 Metal Fabrications 6

Division 06 - Wood and Plastics

06100 Rough Carpentry 7

Division 07 - Thermal and Moisture Protection

07270 Fire Stopping and Smoke Seals 4

07465 Preformed Metal Cladding Siding 4

07900 Sealants 7

Division 09 - Finishes

09111 Interior 21

Division 15 - Mechanical

Refer to Mechanical Specifications attached

Division 16 - Electrical

Refer to Electrical Specifications attached

PART 1 GENERAL

1.1 THE CONSULTANT (ARCHITECT)

WK Lim Architect Inc.
Unit 100-706 Euclid Avenue
Toronto, Ontario M6G 2T9
Tel: (416) 591-6575
Fax: (416) 591-1010

1.2 THE SUBCONSULTANTS

1. The Mechanical/Electrical/Structural Consultant for this Project is:
Moon-Matz Ltd.
2902 South Sheridan Way, Suite 300
Oakville, Ontario
Tel: (905) 288-5353
Fax: (905) 657-5811

END OF SECTION

List of Drawings

Architectural Drawings

WK Lim Architect Inc.
Unit 100 – 706 Euclid Avenue
Toronto, Ontario M6G 2T9
Tel: (416) 591- 6575
Fax: (416)591- 1010

<u>No.</u>	<u>Title</u>	<u>Date</u>	<u>Revision</u>
A0	Title Sheet	January 2021	December 7, 2021
SP1	Site Plan	January 2021	December 7, 2021
A1	Wall Type Legend, Ground Floor Plan	January 2021	December 7, 2021
A2	Second Floor Plan, Partial Penthouse Plan, Partial Penthouse Section	January 2021	December 7, 2021

Structural Drawings

Moon-Matz Ltd.
2902 South Sheridan Way, Suite 300
Oakville, Ontario
Tel: (905) 288-5353
Fax: (905) 657-5811

<u>No.</u>	<u>Title</u>	<u>Date</u>	<u>Revision</u>
S-1	RTU Framing Plan, Section, OWSJ Reinforcement and Notes	March 2021	April 2, 2021
S02	Partial Framing Plan and Details	March 2021	April 2, 2021

Mechanical Drawings

Moon-Matz Ltd.
2902 South Sheridan Way, Suite 300
Oakville, Ontario
Tel: (905) 288-5353
Fax: (905) 657-5811

<u>No.</u>	<u>Title</u>	<u>Date</u>	<u>Revision</u>
M-1	Drawing List, Legend, Symbols and Details	January 2021	December 6, 2021
M-2	Details	January 2021	December 6, 2021
M-3	Details	January 2021	December 6, 2021
M-4	Proposed Equipment Schedule	January 2021	December 6, 2021
M-5	HVAC & BAS Demolition-(Ground Floor	January 2021	December 6,

M-6	Year 2009 and 1970 Building) HVAC & BAS Demolition-(Ground Floor Year 1968 Building)	January 2021	2021 December 6, 2021
M-7	HVAC & BAS Demolition-Second Floor	January 2021	December 6, 2021
M-8	HVAC & BAS Demolition-Roof (Year 2009 and 1970 Building)	January 2021	December 6, 2021
M-9	HVAC & BAS Demolition-Roof (Year 1968 Building)	January 2021	December 6, 2021
M-10	HVAC & BAS Proposed-(Ground Floor Year 2009 and 1970 Building)	January 2021	December 6, 2021
M-11	HVAC & BAS Proposed-(Ground Floor Year 1968 Building)	January 2021	December 6, 2021
M-12	HVAC & BAS Proposed-Second Floor	January 2021	December 6, 2021
M-13	HVAC & BAS Proposed-Roof (Year 2009 and 1970 Building)	January 2021	December 6, 2021
M-14	HVAC & BAS Proposed-Roof (Year 1968 Building)	January 2021	December 6, 2021
M-15	AHU Plan-Gym Roof, Mechanical Rooms and Janitor's Room	January 2021	December 6, 2021
M-16	Penthouse Mechanical Room, Proposed Point List	January 2021	December 6, 2021
M-17	Cooling System Control Diagram	January 2021	December 6, 2021
M-18	Control Diagrams	January 2021	December 6, 2021
M-19	Control Diagrams	January 2021	December 6, 2021
M-20	Control Diagrams	January 2021	December 6, 2021

Electrical Drawings

Moon-Matz Ltd.
2902 South Sheridan Way, Suite 300
Oakville, Ontario
Tel: (905) 288-5353
Fax: (905) 657-5811

<u>No.</u>	<u>Title</u>	<u>Date</u>	<u>Revision</u>
E-1	Electrical Legend, Notes, Schedules & Details	January 2021	December 12, 2021
E-2	Electrical Ground Floor Demolition Plan	January 2021	December 12, 2021
E-3	Electrical Roof Demolition Plan	January 2021	December 12, 2021
E-4	Electrical Ground Floor Proposed Plan	January 2021	December 12, 2021
E-5	Electrical Roof Proposed Plan	January 2021	December 12, 2021
E-6	Electrical Mechanical Room &	January 2021	December 12,

	Janitor Room Demolition & Proposed Plan		2021
E-7	Electrical Mechanical Room & Boiler Room Proposed Plan	January 2021	December 12, 2021

END OF SECTION

1.1 Hazardous Material Report

- .1 A copy of a detailed Designated Substances Report is included herein, titled as: "Survey and Assessment of Asbestos-Containing Materials" for Montclair Public School, 1285 Montclair Dr, Oakville Ontario, dated xx prepared for the Halton District School Board by Arcadis Canada Ltd. and The Halton District School Board List of Pre-approved Contractors.
- .2 This report identifies existing building components which contain designated substances and asbestos products. The recommendations given in the report shall not be construed as a requirement of this Contract unless Work under the Contract results in disturbance to identified asbestos products. The Contractor is to review the contents of the report and exercise means as required to conform to Ontario Regulation 654/85.
- .3 The report, by its nature, cannot reveal all conditions that exist or can occur on the site. Should subsurface conditions be found to vary substantially from the report, changes in the Work will be made, with resulting credits or expenditures to the contract Price accruing to the Owner.
- .4 The Contractor is to note that subsequent to the preparation of this Report, some corrective work has been undertaken.
- .5 Asbestos removal/containment Work is to be performed only during the Christmas Break, Spring Break, or Summer Break, with exact dates as defined by the Board. If phasing is required, Work area is to be isolated from the remainder of the school and phased Work is to be commenced and completed within each break period.
- .6 As the investigation for asbestos was not intrusive, should the Work uncover a material that is suspected to contain asbestos, then with notification to and the authorization by the Board, Norrox is to be engaged by the Board and co-ordinated by the Contractor for sample collection and analysis. If required, further instruction will be forwarded where materials are confirmed to contain asbestos and will impact on the construction work.

1.1 GENERAL CONDITIONS

- 1.1.1 CCDC 2 - 2008 The General Conditions of the Stipulated Price Contract is the General Conditions between the Owner and the Contractor.

1.2 SUPPLEMENTARY CONDITIONS

- 1.2.1 Refer to Document 00830 for amendments to these General Conditions.

END OF DOCUMENT

**SUPPLEMENTARY GENERAL CONDITIONS
to CCDC 2, 2008 Stipulated Price Contract for Montclair Public School Renovations.**

SC1 GENERAL

- 1.0 Where a General Condition or paragraph of the General Conditions of the Contract is deleted by the Supplementary General Conditions, the numbering of the remaining General Conditions or paragraph shall remain unchanged, unless stated otherwise herein, and the numbering of the deleted item will be retained, unused.
- 1.1 The General Conditions for Canadian Standard Construction Document, CCDC No. 2, 2008 edition for the construction of the **MONTCLAIR PUBLIC SCHOOL RENOVATIONS project, in Oakville, Ontario** are hereby amended, including Articles A-1 through A-8, the Definitions and the General Conditions GC 1.1 to GC 12.3 inclusive. These Supplementary General Conditions supersede, replace or amend the *Contract Document* clauses, as noted in each item. Supplementary General Conditions are indicated in this Document 00810 as "SC 1" (for Supplementary Condition No. 1), "SC 2", etc. General Conditions stated in the *Contract Document* are referred to in this Document 00810 as "GC 1.1" (for General Condition No. 1.1 of CCDC No. 2, 2008), "GC 2.1", etc.
- 1.2 Throughout the *Contract Documents* references to the "General Conditions of the *Contract*" or "General Conditions" shall include the Supplementary General Conditions listed in this Document 00810.
- 1.3 These Supplementary General Conditions shall apply to all work.
- 1.4 Where any article, paragraph or sub-paragraph in the General Conditions is supplemented by one of the following paragraphs, the provisions of such article, paragraph or sub-paragraph shall remain in effect and the supplemental provisions shall be considered as added thereto.
- 1.5 Where any article, paragraph, or sub-paragraph in the General Conditions is amended, voided, or superseded by any of the following paragraphs, the provisions of such article, paragraph, or sub-paragraph not so amended, voided or superseded shall remain in effect.

AGREEMENT BETWEEN OWNER AND CONTRACTOR

SC2 ARTICLE A-3 – CONTRACT DOCUMENTS

- 3.1 Add the following to the list of *Contract Documents* in paragraph 3.1:
- Supplementary General Conditions to CCDC 2 – 2008 (this Document)
 - Drawings and Specifications
 - Bid Documents, including Instructions to Bidders, Form of Tender, and Tender addenda, if applicable
 - Performance Bond
 - Labour and Material Payment Bond

SC3 ARTICLE A-5 – PAYMENT

5.1 Amend the first sentence of paragraph 5.1, to read:
“Subject to the provisions of the contract documents and in accordance with legislation and statutory regulations respecting holdback percentages and, where such legislation does not exist or apply, subject to a lien holdback of Ten percent (10%) PLUS a Reserve Fund of One percent (1%), the Board shall:”

5.3.1 Delete paragraph 5.3.1 in its entirety and replace it with the following:

5.3.1 “Interest

.1 Should either party fail to make payments as they become due under the terms of the Contract or in an award by arbitration or court, interest shall also become due and payable on such unpaid amounts at 2% above the prime rate. Such interest shall be compounded on a monthly basis. The prime rate shall be the rate of interest quoted by the Bank of Canada for prime business loans, as it may change from time to time.”

SC4 ARTICLE A-9 – CONFLICT OF INTEREST

Add new Article A-9 – CONFLICT OF INTEREST as follows:

9.1 “The *Contractor*, all of the *Subcontractors* and *Suppliers* and any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall not engage in any activity or provide any services where such activity or the provision of such services creates a conflict of interest (actually or potentially, in the sole opinion of the *Owner*) with the provision of the *Work* pursuant to the *Contract*. The *Contractor* acknowledges and agrees that a conflict of interest, as described in this Article A-9, includes, but is not limited to, the use of *Confidential Information* where the *Owner* has not specifically authorized such use.”

9.2 “The *Contractor* shall disclose to the *Owner*, in writing, without delay, any actual or potential situation that may be reasonably interpreted as either a conflict of interest or a potential conflict of interest, including the retention of any *Subcontractor* or *Supplier* that is directly or indirectly affiliated with or related to the *Contractor*.”

9.3 “The *Contractor* covenants and agrees that it will not hire or retain the services of any employee or previous employee of the *Owner* where to do so constitutes a breach by such employee or previous employee of the *Owner*’s conflict of interest policy, as it may be amended from time to time, until after completion of the *Work* under the *Contract*.”

9.4 “It is of the essence of the *Contract* that the *Owner* shall not have direct or indirect liability to any *Subcontractor* or *Supplier*, and that the *Owner* relies on the maintenance of an arm's-length relationship between the *Contractor* and its *Subcontractors* and *Suppliers*. Consistent with this fundamental term of the *Contract*, the *Contractor* will not enter into any agreement or understanding with any *Subcontractor* or *Supplier*, whether as part of any contract or any written or oral collateral agreement, pursuant to which the parties thereto agree to cooperate in the presentation of a claim for payment against the *Owner*, directly or through the *Contractor*, where such claim is, in whole or in part, in respect of a disputed claim by the *Subcontractor* or *Supplier* against the

Contractor, where the payment to the *Subcontractor* or *Supplier* by the *Contractor* is agreed to be conditional or contingent on the ability to recover those amounts or a portion thereof from the *Owner*, failing which the *Contractor* shall be saved harmless from all or a portion of those claims. The *Contractor* acknowledges that any such agreement would undermine the required arm's-length relationship and constitute a conflict of interest. For greater certainty, the *Contractor* shall only be entitled to advance claims against the *Owner* for amounts pertaining to *Subcontractor* or *Supplier* claims where the *Contractor* has actually paid or unconditionally acknowledged liability for those claims or where those claims are the subject of litigation or binding arbitration between the *Subcontractor* or *Supplier* and the *Contractor* has been found liable for those claims.

- 9.5 “Notwithstanding paragraph 7.1.2 of GC 7.1 - OWNER’S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR’S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK OR TERMINATE THE CONTRACT, a breach of this Article by the *Contractor*, any of the *Subcontractors*, or any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall entitle the *Owner* to terminate the *Contract*, in addition to any other rights and remedies that the *Owner* has in the *Contract*, in law, or in equity.”

SC5 ARTICLE A-10 CONSTRUCTION SAFETY

SC5.1 Add new Article A-10 – CONSTRUCTION SAFETY as follows:

- 10.1 “The *Contractor* represents and warrants that in tendering for the *Work*, and in entering into a *Contract* with the *Owner* for the performance of the *Work* that the *Contractor* will comply with all applicable statutory obligations, including without limitation, the obligations imposed by the Occupational Health and Safety Act (Ontario) and all Regulations thereto, and all amending and successor legislation, including without limitation, Bill 208 (the “Act”), in connection with all *Work* performed by either the *Contractor*, *Sub-Contractors*, or any other contractor on, or in connection with the *Project*.”
- 10.2 “The *Contractor* further declares and agrees that if awarded the *Contract*, the undersigned shall abide by all of the items identified under Construction Safety in the General Instructions of the *Contract Documents* and, for the purposes of the *Project*, the undersigned specifically agrees to be the “constructor” of the *Project* within the meaning of the Act, and as such, shall assume all the obligations and responsibilities, and observe all construction safety requirements and procedures and duties of inspection imposed by the Act on the “constructor”, as defined in the General Instructions of the *Contract Documents*, for all work and services performed by the undersigned, the *Sub-Contractors* or other *Contractors* on or in connection with the *Project*.”

SC6 ARTICLE A-11 DECLARATION OF NO CONFLICT

SC6.1 Add new Article A-11 – DECLARATION OF NO CONFLICT as follows:

11.1 “The *Contractor* represents and warrants that in tendering for the *Work*, and in entering into a *Contract* with the *Owner* for the performance of the *Work* that the Contractor’s Tender submission was made in good faith and without any connection, knowledge, comparison of figures, or arrangements with any other company, firm, or person making a Tender for the same work and is, in all respects, fair and without collusion with any other bidder for this Contract, and without fraud. The undersigned also represents and warrants that, to the best of the undersigned’s knowledge and belief, no actual or potential conflict of interest exists with respect to the submission of the Tender or performance of the Contract other than those disclosed hereunder. The undersigned confirms that, where the Board discovers that the undersigned has failed to disclose all actual or potential conflicts of interest, the Board may disqualify the undersigned or terminate any Contract awarded to the undersigned pursuant to this Tender process. The undersigned understands that, for the purposes hereof, “conflict of interest” also includes:

- .1 in relation to the Tender process, the undersigned has an unfair advantage or engages in conduct, directly or indirectly, that may give the undersigned an unfair advantage, including:
 - .1 having or having access to information in the preparation of the undersigned’s proposal that is confidential to the Board and not available to other bidders;
 - .2 communicating with any person with a view to influencing preferred treatment in the Tender process; or,
 - .3 engaging in conduct that compromises or could be seen to compromise the integrity of the open and competitive process and render that process non-competitive and unfair; or,
- .2 in relation to the performance of its contractual obligations in a Board contract, the undersigned’s other commitments, relationships or financial interests:
 - .1 could or could be perceived to exercise an improper influence over the objective, unbiased and impartial exercise of the Board’s independent judgment; or,
 - .2 could or could be perceived to compromise, impair or be incompatible with the effective performance of the undersigned’s contractual obligations.”

SC7 DEFINITIONS

4. Amend Definition 4 (Consultant) by adding the following to the end of the Definition:
“For the purposes of the *Contract*, the terms “*Consultant*”, “*Architect*” and “*Engineer*” shall be considered synonymous.”
12. Amend Definition 12 (Owner) by adding the following to the end of the Definition:
“The words “*Owner*” and “*Board*” shall be considered synonymous.”
16. Amend Definition 16 (Provide) by adding the following to the end of the Definition:
“*The word “Provide”* has this meaning whether or not the first letter is capitalized.”

Add the following **new** definitions:

27. Confidential Information

Confidential Information means all the information or material of the *Owner* that is of a proprietary or confidential nature, whether it is identified as proprietary or confidential or not, including but not limited to information and material of every kind and description (such as drawings and move-lists) which is communicated to or comes into the possession or control of the *Contractor* at any time, but *Confidential Information* shall not include information that:

- 1) is or becomes generally available to the public without fault or breach on the part of the *Contractor*, including without limitation breach of any duty of confidentiality owed by the *Contractor* to the *Owner* or to any third party, but only after that information becomes generally available to the public;
- 2) the *Contractor* can demonstrate to have been rightfully obtained by the *Contractor* from a third party who had the right to transfer or disclose it to the *Contractor* free of any obligation of confidence;
- 3) the *Contractor* can demonstrate to have been rightfully known to or in the possession of the *Contractor* at the time of disclosure, free of any obligation of confidence; or
- 4) is independently developed by the *Contractor* without use of any *Confidential Information*.

28. Construction Schedule

Construction Schedule means the schedule for the performance of the *Work* provided by the *Contractor* pursuant to GC 3.5, including any amendments to the *Construction Schedule* made pursuant to the *Contract Documents*.

29. Force Majeure

Force Majeure means any cause, beyond the *Contractor's* control, other than a lack of funds, which prevents the performance by the *Contractor* of any of its obligations under the *Contract* and the event of *Force Majeure* was not caused by the *Contractor's* default or active commission or omission and could not be avoided or mitigated by the exercise of reasonable effort or foresight by the *Contractor*. *Force Majeure* includes *Labour Disputes*, fire, unusual delay by common carriers or unavoidable casualties, civil disturbance, acts, orders, legislation, regulations or directives of any government or other public authority, acts of a public enemy, war, riot, sabotage, blockage, embargo, lightning, earthquake, or acts of God.

30. Install

Install means install and connect. *Install* has this meaning whether or not the first letter is capitalized.

31. Labour Dispute

Labour Dispute means any lawful or unlawful labour problems, work stoppage, labour disruption, strike, job action, slow down, lock-outs, picketing, refusal to work or continue to work, refusal to supply materials, cessation of work or other labour controversy which does, or might, affect the *Work*.

32. Overhead

Overhead means all site and head office operations and facilities, all site and head office administration and supervision; all duties and taxes for permits and licenses required by the authorities having jurisdiction at the *Place of the Work*; all requirements of Division 1, including but not limited to submittals, warranty, quality control, insurance and bonding; calculations, testing and inspections; meals and accommodations; and, tools, expendables and clean-up costs.

33. Request for Information (RFI)

Request for Information or RFI means written documentation sent by the *Contractor* to the *Owner* or to the *Owner's* representative or the *Consultant* requesting written clarification(s) and/or interpretation(s) of the *Drawings* and/or *Specifications*, *Contract* requirements and/or other pertinent information required to complete the *Work* of the *Contract* without applying for a change or changes to the *Work*.

SC8 GC 1.1 CONTRACT DOCUMENTS

SC8.1 Add the following sub-paragraphs to the end of paragraph 1.1.6:

- .1 “The *Specifications* are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Owner* or the *Consultant* to settle disputes among the *Sub-Contractors* and *Suppliers* with respect to such divisions.”
- .2 “The *Drawings* are divided into groups, types and sets for convenience but shall be read as a whole and neither such grouping, nor separation of information from drawing to drawing nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Owner* or the *Consultant* to divide or control the *Work*, nor to settle disputes among the *Sub-Contractors* and *Suppliers* with respect to such divisions.”
- .3 “The *Drawings* are, in part, diagrammatic and are intended to convey the scope of the *Work* and indicate general and appropriate locations, arrangements and sizes of fixtures, equipment and outlets. The *Contractor* shall obtain more accurate information about the locations, arrangements and sizes from study and coordination of the *Drawings*, including *Shop Drawings*, and shall become familiar with conditions and spaces affecting those matters before proceeding with the *Work*.”
- .4 “Where site conditions require reasonable minor changes in indicated locations and arrangements, the *Contractor* shall make such changes at no additional cost to the *Owner*. Similarly, where known conditions or existing conditions interfere with new installation and require relocation, the *Contractor* shall include such relocation in the *Work*.”
- .5 “The *Contractor* shall arrange and install fixtures and equipment in such a way as to conserve as much headroom and space as possible.”

- .6 “The Schedules are those portions of the *Contract Documents*, wherever located and whenever issued, which compile information of similar content and may consist of drawings, tables, charts and/or lists.”

SC8.2 Add new paragraphs 1.1.7.5, 1.1.7.6, 1.1.7.7, 1.1.7.8 and 1.1.7.9 as follows:

- 1.1.7.5 “Noted materials and annotations on the *Drawings* shall govern over the graphic representation of the *Drawings*.”
- 1.1.7.6 “Finishes in the Room Finish Schedules shall govern over those shown on the *Drawings*.”
- 1.1.7.7 “Items, Procedures and Requirements as specified in the Sections of Division 01 – General Requirements of the *Specifications* shall form part of and be read in conjunction with the technical specification Sections found elsewhere in the (overall) *Specifications*.”
- 1.1.7.8 “Architectural drawings shall have precedence over structural, plumbing, mechanical, electrical and landscape drawings insofar as outlining, determining and interpreting conflicts over the required design intent of all architectural layouts and architectural elements of construction, it being understood that the integrity and installation of the systems designed by the *Consultant* or its *Sub-Consultants* are to remain with each of the applicable drawing disciplines.”
- 1.1.7.9 “Should reference standards and *Specifications* conflict with each other or if certain requirements of the *Specifications* conflict with other requirements of the *Specifications*, the more stringent requirements shall govern.”

SC9 GC 1.4 ASSIGNMENT

SC9.1 Delete paragraph 1.4.1 in its entirety and replace with the following:

- 1.4.1 “The Contractor shall not assign the Contract or any portion thereof, without the prior written consent of the Owner, which consent may be unreasonably withheld. The Owner shall be entitled to assign the Contract to a corporation, partnership or other entity (the “Assignee”). Upon the assumption by the Assignee of the Owner’s obligations under the Contract, the Owner shall be released from its obligations under the Contract “.

SC10 GC 1.5 EXAMINATION OF DOCUMENTS AND SITE

SC10.1 Add new GC 1.5 – EXAMINATION OF DOCUMENTS AND SITE as follows:

- 1.5.1 “The *Contractor* declares and represents that in tendering for the *Work*, and in entering into a *Contract* with the *Owner* for the performance of the *Work*, it has either investigated for itself the character of the *Work* to be done and all local conditions, including the location of any utility which can be determined from the records or other information available at the offices of any person, partnership, corporation, including a municipal corporation and any board or commission thereof

having jurisdiction or control over the utility that might affect its tender or its acceptance of the *Work*, or that, not having so investigated, the *Contractor* has assumed and does hereby assume all risk of conditions now existing or arising in the course of the *Work* which might or could make the *Work*, or any items thereof more expensive in character, or more onerous to fulfil, than was contemplated or known when the tender was made or the *Contract* signed.”

- 1.5.2 “The *Contractor* also declares that in tendering for the *Work* and in entering into this *Contract*, the *Contractor* did not and does not rely upon information furnished by the *Owner* or any of its agents or servants respecting the nature or confirmation of the ground at the site of the *Work*, or the location, character, quality or quantity of the materials to be removed or to be employed in the construction of *Work*, or the character of the construction machinery and equipment or facilities needed to perform the *Work*, or the general and local performance of the work under the *Contract* and expressly waives and releases the *Owner* from all claims with respect to the said information with respect to the *Work*.”

SC11 GC 2.2 ROLE OF THE CONSULTANT

- SC11.1 In paragraph 2.2.7, delete the words “Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER”.

- SC11.2 Amend paragraph 2.2.13 by adding the following to the end of that paragraph:

“If, in the opinion of the *Contractor*, the *Supplemental Instruction* involves an adjustment in the *Contract Price* or in the *Contract Time*, it shall, within ten (10) *Working Days* of receipt of a *Supplemental Instruction*, provide the *Consultant* with a notice in writing to that effect. Failure to provide written notification within the time stipulated in this paragraph 2.2.13 shall be deemed an acceptance of the *Supplemental Instruction* by the *Contractor*, without any adjustment in the *Contract Price* or *Contract Time*.”

- SC11.3 Add new paragraph 2.2.19 as follows:

“The *Consultant* or the *Owner*, acting reasonably, may from time to time require the *Contractor* to remove from the *Project* any personnel of the *Contractor*, including project managers, superintendents or *Subcontractors*. Such persons shall be replaced by the *Contractor* in a timely fashion to the satisfaction of the *Consultant* and the *Owner*, at no cost to the *Owner*.”

SC12 GC 2.3 REVIEW AND INSPECTION OF THE WORK

- SC12.1 Amend paragraph 2.3.2 by adding the words “and *Owner*” after the words “*Consultant*” in the second and third lines.

- SC12.2 In the first and second lines of paragraph 2.3.4. insert the word “review” after the word “inspections”.

- SC12.3 Paragraph 2.3.5: In the first line after “*Consultant*”, add “or the *Owner*”.

SC12.4 Add a new paragraph 2.3.8 as follows:

2.3.8 “The *Owner* shall have access to the *Work* at all times. The *Contractor* shall provide sufficient, safe, and proper facilities at all time for the review of the *Work* by the *Owner* and the inspection of the *Work* by authorized agencies.”

SC13 GC 2.4 DEFECTIVE WORK

SC13.1 Amend GC 2.4.1 by inserting “or the *Owner*” in the first sentence following “rejected by the *Consultant*”.

SC13.2 Add new paragraphs 2.4.1.1 and 2.4.1.2 as follows:

2.4.1.1 “The *Contractor* shall rectify, in a manner acceptable to the *Owner* and the *Consultant*, all defective work and deficiencies discovered throughout the *Work*, whether or not they are specifically identified by the *Consultant*.”

2.4.1.2 “The *Contractor* shall prioritize the correction of any defective work, which, in the sole discretion of the *Owner*, adversely affects the day to day operations of the *Owner* or which, in the sole discretion of the *Consultant*, adversely affects the progress of the *Work*.”

SC13.3 Add new paragraph 2.4.4 as follows:

2.4.4 “Neither acceptance of the *Work* by the *Consultant* or the *Owner*, nor any failure by the *Consultant* or the *Owner* to identify, observe or warn of defective *Work* or any deficiency in the *Work* shall relieve the *Contractor* from the *Contractor*’s responsibility for rectifying such defects or deficiencies at the *Contractor*’s sole cost.”

SC14 GC 3.1 CONTROL OF THE WORK

SC14.1 Add a new paragraph 3.1.3 as follows:

3.1.3 “Prior to or concurrent with individual procurement, fabrication and construction activities, the *Contractor* shall verify at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included or exact locations are not apparent, and the *Contractor* requires additional information in order to proceed with *Work*, the *Contractor* shall immediately notify the *Consultant* in writing and obtain written instructions from the *Consultant* before proceeding with the affected *Work*.”

SC15 GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

SC15.1 Delete paragraphs 3.2.2.1, 3.2.2.2 and 3.3.2.4 in their entirety.

SC15.2 Add new paragraph 3.2.3.4 as follows:

3.2.3.4 “Subject to GC 9.4 CONSTRUCTION SAFETY, for the *Owner’s* own forces and for other contractors, assume overall responsibility for compliance with all aspects of the applicable health and safety legislation in force at the *Place of the Work*, including all of the responsibilities of the “Constructor”, pursuant to the *Occupational Health and Safety Act* (Ontario).”

SC16 GC 3.5 CONSTRUCTION SCHEDULE

SC16.1 Delete paragraph 3.5.1 in its entirety and replace with the following:

“The *Contractor* shall:

.1 Within five (5) calendar days of receiving written confirmation of the award of the Contract, prepare and submit to the *Owner* and the *Consultant* for their review and acceptance, a construction schedule in the format indicated below that indicates the timing of the activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time* and in accordance with the *Contract Documents*.

.1 Such schedule is to include a delivery schedule for *Products* whose delivery is critical to the schedule for the *Work* or are required by the *Contract* to be included in a *Products* delivery schedule; and,

.2 The *Contractor* shall employ construction scheduling software, being the latest version of “Microsoft Project”, that permits the progress of the *Work* to be monitored in relation to the critical path established in the schedule; and,

.3 The *Contractor* shall provide the schedule and any successor or revised schedules in both electronic format and hard copy; and,

.4 Once accepted by the *Owner* and the *Consultant*, the construction schedule submitted by the *Contractor* shall become the baseline construction schedule; and,

.2 Monitor the progress of the *Work* and report to the *Consultant* and *Owner* in writing on a weekly basis relative to the baseline construction schedule, or any revised schedule previously accepted by the *Owner*. Report on any variation from the baseline or slippage in the schedule.

.3 Update and submit to the *Consultant* and *Owner* the electronic and hard copy schedule on a monthly basis, at a minimum, or as required by the *Consultant*.

SC16.2 Add new paragraphs 3.5.2 and 3.5.3 as follows:

3.5.2 “If, at any time, it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to become behind schedule, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant* pursuant to subparagraph 3.5.1.3, the *Contractor* shall, either at the request of the *Owner* or the *Consultant*, or following giving notice pursuant to

subparagraph 3.5.1.3, take appropriate steps to cause the actual progress of the *Work* to conform to the schedule or minimize the resulting delay. Within five (5) calendar days of the request by the *Owner* or the *Consultant* or the notice being given pursuant to subparagraph 3.5.1.3, the *Contractor* shall produce and present to the *Owner* and the *Consultant* a plan demonstrating how the *Contractor* will achieve the recovery of the last accepted schedule.”

3.5.3 “The *Contractor* is responsible for performing the *Work* within the *Contract Time*. Any schedule submissions revised from the accepted baseline construction schedule or revised schedule accepted by the *Owner* pursuant to GC 3.5 CONSTRUCTION SCHEDULE, during construction are not deemed to be approved extensions to the *Contract Time*. All extensions to the *Contract Time* must be made in accordance with the *Contract Documents*.”

SC17 GC 3.6 SUPERVISION

SC17.1 In paragraphs 3.6.1 and 3.6.2 replace the word “representative” with “superintendent”.

SC17.2 Add new paragraph 3.6.3 , 3.6.4, 3.6.5 and 3.6.6 as follows:

3.6.3 “The superintendent for the project shall be acceptable to the *Owner* and *Consultant*, and shall be in full time attendance at the *Place of Work* while the *Work* is being performed. The *Contractor* shall provide the *Owner* and the *Consultant* with the names, addresses and telephone numbers of the superintendent referred to in this paragraph 3.6.1 and other responsible persons who may be contacted for emergency and other reasons during non-working hours.”

3.6.4 “The superintendent shall not be changed by the *Contractor* without valid reason, which reason shall be provided in writing. The superintendent shall not be changed without prior consultation with and agreement by the *Owner* and the *Consultant*.”

3.6.5 “The *Contractor* shall replace the superintendent within 7 *Working Days* of the *Owner’s* written notification, if the superintendent’s performance is not acceptable to the *Owner*.”

3.6.6 “The superintendent must remain assigned to the project and present on the project worksite from the start of the *Work*, through the lien period, and shall remain on the project worksite until all deficiencies are completed and accepted, unless otherwise authorized by the *Consultant* or the *Owner*.”

SC18 GC 3.7 SUBCONTRACTORS AND SUPPLIERS

SC18.1 In paragraph 3.7.1.1 add to the end of the second line “including any warranties and service agreements which extend beyond the term of the *Contract*.”

SC18.2 In subparagraph 3.7.1.2 after the words “the *Contract Documents*” insert the words “including any required surety bonding”.

SC18.3 Add to the end of paragraph 3.7.2 the following sentences:

“Substitution of any *Subcontractor* and/or *Suppliers* after submission of the *Contractor’s* bid will not be accepted unless a valid reason is given in writing to and approved by the *Owner*, whose approval may be arbitrarily withheld. The reason for substitution must be provided to the *Owner* and to the original *Subcontractor* and/or *Supplier* and the *Subcontractor* and/or *Supplier* shall be given the opportunity to reply to the *Contractor* and *Owner*. The *Contractor* shall be fully aware of the capability of each *Subcontractor* and/or *Supplier* included in its bid, including but not limited to technical ability, financial stability and ability to maintain the proposed construction schedule.”

SC18.4 In paragraph 3.7.4, change the word “shall” to “may” in the second line.

SC18.5 Add new paragraphs 3.7.7 and 3.7.8 as follows:

3.7.7 “Where provided in the *Contract*, the *Owner* may assign to the *Contractor*, and the *Contractor* agrees to accept, any *Contract* procured by the *Owner* for *Work* or services required on the *Project* that has been pre-tendered or pre-negotiated by the *Owner*.”

3.7.8 “The *Contractor* covenants that each subcontract or supply contract which the *Contractor* enters into for the purpose of performing the *Work* shall expressly provide for the assignment thereof to the *Owner* (at the option of the *Owner*) and the assumption by the *Owner* of the obligations of the *Contractor* thereunder, upon the termination of the *Contract* and upon written notice by the *Owner* to the other parties to such subcontracts or supply contracts, without the imposition of further terms or conditions; provided, however, that until the *Owner* has given such notice, nothing herein contained shall be deemed to create any contractual or other liability upon the *Owner* for the performance of obligations under such subcontracts or supply contracts.”

SC19 GC 3.8 LABOUR AND PRODUCTS

SC19.1 Add new paragraphs 3.8.4 and 3.8.5 as follows:

3.8.4 “All manufactured *Products* which are identified by their proprietary names or by part or catalogue number in the *Specifications* shall be used by the *Contractor*. No substitutes for such specified *Products* shall be used without the written approval of the *Owner* and the *Consultant*. Substitutes will only be considered by the *Consultant* when submitted in sufficient time to permit proper review and investigation. When requesting approval for the use of substitutes, the *Contractor* shall include in its submission any proposed change in the *Contract Price*. The *Contractor* shall use all proprietary *Products* in strict accordance with the manufacturer’s directions.”

3.8.5 “Materials, appliances, equipment and other *Products* are sometimes specified by reference to brand names, proprietary names, trademarks or symbols. In

such cases, the name of a manufacturer, distributor, *Supplier* or dealer is sometimes given to assist the *Contractor* to find a source *Supplier*. This shall not relieve the *Contractor* from its responsibility from finding its own source of supply even if the source names no longer supplies the *Product* specified. If the *Contractor* is unable to obtain the specified *Product*, the *Contractor* shall supply a substitute product equal to or better than the specified *Product*, as approved by the *Consultant*, with no extra compensation. Should the *Contractor* be unable to obtain a substitute *Product* equal to or superior to the specified *Product* and the *Owner* accepts a different *Product*, the *Contract Price* shall be adjusted accordingly, as approved by the *Consultant*.”

SC20 GC 3.10 SHOP DRAWINGS

SC20.1 Add new paragraph 3.10.13 as follows:

3.10.13 “Reviewed *Shop Drawings*, including comments and/or instructions marked thereon, shall not authorize a change in the *Contract Price* and/or the *Contract Time*.”

SC21 GC 3.13 CLEAN UP

SC21.1 Add new paragraph 3.13.4 as follows:

3.13.4 “In the event that the *Contractor* fails to remove waste and debris as provided in this GC 3.13, then the *Owner* or the *Consultant* may give the *Contractor* twenty-four (24) hours written notice to meet its obligations respecting clean up. Should the *Contractor* fail to meet its obligations pursuant to this GC 3.13 within the twenty-four (24) hour period next following delivery of the notice, the *Owner* may remove such waste and debris and deduct from payments otherwise due to the *Contractor*, the *Owner’s* costs for such clean up, including a reasonable mark-up for administration costs.”

SC22 GC 3.14 BOARD OCCUPANCY

SC22.1 Add a new General Condition 3.14 – BOARD OCCUPANCY as follows:

3.14.1 “The *Board* and other *Contractors* as assigned by the *Board* shall have the right to enter, use and occupy the *Work* site, in whole or in part, and place fittings and equipment at or within the *Work* before completion of the *Contract*. The *Contractor* shall observe and protect the right of other *Contractors* and persons authorized by the *Board* or *Consultant* to use the *Work* site.”

3.14.2 “The *Contractor* shall provide free and safe access to the building should the *Board* require occupation prior to completion of the *Contract*. The *Contractor* shall not be entitled to an indemnity for any interference with the *Contractor’s* operations and any *Work* still to be performed by the *Contractor* shall be performed at times other than when the building is occupied. *Board* costs for *Board* staff required to be present during *Work* being carried out by the *Contractor* and/or by any of the *Sub-Contractors* on weekends and after hours

shall be paid by the *Contractor*.”

- 3.14.3 “Such entry and occupancy by the *Board* shall not be considered as acceptance of the *Work* or relieve the *Contractor* of the *Contractor*’s responsibility to complete the project in an acceptable manner, to an acceptable level of quality, within the agreed *Project Schedule*.”

SC23 GC 4.1 CASH ALLOWANCES

- SC23.1 Delete and replace the last sentence in paragraph 4.1.4 with the following sentence:

“Multiple cash allowances, if more than one exists, may be combined for the purpose of calculating the foregoing.

- SC23.2 Delete and replace paragraph 4.1.5 with the following sentence:

“Where costs exceed the total amount of all Cash Allowances, the Contract Price shall be adjusted by Change Order. Overhead and Profit charges may only be charged to overruns on the sum total of the Cash Allowances. The maximum mark up on the authorized overrun on Cash Allowances shall be 5%.”

- SC23.3 Add new paragraphs 4.1.8 and 4.1.9 as follows:

4.1.8 “The *Owner* reserves the right to call, or to have the *Contractor* call, for competitive bids for portions of the *Work*, which are to be paid for from cash allowances.”

4.1.9 “Cash allowances cover the net cost to the *Contractor* of services, *Products*, *Construction Equipment*, freight, unloading, handling, storage, installation, provincial sales tax, and other authorized expenses incurred in performing any *Work* stipulated under the cash allowances but does not include any *Value Added Taxes* payable by the *Owner* and the *Contractor*.”

SC24 GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

- SC24.1 Delete GC 5.1, including paragraphs 5.1.1 and 5.1.2 in their entirety.

SC25 GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT

- SC25.1 Delete and replace paragraph 5.2.3 with the following:

“The amount claimed shall be for the value, proportionate to the amount of the *Contract*, of *Work* performed and *Products* delivered and incorporated into the *Work* as of the last day of the payment period. No amount claimed shall include *Products* not incorporated into the *Work* (whether delivered to the site or not) except when prior financial and/or security arrangements are made and agreed to by the *Contractor*, *Owner* and *Consultant*.”

- SC25.2 Add the following additional sentence to the end of paragraph 5.2.7:

“Such *Products* not incorporated shall, prior to any such consideration for payment, be free and clear of all security interests, liens and other claims of third parties.”

SC25.3 Add new paragraph 5.2.8 as follows:

5.2.8 “Each application for payment, except the first, shall include a statutory declaration, in the CCDC 9A – 2001 form, up to the date of the application for payment, in a form approved by the Consultant. Each application for payment (including the first), shall also include:

- .1 A certificate, issued by an agency or firm providing workers’ compensation insurance to the *Contractor*, verifying that coverage is in force at the time of making the application for payment, and that coverage will remain in force for at least sixty (60) days thereafter.
- .2 A declaration by the *Contractor*, in a form approved by the *Consultant*, verifying that the performance of the *Work* is in compliance with all applicable regulatory requirements respecting environmental protection, fire safety, public safety and occupational health and safety.
- .3 A pre-approved schedule of values, supplied by the *Contractor*, for Divisions 1 through 14 of the *Work*, aggregating the total amount of the *Contract Price*.
- .4 A separate pre-approved schedule of values, supplied by each *Subcontractor*, for each of Division 15 (Mechanical) and 16 (Electrical) of the *Work*, aggregating the total amount of the *Contract Price* for those divisions of work.
- .5 Invoices to support all claims against the cash allowance.
- .6 An acceptable construction schedule pursuant to GC 3.5.”

SC26 GC 5.3 PROGRESS PAYMENT

SC26.1 In the first sentence, after the words “after the receipt by the Consultant” add the word “complete”.

SC26.2 Delete subparagraph 5.3.1.3 in its entirety and substitute as follows:

“The *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement – PAYMENT no later than 30 calendar days after the date of a complete certificate of payment is issued by the *Consultant*”

SC26.3 Add new paragraphs 5.3.4 and 5.3.5 as follows:

5.3.4 “The schedule of values required by paragraph 5.2.4, shall provide for the establishment of a Reserve Fund equivalent to the value of One percent (1%) of the *Work* performed, which fund shall be held in an interest-bearing trust account in the name of the *Owner* and paid to the *Contractor* at the time of final completion of the *Work*. This Reserve Fund shall be in addition to any required Construction Lien Holdback. The funds shall be subject to claims by the *Owner* and others as provided for under the terms of the *Contract Documents*.”

- 5.3.5 “In the event of construction lien action affecting the Project, the Contractor agrees to indemnify and compensate the *Owner* for any expenses incurred. The *Owner* reserves the right to secure the possible cost of construction liens by retaining from the amount of the next payment certificate a sum equal to the amount of any lien claim plus an additional amount of 25% of any such lien amount. Funds so retained and not so expended, shall be released to the Contractor upon the full discharge of all liens and dismissal of all actions against the *Owner*”.

SC27 GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK

SC27.1 Add new paragraphs 5.4.4, 5.4.5 and 5.4.6 as follows:

- 5.4.4 Following the issuance of a certificate of *Substantial Performance of the Work*, the *Consultant* will review the *Work* and prepare a list of deficiencies and incomplete *Work* items.
- .1 The *Consultant* will assign a monetary value to each item.
 - .2 Values assigned shall be those estimated to be required to have deficiencies corrected by an outside Contractor, not currently engaged in the *Work* of the Contract.
 - .3 The total of such amounts will be withheld from payments form a portion of the Deficiency Holdback, conditions for which are listed in GC 5.10 – DEFICIENCY HOLDBACK.
 - .4 Re-review of deficiencies and incomplete *Work* items shall be in accordance with provisions and procedures as detailed in the Specifications, including payment and/or withholding of payment provisions and procedures.
- 5.4.5 “Within the time prescribed by the construction/builder’s lien legislation in force at the *Place of the Work*, or where there is no legislation or no time prescribed, within a reasonable time of receiving a copy of the certificate of *Substantial Performance of the Work* signed by the *Consultant*, the *Contractor* shall take whatever steps are required to publish or post a signed copy of the certificate, as is required by such legislation. If the *Contractor* fails to comply with this provision, the *Owner* may take the required steps pursuant to the legislation and charge the *Contractor* for any costs so incurred.”
- 5.4.6 Following the issuance of the certificate of *Substantial Performance of the Work*, the following shall apply to completing the *Work*:
- .1 *Contractor* is to complete the *Work* within sixty (60) calendar days, or such shorter time period as is established under paragraph 5.4.3.
 - .2 No payments will be processed following *Substantial Performance of the Work* and prior to Total Performance of the *Work*.
 - .3 The *Owner* reserves the right to contract out any or all unfinished *Work* if it has not been completed within sixty (60) days of *Substantial Performance of the Work* without prejudice to any other right or remedy and without affecting the warranty period. The cost of completing the *Work* shall be deducted from the *Contract Price*.

SC28 GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

SC28.1 Amend paragraph 5.5.2 by adding the following sentence to the end of that paragraph:

“In addition to a Reserve Fund noted in SC27.3, paragraph 5.3.4, a Deficiency Holdback may also be retained by the *Owner* to secure the correction of deficiencies and/or warranty claims. Included in these amounts would be all *Consultant* and *Owner* costs related to the correction of deficiencies and/or warranty claims.”

SC28.2 Delete paragraphs 5.5.3 and 5.5.5 in their entirety.

SC28.3 Add new replacement subparagraph 5.5.3 as follows:

5.5.3 “Failure by the *Contractor* to publish the Substantial Performance Certificate places no onus on the *Consultant* or *Owner* to do so. If the Certificate is not published, the *Owner* shall release the holdback to the *Contractor* 45 days after the contract is deemed complete, again having satisfied themselves as above.”

SC29 GC 5.6 PROGRESSIVE RELEASE OF HOLDBACK

SC29.1 Delete GC 5.6 in its entirety and replace with the following paragraph 5.6.1:

5.6.1 “No progressive release of holdback on separate sub-contracts will be made. After *Substantial Performance of the Work* and until *Total Performance of the Work*, no payments will be made on the *Contract* with the exception of release of holdback.”

SC30 GC 5.7 FINAL PAYMENT

SC30.1 Add to the end of paragraph 5.7.2 the following:

“The *Work* shall be deemed not to be completed until all of the documents listed in the Contract Documents have been delivered and confirmed as being satisfactory. The *Owner* may withhold payment in respect of the delivery of any documents in an amount determined by the *Consultant* in accordance with the provisions of GC 5.8 - WITHHOLDING OF PAYMENT.”

SC30.2 Delete from the second line of paragraph 5.7.4 the words, “ 5 calendar days after the issuance” and substitute the words “30 calendar days after receipt of”.

SC31 GC 5.10 DEFICIENCY HOLDBACK

SC31.1 Add a new General Condition 5.10 – DEFICIENCY HOLDBACK as follows:

5.10.1 “Notwithstanding any provisions contained in the *Contract Documents* concerning certification and release of monies to the *Contractor*, the *Owner* reserves the right to establish a Deficiency Holdback, in addition to a Reserve Fund, at the time of the review for *Substantial Performance*.”

- 5.10.2 “Amount of the Deficiency Holdback shall be based upon one or more of the following:
- .1 The total of the values assigned to Deficiency List items, as described in GC 5.4, Item 5.4.4.1;
 - .2 A premium to be determined, based upon individual *Project* completion circumstances present at the time of the deficiency review, up to a total of 100% of the dollar value of the deficiencies listed by the *Consultant*.”
- 5.10.3 “The *Owner* shall retain the entire deficiency holdback amount until completion of all of the deficiencies listed by the *Consultant* to the satisfaction of the *Consultant and Owner*.”

SC32 GC 6.1 OWNER’S RIGHT TO MAKE CHANGES

SC32.1 Add new paragraphs 6.1.3 and 6.1.4 as follows:

- 6.1.3 “The *Contractor* agrees that changes resulting from construction coordination, including but not limited to, site surface conditions, site coordination, and *Sub-Contractor and Supplier* coordination are included in the *Contract Price* and the *Contractor* shall be precluded from making any claim for a change in the *Contract Price* as a result of such changes.”
- 6.1.4 “Labour costs shall be actual, prevailing rates at the *Place of the Work* paid to workers, plus statutory charges on labour including WSIB, unemployment insurance, Canada pension, vacation pay, hospitalization and medical insurance. The *Contractor* shall provide proof of these rates, when requested by the *Consultant*, for review and/or agreement.”

SC33 GC 6.2 CHANGE ORDER

SC33.1 Add new paragraph 6.2.3 as follows:

- 6.2.3 “The value of a change shall be determined in one or more of the following methods as directed by the *Consultant*:
- .1 by estimate and acceptance of a lump sum, such estimate including a detailed breakdown of all labour and materials involved in executing the change to the *Work*;
 - .2 by negotiated unit prices which include the *Contractor’s* overhead and profit, as noted in paragraph 6.2.4, or;
 - .3 by negotiated and accepted lump sum amount, including the *Contractor’s* overhead and profit, *as noted in paragraph 6.2.4*.”

SC33.2 Add new paragraph 6.2.4 as follows:

- 6.2.4 “Overhead and profit charged on Changes, resulting in extra costs, shall be calculated as follows:
- .1 Combined overhead and profit mark up on *Work* performed by the General *Contractor’s* own forces shall not exceed 10%.

- .2 Overhead and profit shall not be charged on credits to the *Contract*. Where a change includes both credits and extras, overhead and profit shall apply only to the net extra amount.
- .3 General *Contractor's* combined overhead and profit mark up on subcontract work shall not exceed 5%.
- .4 Combined overhead and profit mark up charged by *Subcontractors* on their own *Work*, shall not exceed 10%.”
- .5 Subcontractor’s combined overhead and profit mark up on subcontract work shall not exceed 5%”.

SC33.3 Add new paragraph 6.2.5 as follows:

6.2.5 “All quotations will be submitted in a complete manner listing:

- .1 quantity of each material,
- .2 unit cost of each material,
- .3 man hours involved for each type of labour,
- .4 cost per hour for each type of labour,
- .5 overhead and profit (markup),
- .6 *Subcontractor* quotations submitted listing items .1 to .5 above.”

SC33.4 Add new paragraph 6.2.6 as follows:

“Allowances for overhead and profit shall cover all of the General Contractor’s and Subcontractor’s administrative and incidental costs relating to a change including, without limitation, costs relating to project managers, superintendents, assistants, watchpersons and administrative personnel, shop drawing production, head office and site office expenses, worker tools, temporary facilities, bonds, insurance, transportation, record drawings, cleanup and disposal of waste materials”.

SC34 GC 6.3 CHANGE DIRECTIVE

SC34.1 Delete and replace paragraph 6.3.6.1 with the following:

6.3.6.1 “Overhead and profit charged on Change Directive items shall be calculated as follows:

- .1 Combined overhead and profit mark up on *Work* performed by the General *Contractor's* own forces shall not exceed 10%.
- .2 Overhead and profit shall not be charged on credits to the *Contract*. Where a change includes both credits and extras, overhead and profit shall apply only to the net extra amount.
- .3 General *Contractor's* combined overhead and profit mark up on subcontract work shall not exceed 5%.
- .4 Combined overhead and profit mark up charged by *Subcontractors* on their own *Work*, shall not exceed 10%.”
- .5 Subcontractor’s combined overhead and profit mark up on subcontract work shall not exceed 5%.

SC34.2 In subparagraph 6.3.7.1 insert “while directly engaged in the work attributable to the change” after the words “in the direct employ of the *Contractor*”.

SC35 GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

SC35.1 Add new paragraph 6.4.5 as follows:

6.4.5 "Prior to the submission of the bid on which the *Contract* was awarded, the *Contractor* confirms that it carefully investigated the *Place of the Work* and carried out such tests as it deemed appropriate and, in doing so, applied to that investigation an appropriate degree of care and skill.

The *Contractor* is deemed to assume all risk of conditions or circumstances now existing or arising in the course of the *Work* which could make the *Work* more expensive or more difficult to perform than was contemplated at the time the *Contract* was executed. No claim by the *Contractor* will be considered by the *Owner* or the *Consultant* in connection with conditions which could reasonably have been ascertained by such investigation or other due diligence undertaken prior to the execution of the *Contract*."

SC35.2 Add new paragraph 6.4.6 as follows:

6.4.6 "Having regard to paragraph 6.4.5, if the *Contractor* believes that the conditions of the *Place of the Work* differ materially from those indicated in the *Contract Documents*, from those reasonably anticipated, or conditions which were reasonably concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.5, it shall provide the *Owner* and the *Consultant* with *Notice in Writing* no later than five (5) *Working Days* after the first observation of such conditions." If contractor does not provide notice in writing within five working days, it will be understood by the *Owner* and *Contractor* that the conditions of the site are as per *Contract Drawings* and *Specifications*.

SC36 GC 6.5 DELAYS

SC36.1 Delete paragraph 6.5.3 in its entirety and replace with the following:

"If the *Contractor* is delayed in the performance of the *Work* by *Force Majeure*, then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. The extension of time shall not be less than the time lost as a result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for costs incurred by such delays unless such delays result from the actions of the *Owner*."

SC36.2 Add new paragraphs 6.5.6, 6.5.7 and 6.5.8 as follows:

6.5.6 "If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Contractor* or anyone directly or indirectly employed or engaged by the *Contractor*, or by any cause within the *Contractor's* control, then the *Contract Time* may be extended for such reasonable time as the *Owner* may decide in consultation with the *Consultant* and the *Contractor*. The *Owner* shall be reimbursed by the *Contractor* for all reasonable costs incurred by the *Owner* as the result of such delay, including, but not limited to, the cost of all additional

services required by the *Owner* from the *Consultant* or any sub-consultants, project managers, or others employed or engaged by the *Owner*, and in particular, the costs of the *Consultant's* services during the period between the date of *Substantial Performance of the Work* stated in Article A-1 herein, as the same may be extended through the provision of these General Conditions, and any later or actual date of *Substantial Performance of the Work* achieved by the *Contractor*.”

6.5.7 “No claim for delay shall be made and the *Contract Time* shall not be extended due to climatic conditions which are within normal or expected statistical maximums and minimums, within a ten year time period, or arising from the *Contractor's* efforts to maintain the *Contract* schedule.”

6.5.8 “The parties acknowledge the construction of the *Work* is designed to accommodate the requirements of the *Owner* and failure to attain *Substantial Performance* by the date stipulated in the Agreement shall result in inconvenience and expense to the *Owner* and its teachers, students, and others – the exact extent of which is virtually impossible to calculate. Consequently, the parties agree that their best estimate of costs involved in delay beyond the stipulated date for *Substantial Performance* is \$ 1000.00 (**One Thousand Dollars**) per day and said sum shall be paid by the *Contractor* to the *Owner* for each Working Day of the delay, and shall be deemed for all purposes as reasonable compensation to the *Owner* for delay costs only. This amount is not, and shall not be deemed to be a penalty, but is a fair estimate of the actual costs resulting from the delay, and shall be charged in addition to all other cost provided for in the contract documents”.

SC37 GC 6.6 CLAIMS FOR A CHANGE IN THE CONTRACT PRICE

SC37.1 Delete GC 6.6 in its entirety.

SC38 GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

SC38.1 Add a new subparagraph 7.1.3.4 as follows:

7.1.3.4 “An “acceptable schedule” as referred to in subparagraph 7.1.3.2. means a schedule approved by the *Consultant* and the *Owner* wherein the default can be corrected within the balance of the *Contract Time* and shall not cause delay to any other aspect of the *Work* or the *Work* of other *Contractors*, and in no event shall it be deemed to give a right to extend the *Contract Time*.”

SC38.2 Add new paragraph 7.1.7 as follows:

7.1.7 “In addition to any changes certified by the *Consultant*, pursuant to the provisions of item 7.1.5.3 of the General Conditions, the *Contractor* shall:

- .1 pay an allowance for the additional time and services required by the *Board's* representative and other employees equivalent to the relevant payroll costs, plus 150%.
- .2 be responsible for all legal costs incurred by the *Board* with respect to liens arising out of this *Contract*. This includes all costs to perform more than one search per payment such that it includes the costs of all searches discovering liens registered against the *Board's* property, arising out of the *Contract*."

SC39 GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

SC39.1 Delete paragraph 7.2.2, in its entirety.

SC39.2 Delete subparagraph 7.2.3.1, 7.2.3.2 and 7.2.3.3 in their entirety.

SC39.3 In subparagraph 7.2.3.4, delete the words "except for GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER".

SC39.4 Renumber paragraph 7.2.5 as paragraph 7.2.6. Add a new paragraph 7.2.5 as follows:

- 7.2.5 "If the default cannot be corrected within the 5 *Working Days* specified in paragraph 7.2.4, the *Owner* shall be deemed to have cured the default if it:
- .1 commences correction of the default within the specified time;
 - .2 provides the *Contractor* with an acceptable schedule for such correction; and,
 - .3 completes the correction in accordance with such schedule."

SC39.5 Delete paragraph 7.2.6 (previous 7.2.5) entirely and replace with the following:

- 7.2.6 "If the *Contractor* terminates the *Contract* under the conditions described in GC 7.2 – CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of termination, as determined by the *Consultant*. The *Contractor* shall also be entitled to recover the direct costs associated with termination, including the costs of demobilization and losses sustained on *Products* and *Construction Equipment*. The *Contractor* shall not be entitled to any recovery for any special, indirect or consequential losses, including loss of profit."

SC39.6 Add new paragraphs 7.2.7, 7.2.8 and 7.2.9 as follows:

- 7.2.7 "The *Contractor* shall not be entitled to give notice of the *Owner's* default or terminate the *Contract* in the event the *Owner* withholds certificates or payment or both in accordance with the *Contract* because of:
- .1 the *Contractor's* failure to pay all legitimate claims promptly, or
 - .2 the *Contractor's* failure to correct deficiencies and incomplete *Work* in accordance with timelines set out elsewhere in the Contract Documents, or

- .3 the failure of the *Contractor* to discharge construction liens which are registered against the title to the *Place of the Work*.”

SC40 GC 8.2 NEGOTIATION, MEDIATION AND ARBITRATION

SC40.1 Delete paragraph 8.2.1 and substitute the following therefore:

“Subject to the consent of each of the Owner and Contractor, the parties may appoint a Project Mediator in accordance with the Rules for Mediation of Construction Disputes as provided in CCDC 40 in effect at the time of bid closing, within 20 Working Days after Notice in Writing is given by one party to another of a dispute which the parties have been unable to resolve amicably with the assistance of the Consultant”.

SC40.2 Amend paragraph 8.2.4 by changing part of the second line from “the parties shall request the Project Mediator” to “and subject to paragraph 8.2.1 the parties may request the Project Mediator”.

SC40.3 Delete paragraphs 8.2.6, 8.2.7 and 8.2.8 in their entirety.

SC40.4 Add new paragraph as follows:

The dispute may be finally resolved by arbitration under the Rules of Arbitration of Construction Disputes, as provided in CCDC 40 in effect at the time of bid closing, provided that both the Contractor and the Owner agree. If the Contractor and the Owner agree to resolve the dispute by arbitration, the arbitration shall be conducted in the jurisdiction of the Place of Work.

SC41 GC 9.1 PROTECTION OF WORK AND PROPERTY

SC41.1 Delete subparagraph 9.1.1.1 in its entirety and substitute the following:

“Errors in the *Contract Documents* which the *Contractor* could not reasonably have discovered applying the proper level of care and diligence;”

SC42 GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

SC42.1 Add a new subparagraph 9.2.5.5 as follows:

9.2.5.5 “In addition to the steps described in subparagraph 9.2.5.3, take any further steps it deems necessary to mitigate or stabilize any conditions resulting from encountering toxic or hazardous substances or materials.”

SC42.2 Add new paragraphs 9.2.10, 9.2.11 and 9.2.12 as follows:

9.2.10 “The *Contractor*, *Sub-Contractors* and *Suppliers* shall not bring on to the *Place of the Work* any toxic or hazardous substances and materials except as required in order to perform the *Work*. If such toxic or hazardous substances or materials are required, storage in quantities sufficient to allow *Work* to proceed to the end of any current *Work* week only shall be permitted. All such

toxic and hazardous materials and substances shall be handled and disposed of only in accordance with all laws and regulations that are applicable at the *Place of the Work*.”

9.2.11 “The *Contractor* shall indemnify and hold harmless the *Owner*, the *Consultant* and their respective directors, officers, trustees, agents and employees, from and against any and all liabilities, costs, expenses, and claims resulting from bodily injury, including death, and damage to property of any person, corporation or other body politic, that arises from the use by the *Contractor*, *Sub-Contractors* and *Suppliers* of any toxic or hazardous substances or materials at the *Place of the Work*.”

9.2.12 “Renovation and/or Alterations Projects: Asbestos containing materials may have been used during the original construction or previous alteration of School Board facilities. If asbestos containing materials are discovered during the course of the *Project*, stop Work and immediately notify the *Owner* and the *Consultant*. Do not remove existing material containing asbestos fibres.”

SC43 GC 9.4 CONSTRUCTION HEALTH AND SAFETY

SC43.1 Rename General Condition 9.4 to read: CONSTRUCTION HEALTH AND SAFETY

SC43.2 Delete paragraph 9.4.1 in its entirety and substitute as follows:

9.4.1 “The *Contractor* shall be solely responsible for construction safety at the *Place of the Work* and for compliance with the rules, regulations, and practices required by the applicable construction health and safety legislation and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the *Work*.”

SC43.3 Add new paragraphs 9.4.2 to 9.4.10 as follows:

9.4.2 “Observe and enforce construction safety measures required by the National Building Code (1990) Part 8; the Provincial Government; Workers' Compensation Board; and, Municipal authorities. In particular, the Occupational Health and Safety Act (Ont. Reg. 213/91), the Ontario Construction Safety Act, WHMIS, the regulations of the Ontario Ministry of Labour and Ontario Hydro Safety Requirements shall be strictly enforced.”

9.4.3 “The *Board* reserves the right to engage in separate contracts, beyond those of the *General Contractor*, as part of the total construction of the *Project*. These separate contracts shall include, but need not be limited to, the supply and installation of plug-in/plug-out units; supply and installation of draperies, stage equipment, projection equipment and storage shelving units; the supply and installation of telephone, communication, computer and surveillance systems, equipment, wiring and components; the supply and placement of furnishings; and graphic art services.”

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- 9.4.4 “The General *Contractor*, hereafter called the "*Constructor*" as defined by the Occupational Health and Safety Act of Ontario, shall be responsible for supervising and directing any such contractors as the Board may choose to perform Work on the site. The *Constructor* shall ensure that all contractors conform to the requirements of Health and Safety legislation and site policies while on the contract site.”
- 9.4.5 “*Constructor* shall ensure that copies of all applicable construction safety regulations, codes and standards are available on the job-site throughout the period of construction. All workers are to be informed that these documents are available for reference at any time.”
- 9.4.6 “The *Constructor* shall ensure that all supervisory personnel on the job-site are fully aware of the contents of the Occupational Health and Safety Act (Ontario Regulation 213/91 - Construction Projects), as amended, and the "Workers' Compensation Act" and that they comply with all requirements and procedures prescribed therein including, but not limited to, the following construction safety requirements:
- .1 *Constructor* to register with the Director of the Occupational Health and Safety Division prior to commencement of *Work* on the Project, and (O. Reg. 213/91, sec 5).
 - .2 File a notice of Project and commencement of the Project, (O. Reg. 213/91, sec 6).
 - .3 Notification prior to trenching deeper than 1.2 m, (O. Reg. 213/91, sec 7).
 - .4 Establish a Joint Health and Safety and/or Worker Trades Committee, as required.
 - .5 Ensure that all activities arising out of the above are recorded and that minutes are available to an inspector of the Ontario Ministry of Labour.
 - .6 The *Contractor* shall be considered as the "Constructor" in consideration of the rights and responsibilities for all construction safety requirements, procedures, facilities and inspection of all Work performed by the *Contractor*, *Sub-Contractors*/Sub-trades and other *Contractors* engaged on this Project.
 - .7 In the event of a conflict between any of the provisions of the above authorities, **the most stringent provisions are to be applied.**”
- 9.4.7 “Material Safety Data Sheets (MSDS) must be available at the Project site for any product **designated hazardous** or containing **hazardous ingredients** prior to being used, installed or applied inside the building.”
- 9.4.8 “The *Constructor* must provide a job introduction or safety indoctrination session for all personnel and trades Working, inspecting and/or supervision the site.”
- 9.4.9 “The *Constructor* will be responsible for taking all necessary steps to protect personnel (Workers, visitors, general public, etc.) and property from any harm throughout the duration of the Contract.”

- 9.4.10 “The *Constructor* shall supply **competent personnel** to implement the Health and Safety program and ensure compliance with the company's standards and those of the Occupational Health and Safety Act of Ontario.”
- 9.4.11 “The *Constructor* will include these provisions in any agreement with sub-contractors or trades and shall monitor compliance.”
- 9.4.12 “The *Constructor* is responsible for any delays in the progress of Work due to an infraction of legislated or site Health and Safety requirements.
.1 If, in the opinion of the consultant, additional Work and steps to recover such delays are necessary to meet dates set in the Contract, the Constructor shall provide all such services without any additional cost to the Board.”
- 9.4.13 “During the course of the Project, if the Health and Safety policies of the Constructor are found to be deficient and/or the CAD-7 rating by the WCB has changed adversely, additional full-time **accredited safety personnel** must be appointed without extra cost to the *Board*.”
- 9.4.14 “The *Contractor* shall promptly report in writing to the *Owner* and the *Consultant* all accidents of any sort arising out of or in connection with the performance of the *Work*, whether on or adjacent to the job site, giving full details and statement of witnesses. If death or serious injuries or damages are caused, the accident shall be promptly reported by the *Contractor* to the *Owner* and the *Consultant* by telephone or messenger in addition to any reporting required under the applicable safety regulations.”

SC44 GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

SC44.1 Amend paragraph 10.2.2 by deleting the words “building permit”.

SC44.2 Delete and replace paragraph 10.2.3 to read:

10.2.3 “The Contractor shall be responsible for the procurement of permits, licenses, inspections, and certificates, which are necessary for the performance of the Work, except those as noted in paragraph 10.2.2 and as described in the Specifications, Section 01001 – *Summary of Work and Special Conditions*, Item 1.14.3 – *Construction Related Fees, Permits, Building Permit*.”

SC44.3 Add new paragraph 10.2.8 as follows:

10.2.8 “The *Contractor* shall furnish all certificates that are required or given by the appropriate governmental authorities as evidence that the *Work* as installed conforms with the laws and regulations of authorities having jurisdiction, including certificates of compliance for the *Owner's* occupancy or partial occupancy. The certificates are to be final certificates giving complete clearance of the *Work*, in the event that such governmental authorities furnish such certificates.”

SC44.4 Add new GC 10.2.9 – NOTIFICATIONS TO CHIEF BUILDING OFFICIAL, as follows:

10.2.9 “The contractor shall notify the Chief Building Official or the registered code agency where applicable, of the readiness, substantial completion and completion of the stages of construction set out in Division C - Part 1 1.3.5.1 of the Building Code, O. Reg. 332/12 as amended. The contractor shall be present at each site inspection by an inspector or registered code agency as applicable under Division C - Part 1 1.3.5.1 of the Building Code.”

SC45 GC 10.4 WORKERS’ COMPENSATION

SC45.1 Revise paragraph 10.4.1 to read as follows:

“Prior to commencing the *Work*, and with each and every application for payment thereafter, including the *Contractor’s* application for payment of the holdback amount following *Substantial Performance of the Work* and again with the *Contractor’s* application for final payment, the *Contractor* shall provide evidence of compliance with workers’ compensation legislation in force at the *Place of the Work*, including payments due thereunder.”

SC46 GC 12.1 INDEMNIFICATION

SC46.1 Inclusion of indemnification of *Consultant* by other parties:

Replace the words “*Owner* and the *Contractor*” with the words “*Owner, the Contractor* and the *Consultant*” in paragraphs 12.1.1, 12.1.2.1, 12.1.2.2, 12.1.4, 12.1.6

SC46.2 The provisions of GC 12.1 - INDEMNIFICATION shall survive the termination of the *Contract*, howsoever caused and no payment or partial payment, no issuance of a final certificate of payment and no occupancy in whole or in part of the *Work* shall constitute a waiver or release of any of the provisions of GC 12.1.

SC47 GC 12.2 WAIVER OF CLAIMS

SC47.1 Delete GC 12.2 – WAIVER OF CLAIMS, in its entirety.

SC48 GC 12.3 WARRANTY

SC48.1 Add new paragraphs 12.3.7 to 12.3.12 as follows:

12..3.7 “Where required by the *Contract Documents*, the *Contractor* shall provide a maintenance bond as security for the performance of the *Contractor’s* obligations as set out in GC 12.3 WARRANTY.”

12.3.8 “The *Contractor* shall provide fully and properly completed and signed copies of all warranties and guarantees required by the *Contract Documents*, containing:

- .1 the proper name of the *Owner*,
- .2 the proper name and address of the *Project*,
- .3 the date the warranty commences, which shall be at the “date of *Substantial Performance of the Work*” unless otherwise directed by the *Consultant* in writing.
- .4 a clear definition of what is being warranted and/or guaranteed as required by the *Contract Documents*; and
- .5 the signature and seal (if required by the governing law of the *Contract*) of the company issuing the warranty, countersigned by the *Contractor*.”

12.3.9 “Should any *Work* be repaired or replaced during the time period for which it is covered by the specified warranty, a new warranty shall be provided under the same conditions and for the same period as specified herein before. The new warranty shall commence at the completion of the repair or replacement.”

12.3.10 “The *Contractor* shall ensure that its *Subcontractors* are bound to the requirements of GC 12.3 – WARRANTY for the *Subcontractor’s* portion of the *Work*.”

SC49 PART 13 OTHER PROVISIONS

SC49.1 Add new Part 13 OTHER PROVISIONS, including GC13.1 as follows:

SC50 GC 13.1 CONSTRUCTION LIENS

SC50.1 Add new GC 13.1 – CONSTRUCTION LIENS, as follows:

13.1.1 “In the event that a claim for lien is registered against the *Project* by a *Sub-Contractor*, *Sub-Sub-Contractor* or *Supplier*, and provided the *Owner* has paid all amounts properly owing under the *Contract*, the *Contractor* shall, at its own expense:

- .1 within 10 calendar days, ensure that any and all claims for lien and certificates of action are discharged, released, or vacated by the posting of security or otherwise; and
- .2 in the case of written notices of lien, ensure that such notices are withdrawn, in writing.

13.1.2 In the event that the *Contractor* fails to conform with the requirements of paragraph 13.1.1, the *Owner* may fulfil those requirements and set off and deduct from any amount owing to the *Contractor*, all costs and associated expenses, including the costs of posting security and all legal fees and disbursements associated with discharging or vacating the claim for lien or certificate of action and defending the action. If there is no amount owing by the *Owner* to the *Contractor*, then the *Contractor* shall reimburse the *Owner* for all of the said costs and associated expenses.

SC51 Add new GC 1.5 – CONTRACT DOCUMENTS, as follows:

- 1.5.1. Abbreviations may be used in the contract documents and are to be governed by the following clauses.
- .1 Abbreviations may or may not be punctuated by periods
 - .2 Tense, singularity or plurality is to be read in context of note
 - .3 All notes are to be read in demonstrative syntax
 - .4 The Contractor is to advise of undefined abbreviations and be responsible for unverifiable assumptions.
 - .5 Only the Architect has the authority to define abbreviations – clarification will be provided upon request.
 - .6 The following table (Table 1.5.1) contains abbreviations which may be used in the contract documents:

TABLE 1.5.1:

&	AND
@	AT
+	PLUS
+/-	PLUS OR MINUS, APPROXIMATE SUBJECT TO VERIFICATION
ACT, AC. TILE	ACOUSTIC TILE
AD, A.D.	AREA DRAIN
AD, A.D.	AREA DRAIN
ADJ	ADJUSTABLE
AFF	ABOVE FINISHED FLOOR
ALT	ALTERNATE
ALUM	ALUMINUM
ARCH	ARCHITECTURAL
AVG	AVERAGE
B/F, BF	BARRIER FREE
BR	BRICK
C.T., CT	CERAMIC TILE
C/B	CHALKBOARD
C/C	CENTRE TO CENTRE
C/L	CENTER LINE
C/W	COMPLETE WITH
CAR	CARPET
CB	CHALK BOARD
CCM	CONVEX CEILING MIRROR
CCTV	CLOSED CIRCUIT TV

CH	COAT HOOKS
CH	COAT HOOKS
CLG	CEILING
CON	CONSULTANT
CONC	CONCRETE
CONC BL	CONCRETE BLOCK
CR	COAT RACK
CS	CONVENIENCE SHELF
DEMO	DEMOLITION, DEMOLISH
DET	DETAIL
DF	DRINKING FOUNTAIN
DIA.	DIAMETER
DIM	DIMENSION
DIV	DIVISION
DIV	DIVISION
DO, DITTO	SAME, TYPICAL, REPEAT
DP. C	DAMPPROOF COURSE
DR	DOOR
DR	DOOR
ELEC	ELECTRICAL
ELEV	ELEVATION
EXIST	EXISTING
EXT	EXTERIOR
FB	FIRE BLANKET
FD, F.D.	FLOOR DRAIN
FE	FIRE EXTINGUISHER
FEC	FIRE EXTINGUISHER CABINET
FHC	FIRE HOSE CABINET
FH	FIRE HYDRANT
FIN	FINISH, FINISHED
FIN. FL.	FINISHED FLOOR
FIN. GR	FINISHED GRADE
FRR	FIRE RESISTANCE RATED
FSS	FOLDING SHOWER SEAT
FSS	FOLDING SHOWER SEAT
GALV.	GALVANIZED
GB	GRAB BAR
GBF	FOLDING GRAB BAR
GBL	GRAB BAR L-SHAPE
GBR	GRAB BAR

GBS	SHOWER GRAB BAR
GC	GENERAL CONTRACTOR
GEN	GENERAL
GFA	GROSS FLOOR AREA
GFI	GROUND FAULT INTERRUPTOR
GL	GLAZING
GR	GRADE
GYP BD, G.B.	GYPSUM BOARD
HD	HAND DRYER
HD	HEAVY DUTY
HDF	HIGH DENSITY FIBRE BOARD
HOR	HORIZONTAL
HVAC	HEATING VENTILATION AND AIR CONDITIONING
INT	INTERIOR
LAP	LAY-IN ACCOUSTIC PANEL
M	MIRROR
MAS	MASTIC
MAS	MASONRY
MAX	MAXIMUM
MDF	MEDIUM DENSITY FIBRE BOARD
MECH	MECHANICAL
MET	METAL
MG, M.G.	MAKE GOOD
MH	MAN HOLE
MIN	MINIMUM
MIR	MIRROR
MISC.	MISCELLANEOUS
MOD. BIT	MODIFIED BITUMEN
N.I.C./NIC	NOT IN CONTRACT
N.T.S	NOT TO SCALE
N/A	NOT APPLICABLE
O.C	ON CENTER
OBC	ONTARIO BUILDING CODE
OWSJ	OPEN WEB STEEL JOIST
P.T.	PORCELAIN TILE
PA	PUBLIC ADDRESS SYSTEM
PCT	PRIVACY CURTAIN TRACK INCLUDING CURTAIN
PEO	PROFESSIONAL ENGINEERS OF ONTARIO
PLAM	PLASTIC LAMINATE
PLY	PLY WOOD

POLY	POLYETHYLENE
PREF	PREFERRED
PRE-FIN	PRE-FINISHED
PRE-MAN	PRE-MANUFACTURED
PS	PRESSED STEEL
PTD	PAPER TOWEL DISPENSER
PTD	PAINTED
PVC	POLYVINYL CHLORIDE
R+S	ROD AND SHELF
RD, R.D.	ROOF DRAIN
RE-BAR	REINFORCING BAR
REIN.	REINFORCED
RENO	RENOVATION
REQ'D	REQUIRED
RM	ROOM
RT/SRT/IT	
RWL	RAINWATER LEADER - SEE MECHANICAL OR SITE SERVICING
S.S, SS	STAINLESS STEEL
SCB	SLIDING CHALK BOARD
SD	SOAP DISPENSER
SEC, SECT	SECTION
SEP	SEPARATE
SIM	SIMILAR
SMT	SCIENCE MATH & TECHNOLOGY
SND	SANITARY NAPKIN DISPOSAL
SNDISP	SANITARY NAPKIN DISPENSER
SPEC	SPECIFICATION
SPEC. ED.	SPECIAL EDUCATION
SPMDD	STANDARD PROCTOR MAXIMUM DRY DENSITY
SR+C	SHOWER ROD + CURTAIN
SSD	SHOWER SOAP DISH
STO / STOR	STORAGE
STOR	STORAGE
STRUC	STRUCTURAL
STRUC	STRUCTURAL
SUP	SUPPORT, SUPPORTED
SW/B, SWB	SLIDING WHITE BOARD
T/B	TACKBOARD
T/O	TOP OF

TB	TACK BOARD
TD	TOILET TISSUE DISPENSER
TDD	PAPER TOWEL DISPENSER AND DISPOSAL
TLB	TOWEL BAR
TM T/M	TILTED MIRROR
TYP.	TYPICAL
U/N	UNLESS NOTED OTHERWISE
U/S	UNDERSIDE
V.B	VAPOUR BARRIER
VCT	VINYL COMPOSITE TILE
VCT	VINYL COMPOSITION TILE
VERT, VER	VERTICAL
VEST	VESTIBULE
W/	WITH
W/B	WHITEBOARD
W/D	WASHER DRYER
WC	WATER CLOSET
WD	WOOD
WIN	WINDOW

End of Document 00830 - Supplementary General Conditions to CCDC 2, 2008

PART 1 - GENERAL

1.1 Work Covered by Contract Documents

- .1 Work of this Contract comprises general construction and renovations to the Montclair Public School located at 1285 Montclair Dr, Oakville, ON, identified as Project No. 20144.

1.2 Contract Method

- .1 Construct the Work under a single fixed price contract.

1.3 Work Sequence

- .1 Construct Work in stages to accommodate Owner's continued use of premises during construction and as follows:
 - .1 Commence Work July 04, 2022, or as instructed by the Owner. Work to include:
 - .1 Provision of construction hoarding and isolation as required of Work Areas and staging areas.
 - .2 Establishment of temporary exits during construction if required, reviewed and approved by local authorities having jurisdiction.
 - .2 Complete all work for Occupancy on or before August 19, 2022.
 - .3 Coordinate Progress Schedule and coordinate with Owner Occupancy during construction.
 - .4 Required stages:
 - .1 Mobilization including preparation of Shop Drawings and ordering of materials and equipment are to commence immediately upon the award of Contract.
 - .2 Contractor to co-ordinate parts of the Work to expedite the required stages.

1.4 Progress Draw Breakdown

- .1 Submit proposed breakdown to Consultant for review following award of Contract. Itemized in detail indicating proportions of work of each subtrade in accordance with Sections of this specification, and in further detail as required by the Consultant to accurately assess the progress of Work.

1.5 Contractor Use of Premises

- .1 Contractor has unrestricted use of the Work Area until Substantial Performance as scheduled and co-ordinated with the Board.
- .2 Contractor shall limit use of premises for Work, for storage, and for access, to allow;
 - .1 Owner occupancy.
 - .2 Work by other contractors.
 - .3 Public usage.
- .3 Coordinate use of premises under direction of Owner and Consultant.
- .4 Assume full responsibility for protection and safekeeping of products under this Contract.
- .5 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

1.6 Owner Occupancy

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.7 No Smoking Policy

- .1 No person is allowed to smoke at any time on the property. It is the Contractor's responsibility to ensure that his employees and Sub-Contractors, if any, comply with this policy.

1.8 Vehicle and Operation

- .1 Conform to regulation of Municipality regarding cleanup of tracking on streets and protection of sidewalks and curbs and other applicable Laws, By-laws and Regulations.
- .1 Make arrangements with Owner for suitable access for the site. Pay all charges in connection therewith.
- .2 Drivers of motor vehicles shall not operate their vehicles beyond the parking area. Such vehicles shall be operated with due caution at all times while on school property. Speed limits shall not exceed 8 kilometers (5 miles) per hour at any time.

1.9 Digital Photographs

- .1 Provide digital photographs as requested by the Consultant to verify progress of the Work as Work progresses.

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

1 Requirements Included

- .1 Cash allowances

2 Cash Allowances

- .1 Refer to GC 4.1.
- .2 Include in the Contract Price, cash allowances stated herein.
- .3 Cash allowances, unless otherwise specified, cover the net cost to the Contractor of services, products, construction machinery and equipment, freight, handling, unloading, storage and other authorized expenses incurred in performing the Work.
- .4 The Contract Price, and not the cash allowance, includes the Contractor's overhead and profit in connection with such cash allowance.
- .5 The Contract Price will be adjusted by written order to provide for an excess or deficit to each cash allowance.
- .6 Where costs under a cash allowance exceed the amount of the allowance, the Contractor will be compensated for any excess incurred and substantiated plus an allowance for overhead and profit as set out in the Contract Documents.
- .7 Progress payments on accounts of work authorized under cash allowances shall be included in the Consultant's monthly certificate for payment.
- .8 A schedule shall be prepared jointly by the Consultant and Contractor to show when items called for under cash allowances must be authorized by the Consultant for ordering purposes so that the progress of the Work will not be delayed.
- .9 The total value of the Cash Allowance, \$25,000.00 for items not included in the Contract including:
 - .1 Subgrade Compaction Testing
 - .2 Concrete Testing
 - .3 Steel Testing and Inspection
 - .4 Envelope Testing and Inspection

3 Contingency Allowances

- .1 Refer to GC 4.2.

- .2 Include in the Contract Price a stipulated sum contingency allowance in the amount of 15% of the Bid Price. Refer to Form of Tender.
- .3 Do not include in the Contract Price, additional sums for products, installation, overhead or profit.
- .4 Expenditures under the contingency allowance will be authorized in accordance with the procedures provided in Part 6 - Changes in the Work, and evaluated under GC 6.3.

PART 1 - GENERAL

1.1 Section Includes

- .1 Project meetings.
- .2 Project coordination.
- .3 Cutting and patching.
- .4 Field engineering.
- .5 Identification systems.

1.2 Related Sections

- .1 Section 01601 - Material and Equipment.
- .2 Individual Product Sections: Cutting and patching incidental to work of the section. Advance notification to other sections required.

1.3 Meetings

- .1 Schedule and administer project meetings throughout the progress of the work at the call of the Consultant.
- .2 Provide physical space and make arrangements for meetings.
- .3 Record the minutes. Agenda for Meeting and format to be as determined by Consultant. Reproduce and distribute copies of minutes within three days after each meeting and transmit to meeting participants.
- .4 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.

- .5 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .6 During the course of Work schedule progress meetings monthly.
- .7 Contractor, major Subcontractors involved in Work and Consultants and Owner are to be in attendance.

1.4 Coordination

- .1 Allocate of mobilization areas of site; for field offices and sheds, access, traffic, and parking facilities.
- .2 During construction coordinate use of site and facilities through procedures for submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
- .3 Provide information required for preparation of coordination drawings. Review and approve revised drawings for submission to Consultant.
- .4 Mechanical and Electrical Coordinator: Employ and pay for services of a person or firm technically qualified and experienced in field coordination for the type of mechanical and electrical work required for this Project, for duration of construction work.

1.5 Cutting and Patching

- .1 Execute cutting, fitting, and patching including excavation and fill, to complete the Work.
- .2 Remove and replace defective and non-conforming work.
- .3 Restore work with new products in accordance with requirements of Contract Documents.
- .4 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical work.
- .5 Execute work by methods to avoid damage to other work, and which will provide proper surfaces to receive patching and finishing.

- .6 Employ original installer to perform cutting and patching for exposed to view materials.
- .7 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed with masonry materials without prior approval.
- .8 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.

1.6 Field Engineering

- .1 Qualified registered land surveyor, acceptable to Owner.
- .2 Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
- .3 Report to Consultant when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or location.
- .4 Establish two permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
- .5 Establish lines and levels, locate and lay out, by instrumentation.
- .6 On completion of foundation, prepare a certified survey showing dimensions, locations, angles and elevations of Work.

1.7 Identification Systems

- .1 Submit 2 typed copies of schedules for nameplates and valve tags 15 days prior to inspection for Substantial Performance or 5 days prior to date scheduled for instruction of Owner's personnel.
- .2 Nameplate schedules shall list: Pump, control, valves and electrical equipment nameplates.
- .3 Include nameplate designation, manufacturer's nameplate data, equipment and component parts; numbers, location of equipment, and switch location and normal operating position of switch.
- .4 Valve tag schedules shall list each tag by system. Include reference

Montclair Public School
Renovations
1285 Montclair Dr, Oakville,
Ontario L6H 1Z3

Coordination

Section 01040
Page 4
April 2021

number, valve location and usage, system identification, colour code, and function, size and valve manufacturer with model number, and normal operating position of valve.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

1 Section Includes

- .1 Shop drawings and product data
- .2 Samples
- .3 Certificates and transcripts

2 Related Sections

- .1 Section 01310 - Construction Schedule: Submissions of schedules
- .2 Section 01400 - Quality Control: Submission of test and mix design mill tests.
- .3 Section 01601 - Material and Equipment: Submission of manufacturer's instructions.
- .4 Section 01655 - Facility Start-Up: Submission of system and equipment documents.
- .5 Section 01721 - Project Record Documents: Operating and maintenance manuals, and record drawings.

3 Administrative

- .1 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2 Work affected by the submittal shall not proceed until review is complete.
- .3 Review submittals prior to submission to the Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and

co-ordinated with the requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project will be returned without being examined and shall be considered rejected.

- .4 Verify field measurements and affected adjacent Work are coordinated.
- .5 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
- .6 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.
- .7 Keep one reviewed copy of each submission on site.

4 Shop Drawings and Product Data

- .1 Refer to G.C 3.10.
- .2 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.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the Section under which the adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Adjustments made on shop drawings by the Consultant are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Consultant prior to proceeding with the Work.
- .5 Make changes in shop drawings as the Consultant may require, consistent with Contract Documents. When resubmitting, notify the Consultant in writing of any revisions other than those requested.
- .6 Submit one transparency and six (6) prints of shop drawings for each requirement requested in specification Sections and as the consultant may reasonably request.

- .7 Submit six (6) copies of product data sheets or brochures for requirements requested in specification Sections and as the Consultant may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.
- .8 If upon review by the Consultant, no errors or omissions are discovered or if only minor corrections are made, the transparency will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through the same procedure indicated above, shall be performed before fabrication and installation of Work may proceed.

5 Samples

- .1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples as to origin and intended use in the Work.
- .2 Deliver samples prepaid to Consultant's business address.
- .3 Notify the Consultant in writing, at the time of submission of deviations in samples from requirements of Contract Documents.
- .4 Adjustments made on samples by the Consultant are not intended to change the Contract Price. If adjustments affect the value of Work, state such in writing to the Consultant prior to proceeding with the Work.
- .5 Make changes in samples which the Consultant may require, consistent with Contract Documents.

6 Certificates and Transcripts

- .1 Immediately after award of Contract, submit Workers' Compensation Board status transcription of insurances.

1 Section Includes

- .1 Schedule, form, content
- .2 Scheduled revisions
- .3 Critical path scheduling

2 Related Sections

- .1 Section 01770 - Take-Over Procedures: Project closeout requirements.

3 Schedules Required

- .1 Submit the following schedules:
 - .1 Construction Progress Schedule
 - .2 Submittal Schedule for Shop Drawings and Product Data
 - .3 Submittal Schedule for Samples
 - .4 Submittal Schedule for timeliness of Owner furnished Products
 - .5 Product Delivery Schedule
 - .6 Cash Allowance Schedule for purchasing Products

4 Format

- .1 Prepare schedule in the form of a horizontal bar chart.
- .2 Provide a separate bar for each trade or operation.
- .3 Provide horizontal time scale identifying the first work day of each week.
- .4 Format for listings: The chronological order of trades for the Work.
- .5 Identification of listings: By specification Section numbers and

Specification subjects .

5 Submission

- .1 Submit initial schedules within 15 days after award of Contract.
- .2 Submit one opaque reproduction, plus 2 copies to be retained by the Consultant.
- .3 Consultant will review schedule and return review copy within 10 days after receipt.
- .4 Resubmit finalized schedule within 7 days after return of review copy.
- .5 Submit revised progress schedule with each application for payment.
- .6 Distribute copies of the revised schedule to:
 - .1 Job site office.
 - .2 Subcontractors.
 - .3 Other concerned parties.
- .7 Instruct recipients to report to the Contractor within 10 days, any problems anticipated by the timetable shown in the schedule.

6 Construction Progress Schedule

- .1 Include the complete sequence of construction activities.
- .2 Include the dates for the commencement and completion of each major elements of construction including the following.
 - .1 Site clearing.
 - .2 Site utilities.
 - .3 Foundation Work.
 - .4 Structural framing.
 - .5 Special Subcontractor work.
 - .6 Equipment Installations.
 - .7 Finishes.
- .3 Show projected percentage of completion of each item as of the first day of the month.

- .4 Indicate progress of each activity to date of submission schedule.
- .5 Show changes occurring since previous submission of schedule:
 - .1 Major changes in scope.
 - .2 Activities modified since previous submission.
 - .3 Revised projections of progress and completion.
 - .4 Other identifiable changes.
- .6 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and the impact on the schedule.
 - .2 Corrective action recommended and its effect.
 - .3 The effect of changes on schedules of other prime contractors.

7 Submittals Schedule

- .1 Include schedule for submitting shop drawings, product data, samples .
- .2 Indicate dates for submitting, review time, resubmission time, float time, last date for meeting fabrication schedule.
- .3 Include dates when reviewed submittals will be required from the Consultant.

1 Section Includes

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mock-ups.
- .4 Mill tests.
- .5 Equipment and system adjust and balance.

2 Related Sections

- .1 Section 01300 - Submittals: Submission of samples to confirm product quality.
- .2 Section 01601 - Material and Equipment: Material and workmanship quality, reference standards.

3 Inspection

- .1 Refer to GC 2.3.
- .2 The Owner and the Consultant shall have access to the Work. If part of the Work is in preparation at locations other than the Place of the Work, access shall be given to such work whenever it is in progress.
- .3 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Consultant instructions, or the law of the Place of the Work.
- .4 If the Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have the inspections or tests satisfactorily completed and make good such Work.
- .5 The Consultant may order any part of the Work to be examined if the

Work is suspected to be not in accordance with the Contract Documents. If, upon examination such work is found not in accordance with the Contract Documents, correct such work and pay the cost of examination and correction. If such Work is found in accordance with the Contract Documents, the Owner shall pay the cost of examination and replacement.

4 Independent Inspection Agencies

- .1 Independent Inspection/Testing Agencies will be engaged by the Owner for the purpose of inspecting and/or testing portions of Work.
- .2 Costs shall be allocated as set out in Section 01021 - Allowances.
- .3 Provide equipment required for executing inspection and testing by the appointed agencies.
- .4 Employment of inspection/testing agencies does not relax the responsibility to perform Work in accordance with the Contract Documents.
- .5 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to the Owner. Pay costs for retesting and reinspection.

5 Access to Work

- .1 Allow inspection/testing agencies access to the Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

6 Procedures

- .1 Notify the appropriate agency and Consultant in advance of the requirement for tests, in order that attendance arrangements can be made.

- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

7 Rejected Work

- .1 Refer to GC 2.4.
- .2 Remove defective Work, whether the result of poor workmanship, use of defective products or damage and whether incorporated in the Work or not, which has been rejected by the Consultant as failing to conform to the Contract Documents. Replace or re-execute in accordance with the Contracts Documents.
- .3 Make good other Contractor's work damaged by such removals or replacements promptly.
- .4 If in the opinion of the Consultant it is not expedient to correct defective Work or Work not performed in accordance with the Contract Documents, the Owner may deduct from the Contract Price the difference in value between the Work performed and that called for by the Contract Documents, the amount of which shall be determined by the Consultant.

8 Reports

- .1 Submit 4 copies of inspection and test reports to the Consultant.
- .2 Provide copies to Subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested .

9 Tests and Mix Designs

- .1 Furnish test results and mix designs as may be requested.
- .2 The cost of tests and mix designs beyond those called for in the Contract Documents or beyond those required by the law of the Place of Work shall

be appraised by the Consultant and may be authorized as recoverable.

10 Mockup

- .1 Prepare mock-up for Work specifically requested in the specifications. Include for Work of all Sections required to provide mock-ups.
- .2 Construct in all locations acceptable to the Consultant.
- .3 Prepare mock-up for Consultant review with reasonable promptness and in an orderly sequence, so as not to cause any delay in the Work.
- .4 Failure to prepare mock-up in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .5 If requested, the Consultant will assist in preparing a schedule fixing the dates for preparation.
- .6 Mock-up may remain as part of the Work.

11 Mill Tests

- .1 Submit mill test certificates as may be requested.

12 Equipment and Systems

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

PART 1 - GENERAL

1.1 Section Includes

- .1 Temporary utilities.

1.2 Related Sections

- .1 Construction Section 01535 Temporary facilities: Construction Facilities
- .2 Temporary Section 01560 Temporary controls

1.3 Installation and Removal

- .1 Provide temporary utilities controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.4 Dewatering

- .1 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.5 Sanitary Facilities

- .1 Provide sufficient sanitary facilities for workers in accordance with

local health authorities.

- .2 Maintain in clean condition.

1.6 Water Supply

- .1 The Owner will provide a continuous supply of potable water for construction use.
- .2 Arrange for connection with appropriate utility company and pay all costs for installation, maintenance and removal.
- .3 Pay for utility charges at prevailing rates.

1.7 Temporary Heating

- .1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.
- .2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders not permitted.
- .3 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress, unless indicated otherwise in specifications.
- .4 Ventilate heated areas and keep building free of exhaust or combustion gases.
- .5 The use of the permanent heating system of building, or portions thereof, may not be used.
- .6 Date of Substantial Performance and Warranties for heating system do not commence until entire system is in as near original condition as possible and is so certified by Consultant.
- .7 Be responsible for damage to work due to failure in providing adequate heat and protection during construction.

1.8 Temporary Power and Light

- .1 Provide and pay for temporary power during construction for temporary lighting and operating of power tools, to a maximum supply of 230 volts 30 amps.
- .2 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.
- .3 Temporary power for electric cranes and other equipment requiring in access of above is responsibility of Contractor.
- .4 Provide and maintain temporary lighting throughout project. Level of illumination on all floors and stairs shall not be less than 15 foot candles 162 Lx.

1.9 Temporary Telephone

- .1 Provide and pay for temporary telephones necessary for own use and use of Consultant and Owner.

1.10 Fire Protection

- .1 Provide and maintain temporary fire protection equipment during performance of work required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
- .2 Open and burning rubbish are not permitted on site.

PART 2 - PRODUCTS Not used.

PART 3 - EXECUTION Not used.

PART 1 - GENERAL

1.1 Section Includes

- .1 Construction aids.
- .2 Traffic controls.
- .3 Office and sheds.
- .4 Project identification.

1.2 Related Sections

- .1 Temporary Section 01510 utilities: Temporary Utilities
- .2 Temporary Section 01560 controls: Temporary Controls

1.3 Installation and Removal

- .1 Provide construction facilities in order to execute work expeditiously.
- .2 Remove from site all such work after use.

1.4 Scaffolding

- .1 Provide and maintain scaffolding, ramps, ladders, swing staging, platforms and temporary stairs.

1.5 Hoisting

- .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
- .2 Hoists shall be operated by qualified operator.

1.6 Site Storage/ Loading

- .1 Refer to GC 3.3.
- .2 Confine work and operations of employees by Contract documents. Do not unreasonably encumber premises with products.
- .3 Do not load or permit to load any part of work with a weight or force that will endanger the work.

1.7 Security

- .1 Provide and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.8 Offices

- .1 Provide and maintain in clean condition during progress of work, adequately lighted, heated and ventilated Consultant's temporary office and Contractor's office with space for filing and layout of Contract Documents and Contractor's normal site office staff.
- .2 Provide adequate required first aid facilities.
- .3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.9 Equipment, Tool and Materials Storage

- .1 Provide and maintain, in a clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

PART 2 - PRODUCTS Not used.

PART 3 - EXECUTION Not used.

PART 1 - GENERAL

1.1 Section Includes

- .1 Barriers.
- .2 Environmental Controls.
- .3 Traffic Controls.

1.2 Related Sections

- .1 Temporary Section 01510 Temporary Utilities
- .2 Construction Section 01535 Temporary Facilities: Construction Facilities

1.3 Installation and Removal

- .1 Provide temporary controls in order to execute work expeditiously.
- .2 Remove from site all such work after use.
- .3 Conform to requirements of authorities having jurisdiction.

1.4 Hoarding

- .1 Erect hoarding where indicated on drawings to protect the public, workers, public and private property from injury or damage.
- .2 Provide hoarding with solid 16mm plywood barricade painted to Owner's

approval 2.4 m high, protecting public and private property from injury or damage. Provide lockable gates within hoarding for access to site by workers and vehicles.

- .3 Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to building.
- .4 Provide barriers around trees and plants designated to remain. Protect from damage.

1.5 Guard Rails and Barricades

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide as required by governing authorities.

1.6 Weather Enclosures

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Design enclosures to withstand wind pressure and snow loading.

1.7 Dust Tight Screens

- .1 Provide dust tight screens or partitions to localize dust generating activities, and for the protection of workers, finished areas of work and the public.
- .2 Maintain and relocate protection until such work is complete.

1.8 Access to Site

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to the work.

1.9 Public Traffic Flow

- .1 Provide and maintain flagpersons, traffic signals, barricades and flares, lights, or lanterns as required to perform the work and protect the public.

1.10 Protection for Off-Site and Public Property

- .1 Protect surrounding private and public property from damage during performance work.
- .2 Be responsible for damage incurred.

1.11 Protection of Building Finishes and Equipment

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of work.
- .2 Provide necessary screens, covers, and hoardings as required.
- .3 Be responsible for damage incurred due to lack of or improper protection.

1.12 Maintenance of Existing Building Exits

- .1 Maintain and protect existing building exits during Construction. Provide temporary exits through the work area as required.
- .2 Review temporary exits with Consultant and local Building Officials and provide as required.

1.13 Fire Routes

- .1 Maintain access to property including overhead clearance for use by emergency response vehicles.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

PART 1 - GENERAL

1.1 Section Includes

- .1 Reference standards.
- .2 Product quality, availability, storage, handling, protection, transportation.
- .3 Manufacturer's instructions.
- .4 Workmanship, coordination and fastenings.
- .5 Existing facilities.

1.2 Related Sections

- .1 Section 01400 - Quality Control: Quality control and inspection of Work.

1.3 Reference Standards

- .1 Within the text of the specifications, reference may be made to the following standards: ACI - American Concrete Institute AISC - American Institute of Steel Construction ANSI - American National Standards Institute ASTM - American Society of Testing and Materials CEC - Canadian Electrical Code (published by CSA) CEMA - Canadian Electrical Manufacturer's Association CGSB - Canadian General Standards Board CISC - Canadian Institute of Steel Construction CLA - Canadian Lumberman's Association CPCA - Canadian Painting Contractors' Association CPCI - Canadian Prestressed Concrete Institute CRCA - Canadian Roofing Construction Association CSA - Canadian Standards Association FM - Factory Mutual Engineering Corporation IEEE - Institute of Electrical and Electronic Engineers IPCEA - Insulated Power Cable Engineers Association NAAMM - National Association of Architectural Metal Manufacturers NBC - National Building Code NEMA - National Electrical

Manufacturers' Association TTMAC - Terrazzo, Tile and Marble
Association of Canada ULC - Underwriters' Laboratories of Canada

- .2 Conform to these standards, in whole or in part as specifically requested in the specifications.
- .3 If there is question as to whether any product or system is in conformance with applicable standards, the Consultant reserves the right to have such products or systems tested to prove or disprove conformance.
- .4 The cost for such testing will be born by the Owner in the event of conformance with Contract Documents or by the Contractor in the event of non-conformance.
- .5 Conform to latest date of issue of referenced standards in effect on date of submission of bids, except where a specific date or issue is specifically noted.

1.4 Associations

- .1 AA - Aluminum Association, 900 19th Street N.W., Washington, D.C., U.S.A. 20006 <http://www.aluminum.org>
- .2 AASHTO - American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, D.C., U.S.A. 20001 <http://www.aashto.org>
- .3 ACI - American Concrete Institute, P.O. Box 9094, Farmington Hills, Michigan U.S.A. 48333 <http://www.aci-int.org>
- .4 AHA - American Hardboard Association, 887-B Wilmette Road, Palatine, Illinois, U.S.A. 60067
- .5 AITC - American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140, Englewood, Colorado, U.S.A. 80112 <http://www.aitc-glulam.org>
- .6 AMCA - Air Movement and Control Association Inc., 30 West University Drive, Arlington Heights, Illinois, U.S.A. 60004-1893 <http://www.amca.org>
- .7 ANSI - American National Standards Institute, 11 West 42nd Street, New York, New York, U.S.A. 10036 <http://www.ansi.org>
- .8 API - American Petroleum Institute, 1220 L St. Northwest, Washington,

- D.C., U.S.A. 20005-4070 <http://www.api.org>
- .9 ARI - Air Conditioning and Refrigeration Institute, 1815 North Fort Myer Drive, Arlington, Virginia, U.S.A. 22209 <http://www.ari.org>
- .10 ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, Georgia, U.S.A. 30329 <http://www.ashrae.org>
- .11 ASME - American Society of Mechanical Engineers, United Engineering Centre, 345 East 47th Street, New York, New York, U.S.A. 10017-2392 <http://www.asme.org>
- .12 ASTM - American Society for Testing and Materials, 100 Barr Harbor Drive West, Conshohocken, Pennsylvania 19428-2959 <http://www.astm.org>
- .13 AWCI - Association of the Wall and Ceiling Industries, 1711 Connecticut Avenue N.W., Washington, D.C. U.S.A. 20009 <http://www.awci.org>
- .14 AWMAC - Architectural Woodwork Manufacturers Association of Canada, 516 4 Street West, High River, Alberta T1V 1B6 <http://www.awmac.com>
- .15 AWS - American Welding Society, 550 N.W. LeJeune Road, Miami, Florida U.S.A. 33126 <http://www.amweld.org>
- .16 AWWA - American Water Works Association, 6666 W. Quincy Avenue, Denver, Colorado, U.S.A. 80235 <http://www.awwa.org>
- .17 CFFM - Canadian Forces Fire Marshal, 101 Colonel By Drive, 8NT MGen George R. Pearkes Bldg., Ottawa, Ontario K1A 0K2
- .18 CGA - Canadian Gas Association, 243 Consumers Road, Suite 1200, North York, Ontario M2J 5E3 <http://www.cga.ca>
- .19 CGSB - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 <http://w3.pwgsc.gc.ca/cgsb>
- .20 CISC - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, Ontario M2J 4G8
- .21 CITC - Canadian Institute of Timber Construction, 200 Cooper Street, Ottawa, Ontario K2P 0G1
- .22 CMB - Construction Materials Board, 101 Colonel By Drive, 8NT MGen George R. Pearkes Bldg., Ottawa, Ontario K1A 0K2
- .23 COFI - Council of Forest Industries, 555 Burrard, Suite 1200, Vancouver, B.C. V7X 1S7 <http://www.cofi.org>

- .24 CRCA - Canadian Roofing Contractors Association, 151 Slater Street, Suite 606, Ottawa, Ontario K1P 5H3
- .25 CSA - Canadian Standards Association, 178 Rexdale Blvd., Etobicoke, Ontario M9W 1R3 <http://www.csa.ca>
- .26 CSC - Construction Specifications Canada, 100 Lombard Street, Suite 200, Toronto, Ontario M5C 1M3 <http://www.csc-dcc.ca>
- .27 CSDFMA - Canadian Steel Door and Frame Manufacturing Association One Yonge Street, Suite 1400, Toronto, Ontario M5E 1J9
- .28 CSPI - Corrugated Steel Pipe Institute, 201 Consumers Road, Suite 306, Willowdale, Ontario M2J 4G8
- .29 CSSBI - Canadian Sheet Steel Building Institute, 201 Consumers Road, Suite 305, Willowdale, Ontario M2J 4G8 <http://www.cssbi.ca>
- .30 CWC - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, Ontario K1J 9B8 <http://www.cwc.ca>
- .31 EEMAC - Electrical and Electronic Manufacturers' Association of Canada, 1 Yonge Street, Suite 1608, Toronto, Ontario M5E 1R1 <http://www.electro.ca>
- .32 FCC - Fire Commissioner of Canada, Place du Portage, Phase II, 165 rue Hotel de Ville, Hull Quebec K1A 0J2
- .33 ICPI - Interlocking Concrete Pavement Institute, P.O. Box 23053, Milton, Ontario L9T 2M0 <http://www.icpi.org/icpi>
- .34 IEEE - Institute of Electrical and Electronics Engineers, 345 East 47th Street, New York, New York U.S.A. 10017 <http://www.ieee.org>
- .35 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, Virginia U.S.A.22180
- .36 NAAMM - National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, Illinois U.S.A. 60603 <http://www.naamm.org>
- .37 NEMA - National Electrical Manufacturers Association, 1300 N. 17th Street, Suite 1847, Rosslyn, Virginia 22209 <http://www.nema.org>
- .38 NFPA - National Fire Protection Association, 1 Batterymarch Park, Quincy, Massachusetts, U.S.A. 02269-9101 <http://www.nfpa.org>
- .39 NFSA - National Fire Sprinkler Association, P.O. Box 1000, Patterson,

- New York, U.S.A. 12563 <http://www.nfsa.org>
- .40 NHLA - National Hardwood Lumber Association, P.O. Box 34518, Memphis, Tennessee, U.S.A 38184-0518 <http://www.natlhardwood.org>
- .41 NLGA - National Lumber Grades Authority, 260-1055 West Hastings, Vancouver, B.C. V6E 2E9
- .42 NRC - National Research Council, Montreal Road, Ottawa, Ontario K1A 0S2
- .43 PCI - Prestressed Concrete Institute, 175 W. Jackson Blvd., Suite 1859, Chicago, Illinois, U.S.A. 60604 <http://www.pci.org>
- .44 QPL - Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, Quebec K1A 1G6 <http://w3.pwgsc.gc.ca/cgsb>
- .45 SAE - Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, Pennsylvania 15096-0001 <http://www.sae.org>
- .46 SCC - Standards Council of Canada, 1200-45 O'Connor Street, Ottawa, Ontario K1P 6N7 <http://www.scc.ca>
- .47 SMACNA - Sheet Metal and Air Conditioning Contractors' National Association, 4201 Lafayette Center Drive, Chantilly, Virginia 20151-1209 <http://www.smacna.org>
- .48 SSPC - Steel Structures Painting Council, 40 24th Street, Pittsburgh, Pennsylvania 15222-4656 <http://www.sspc.org>
- .49 TTMAC - Terrazzo, Tile and Marble Association of Canada, 30 Capston Gate, Unit 5 Concord, Ontario L4K 3E8 <http://www.ttmac.com>
- .50 UL - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, Illinois, U.S.A. 60062 <http://www.ul.com>
- .51 ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Scarborough, Ontario M1R 3A9 <http://www.ulc.ca>
- .52 USACE - United States Army Corps Engineers, Huntsville, Alabama <http://www.hnd.usace.army.mil>

- .1 Refer to GC 3.8.
- .2 Products, materials, equipment and articles (referred to as Products throughout the specifications) incorporated in the Work shall be new, not damaged or defective, and of the best quality (compatible with specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of Products provided.
- .3 Defective Products, whenever identified prior to the completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should any dispute arise as to the quality or fitness of Products, the decision rests strictly with the Consultant based upon the requirements of the Contract Documents.
- .5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the building.
- .6 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.6 Availability

- .1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of Products are foreseeable, notify the Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.
- .2 In the event of failure to notify the Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Consultant reserves the right to substitute more readily available products of similar character, at no increase in Contract Price.

1.7 Storage, Handling and Protection

- .1 Handle and store Products in a manner to prevent damage, adulteration,

deterioration and soiling and in accordance with manufacturer's instructions when applicable.

- .2 Store packaged or bundled Products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in the Work.
- .3 Store products subject to damage from weather in weatherproof enclosures.
- .4 Store cementitious products clear of earth or concrete floors, and away from walls.
- .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.
- .6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and mix paints in a heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.
- .8 Remove and replace damaged Products at own expense and to the satisfaction of the Consultant.

1.8 Transportation

- .1 Pay costs of transportation of Products required in the performance of Work.
- .2 Transportation cost of Products supplied by the Owner will be paid for by the Owner. Unload, handle and store such Products.

1.9 Manufacturer's Instructions

- .1 Unless otherwise indicated in the 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 the Consultant in writing, of conflicts between the specifications and manufacturer's instructions, so that the Consultant may establish the course of action.
- .3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Consultant to require removal and re-installation at no increase in Contract Price.

1.10 Workmanship

- .1 Workmanship shall be the best quality, executed by workers experienced and skilled in the respective duties for which they are employed. Immediately notify the Consultant if required Work is such as to make it impractical to produce required results.
- .2 Do not employ any unfit person or anyone unskilled in their required duties. The Consultant reserves the right to require the dismissal from the site, workers deemed incompetent, careless, insubordinate or otherwise objectionable.
- .3 Decisions as to the quality or fitness of workmanship in cases of dispute rest solely with the Consultant, whose decision is final.

1.11 Co-Ordination

- .1 Insure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.12 Concealment

- .1 In finished areas, conceal pipes, ducts and wiring in floors, walls and ceilings, except where indicated otherwise.
- .2 Before installation, inform the Consultant if there is a contradictory situation. Install as directed by Consultant.

1.13 Remedial Work

- .1 Refer to GC 2.4 and Section 01040.
- .2 Perform remedial work required to repair or replace the parts or portions of the Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.
- .3 Perform remedial work by specialists familiar with the materials affected. Perform in a manner to neither damage nor endanger any portion of Work.

1.14 Location of Fixtures

- .1 Consider the location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform the Consultant of a conflicting installation. Install as directed.

1.15 Fastenings

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use noncorrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in the affected specification Section.
- .4 Space anchors within their load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.16 Protection of Work in Progress

- .1 Adequately protect Work completed or in progress. Work damaged or defaced due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Consultant, at no increase in Contract Price.
- .2 Prevent overloading of any part of the building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated without written approval of Consultant.

1.17 Existing Utilities

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with a minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in a manner approved by authority having jurisdiction, stake and record location of capped service.

PART 2 - PRODUCTS Not Used

PART 3 - EXECUTION Not Used

PART 1 - GENERAL

1.1 Section Includes

- .1 Testing, adjusting and balancing of building equipment and systems.
- .2 Procedures for demonstration and instruction of equipment and systems to Owner's personnel.

1.2 Related Section

- .1 Section 01400 - Quality Control: Employment of testing agency and payment for services.
- .2 Individual Sections: Demonstrating systems and equipment.

1.3 References

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

1.4 Quality Assurance

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

1.5 Submittals

- .1 Prior to start of Work, submit name of organization proposed to perform services and names of specialty personnel proposed to perform services. Designate who has managerial responsibilities for coordination of entire testing, adjusting and balancing.
- .2 Submit documentation to confirm organization compliance with quality assurance provision.
- .3 Submit 3 preliminary specimen copies of each of report forms proposed for use.
- .4 Fifteen days prior to Substantial Performance, submit 3 copies of final reports on applicable forms.
- .5 Submit reports of testing, adjusting, and balancing postponed due to seasonal, climatic, occupancy, or other reasons beyond Contractor's control, promptly after execution of those services.

1.6 Procedures

- .1 Comply with procedural standards of certifying association under whose standard services will be performed.
- .2 Report to Consultant any deficiencies or defects noted during performance of services.
- .3 Prepare each system for testing and balancing.
- .4 Cooperate with testing organization, provide access to equipment and systems.
- .5 Notify testing organization 7 days prior to time project will be ready for testing, adjusting, and balancing.

1.7 Final Reports

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

1.8 Contractor Responsibilities

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

1.9 Preparation

- .1 Provide instruments required for test, adjust, and balance operations.
- .2 Verify systems installation is complete and in continuous operation.
- .3 Verify lighting is turned on when lighting is included in cooling load.
- .4 Verify equipment such as computers, laboratory and electronic equipment are in full operation.
- .5 Test equipment, balance distribution systems, and adjust devices for HVAC systems.

1.10 Systems Demonstration

- .1 Demonstrate start-up, operation, control, adjustment,

trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment designated location.

- .2 Owner will provide list of personnel to receive instructions, and will coordinate their attendance at agreed-upon times.
- .3 Instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .4 Review contents of manual in detail to explain all aspects of operation and maintenance.
- .5 Prepare and insert additional data in operations and maintenance manuals when the need for additional data becomes apparent during instructions.

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

PART 1 - GENERAL

1.1 Section Includes

- .1 Progressive cleaning.
- .2 Final cleaning.

1.2 Related Section

- .1 Section 01770 - Take-Over Procedures.

1.3 Project Cleanliness

- .1 Maintain the Work in tidy condition, free from accumulation of waste products and debris, other than that caused by the Owner or other Contractors.
- .2 Remove waste material and debris from the site and deposit in waste container at the end of each working day. Do not burn waste materials on site.
- .3 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Dispose of waste materials and debris off site .
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8 Provide adequate ventilation during use of volatile or noxious

substances. Use of building ventilation systems is not permitted for this purpose.

- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.4 Final Cleaning

- .1 Refer to GC 3.13.
- .2 When the Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for the performance of the remaining Work.
- .3 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 the occupancy by Owner.
- .4 Prior to final review, remove surplus products, tools, construction machinery and equipment. Remove waste products and debris other than that caused by the Owner or other Contractors.
- .5 Remove waste materials and the site at regularly scheduled times or dispose of as directed by the consultant. Do not burn waste materials on site, unless approved by the Consultant.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Leave the work broom clean before the inspection process commences.
- .8 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .9 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

- .11 Wax, seal, shampoo or prepare floor finishes, as recommended by the manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean and sweep roofs, gutters, areaways, sunken wells.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to a sanitary condition, clean or replace filters of mechanical equipment.
- .18 Clean roofs, downspouts, and drainage systems.
- .19 Clean lighting reflectors, lenses and other lighting surfaces.
- .20 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .21 Remove snow and ice from access to building.

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

PART 1 - GENERAL

1.1 Section Includes

- .1 Record documents, samples, specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Warranties and bonds.

1.2 Related Sections

- .1 Section 01040 - Coordination
- .2 Section 01300 - Submittals: Shop drawings, samples, manufacturers instructions, photographs.
- .3 Section 01310 - Construction Schedule: Total project Schedule.
- .4 Section 01400 - Quality Control: Test and inspect reports.
- .5 Section 01655 - Facility Start-up: Test and balance, system performance verification and takeover procedures.
- .6 Individual Specifications Sections: Specific requirements for operation and maintenance data.

1.3 Submission

- .1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.

- .2 Submit one copy of completed volumes in final form 15 days prior to substantial performance.
- .3 Copy will be returned after final inspection, with Consultant comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Two weeks prior to Substantial Performance of the work, submit to the Consultant, two final copies of operating and maintenance manuals.

1.4 Format

- .1 Organize data in the form of an instructional manual.
- .2 Binders: commercial quality, 8 1/2 x 11 inch maximum ring size.
- .3 When multiple binders are used, correlate data into related consistent groupings.
- .4 Cover: Identify each binder with type or printed title "Project Record Documents"; list title of Project, identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Test: Manufacturer's printed data, or typewritten data on 20 pound paper.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.5 Contents, Each Volume

- .1 Table of Contents: provide title of project; names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
- .2 For Each Product or System: list names, addresses and telephone numbers

of subcontractors and suppliers, including local source of supplies and replacement parts.

- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01400.

1.6 Record Documents and Samples

- .1 In addition to requirements in General Conditions, Maintain at the site for Owner one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store Record Documents and Samples in Field Office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain Record Documents in a clean, dry and legible condition. Do not use Record Documents for construction purposes.
- .5 Keep Record Documents and samples available for inspection by Consultant.
- .6 Consolidate, index, bind and submit record documents in accordance with Section 1780 Closeout Submittals.

1.7 Recording Actual Site Conditions

- .1 Record information on a full set of black line opaque As-Built drawings provided by Owner, and in a copy of a Project Manual.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measure depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalog number of each project actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

1.8 Record Drawings

- .1 Construction drawings for this project have been prepared on a CAD system. The software used is AutoCAD 2010.
- .2 Submit As-Built drawings to Consultant for preparation of Record Drawings.

- .3 Submit As-Built drawings to the Consultant for review prior to Application for Certificate for Substantial Performance of the work.
- .4 The Consultant will update computer drawings and submit computer disk copies and print copies directly to the Owner. Cost for preparation of Record Drawings is included in Section 01021. Consultant will submit invoices directly to Contractor for direct payment. Invoice is due and payable upon receipt.

1.9 Equipment and Systems

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panelboard Circuit Directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break- in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01400 and 01655.
- .15 Additional Requirements: As specified in individual specification sections.

1.10 Materials and Finishes

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalog number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommend schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.11 Warranties and Bonds

- .1 Separate each warranty or bond with index tab sheets keyed to the List of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.

- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

1 Manual

- .1 An organized compilation of operating and maintenance data including detailed technical information, documents and records describing operation and maintenance of individual products or systems as specified in individual sections of Divisions 02 - 16.

2 General

- .1 Assemble, coordinate, bind and index required data into Operation and Maintenance Manual.
- .2 Submit complete operation and maintenance manual to Consultant 2 weeks prior to application for Substantial Performance.
- .3 Submit 4 bond hard copies and one USB flash drive with each page converted .pdf file format matching order of hard copy submission.
- .4 Organize data into same numerical order as contract specifications.
- .5 Material: label each section with tabs protected with celluloid covers fastened to hard paper dividing sheets.
- .6 Type lists and notes.
- .7 Drawings, diagrams and manufacturers literature must be legible.

3 Binders

- .1 Binders: vinyl, hard covered, 3 "D" ring, loose leaf, sized for 215 x 280 mm paper, with spine pocket.
- .2 Identify contents of each binder on spline.

4 Contents

- .1 Binder 1:
 - .1 Cover sheet containing:
 - .1 Date submitted.
 - .2 Project title, location and project number.
 - .3 Names and addresses of Contractor, and all Sub-contractors.
 - .2 Table of Contents of all binders.
 - .3 List of maintenance materials as specified in Section 01750 - Maintenance Materials, Special Tools and Spare Parts.
 - .4 List of special tools as specified in Section 01750 - Maintenance Materials, Special Tools and Spare Parts.
 - .5 List of spare parts as specified in Section 01750 - Maintenance Materials, Special Tools and Spare Parts.
 - .6 Warranties, guarantees.
 - .7 Copies of approvals, and certificates.
- .2 Remaining binders:
 - .1 Cover sheet containing:
 - .1 Date submitted.
 - .2 Project title, location and project number.
 - .2 Table of Contents of individual binder.
 - .3 Provide data as specified in individual sections of Divisions 02 to 16.
 - .1 List of equipment including service depot.
 - .2 Nameplate information including equipment number, make, size, capacity, model number and serial number.
 - .3 Parts list.
 - .4 Installation details.
 - .5 Operating instructions.
 - .6 Maintenance instructions for equipment.
 - .7 Maintenance instructions for finishes.
- .3 Shop drawings:
 - .1 Bind separately one complete set of reviewed final shop drawings and product data.

PART 1 - GENERAL

1.1 Section includes

- .1 Section includes:
 - .1 Spare parts.
 - .2 Maintenance materials.
 - .3 Special tools.

1.2 Related Sections

- .1 Delivery Section 01655 and receipt of Testing, Adjusting spare parts and Balancing of associated with Systems testing, adjusting and balancing:
- .2 Systems Section 01655 Facility Start-up
- .3 Take-over procedures: Section 01770 Take-Over Procedures
- .4 Project record Section 01721 Project Record Documents
- .5 Individual Specifications Sections: Specific requirements for operation and maintenance data.

1.3 Quality

- .1 Spare parts, maintenance materials and special tools provided shall be new, not damaged or defective, and of the same quality and manufacture as Products provided in the Work.
- .2 If requested, furnish evidence as to type, source and quality of Products provided.
- .3 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

1.4 Transportation

- .1 Pay costs of transportation.

1.5 Storage, handling and protection

- .1 Store spare parts, maintenance materials and special tools in a manner to prevent damage, or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.6 Spare Parts

- .1 Provide spare parts in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in the Work.
- .3 Deliver to Project site or location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual specified in Section 01300.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.7 Maintenance Materials

- .1 Provide maintenance and extra materials in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in the Work.
- .3 Deliver to Project site or location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual specified in Section 01300.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.8 Special Tools

- .1 Provide special tools in quantities specified in individual specification Sections.
- .2 Provide items with tags identifying their function and equipment to which they are associated.
- .3 Deliver to Project site or location as directed; place and store.
- .4 Receive and catalogue all items. Include listings in Maintenance Manual specified in Section 01300.

PART 2 - PRODUCTS Not used

PART 3 - EXECUTION Not used

PART 1 - GENERAL

1.1 Section Includes

- .1 Administrative procedures preceding preliminary and final inspections of the Work.

1.2 Related Sections

- .1 Testing, adjusting Section 01655 and balancing: Testing, Adjusting and Balancing of Systems
- .2 Conform to OAA/OGCA Take-Over Procedures Document No. 100 dated November 1983.

1.3 Inspection and Declaration Procedures

- .1 Contractor's Inspection: Contractor and all Subcontractors shall conduct an inspection of the Work, identify deficiencies and defects; repair as required to conform to Contract Documents. Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made. Request a Consultant's Inspection.
- .2 Consultant's Inspection: Consultants and Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. Contractor shall correct Work accordingly.
- .3 Completion: submit a written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents,
 - .2 Defects have been corrected and deficiencies have been completed,
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational,
 - .4 Certificates required by authorities having jurisdiction have

been submitted,

- .5 Operation of systems have been demonstrated to Owner's personnel, and
 - .6 Work is complete and ready for Final Inspection.
- .4 Final Inspection: when items noted above are completed, request a final inspection of the Work by Owner, Consultants, and Contractor. If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request a reinspection.
 - .5 Declaration of Substantial Performance: when Owner and Consultants consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance. Refer to General Conditions Article GC 5.4 Substantial Performance of the Work. Submission of Project Record Documents in accordance with Section 01721 and Operation and Maintenance Manual in accordance with Section 01730 is a requirement for Substantial Performance.
 - .6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of the Place of the Work.
 - .7 Final Payment: When Owner and Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. Refer to CCDC 2, General Conditions Article GC 5.7 for specifics to application. If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request reinspection.
 - .8 Payment of Holdback: After issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with CCDC 2, General Conditions Article 5.5.

1.4 Reinspection

- .1 Should status of the Work require reinspection by Consultant due to failure of Work to comply with Contractor's claims for inspection, Owner will deduct amount of Consultant's compensation for reinspection services from payment to Contractor.

Montclair Public School
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Take-Over Procedures

Section 01770
Page 3
April 2021

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION Not Used.

PART 1 - GENERAL

1.1 Section Includes

- .1 As-built, samples, and specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Spare parts, special tools and maintenance materials.
- .6 Warranties and bonds.
- .7 Final site survey.

1.2 Related Sections

- .1 Section 01300 - Submittals.
- .2 Section 01400 - Quality Control.
- .3 Section 01770 - Closeout Procedures.

1.3 Submission

- .1 Prepare instructions and data by personnel experienced in maintenance and operation of described products.
- .2 Copy will be returned after final inspection, with Consultant's comments.

- .3 Revise content of documents as required prior to final submittal.
- .4 Two weeks prior to Substantial Performance of the Work, submit to the Consultant, four final copies of operating and maintenance manuals in English.
- .5 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .6 If requested, furnish evidence as to type, source and quality of products provided.
- .7 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .8 Pay costs of transportation.

1.4 Format

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content by systems, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: Manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .9 USB flash drive with each page converted .pdf file format matching order of hard copy submission.

1.5 Contents - Each Volume

- .1 Table of Contents: provide title of project;
 - .1 date of submission; names,
 - .2 addresses, and telephone numbers of Consultant and Contractor with name of responsible parties;
 - .3 schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01450 - Quality Control .
- .6 Training: Co-ordinate with Owner and submit schedule for demonstrations and training.

1.6 As-builts and Samples

- .1 In addition to requirements in General Conditions, maintain at the site for Consultant/Owner one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents

used for construction. Provide files, racks, and secure storage.

- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Consultant

1.7 Recording Actual Site Conditions

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Consultant .
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Changes made by change orders.
 - .6 Details not on original Contract Drawings.
 - .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual

specifications sections.

1.8 Final Survey

- .1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non-conformance with Contract Documents.

1.9 Equipment and Systems

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.

- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01450 - Quality Control and 01810 - Commissioning .
- .15 Additional requirements: As specified in individual specification sections.

1.10 Materials and Finishes

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.11 Spare Parts

- .1 Provide spare parts, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to site location as directed; place and store.

- .4 Receive and catalogue all items. Submit inventory listing to Engineer Consultant . Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.12 Maintenance Materials

- .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
- .2 Provide items of same manufacture and quality as items in Work.
- .3 Deliver to location as directed ; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Consultant.

Include approved listings in Maintenance Manual.
- .5 Obtain receipt for delivered products and submit prior to final payment.

1.13 Special Tools

- .1 Provide special tools, in quantities specified in individual specification section.
- .2 Provide items with tags identifying their associated function and equipment.
- .3 Deliver to location as directed; place and store.
- .4 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

1.14 Storage, Handling and Protection

- .1 Store spare parts, maintenance materials, and special tools in manner

to prevent damage or deterioration.

- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

1.15 Warranties and Bonds

- .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
- .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
- .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of the applicable item of work.
- .4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.
- .5 Verify that documents are in proper form, contain full information, and are notarized.
- .6 Co-execute submittals when required.
- .7 Retain warranties and bonds until time specified for submittal.

PART 2 - PRODUCTS

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Ontario L6H 1Z3

Closeout Submittals

Section 01780
Page 9
April 2021

PART 3 - EXECUTION

PART 1 - GENERAL

1.1 Protection

- .1 Protect existing items designated to remain and materials designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of Consultant and at no cost to Owner.

PART 2 - PRODUCTS Not Used.

PART 3 - EXECUTION

3.1 Preparation

- .1 Inspect site and verify with Consultant items designated for removal and items to remain.
- .2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.
- .3 Notify utility companies before starting demolition.

3.2 Removal

- .1 Remove items as indicated.
- .2 Do not disturb adjacent items designated to remain in place.

3.3 Salvage

- .1 Carefully dismantle items containing materials for salvage and stockpile salvaged materials at locations as indicated or as directed by Consultant.

3.4 Disposal of Material

- .1 Dispose of materials not designated for salvage or re-use in work, off-site.

3.5 Restoration

- .1 Upon completion of work, remove debris, trim surfaces and leave work site clean.
- .2 Reinstate areas and existing works outside areas of demolition to match condition of adjacent, undisturbed areas.

**ASBESTOS ABATEMENT SPECIFICATIONS
MONTCLAIR SENIOR PUBLIC SCHOOL**

ASBESTOS ABATEMENT SPECIFICATIONS
Montclair Senior Public School

TABLE OF CONTENTS

1.0	PART 1 – GENERAL	2
1.1	GENERAL	2
1.2	OUTLINE OF WORK	2
1.3	GENERAL REQUIREMENTS	5
1.4	DEFINITIONS	7
1.5	REGULATORY AGENCIES.....	8
1.6	FIRE SAFETY PLAN.....	9
1.7	SUBMITTALS.....	9
	1.7.1 Submittals Before Commencing Work.....	9
	1.7.2 Submittals Before Commencing Asbestos Removal	11
	1.7.3 Submittals Upon Completion of Work.....	11
1.8	EXISTING CONDITIONS.....	12
1.9	RESTRICTIONS	12
1.10	WORKER PROTECTION	12
1.11	NOTIFICATIONS	13
1.12	PROTECTION, REPAIR AND REPLACEMENT OF EQUIPMENT AND MATERIALS.....	14
1.13	CONFINED SPACES.....	14
2.0	PART 2 – PRODUCTS	15
2.1	MATERIALS	15
2.2	EQUIPMENT.....	15
3.0	PART 3 – EXECUTION.....	18
3.1	MAJOR ASBESTOS WORK (TYPE 3 OPERATIONS).....	18
3.2	GLOVEBAG REMOVAL METHOD	18
3.3	TYPE 2 ENCLOSURE METHOD	20
3.4	TYPE 1 OPERATION	22
3.5	WASTE DISPOSAL.....	22
3.6	AIR MONITORING.....	23

At Rear:

Drawing No. 30065550-1 – Locations of Work Areas – First Floor Plan
Drawing No. 30065550-2 – Locations of Work Areas – Second Floor Plan

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

1.0 PART 1 – GENERAL

1.1 GENERAL

- .1 The requirements as set out in these specifications may, at times, exceed the procedures detailed in the various applicable regulations. All work shall be done in compliance with the specifications AND the regulations. Should there be any discrepancy or conflict between the documents, the most stringent shall apply.

1.2 OUTLINE OF WORK

- .1 The intent of the work is to remove select asbestos-containing materials to the extent practicable, in designated areas in the facility prior to renovations.
- .2 Replacement of removed materials is not part of this contract unless otherwise noted.
- .3 Coordinate all work with the General Contractor and sub trades as required.
- .4 Refer to structural, mechanical, and electrical drawings for additional details.
- .5 All mechanical, electrical, communication and life safety isolations and disconnects to facilitate asbestos removal operations and removal of ductwork to allow access to asbestos-containing building materials, will be performed by the General Contractor's sub trades prior to commencement of remedial work.
- .6 Florescent light tubes in ceiling assemblies being demolished by the asbestos abatement contractor will be removed by the General Contractor's sub trades prior to commencement of remedial work.
- .7 If required, electrical hookups of GFI panels will be performed by the General Contractor's licensed electrician in compliance to all regulatory requirements and codes.
- .8 Each negative pressure unit shall be integrity tested at the work site prior to commencement of asbestos removal operations.
- .9 Provide all supervision, labour, equipment, tools, materials, waste management, haulage and disposal, and other services, as required, for undertaking and completing all the work, as detailed below.
- .10 **Work Area 1 – Room 130**
 - .1 Prepare the areas as indicated above and on the attached floor plans for Type 2 enclosure and glovebag asbestos removal operations.
 - .2 Supply and install scaffolding in accordance with all applicable regulations, to provide sufficient and safe access to the work areas.
 - .3 Remove and dispose as asbestos waste, entire ceiling assembly including, but not limited to, gypsum board and associated asbestos-containing joint compounds and all underlying materials, ceiling support systems, light fixtures and other attachments. Ceiling support systems, light fixtures and other attachments may be disposed as clean demolition waste provided, they are thoroughly cleaned of all dust and debris.

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

- .4 Using glovebags inside the enclosure work area, remove and dispose as asbestos waste, all asbestos-containing thermal insulation applied to pipe fittings. For costing purposes, allow for the removal of thermal insulation from twenty (20) pipe fittings.

.11 **Work Area 2 – Rooms 102, 103, 104A, 115A and 116A**

- .1 Prepare the areas as indicated above and on the attached floor plans for Type 2 enclosure and glovebag asbestos removal operations.
- .2 Supply and install scaffolding in accordance with all applicable regulations, to provide sufficient and safe access to the work areas.
- .3 Using hand tools or power tools that are attached to dust collecting devices equipped with HEPA filters, remove and dispose as asbestos waste, select sections of gypsum board and associated asbestos-containing joint compounds applied to the ceilings to allow access to mechanical systems inside the ceiling cavities. Care must be taken to limit damage to ceiling support systems which will remain. The General Contractor will clearly identify and mark up all areas of gypsum board removal. For costing purposes, allow for the removal of four (4) square feet (2' x 2") of gypsum board in each of the six (6) separate areas in the work locations.
 - .1 Care must be taken to carefully follow the dimensions given by the General Contractor for gypsum board removals as the General Contractor will be installing ceiling access hatches in each location where gypsum board was removed.
- .4 Using glovebags inside the enclosure work areas, remove and dispose as asbestos waste, asbestos-containing thermal insulation applied to select pipe fittings. The General Contractor will clearly identify all pipe fittings where thermal insulation will be removed. For costing purposes, allow for the removal of thermal insulation from a total of twenty (20) pipe fittings.

.12 **Work Area 3 – Room 110**

- .1 Prepare the areas as indicated above and on the attached floor plans for a Type 2 asbestos encapsulation operation.
- .2 Supply and install scaffolding in accordance with all applicable regulations, to provide sufficient and safe access to the work areas.
- .3 Supply and apply canvas and lagging to encapsulate damaged asbestos-containing thermal insulation on one (1) pipe fitting.

.13 **Work Area 4 – Rooms 107M and 212M**

- .1 Prepare the areas as indicated above and on the attached floor plans for Type 2 enclosure and glovebag asbestos removal operations.
- .2 Supply and install scaffolding in accordance with all applicable regulations, to provide sufficient and safe access to the work areas.
- .3 Establish a measurable negative pressure differential in the enclosure work areas by using fan/filter units equipped with High Efficiency Particulate Air (HEPA) filters.

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

Units must be integrity-tested on site and where practicable, are to be exhausted directly outdoors.

- .4 Using glovebags inside the enclosure work areas, remove and dispose as asbestos waste, all asbestos-containing thermal insulation applied to pipe fittings. For costing purposes, allow for the removal of thermal insulation from sixty (60) pipe fittings in Room 107M and seventy (70) pipe fittings in Room 212M.

.14 Work Area 5 – Room 212 and Stair Leading to Room 212M

- .1 Prepare the areas as indicated above and on the attached floor plans for Type 2 enclosure and glovebag asbestos removal operations.
- .2 Supply and install scaffolding in accordance with all applicable regulations, to provide sufficient and safe access to the work areas.
- .3 Remove and dispose as asbestos waste, entire ceiling assembly and gypsum board bulkheads including, but not limited to, gypsum board and associated asbestos-containing joint compounds and all underlying materials, ceiling and bulkhead support systems, light fixtures and other attachments. Ceiling and bulkhead support systems, light fixtures and other attachments may be disposed as clean demolition waste provided, they are thoroughly cleaned of all dust and debris.
- .4 Using glovebags inside the enclosure work area, remove and dispose as asbestos waste, all asbestos-containing thermal insulation applied to pipe fittings. For costing purposes, allow for the removal of thermal insulation from twenty (20) pipe fittings.

.15 Work Area 6 – Locations To Be Determined

- .1 Prepare locations pre-determined by the General Contractor for Type 2 asbestos removal operations.
- .2 Supply and install scaffolding, in accordance with all applicable regulations, in order to provide sufficient and safe access to the work areas.
- .3 During the rebuild phase, remove and dispose as asbestos, select sections of gypsum board and associated asbestos-containing joint compounds to allow for installation of electrical and mechanical systems. The General Contractor will clearly identify all areas of gypsum board removals. For costing purposes, allow for the removal of a total of six (6) square metres of gypsum board.
- .4 During the rebuild phase, assist General Contractor's sub trades in attaching items to gypsum board applications with asbestos-containing joint compounds.
 - .1 Using power tools attached to dust collecting devices equipped with HEPA filters, mechanically fasten items supplied by the General Contractor to gypsum board applications with asbestos-containing joint compound. The General Contractor will supply mechanical fasteners and items to be fastened and will clearly identify locations where attachments are required.
- .5 For costing purposes, allow for two workers over a 10-hour shift (including travel time) per mobilization. Allow for two (2) separate mobilizations.

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

- .16 **Work Area 7 – To Be Determined**
- .1 Prepare locations pre-determined by the General Contractor for Type 2/glovebag asbestos removal operations.
 - .2 Supply and install scaffolding, in accordance with all applicable regulations, in order to provide sufficient and safe access to the work areas.
 - .3 Remove and dispose, as asbestos waste, accessible asbestos-containing thermal insulation from pipe fittings to allow for modifications to mechanical systems and mechanical tie-ins. The General Contractor will clearly mark all locations for thermal insulation removals. For costing purposes, allow for twelve glovebag removal operations of less than one square metre of asbestos thermal insulation per glovebag location per mobilization. For costing purposes allow for two workers over a 10-hour shift (including travel time) per mobilization. Allow for one (1) separate mobilization.
- .17 Joint compounds on gypsum board applications contain 0.5% chrysotile asbestos. Thermal insulation on pipe fittings contains 37% to 70% chrysotile asbestos.
- .18 All waste is to be removed from the site and disposed. Asbestos waste disposal bins are not to be left on School property unless fully enclosed with an integral metal roof system and locked. Disposal bins must be removed immediately on completion of work.
- .19 **Schedule**
- .1 Mobilization To be Coordinated with the General Contractor
 - .2 Complete Work and Demobilize To be Coordinated with the General Contractor

1.3 GENERAL REQUIREMENTS

- .1 The location and availability of utilities including water, sewer and electrical power is to be determined on site. The Asbestos Contractor shall co-operate with all others on site. Should there be any disagreement, or should Contractors be unable to reach a satisfactory working arrangement, the Asbestos Consultant shall determine the manner for proceeding. The Asbestos Contractor shall not be entitled to any additional payment.
- .2. The Asbestos Contractor is responsible for making all arrangements, and for paying for the disposal of all waste materials in accordance to all applicable government laws and regulations including local, provincial and federal.
- .3 The Asbestos Contractor is advised that extended hours of work may be required to meet the schedules as detailed in the Scope of Work and shall allow for the cost thereof including shift premiums and overtime. The Asbestos Consultant shall be advised in writing at least four days in advance of the proposed working hours.
- .4 The Asbestos Contractor shall furnish and post on site the name and current phone number of an authorized representative(s) who can be contacted on a 24-hour basis in case of an emergency.
- .5 All precautions will be taken to prevent the spread of contaminated material and to protect all parties including Asbestos Contractor's personnel, Owner's employees and the public from

ASBESTOS ABATEMENT SPECIFICATIONS Montclair Senior Public School

asbestos dust exposure during the course of the work. The documents outline the minimum levels of precaution to be taken.

- .6 **All work shall be done in compliance with the specifications and the Ontario Regulation 278/05 – Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations – made under the Occupational Health and Safety Act.** Should there be any discrepancy or conflict between the documents, the most stringent shall apply.
- .7 Contract conditions include, but are not limited to, complying with all Regulations, taking all precautions necessary to control the release of asbestos fibres within the work areas, preventing the release of asbestos fibres outside the work areas, and providing appropriate protection from exposure to asbestos fibres for all parties. Failure to meet any of these conditions will be considered a fundamental breach of the Contract.
- .8 The Asbestos Consultant will visit the site at his/her discretion to familiarize himself/herself with the progress and quality of the Work and to determine if the Work is proceeding in accordance with the Contract Documents.
- .9 The Asbestos Consultant shall have the authority to immediately stop the Work through a written instruction if, in his opinion, the Work does not conform to the requirements of the Contract Documents, or if continuance of the Work could subject the Owner, his employees or the public to a hazardous condition. The Work shall not recommence until such time as the deficiency or hazardous situation has been corrected and a written notice to proceed has been issued by the Asbestos Consultant.
- .10 If the Asbestos Contractor fails to comply with requirements dealing with the control of asbestos fibres and the health and safety of Asbestos Contractor employees, Asbestos Consultant and Owner personnel or the Public, the Owner, or the Owner's representative, may verbally instruct the Asbestos Contractor to cease work immediately with written confirmation to follow within two working days. If the Asbestos Consultant gives a written statement to the Owner and the Asbestos Contractor that sufficient cause exists, the Owner may notify the Asbestos Contractor in writing that he is in default of his contractual obligations.
- .11 Any employee shall be replaced, at the written request of the Asbestos Consultant, if working, or causing others to work, in violation of O.Reg. 278/05.
- .12 The Asbestos Contractor's insurance coverage limits, per occurrence, shall equal or exceed the following and shall name the Owner and Arcadis Canada Inc. as additional insureds:
 - .1 General Liability \$5 million;
 - .2 Automotive Liability \$2 million;
 - .3 Pollution Liability \$5 million including asbestos operations.
- .13 The supervisor must have proven experience and proficiency in the type of Work being undertaken under this Contract.
- .14 The supervisor shall be replaced, at the written request of the Asbestos Consultant, if found to be incompetent or inattentive to the needs of the project.
- .15 Where standards of performance are specified or implied and the Work does not comply with the performance specified or implied, such deficiencies shall be corrected as directed by the

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

Asbestos Consultant. Any subsequent testing shall be done at the Asbestos Contractor's expense.

1.4 DEFINITIONS

.1 *HEPA Vacuum:*

- .1 High Efficiency Particulate Aerosol (HEPA) filtered vacuum equipment acceptable to Health and Welfare Canada and meeting U.S. Military Standard 282. This vacuum equipment shall have a filtering system capable of collecting and retaining asbestos fibres to an efficiency of 99.97% for fibres of 0.3 micrometer or larger.

.2 *Polyethylene sheeting sealed with tape:*

- .1 Polyethylene sheeting of thickness specified sealed with tape along all edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide a continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through the sheeting into a clean area.

.3 *Inspector:*

- .1 Representative of Arcadis Canada Inc. (Arcadis) designated by the owner to provide inspection and air monitoring of the Contractor's work.

.4 *Authorized Visitor:*

- .1 Representative of the building owner, Arcadis, and/or persons representing regulatory agencies.

.5 *Amended Water:*

- .1 Water with a non-ionic surfactant added to reduce water tension to allow thorough wetting of asbestos fibres.

.6 *Airlock:*

- .1 A system for permitting ingress or egress without permitting air movement between a contaminated area and an uncontaminated area typically consisting of two curtained doorways at least 1.5 m apart.

.7 *Curtained Doorways:*

- .1 An arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed by placing two overlapping sheets of polyethylene over an existing or temporarily framed doorway, securing each along the top of the doorway, securing the vertical edge of one sheet along one vertical side of the doorway and securing the vertical edge of the other sheet along the opposite vertical side of the doorway.
- .2 All free edges of polyethylene shall be reinforced with duct tape and the bottom edge shall be weighted to ensure proper closing. Each polyethylene sheet shall overlap openings an additional 1/3 of the doorway width.

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

- .8 *Operating Area:*
 - .1 Area where no removal or repair Work is underway.
- .9 *Clean Area:*
 - .1 Either an operating area or an area in which removal Work has already been completed.
- .10 *Work Area:*
 - .1 Where the actual removal of asbestos-containing materials take place.
- .11 *Negative Pressure:*
 - .1 A system which extracts air from the work area and discharges this air directly outside the building, sufficient to maintain a minimum pressure differential of 0.5 mm (0.02 inch) of water column relative to adjacent areas outside of work areas. This air extraction system is to be equipped with a High Efficiency Particulate Aerosol filtering system before discharge.
- .12 *Confined Space:*
 - .1 A fully or partially enclosed space,
 - .1 that is not both designed and constructed for continuous human occupancy, and
 - .2 in which atmospheric hazards may occur because of its construction, location or contents or because of work that is done in it.

1.5 REGULATORY AGENCIES

- .1 Comply with Federal, Provincial, and local requirements pertaining to asbestos, provided that in any case of conflict among those requirements or with these Specifications the more stringent requirement shall apply. These include, but are not limited to, the following:
 - .1 Ontario Ministry of Labour, Occupational Health and Safety Division, *Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations*, O.Reg. 278/05 – made under the *Occupational Health and Safety Act*.
 - .2 Ontario Ministry of the Environment *Regulation 347* (previously 309) under the Environmental Protection Act (as amended by O.Reg. 175/83; O.Reg. 574/84; O.Reg. 322/85), June 17, 1985.
 - .3 Government of Canada *Regulations Respecting the Handling, Offering for Transport and Transporting of Dangerous Goods*. (Extract from the Canada Gazette Part II, dated February 6, 1985.)
 - .4 Government of Ontario *Occupational Health and Safety Act, 1978 and Regulations for Construction Projects*.
 - .5 Office of the Fire Commissioner of Canada.

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

- .6 Ontario Electrical Safety Code.
- .7 Regulation 647 RRO '70 of the Plumbing Code.
- .2 *Patents:*
 - .1 It shall be the Contractor's responsibility to ensure that all applicable patent laws are complied with.

1.6 FIRE SAFETY PLAN

- .1 Prior to initiating any work on the site, the Contractor shall prepare and submit in writing to the Engineer a Fire Safety Plan. The Plan shall be in accordance to the requirements set forth in Section 2.14, Construction and Demolition Sites, of the National Fire Code and shall include:
 - .1 the designation and organization of site personnel to carry out fire safety duties, including fire water services if applicable;
 - .2 the emergency procedures to be used in the case of fire, including:
 - .1 sounding the fire alarm;
 - .2 notifying the fire department;
 - .3 instructing site personnel on procedures to be followed when the alarm sounds; and
 - .4 fire fighting procedures;
 - .3 the control of fire hazards in and around the building;
 - .4 maintenance of fire fighting facilities; and
 - .5 special requirements as may be identified by the building owner.
- .2 Implementation of the Fire Safety Plan shall be the sole responsibility of the Contractor, and the above shall, in no way, limit the Contractor's statutory and regulatory obligations. During the work, the Fire Safety Plan shall be prominently displayed at the site and its requirements included in site safety training and awareness programs.

1.7 SUBMITTALS

1.7.1 Submittals Before Commencing Work

- .1 The following documentation shall be submitted to the Inspector with a dated covering letter listing attachments a minimum 48 hours prior to commencement of the Work:

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

- .1 *Permits and Notifications:*
 - .1 All necessary permits for transporting and disposal of asbestos waste. Submit proof satisfactory to Inspector that suitable arrangements have been made to receive and properly dispose of asbestos waste. Copies of all Notifications required by Section 1.11.

- .2 *Material Safety Data Sheets:*
 - .1 Material Safety Data Sheets, or equivalent, for any sealant, surfactant or other material proposed for use. Include a separate attachment for each sheet indicating the specific worker protective equipment proposed for use with the material indicated.

- .3 *Supervisory Personnel:*
 - .1 Names of supervisory personnel who will be responsible for work area(s). **One of these supervisors must remain on site at all times asbestos removal or cleanup is occurring.** Submit proof that supervisory personnel have over 2000 hours experience on asbestos abatement projects, have performed supervisory functions on at least two other asbestos projects and have achieved the level of training as set out by the Regulation.

- .4 *Schedule:*
 - .1 Provide a bar chart indicating planned progress for critical activities as required under **Scope of Work** as well as additional information listed below a minimum of 48 hours prior to commencement of any preparatory work indicating:
 - .1 shifts to be worked;
 - .2 proposed workforce;
 - .3 starting date;
 - .4 estimated date of commencement of asbestos removal;
 - .5 estimated date of completion of asbestos removal;
 - .6 estimated completion date.

- .5 *Insurance:*
 - .1 Provide a Certificate signed by the insurance agency naming the Owner and Arcadis Canada Inc. as co-insureds.
 2. The Asbestos Contractor's insurance coverage limits, per occurrence, shall equal or exceed the following:
 - .1 General Liability \$5 million;
 - .2 Automotive Liability \$2 million;
 - .3 Pollution Liability \$5 million including asbestos operations.

ASBESTOS ABATEMENT SPECIFICATIONS Montclair Senior Public School

- .3 The Asbestos Contractor must provide thirty (30) days notice of cancellation or amendment of coverage.

- .6 *Fire Safety Plan:*
 - .1 In accordance to Article 1.6 above.

- .7 *Confined Space:*
 - .1 If a work area, or part thereof, is a confined space, the contractor shall submit:
 - .1 a co-ordination document (see Section 1.13.1.1);
 - .2 a written program (see Section 1.13.1.2);
 - .3 a written plan (see Section 1.13.1.4).

- .8 *Asbestos Training:*
 - .1 A letter certifying that:
 - (a) *every worker involved in a Type 3 operation has successfully completed the Asbestos Abatement Worker Training Program approved by the Ministry of Training, Colleges and Universities; and*
 - (b) *every supervisor of a worker involved in a Type 3 operation has successfully completed the Asbestos Abatement Supervisor Training Program approved by the Ministry of Training, Colleges and Universities. O.Reg. 278/05, s. 20(1).*

1.7.2 Submittals Before Commencing Asbestos Removal

- .1 Proposed Work Area emergency exit procedures.
- .2 Evidence (letter or other suitable documentation) of proper construction, inspection and installation of GFI panel by licensed electrician in compliance to all regulatory requirements and codes.

1.7.3 Submittals Upon Completion of Work

- .1 Asbestos waste haulage and disposal documentations including Bills of Lading, waste transfer documents and dump receipts.
- .2 All documentation as specified in the contract General Conditions including, but not limited to, Workplace Safety and Insurance Board Certificate, Statutory Declarations and Proof of Publication of Substantial Performance.

ASBESTOS ABATEMENT SPECIFICATIONS Montclair Senior Public School

1.8 EXISTING CONDITIONS

- .1 Joint compounds on gypsum board applications contain 0.5% chrysotile asbestos. Thermal insulation on pipe fittings contains 37% to 70% chrysotile asbestos.
- .2 Existing conditions are documented in a report prepared by Arcadis Canada Inc. for the Halton District School Board entitled "*Pre-Renovation Designated Substances and Hazardous Materials Survey, Montclair Public School, 1285 Montclair Drive, Oakville, Ontario*" dated May 17, 2021, which is included with the tender documents.
- .3 Masonry applications may contain silica. Paint applications may contain lead and mercury. Appropriate dust control procedures and respiratory protective equipment are to be used if disturbing these materials.

1.9 RESTRICTIONS

- .1 Do not allow smoking, eating or drinking in the work area.
- .2 Do not allow entry to work area by unauthorized persons.
- .3 Compressed air shall not be used in the work area.
- .4 Open flames will not be permitted in the work area (including but not limited to torches and propane-fired heaters).

1.10 WORKER PROTECTION

- .1 *Instructions:*
 - .1 Before commencing Work, instruct workers in all aspects of work procedures and protective measures.
- .2 *Respiratory Protection:*
 - .1 Provide workers with personally issued and marked respiratory equipment acceptable to the Occupational Health and Safety Division of the Ontario Ministry of Labour, suitable for the asbestos exposure in the work area.
 - .2 Ensure that suitable respiratory protective equipment is worn by every worker who enters the work area. A respirator provided by an employer and used by a worker:
 - .1 shall be in accordance to O.Reg. 278/05, Section 13, respirators.
 - .2 shall be fitted so that there is an effective seal between the respirator and the worker's face;
 - .3 shall be assigned to a worker for the worker's exclusive use;
 - .4 shall be used and maintained in accordance with the procedures specified by the equipment manufacturer;
 - .5 shall be cleaned, disinfected and inspected after use on each shift, or more often if necessary;

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

- .6 shall have damaged or deteriorated parts replaced prior to being used by a worker; and
 - .7 when not in use, shall be stored in a convenient, clean and sanitary location.
- .3 *Protective Clothing:*
- .1 Provide workers with protective clothing which shall:
 - .1 be worn by every worker who enters the work area,
 - .2 be made of a material which does not readily retain nor permit penetration of asbestos fibres,
 - .3 consist of full body covering including head covering with snug fitting cuffs at the wrists, ankles and neck,
 - .4 include suitable footwear, and
 - .5 be repaired or replaced if torn.

1.11 NOTIFICATIONS

- .1 Notify, in writing, the local Fire Department of the extent of the work, including a copy of the Fire Safety Plan detailed in Article 1.6 above.
- .2 Notify, orally and in writing, an inspector at the office of the Ministry of Labour nearest the work place of the operation. O.Reg. 278/05, Section 11.
 - .1 The written notice required by subsection (1) shall set out:
 - .1 the name and address of the person giving the notice;
 - .2 the name and address of the owner of the place where the work will be carried out;
 - .3 the municipal address or other description of the place where the work will be carried out sufficient to permit the inspector to locate the place, including the location with respect to the nearest public highway;
 - .4 a description of the work that will be carried out;
 - .5 the starting date and expected duration of the work; and
 - .6 the name and address of the supervisor in charge of the work.
- .3 Notify the Inspector a minimum of eight hours prior to initiation of the following phases of the project:
 - .1 commencement of asbestos removal;
 - .2 commencement of sealant application;

ASBESTOS ABATEMENT SPECIFICATIONS
Montclair Senior Public School

- .3 dismantling of the enclosure; and
- .4 removing asbestos waste from the work area.

1.12 PROTECTION, REPAIR AND REPLACEMENT OF EQUIPMENT AND MATERIALS

- .1 All equipment within and surrounding the work area shall be suitably protected by the Contractor during the work periods.
- .2 All equipment damaged by the Contractor shall be replaced by the Contractor at no additional cost to the Owner.

1.13 CONFINED SPACES

Not Applicable

ASBESTOS ABATEMENT SPECIFICATIONS Montclair Senior Public School

2.0 PART 2 – PRODUCTS

2.1 MATERIALS

.1 *Polyethylene:*

- .1 In 0.15 mm (6 mil) minimum thickness unless otherwise specified; in sheet size to minimize joints.

.2 *Tape:*

- .1 Reinforced duct tape suitable for sealing polyethylene under both wet conditions using amended water, and dry conditions.

.3 *Wetting Agent:*

- .1 50% polyoxethylene ester and 50% polyglycol or polyxyethylene ether, or equivalent approved product, and shall be mixed with water to a concentration to provide adequate penetration and wetting of asbestos-containing material.

.4 *Asbestos Waste Receptors:*

- .1 0.15 mm (6 mil) minimum thickness appropriately labelled, sealable polyethylene bags and 0.15 mm (6 mil) minimum thickness sealable clear polyethylene bags.

.5 *Rip-Proof Polyethylene:*

- .1 0.20 mm (8 mil) fabric made up from 0.13 mm (5 mil) weave and 2 layers 0.04 mm (1.5 mil) poly laminate, in sheet size to minimize joints.

.6 *Sealant:*

- .1 Slow-drying sealant which remains tacky on surface for a minimum of 8 hours for purpose of trapping residual airborne fibre during settling period. Product must have flame spread and smoke development ratings both less than 50. **Product shall leave a clear finish when dry. Acceptable products “Childers Chil-Lock CP-240” or equivalent.**

2.2 EQUIPMENT

- .1 All equipment brought on site must be thoroughly clean and free of all fibre, asbestos or otherwise, to the satisfaction of the Field Inspector. The Contractor will be fully responsible for the replacement of equipment rejected by the Inspector and for all costs resulting from site contamination due to dirty or faulty equipment.

.2 *Airless Sprayer:*

- .1 Spray equipment for the application of amended water and sealant such as Graco Hydrospray or equivalent:

- .1 Fine atomizing spray nozzle: Nozzle for airless sprayer capable of delivering not less than 4.5 L per minute of fine particle spray of amended water.

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

.3 *Garden Sprayer:*

- .1 Hand pump-type pressure-can garden sprayer fabricated out of either metal or plastic equipped with a wand at the end of a hose that can deliver a stream or spray of liquid under pressure. **Only to be used on small removal and repair projects with the approval of the site inspector.**

.4 *HEPA Vacuum:*

- .1 High Efficiency Particulate Aerosol filtered vacuum equipment. Must have a filtering system capable of collecting and retaining asbestos fibres to an efficiency of 99.97% for fibres of 0.3 um or larger. HEPA filters must have been individually tested and certified by the manufacturer.
- .2 All HEPA vacuums brought onto the job site shall be visibly clean, shall be in a good state of repair and shall be maintained in such state through completion of the project.

.5 *Glovebag:*

- .1 Prefabricated, purposely made, 0.20 mm minimum thickness, polyvinyl chloride bag with integral 0.25 mm thick polyvinyl chloride gloves.
- .2 Bag equipped with reversible double-pull, double-throw zipper on top to facilitate installation on pipe and progressive movement along pipe, with straps for sealing ends of bag around pipe, and with plastic flap under zipper for strength on pipe and to provide effective seal and with "ziploc" feature. Bags shall be secured using manufacturer's prescribed securing devices. Approval must be obtained from the Inspector for use of Glovebags. Bag must be acceptable to the Inspector for use.
- .3 Bag must have valves to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.

.6 *Negative Pressure Units:*

- .1 Exhaust units fitted with High Efficiency Particulate Aerosol (HEPA) filters used to effect a negative pressure differential in the work area as compared to the immediate surrounding or clean area. The filtering system must be capable of collecting and retaining asbestos fibres to an efficiency of 99.97% for fibres of 0.3 um or larger. The HEPA filters must have been individually tested and certified by the manufacturer and bear a label certifying performance. The unit is to be fitted with instrumentation to indicate pressure differential across the HEPA filter with an audible alarm to sound at a preset low differential pressure.
- .2 Construction of HEPA filter/fan cabinet units shall be airtight and all joints shall be caulked. The gasket seal between the filter housing and the retaining frame inside the cabinet shall provide a zero-leakage seal to avoid filter bypassing.
- .3 **Each negative pressure unit shall be integrity tested at the work site prior to commencement of asbestos removal.** The procedure must include the testing of the integrity of the entire cabinet. Written confirmation of the test results are to be provided to the Inspector. Retesting may be requested by the Inspector and

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

performed by the Contractor should the unit be damaged or modified during the work.

.7 *Differential Pressure Recorder:*

.1 Instrument to monitor and record the differential pressure between the Work Area and Clean Area.

.1 sensitivity: 0.025 mm (0.001 inches) WC increments between +0.25 mm to -2.5 mm (+0.010 to -0.100 inches) WC

.2 accuracy: +/- 1 %

.3 pressure alarms: audible high and low level alarm programmable within operating range

.4 printout: minimum 24 hr period at 15 minute intervals

.8 *Ground Fault Panel:*

.1 Electrical Panel equipped with ground fault circuit breakers of sufficient capacity to power all electrical equipment and lights in work area. All breakers shall have 5 mA ground fault protection. Panel should be complete with all necessary accessories including ground fault interrupter lights, test switch to ensure unit is working, and reset switch. Ground fault receptacles on extension cords shall not be used without written authorization by the Consultant.

.2 The GFI Panel must be constructed under the direction of a licensed Electrician and inspected by a licensed Electrician on a regular basis. Evidence of such construction and inspection shall be submitted to the Consultant prior to installation of the Panel on site.

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

3.0 PART 3 – EXECUTION

3.1 MAJOR ASBESTOS WORK (TYPE 3 OPERATIONS)

Not Applicable.

3.2 GLOVEBAG REMOVAL METHOD

.1 The Glovebag Removal Method may only be used with the written approval of the on-site inspector and advance notification, orally and in writing, to an inspector at the office of the Ministry of Labour nearest the work place of the operation if more than one square metre or more of insulation is to be removed.

.2 Preparation

.1 Separate the work place from the rest of the building by placing rope barriers at the boundary of the designated work area. The boundaries of the work area shall be a minimum of 3.0 m from the location of the insulation being removed. Identify the work area with clearly visible warning signs. The signs shall read in 35 mm (1 3/8") *sans serif* letters:

**“CAUTION
ASBESTOS REMOVAL WORK IN PROGRESS.
ACCESS RESTRICTED TO PERSONS WEARING
PROTECTIVE CLOTHING AND EQUIPMENT”.**

.2 Disable the mechanical ventilation system serving the work area and seal all openings or voids, including ventilation duct to and from the working area.

.3 Ensure that all sources of heat for pipe systems have been shut off.

.4 Vacuum surfaces of insulating material using a vacuum equipped with a HEPA filter. Ensure that all friable material that is lying on the surface of any article, thing or place in the work area is cleaned up and removed by damp wiping or by using a vacuum equipped with a HEPA filter.

.3 Worker Protection Procedures

.1 Each worker shall remove street clothes and put on a respirator and disposable coveralls before proceeding to the work site.

.2 Before leaving the work area, a worker shall decontaminate the protective clothing, boots, and respirator by using a HEPA vacuum or damp wiping prior to removing it.

.3 Facilities for the washing of hands and face shall be made available and shall be used by every worker before leaving the work area. The outside of the respirator shall also be cleaned at this time.

.4 Following completion of the work, HEPA vacuum or wet wipe any material from the disposable coveralls and boots, remove the used disposable coverall and dispose of as contaminated waste. Clean the outside of the respirator with soap and water, remove the respirator, remove the filters, if applicable, and wet the outside surfaces, wash and rinse the inside of the respirator.

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

- .4 Asbestos Removal (Glovebag Method)
 - .1 Before performing work:
 - .1 Prepare site by placing new 0.15 mm (6 mil) polyethylene plastic drop sheets on all surfaces immediately below and within 3.0 m of the work area.
 - .2 Remove all obstructions from around pipes to allow access for repair work.
 - .3 Inspect all glovebags for defects before using. A defective bag shall not be used.
 - .4 Ensure that any knife to be used inside the glovebag has a retractable blade and that any saw used inside the glovebag is of the flexible wire type; and brush used inside a glovebag shall not have metal bristles.
 - .2 Perform removal operations using the following procedures (in accordance to the manufacturer's instructions):
 - .1 Place any tools necessary to remove insulation in bottom of the containment bag.
 - .2 Install the bag on the pipe or fitting using shoulder straps and zipper provided. **Duct tape is not to be substituted for shoulder straps.** Support bag as necessary to avoid damage to the piping system or the bag itself.
 - .3 Insert nozzle of spray pump prefilled and primed with water and surfactant mixture (amended water) into the bag through the valve provided. Place hands in gloves and relocate the tools to the tool pouch.
 - .4 Cut or remove exterior insulation jacket, where applicable, to expose asbestos pipe covering. Wet exposed pipe covering with sufficient amended water to suppress any dust. Remove insulation and arrange in bottom of bag to obtain maximum capacity for the bag. Wash down exposed portion of pipe and top section of bag ensuring that insulation in lower portion of bag as well as any exposed end of insulation is thoroughly saturated. Use one hand and a cloth or sponge to aid in washing process.
 - .5 Ensure that pipe and other surfaces are clean of visual residue, dirt or dust prior to removal of the containment bag and seal all surfaces with encapsulant. Seal exposed ends of remaining asbestos insulation with encapsulant.
 - .6 If the glovebag is ripped, cut or opened in any way, work that may disturb friable material shall cease immediately. If the rip, cut or opening is small and easy to repair then the glovebag shall be repaired immediately with tape. Work may continue once the repairs are complete. If the rip, cut or opening is not small and cannot be easily repaired, place the glovebag immediately within a suitable asbestos waste container. Any spilled material containing asbestos shall be cleaned up and removed by using a vacuum equipped with a HEPA filter.

ASBESTOS ABATEMENT SPECIFICATIONS Montclair Senior Public School

- .7 To remove bag after completion of stripping, wash top section and tools thoroughly. Put all tools in one hand (glove), pull hand out inverted, twist to create a separate pouch, double tape to seal ends, cut and place in the next glovebag or into a water bucket, open pouch under water and clean and then allow to dry. Tools may also be cleaned and handed out during the dismantling of the bag while taking all precautions to prevent release of asbestos.
- .8 Remove all air inside the glovebag by means of a vacuum equipped with a HEPA filter. Seal lower portion of bag and place bag into appropriate waste container.
- .9 After removal of bag, ensure pipe is clean of all residue. If necessary after removal of each section of asbestos, vacuum all surfaces of pipe, using HEPA Filtered Vacuum equipment.
- .10 Welds and folds of glovebags are to remain intact without modification to manufacturer's design.
- .11 Glovebags, disposal bags, cloth rags and any porous materials are to be handled and disposed as hazardous waste.
- .12 Frequently, and at regular intervals during the work and immediately upon completion of the work, glovebags containing asbestos-contaminated dust and waste shall be placed in a suitable waste container and shall be removed from the workplace.
- .13 Immediately after removal of asbestos, clean all surfaces and equipment within the work area using a HEPA vacuum and damp wiping.
- .14 Remove polyethylene floor covering, fold inward, and place in 6-mil polyethylene waste bags. Seal bags tightly.
- .15 Place sponges, brushes, etc., in double polyethylene bags and seal tightly.
- .16 Make arrangements for disposal of all asbestos-containing waste material.

3.3 TYPE 2 ENCLOSURE METHOD

- .1 Preparation
 - .1 Separate the work area from the rest of the building using rope barriers, signage and other appropriate means. The extent of the work area will depend on the amount of work to be done, potential for fibre release and the height of the work above floor level.
 - .2 Identify the work area with clearly visible warning signs.
 - .3 Construct a frame for the enclosure from 50 mm x 100 mm (2" x 4") studs or other suitable material (scaffolding, for example); if the potential exists for the disturbance of asbestos-containing material during the construction of the enclosure, wear a respirator and suitable protective clothing; ensure that the enclosure is of adequate size to permit the storage of equipment and waste.

ASBESTOS ABATEMENT SPECIFICATIONS Montclair Senior Public School

- .4 If the room where the work is to take place is small, the room itself may serve as an enclosure, provided that all openings are sealed, the mechanical ventilation system servicing the room is disabled and the ventilation ducts to and from the work area are sealed.
- .5 Shut off the source of heat for piping systems (i.e., boiler or steam line header), where possible.
- .6 Cover the walls, floor and ceiling of the enclosure with clear 0.15 mm polyethylene sheeting sealed with duct tape. Curtains of polyethylene sheeting must be fitted on each side of the entrance to the enclosure (curtain flaps may require weights at the bottoms to ensure proper closing).
- .7 Disable the ventilation system servicing the enclosure; seal ventilation ducts to and from the work area.
- .8 Shut off and lock out electrical power within the enclosure.
- .9 When specified, establish a measurable negative pressure differential in the work area enclosure by using fan/filter units equipped with High Efficiency Particulate Air (HEPA) filters. Units are to be integrity tested on site prior to commencement of asbestos removal operations and are to be exhausted directly outdoors where practicable.
- .10 Wear an appropriate respirator approved for use with asbestos and suitable protective equipment. Only persons wearing protective clothing and equipment shall be allowed to enter the work area. If the type of asbestos is other than chrysotile, a powered air purifying respirator shall be used.
- .11 Do not use compressed air.
- .12 Do not eat, drink, smoke or chew in the work area.
- .13 Vacuum surfaces of insulated material in the work area using a HEPA vacuum.
- .2 Asbestos Removal and Cleanup
 - .1 Carefully cut the outer cover of thermal insulation on the section being worked on; thoroughly wet the asbestos-containing material with amended water using a garden sprayer.
 - .2 Remove wetted asbestos material and covering jackets in small sections directly into a waste receptor (polyethylene bag). **MAINTAIN ASBESTOS IN WET CONDITION AT ALL TIMES DURING REMOVAL AND/OR HANDLING. SEAL BAGS TIGHTLY.**
 - .3 For removal gypsum board with asbestos-containing joint compounds: Spray amended water on the gypsum board material to be removed to reduce dust. Remove gypsum board and immediately place into waste receptor. Double bag when removing debris from work area.
 - .4 For floor tile removal: disconnect all floor-mounted electrical fixtures and outlets and seal with duct tape. Seal other floor penetrations as required. Spray amended water

ASBESTOS ABATEMENT SPECIFICATIONS Montclair Senior Public School

on tiles to be removed to reduce dust. Remove tiles and immediately place into waste receptor. Double bag when removing debris from work area.

- .5 Clean surfaces exposed by asbestos removal with a brush and wet sponge. Ensure that all surfaces of piping and other equipment are clean of all residue.
- .6 Immediately after removal of asbestos, clean all surfaces and equipment within the work area, including polyethylene sheeting, using a HEPA vacuum or by damp wiping.
- .7 Seal all surfaces of pipe or other equipment, enclosure, and ends of exposed insulation with a suitable encapsulant.
- .8 After satisfactory completion of cleaning and before leaving the work area, decontaminate protective clothing (including boots) and equipment, etc., using a HEPA vacuum or by damp wiping.
- .9 Dismantle the enclosure and wet and dispose of all polyethylene sheeting, brushes and sponges as asbestos waste.
- .10 Dispose of protective clothing as asbestos waste.
- .11 Wash hands and face at the completion of the work (before leaving the work area); damp wipe the respirator and store in a proper place.
- .12 Make arrangements for disposal of all asbestos-containing waste material.

3.4 TYPE 1 OPERATION

Not Applicable.

3.5 WASTE DISPOSAL

- .1 Asbestos-containing wastes shall be disposed of in accordance with procedures established by the Ontario Ministry of the Environment *Regulation 347 (as amended) under the Environmental Protection Act* and the Government of Canada *Transportation of Dangerous Goods Regulations*.
- .2 Both sides of every vehicle used for the transportation of asbestos and every waste container must display in large easily legible letters that contrast in colour with the background the word "CAUTION" in letters not less than 10 cm in height and the words:

CONTAINS ASBESTOS FIBRES
Avoid Creating Dust and Spillage
Asbestos May Be Harmful to Your Health
Wear Approved Protective Equipment

- .3 Both sides of every waste container must display in large easily legible letters the words '**ASBESTOS, WHITE, PRODUCT IDENTIFICATION NUMBER 2590**' or '**ASBESTOS, BLUE, PRODUCT IDENTIFICATION NUMBER 2212**' in accordance with the type of asbestos being transported.
- .4 Every vehicle used for the transportation of asbestos waste shall display a Class 9 placard on the front, back and two sides of the vehicle.

ASBESTOS ABATEMENT SPECIFICATIONS

Montclair Senior Public School

- .5 The waste must be transported in a fully enclosed truck, or alternatively, in a waste disposal skip. The driver must be familiar with cleanup and handling procedures and be trained to deal with spills or container breakage.
- .6 The truck must be equipped with a shovel and broom, wetting agent, protective clothing, respiratory protective equipment, polyethylene bags of at least 0.15 mm (6 mil) thickness, and bag closures and duct tape.
- .7 All waste must be transported with a **Bill of Lading** directly from the work area to the waste disposal site. The Bill of Lading is to indicate the source and type of asbestos, the Carrier, the amount, the destination (disposal site) and date all in accordance to applicable regulations. A copy of the Bill of Lading and disposal site receipt is to be provided to the Inspector.

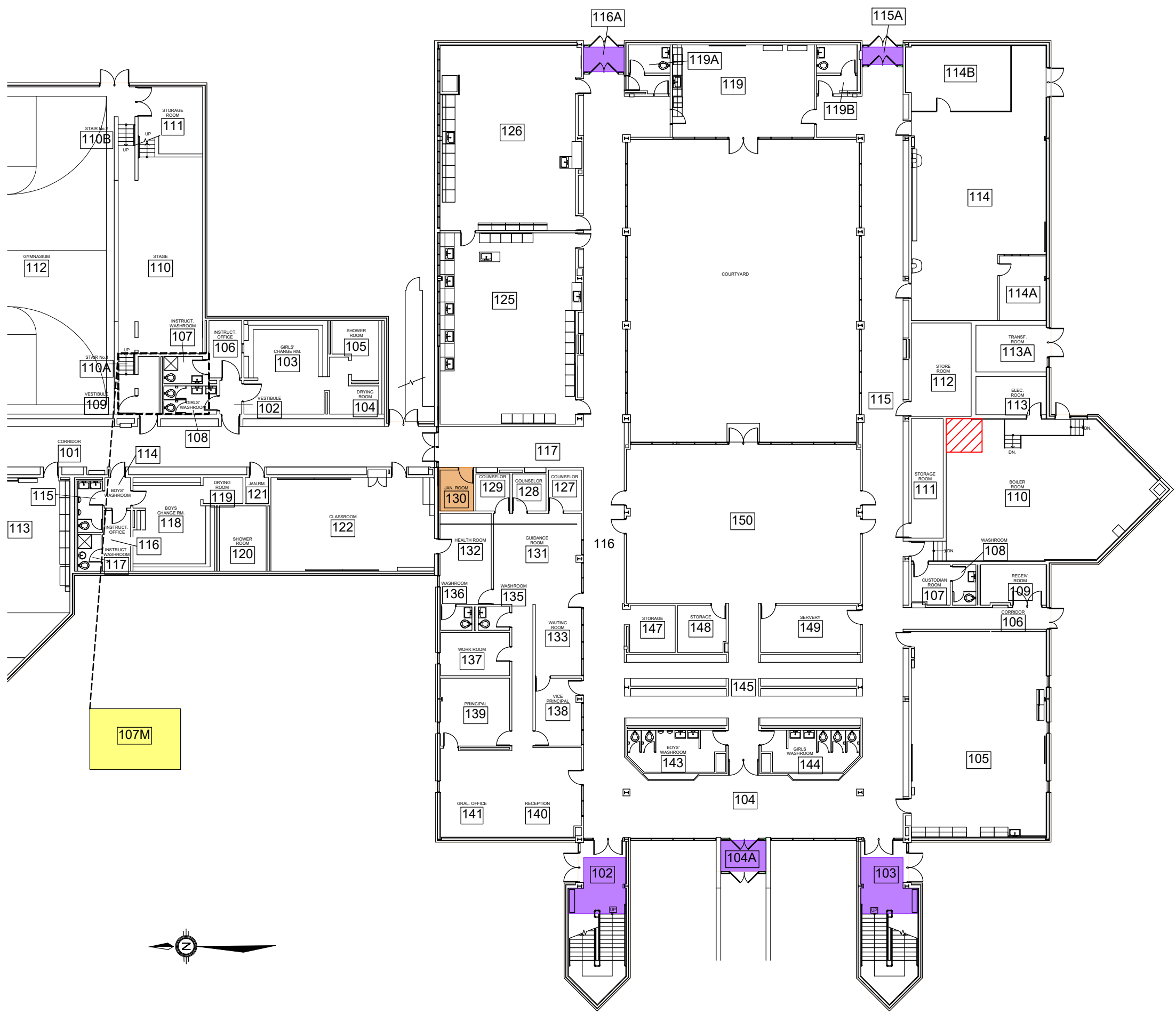
3.6 AIR MONITORING

- .1 Air tests will be taken at the discretion of the Asbestos Consultant using the Phase Contrast Microscopy (PCM) method from the time asbestos-containing materials may be disturbed until the final visual inspection of the work area(s). PCM will be used for final clearance air monitoring analysis.
 - .1 *Outside Asbestos Removal Work Areas:*
 - .1 The maximum allowable fibre concentration outside the Work Areas during asbestos removal or cleanup shall be 0.05 f/cc. Should readings exceed this value, the work shall stop at the discretion of the inspector and proceed only after the cause of the high fibre counts has been remedied.
 - .2 All costs associated with the cleaning, monitoring, and disruption caused by excessive fibre levels outside the Work Area and related to the work, are to be borne by the Asbestos Contractor including but not limited to:
 - .1 thorough cleaning with wet wiping and HEPA vacuuming by the Asbestos Contractor to the extent and satisfaction of the Inspector,
 - .2 all activities deemed necessary by the Inspector including area isolation, personnel relocation, additional visual inspections and air monitoring to confirm that the area has been adequately cleaned,
 - .3 disruption of plant production, office routine, and delays.
 - .2 *Final Clearance Test:*

Not Applicable.

END OF SECTION

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- LEGEND**
- 105 FUNCTIONAL SPACE
 - WORK AREA - 1
 - WORK AREA - 2
 - WORK AREA - 3
 - WORK AREA - 4

REVISIONS:

No.	Date:	By:	Revisions

REFERENCE:

1.



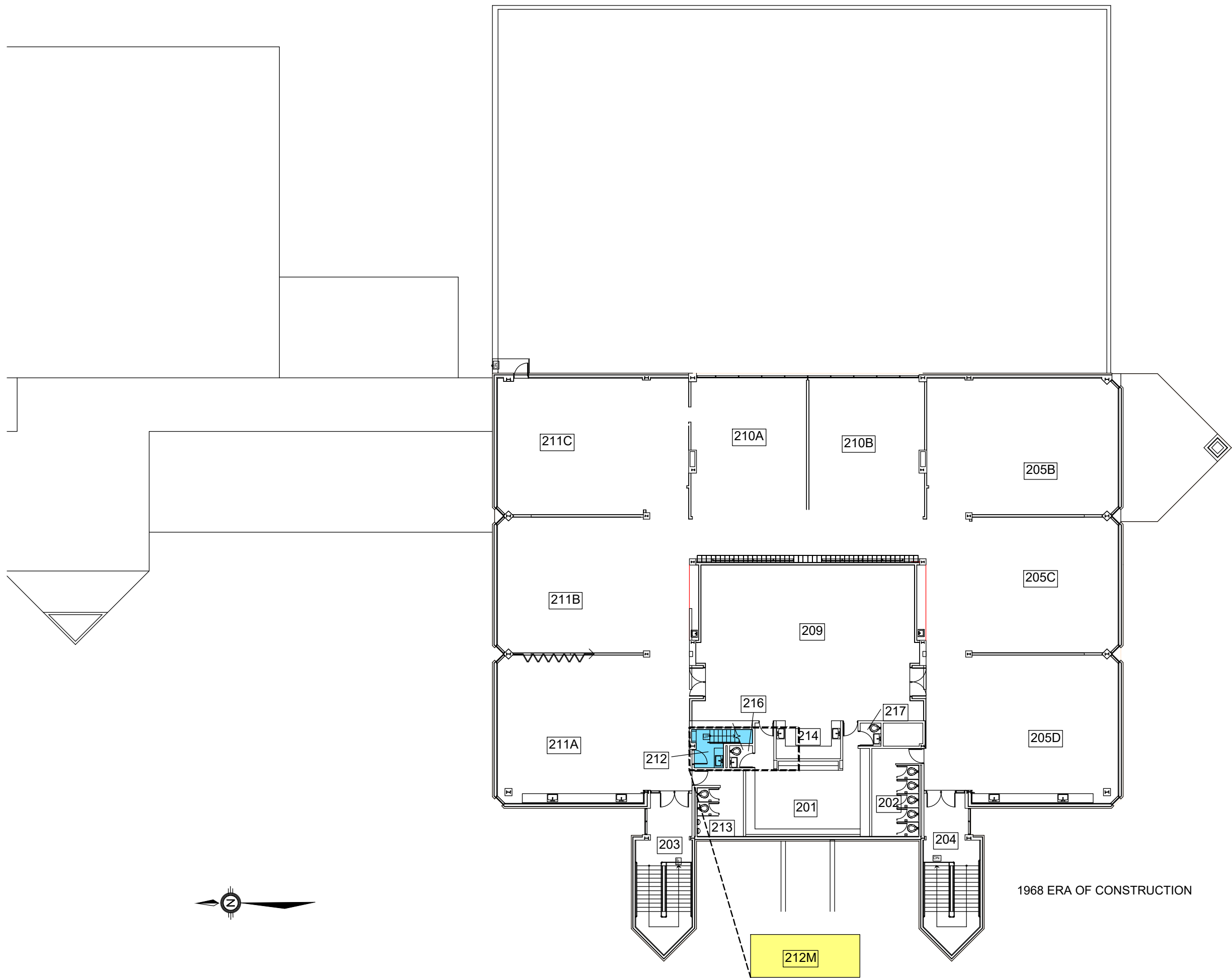
HALTON DISTRICT SCHOOL BOARD
ASBESTOS ABATEMENT SPECIFICATIONS
LOCATIONS OF WORK AREAS

MONTCLAIR SENIOR PUBLIC SCHOOL
 1285 MONTCLAIR DR, OAKVILLE, ON

FIRST FLOOR

Drawn By: M.S	Approved By: JD	Project No: 30065550
Date: JAN. 2022	Scale: N.T.S	Drawing No: 30065550-1

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LEGEND

- 105 FUNCTIONAL SPACE
- WORK AREA - 4
- WORK AREA - 5

REVISIONS:

No.	Date:	By:	Revisions

REFERENCE:

- 1.



HALTON DISTRICT SCHOOL BOARD
**ASBESTOS ABATEMENT SPECIFICATIONS
 LOCATIONS OF WORK AREAS**

MONTCLAIR SENIOR PUBLIC SCHOOL
 1285 MONTCLAIR DR, OAKVILLE, ON

SECOND FLOOR

Drawn By: M.S	Approved By: JD	Project No: 30065550
Date: JAN. 2022	Scale: N.T.S	Drawing No: 30065550-2

1968 ERA OF CONSTRUCTION

PART 1 - GENERAL

1.1 Reference Standards

- .1 Do concrete floor finishing work in accordance with A23.1-94 except where specified otherwise.

PART 2 - PRODUCTS

2.1 Materials

- .1 Concrete materials to Section 03300 - Cast-in-Place Concrete and reinforcement to Section 03200 - Concrete Reinforcement.
- .2 Metallic floor hardener: premixed, metallic hardener.
- .3 Wax: concrete floor buffing compound.
- .4 Use compatible additives, admixtures and hardeners.

PART 3 - EXECUTION

3.1 Floor Finish

- .1 Finish concrete in accordance with A23.1-94 94 Class A.

- .2 Do not sprinkle dry cement or dry cement and sand mixture over concrete surfaces.
- .3 Saw cut crack-control joints to A23.1-94 94.
- .4 Apply floor hardener to manufacturer's instructions. Cure to manufacturers recommendations.
- .5 Apply concrete floor wax in accordance with manufacturer's instructions.
- .6 Cure concrete in accordance with A23.1-94 except where specified otherwise.
- .7 Depress slab maintaining minimum specified thickness as required to accommodate flush floor finishes.

PART 1 - GENERAL

1.1 References

- .1 CSA A179-M76 Mortar and Grout for Unit Masonry.
- .2 A371-94 Masonry Construction for Buildings.

1.2 Source Quality Control

- .1 Submit laboratory test reports in accordance with Section 01300 - Submittals.
- .2 Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with specification requirements.
- .3 For clay units, in addition to requirements set out in referenced CSA and ASTM Standards include data indicating initial rate of absorption for units proposed for use.

1.3 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit samples:
 - .1 Two of each type of masonry unit specified.
 - .2 One of each type of masonry accessory specified.
 - .3 One of each type of masonry reinforcement and tie proposed for use.
 - .4 As required for testing purposes.

1.4 Product Delivery, Storage and Handling

- .1 Deliver materials to job site in dry condition.
- .2 Keep materials dry until use, except where wetting of bricks is specified.
- .3 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.

1.5 Cold Weather Requirements

- .1 Supplement Clause 5.15.2 of A371-94 with following requirements:
 - .1 Maintain temperature of mortar between 5°C and 50°C until used.

1.6 Hot Weather Requirements

- .1 Protect freshly laid masonry from drying too rapidly, by means of waterproof, non-staining coverings.

1.7 Protection

- .1 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.
- .2 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .3 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

PART 2 - PRODUCTS

2.1 Materials

- .1 Masonry materials are specified in other sections.

PART 3 - EXECUTION

3.1 Workmanship

- .1 Do masonry work in accordance with A371-94 except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.2 Tolerances

- .1 Tolerances in notes to Clause 5.3 of A371-94 apply.

3.3 Exposed Masonry

- .1 Remove chipped, cracked, and otherwise damaged units in exposed masonry and replace with undamaged units.

3.4 Jointing

- .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, compressed, uniformly concave joints where concave joints are indicated.
- .2 Allow joints to set just enough to remove excess water, then rake joints uniformly to 6 mm depth and compress with square tool to provide smooth, compressed, raked joints of uniform depth where raked joints are indicated.
- .3 At all exposed horizontal masonry, strike mortar across exposed masonry to drain water and prevent accumulation of snow. Apply clear waterproof sealer.
- .4 Strike flush all joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.

3.5 Cutting

- .1 Cut out neatly for electrical switches, outlet boxes, and other recessed or built-in objects.
- .2 Make cuts straight, clean, and free from uneven edges.

3.6 Building-In

- .1 Build in items required to be built into masonry.
- .2 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.
- .3 Brace door jambs to maintain plumb. Fill spaces between jambs and masonry with mortar.

3.7 Wetting of Bricks

- .1 Except in cold weather, wet clay bricks having an initial rate of absorption exceeding 1 g/minute/1000 mm²: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface

dry.

- .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.

3.8 Parging

- .1 Use parging mortar specified in Section 04100 - Mortar and Grout for Masonry.
- .2 Apply parging in uniform coating not less than 10 mm thick, where indicated.

3.9 Support of Loads

- .1 Use 25 MPa concrete to Section 03300 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.
- .2 Use grout to CSA A179-94(R1999) where grout is used in lieu of solid units.
- .3 Install building paper below voids to be filled with concrete grout; keep paper 25 mm back from faces of units.

3.10 Provision for Movement

- .1 Leave 3 mm space below shelf angles.
- .2 Leave 6 mm space or space as required to accommodate anticipated deflection between top of non-load bearing walls and partitions and structural elements. Do not use wedges. Pack joint with mineral wool batts, and caulk with fire stop material. Provide lateral support at 1200 o.c. as required, unless otherwise specified.
- .3 Build masonry to tie in with stabilizers, with provision for vertical movement.

3.11 Loose Steel Lintels

- .1 Install loose steel lintels. Centre over opening width.

3.12 Control Joints

- .1 Provide continuous control joints at 6.0 m o.c. maximum or as indicated.

3.13 Existing Work

- .1 Make good existing work. Use materials to match existing.

3.14 Recessed Devices

- .1 Recess wall mounted electrical devices in Gymnasium and any other wall mounted equipment which may be prone to damage. Recess concrete block face panel minimum 50mm, size to suit but not smaller than 200mm x 200mm. Provide bullnose blocks at exposed vertical corners. Submit summary of equipment to be recessed and review with Consultant prior to commencement of work.

3.15 Testing

- .1 Inspection and testing will be carried out by Testing Laboratory designated by Consultant.
- .2 Cost of testing will be paid from cash allowance specified in Section 01021 - Allowances.

PART 1 - GENERAL

1.1 Related Work

- .1 Masonry procedures: Section 04050 Masonry Procedures

1.2 References

- .1 CSA A179-94(R1999) Mortar and Grout for Unit Masonry.

1.3 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit two samples of coloured mortar.

PART 2 - PRODUCTS

2.1 Materials

- .1 Mortar and grout: CSA A179-94(R1999).
- .2 Lime Mortars:
 - .1 Portland cement type 10, in accordance with CAN/CSA-A5-93.
 - .2 Hydrated lime type 'S', in accordance with C207-91 (1992).
 - .3 Colouring pigments: pigments constituted of ground coloured natural aggregates or mettalic oxide pigments, colour as selected by

consultant from manufacturer's available range. The ratio of colouring agent/density of cementitious material shall not exceed 10%.

- .4 Do not use admixtures.
- .3 Water: potable, clean exempt from ice, oils, acids, alkalis, organic matter, sediments or any other harmful matter.
- .4 Sand: fine grain aggregates, grading in accordance with A179-94.
- .5 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.
- .6 Colour: ground coloured natural aggregates or metallic oxide pigments to Consultants selection from manufacturer's standard range, one colour for each masonry type.
- .7 Provide materials in strict accordance with mortar and masonry manufacturers' specifications.

2.2 Material Source

- .1 Use same brands of materials and source of aggregate for entire project.

2.3 Mortar Types

- .1 Mortar for exterior masonry above grade:
 - .1 Loadbearing: Type S based on Property specifications.
 - .2 Non-loadbearing: Type S based on Property specifications.
 - .3 Parapet walls, chimneys, unprotected walls: Type S based on Proportion specifications.
- .2 Mortar for foundation walls, manholes, sewers, pavements, walks, patios and other exterior masonry at or below grade: Type M based on Property specifications.
- .3 Mortar for interior masonry:
 - .1 Loadbearing: Type S based on Property specifications.
 - .2 Non-loadbearing: Type N based on Property specifications.
- .4 Following applies regardless of mortar types and uses specified above:
 - .1 Mortar for calcium silicate brick and concrete brick: Type O based

on Proportion specifications.

.2 Mortar for grouted reinforced masonry: Type S based on Proportion specifications.

.3 Mortar for pointing: Type O based on Proportion specifications.

.4 Mortar for glass block: 1 part white portland cement, 1 part hydrated lime, 6 parts white sand aggregate by volume.

2.4 Coloured Mortar

.1 Coloured mortar: use colouring admixture not exceeding 10% of cement content by mass, or integrally coloured masonry cement, or portland/lime to produce coloured mortar to match approved sample.

.2 Use coloured mortar for brick, one colour for each brick type..

2.5 Grout

.1 Grout: to CSA A179-94(R1999) Table 3.

2.6 Parging

.1 Parging mortar: Type N to CSA A179-94(R1999).

PART 3 - EXECUTION

3.1 Mixing

.1 Do masonry mortar and grout work in accordance with CSA A179-94(R1999) except where specified otherwise.

.2 Mix grout to semi-fluid consistency.

- .3 Incorporate colour and admixtures into mixes in accordance with manufacturer's instructions.
- .4 Use clean mixer for coloured mortar.
- .5 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 nor more than 2 hours then remix with sufficient water to produce mortar of proper consistency for pointing.

3.2 Parging

- .1 Apply parging in uniform coating not less than 10mm thick, where indicated.

1 - GENERAL PART

1.1 References

- .1 ASTM D 2240-02b Test Method for Rubber Property - Durometer Hardness.
- .2 A371-94 Masonry Construction for Buildings.

1.2 Samples

- .1 Submit samples in accordance with Section 01300.

PART 2 - PRODUCTS

2.1 Materials

- .1 Control joint filler: purpose-made elastomer 90 durometer hardness to ASTM D 2240-02b of size and shape indicated.
- .2 Nailing inserts: 0.6 mm thick purpose-made galvanized steel inserts for setting in mortar joints.
- .3 Masonry flashing:
 - .1 Membrane masonry flashing and through-wall dampproof course: Blue Skin TWF as manufactured by Bakor Inc. or Colphene 3000 as manufactured by Soprema Inc.
 - .2 Lap adhesive: recommended by manufacturer of flashing material.
- .4 Weep hole vents: purpose-made PVC designed to drain cavities to exterior, complete with insect screens and mortar guards.
- .5 Cavity spacers: purpose made to prevent accumulation of mortar droppings from obstructing cavity. Submit samples and technical information for review.

PART 3 - EXECUTION

3.1 Control Joints

- .1 Install continuous control joint fillers in control joints at locations indicated.

3.2 Weep Hole Vents

- .1 Install weep hole vents in vertical joints immediately over flashings, sills and at top of cavities, in exterior wythes of cavity wall and masonry veneer wall construction, at maximum horizontal spacing of 600 mm oc.

3.3 Nailing Inserts

- .1 Install nailing inserts in mortar joints at 400 mm oc each way, for attachment of wall strapping.

3.4 Masonry Flashing

- .1 Install flashings in masonry in accordance with A371-M94 as follows:
 - .1 Install flashings under exterior masonry bearing on foundation walls, slabs, shelf angles, and steel angles over openings. Install flashings under weep hole courses and as indicated.
 - .2 In double wythe walls and veneered walls, carry flashings from front edge of masonry, under outer wythe, then up backing not less than 150 mm, and as follows:
 - .1 For masonry backing embed flashing 25 mm in joint.
 - .2 For concrete backing, insert flashing into reglets.

- .3 For wood frame backing, staple flashing to walls behind sheathing paper.
- .4 For gypsum board backing, bond to wall using manufacturer's recommended adhesive.
- .3 Lap joints 150 mm and seal with adhesive.
- .4 Lap and seal through-wall dampproof course flashings to air and vapour barrier membranes.
- .5 Lap and seal minimum 150 through-wall dampproof course flashings to adjacent roof flashing membranes. Extend with backing film intact surplus dampproof course membrane for this purpose.
- .6 Provide masonry flashing membrane where continuity of trowelled air/vapour barriers may be compromised.

3.5 Cavity Spacers

- .1 Provide in accordance with manufacturer's specifications cavity spacers minimum 150mm at bottom of cavities above throughwall dampproof courses/masonry flashings.

PART 1 - GENERAL

1.1 References

- .1 CAN/CSA-A23.1-00, Concrete Materials and Methods of Concrete Construction.
- .2 A370-94, Connectors for Masonry.
- .3 A371-94, Masonry Construction for Buildings.
- .4 CSA G30.3-M1983 (R1998) (R1998), Cold-Drawn Steel Wire for Concrete Reinforcement.
- .5 CSA G30.12-M1977, Billet-Steel Bars for Concrete Reinforcement.
- .6 CAN3-S304-M84 (R1997) (R1997), Masonry Design for Buildings.
- .7 CSA W186-M1990 (R1998) (R1998), Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.2 Source Quality Control

- .1 Upon request, provide Consultant with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.
- .2 Upon request inform Consultant of proposed source of material to be supplied.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01300.
- .2 Shop drawings consist of bar bending details, lists and placing

drawings.

- .3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

PART 2 - PRODUCTS

2.1 Materials

- .1 Bar reinforcement: to A371-M94 and CSA G30.12.
- .2 Wire reinforcement: to A371-M94 and CSA G30.3-M1983 (R1998) (R1998), truss type.
- .3 Connectors: to A370-M94 and CAN3-S304-M84 (R1997) (R1997).
 - .1 Interior walls: corrosion resistant or non corroding connectors.
 - .2 Exterior walls: Adjustable hot-dipped galvanized DW130 as manufactured by Dur-O-Wall Limited or approved equal as recommended by manufacturer for intended use.
- .4 Corrosion protection: to CAN3-S304-M84 (R1997) (R1997), galvanized.

2.2 Fabrication

- .1 Fabricate reinforcing in accordance with CAN/CSA-A23.1-00 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Ontario.
- .2 Fabricate connectors in accordance with A370-M94.
- .3 Obtain Consultant's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Upon approval of Consultant, weld reinforcement in accordance with CSA W186-M1990 (R1998) (R1998).
- .5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

PART 3 - EXECUTION

3.1 Installation

- .1 Install masonry connectors and reinforcement in accordance with A370-M94, A371-M94 and CAN3-S304-M84 (R1997) (R1997), unless indicated otherwise.
- .2 Prior to placing concrete mortar grout, obtain Consultant's approval of placement of reinforcement and connectors.
- .3 Do additional reinforcement of masonry as indicated.

3.2 Bonding and Tying

- .1 Bond walls of two or more wythes using metal connectors in accordance with NBC, CAN3-S304-M84 (R1997) (R1997), A371-94 and as indicated.
- .2 Tie masonry veneer to backing in accordance with NBC, CAN3-S304-M84 (R1997) (R1997), A371-94 and as indicated.

3.3 Reinforced Lintels and Bond Beams

- .1 Reinforce masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CAN3-S304-M84 (R1997) (R1997).

3.4 Grouting

- .1 Grout masonry in accordance with CAN3-S304-M84 (R1997) (R1997) and as indicated.

3.5 Metal Anchors

- .1 Do metal anchors as indicated.

3.6 Lateral Support and Anchorage

- .1 Do lateral support and anchorage in accordance with CAN3-S304-M84 (R1997) (R1997) and as indicated.

3.7 Control Joints

- .1 Terminate reinforcement 25 mm short of each side of control joints unless otherwise indicated.

3.8 Field Bending

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

3.9 Field Touch-up

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

PART 1 - GENERAL

1.1 References

- .1 A165 Series-94 Series (CAN3-A165.1)-M85 CSA Standards on Concrete Masonry Units.

PART 2 - PRODUCTS

2.1 Materials

- .1 Standard concrete masonry units: to A165 Series-94 Series (CAN3-A165.1).
 - .1 Classification: H/15/A /M.
 - .2 Size: modular.
 - .3 Special shapes: provide bull-nosed units for exposed corners. Provide purpose-made shapes for lintels and bond beams. At window openings, provide solid bull-nose sill blocks laid on side. Provide additional special shapes as indicated. Provide solid blocks at first course above foundation and as indicated on structural drawings.
 - .4 Colour: standard grey.

PART 3 - EXECUTION

3.1 Laying Concrete Masonry Units

- .1 Bond: running bond for interior units.
- .2 Coursing height: 200 mm for one block and one joint.
- .3 Jointing: concave where exposed or where paint or other finish coating is specified.

3.2 Laying Pre-faced Concrete Masonry Units

- .1 Bond: running.
 - .1 Coursing height: 200 mm for one block and one joint.
 - .2 Jointing: provide concave joints.
 - .3 Clean block faces using soft cloths before mortar hardens rake to 10 mm depth. After completion of block laying fill joints with pointing mortar then point to provide concave joints. Repeat cleaning of faces.

3.3 Concrete Masonry Lintels

- .1 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
- .2 End bearing: not less than 200 mm as indicated on drawings.

3.4 Corridor Bullnose Blocks With Ceramic Tile Base

- .1 At exterior concrete block corners with ceramic tile base, at first course provide square block with upper corner ground to single facet at 45 degree chamfer at corner.

3.5 Cleaning

- .1 Allow mortar droppings on unglazed concrete masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

PART 1 - GENERAL

1.1 Related Work

- .1 Installation of Section 03300 anchors: Cast-in-Place Concrete
- .2 Installation of steel Section 04050 angle lintels: Masonry Procedures
- .3 Structural steel: Section 05120 Structural Steel
- .4 Metal joists: Section 05210 Steel Joists
- .5 Finish painting: Section 09900 Painting

1.2 Reference Standards

- .1 ASTM A 53/A 53M-02 53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
- .2 ASTM A 269-02a, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .3 ASTM A 307-02, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.
- .4 CAN/CGSB-1.40-M89, Primer, Structural Steel, Oil Alkyd Type.
- .5 CAN/CGSB-1.108-M89, Bituminous Solvent Type Paint.
- .6 CAN/CGSB-1.181-99, Ready-Mixed, Organic Zinc-Rich Coating.
- .7 CSA G40.21-98, Structural Quality Steels.
- .8 CAN/CSA-G164-M92 (R1998) (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .9 CSA S16.01, Limit States Design of Steel Structures.

.10 CSA W59-1989 (R2001) (R2001), Welded Steel Construction (Metal Arc Welding).

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

PART 2 - PRODUCTS

2.1 Materials

- .1 Steel sections and plates: to CSA G40.21-98, Grade 300W 350W.
- .2 Steel pipe: to ASTM A 53/A 53M-02 53M-02 extra strong, black finish.
- .3 Welding materials: to CSA W59-1989 (R2001) (R2001).
- .4 Welding electrodes: to CSA W48-01 Series.
- .5 Bolts and anchorbolts: to ASTM A 307-02.
- .6 Grout: non-shrink, non-metallic, flowable, 24h, MPa 15, pull-out strength 7.9 MPa.

2.2 Fabrication

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof oval headed screws on items requiring assembly by screws or as indicated.

- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 Finishes

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164-M92 (R1998)(R1998).
- .2 Chromium plating: chrome on steel with plating sequence of 0.009 mm thickness of copper 0.010 mm thickness of nickel and 0.0025 mm thickness of chromium.
- .3 Shop coat primer: to CAN/CGSB-1.40-M89.
- .4 Zinc primer: zinc rich, ready mix to CAN/CGSB-1.181-99.
- .5 Bituminous paint: to CAN/CGSB-1.108-M89.

2.4 Isolation Coating

- .1 Isolate aluminum from following components, by means of bituminous paint:
 - .1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.
 - .2 Concrete, mortar and masonry.
 - .3 Wood.

2.5 Shop Painting

- .1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.
- .2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7°C.

- .3 Clean surfaces to be field welded; do not paint.

2.6 Angle Lintels

- .1 Steel angles: galvanized at exterior locations, prime painted at interior locations, sizes indicated for openings. Provide 150 mm minimum bearing at ends.
- .2 Weld or bolt back-to-back angles to profiles as indicated.
- .3 Finish: shop painted.

2.7 Pipe Balustrades

- .1 Construct balusters and handrails from steel pipe.
- .2 Cap and weld exposed ends of balusters and handrails.
- .3 Terminate at abutting wall with end flange.

2.8 Bar Balustrades

- .1 Construct bar balustrades as follows except as indicated otherwise on drawings:
 - .1 Balusters: 25 x 25 mm bar.
 - .2 Top rail: 2" dia. pipe.
 - .3 Bottom rail: 25 x 10 mm bar.
 - .4 Pickets: 1/2" dia. bar at 100 mm oc.
- .2 Fabricate supports for wood balustrade from 38 x 38 mm steel tubing with both ends capped and welded.
- .3 Weld balustrades to stringers as indicated.

2.9 Guards

- .1 Construct guards in accordance with drawings. Provide plates, anchors, brackets as required. Weld components.

2.10 Access Ladders

- .1 Stringers: 90 x 8mm thick, steel.
- .2 Steel Rungs: 20 mm diameter, welded to stringers at both sides each rung.
- .3 Brackets: sizes and shapes as indicated and as required, weld to stringers at 800 mm c.c., complete with fixing anchors.
- .4 Prime paint for interior.

PART 3 - EXECUTION

3.1 Erection

- .1 Do welding work in accordance with CSA W59-1989 (R2001) (R2001) unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CSA S16.01, or weld.
- .7 Hand items over for casting into concrete or building into masonry to

appropriate trades together with setting templates.

- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

PART 1 - GENERAL

1.1 References

- .1 Canadian Standards Association (CSA)
 - .1 CSA B111-1974 (R1998) (R1998), Wire Nails, Spikes and Staples.
 - .2 CAN/CSA-G164-M92 (R1998) (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA O121-M1978 (R1998) (R1998), Douglas Fir Plywood.
 - .4 CAN/CSA-O141-91 (R1999) (R1999), Softwood Lumber.
 - .5 CSA O151-M1978 (R1998) (R1998), Canadian Softwood Plywood.
 - .6 CAN/CSA-O325.0-92 (R1998) (R1998), Construction Sheathing.
- .2 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber 1991.

1.2 Quality Assurance

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.
- .3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

1.3 Waste Management and Disposal

- .1 Do not burn scrap at the project site.
- .2 Fold up metal banding, flatten, and place in designated area for recycling.

1.4 Source Quality

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.

PART 2 - PRODUCTS

2.1 Lumber Material

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA-O141-91 (R1999) (R1999).
 - .2 NLGA Standard Grading Rules for Canadian Lumber, latest edition.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Glued end-jointed (finger-jointed) lumber is not acceptable.
- .4 Framing and board lumber: in accordance with NBC 1985 Subsection 9.3.2.
- .5 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 Board sizes: "Standard" or better grade.
 - .2 Dimension sizes: "Standard" light framing or better grade.
 - .3 Post and timbers sizes: "Standard" or better grade.

2.2 Panel Standards

- .1 Panel standards: type, grade and thickness as indicated, in accordance with following standards:

- .1 Douglas fir plywood (DFP): to CSA O121-M1978 (R1998) (R1998), standard construction.
- .2 Canadian softwood plywood (CSP): to CSA O151-M1978 (R1998) (R1998), standard construction.
- .3 Poplar plywood (PP): to CAN/CSA-O15-90 (R1999) (R1999), standard construction.
- .4 Interior mat-formed wood particleboard: to CAN3-0188.1.
- .5 Waferboard: to CAN3-0188.2.
- .6 Hardboard: to CAN/CGSB-11.3-M87.
- .7 Insulating fiberboard sheathing: to CAN/CSA-A247-M86 (R1996) (R1996).
- .8 Glass fibre board sheathing: non- structural, rigid, faced, fiberglass, insulating exterior sheathing board.
- .9 Poly-isocyanurate sheathing: to CGSB 51- GP-21M.
- .10 Expanded polystyrene sheathing: to CAN/CGSB-51.20-M87.
- .11 Gypsum sheathing: to CAN/CSA-A82.27-M91.

2.3 Panel Materials End Uses

- .1 Roof sheathing:
 - .1 Plywood, DFP or CSP sheathing grade or PP standard sheathing grade, T&G square edge, 16 mm thick.
- .2 Exterior wall sheathing:
 - .1 Plywood, DFP or CSP sheathing grade or PP standard sheathing grade, square edge, 16 mm thick.

2.4 Sheathing Paper

- .1 Exterior wall sheathing paper: to CAN/CGSB-51.32-M77 laminated type impregnated .

2.5 Dampproof Membrane

- .1 Polyethylene film: to CAN/CGSB-51.33-M89, Type 1, 0.15 mm thick.
- .2 Roll roofing: to CSA A123.2-M1979 (R2001) (R2001), Type S.

2.6 Adhesives

- .1 Subflooring adhesive: to CAN/CGSB-71.26-M88, cartridge loaded.

2.7 Fasteners

- .1 Nails, spikes and staples: to CSA B111-1974 (R1998) (R1998).
- .2 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.
- .4 Galvanizing: to CAN/CSA-G164-M92 (R1998) (R1998), use galvanized fasteners for exterior work, interior highly humid areas, pressure-preservative, fire-retardant treated lumber.
- .5 Joist hangers: minimum 1 mm thick sheet steel, galvanized ZF001 coating designation.
- .6 Nailing discs: flat caps, minimum 25 mm diameter, minimum 0.4 mm thick, sheet metal, fibre, formed to prevent dishing. Bell or cup shapes not acceptable.

2.8 Wood Preservative

- .1 Surface-applied wood preservative: clear, copper naphthenate or 5% pentachlorophenol solution, water repellent preservative. All lumber utilized at roof and exterior applications to be treated with wood preservative.
- .2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.
- .3 Structures built with wood treated with pentachlorophenol and inorganic

arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

PART 3 - EXECUTION

3.1 Construction

- .1 Comply with requirements of the Ontario Building Code NBC 1985 Part 9 supplemented by following paragraphs.

3.2 Erection of Framing Members

- .1 Install members true to line, levels and elevations.
- .2 Construct continuous members from pieces of longest practical length.
- .3 Install spanning members with "crown-edge" up.
- .4 Use caution when working with particle board. Use dust collectors and high quality respirator masks.

3.3 Erection

- .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

3.4 Defacement Marks

- .1 Install lumber and panel materials so that grade-marks and other defacing marks are not visible or are removed by sanding.

3.5 Wall Sheathing

- .1 Install wall sheathing in accordance with manufacturer's printed instructions.

3.6 Furring and Blocking

- .1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- .2 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.
- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.

3.7 Nailing Strips, Grounds and Rough Bucks

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

3.8 Cants, Curbs, Fascia Backing

- .1 Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- .2 Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.

3.9 Sleepers

- .1 Install sleepers as indicated.

3.10 Fasteners

- .1 Countersink bolts where necessary to provide clearance for other work.
- .2 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

3.11 Surface- Applied Wood Preservative

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.
- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Treat all material as follows:
 - .1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.
 - .2 Wood furring for outside surface of exterior masonry concrete walls.
 - .3 Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

3.12 Electrical Equipment Backboard

- .1 Provide backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around perimeter and at maximum 300 mm intermediate spacing.

PART 1 - GENERAL

1.1 Related Work

- .1 Fire stopping and smoke seals within mechanical assemblies (i.e inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Divisions 15 and 16 respectively.

1.2 References

- .1 ULC-S115-M95, Standard Method of Fire Tests of Firestop Systems.

1.3 Samples

- .1 Submit samples in accordance with Section 01300 Submittals.

1.4 Shop Drawings

- .1 Submit shop drawings and product data in accordance with Section 01300 - Submittals.
- .2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.
- .3 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

PART 2 - PRODUCTS

1.5 Materials

- .1 Fire stopping and smoke seal systems: in accordance with ULC-S115-M95.
 - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115-M95 and not to exceed opening sizes for which they are intended.
 - .2 Firestop system rating: to suit rating of penetrated assembly, minimum 1 hr.
- .2 Service penetration assemblies: certified by ULC in accordance with ULC-S115-M95 and listed in ULC Guide No. 40 U19.
- .3 Service penetration firestop components: certified by ULC in accordance with ULC-S115-M95 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC.
- .4 Fire-resistance rating of installed fire stopping assembly not less than the fire-resistance rating of surrounding floor and wall assembly.
- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 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.
- .10 Sealants for vertical joints: non-sagging.

1.6 Acceptable Manufacturers

- .1 Products in accordance with this specification by only the following manufacturers will be accepted.
 - .1 3M

- .2 AD Fire Protection
- .3 Hilti
- .4 Nuco
- .5 Tremco
- .6 Rectorseal

PART 3 - EXECUTION

1.7 Preparation

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

1.8 Installation

- .1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to a neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

1.9 Inspection

- .1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

1.10 Schedule

- .1 Firestop and smoke seal at:
 - .1 Penetrations through fire separations and fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Top of fire separations and fire-resistance rated masonry and gypsum board partitions.
 - .3 Intersection of fire separations and fire-resistance rated masonry and gypsum board partitions.
 - .4 Control and sway joints in fire separations and fire-resistance rated masonry and gypsum board partitions and walls.
 - .5 Penetrations through fire separations and fire-resistance rated floor slabs, ceilings and roofs.
 - .6 Openings and sleeves installed for future use through fire separations.
 - .7 Around mechanical and electrical assemblies penetrating fire separations.
 - .8 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

1.11 Clean Up

- .1 Remove excess materials and debris and clean adjacent surfaces immediately after application.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

PART 1 - GENERAL

1.1 References

- .1 CSA B35.3-62 Tapping and Drive Screws (Slotted and Recessed Head, Thread Forming and Thread Cutting Screws, and Metallic Drive Screws).
- .2 CSA B111-1974 Wire Nails, Spikes and Staples.
- .3 CAN/CGSB-51.32-M77 Sheathing, Membrane, Breather Type.
- .4 CAN/CGSB-93.4-92 Siding, Soffits and Fascia, Steel, Galvanized, Prefinished.

1.2 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit duplicate samples of siding material, of colour and profile specified.

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01300 - Submittals.
- .2 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, soffits, fascia, metal furring, and related work.

PART 2 - PRODUCTS

2.1 Steel Cladding and Components

- .1 Steel Cladding: profile and components to match existing. Submit samples.

vertical application: to CAN/CGSB-93.4-92.

- .1 Finish coating: Class F1S .
- .2 Colour: standard stock colour to owner's selection.
- .3 Gloss: standard.

2.2 Accessories

- .1 Exposed trim: purpose made, inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same material, colour and gloss as cladding, with fastener holes pre-punched.

2.3 Liner

- .1 Minimum 22ga. in accordance with ASTM A653 of A653M with Z275 galvanized finish. Vicwest L800R or L800SR to match existing.

2.4 Girts

- .1 Notched galvanized Z-bar subgirt and U-channel subgirt size to match existing to gauge as recommended by manufacturer to span existing structural supports.

2.5 Insulation

- .1 Semi-rigid mineral wool batt insulation to fill girt depth. Owen-Corning

ThermaFiber or equal.

2.6 Fasteners

- .1 Nails: to CSA B111-1974. Screws to CSA B35.3-62. Purpose made cadmium plated steel.

2.7 Metal Furring

- .1 Notched galvanized Z-bar sub-girt as recommended by cladding manufacturer.
- .2 Galvanize U-channel sub-girt as recommended by cladding manufacturer.

2.8 Caulking

- .1 Sealants: in accordance with Section 07900.

PART 3 - EXECUTION

3.1 Installation

- .1 Install cladding in accordance with CAN/CGSB-93.5-92, and manufacturer's written instructions
- .2 Install liner in accordance with manufacturer's specifications including perimeter caulking at each liner panel to form air/vapour barrier.
- .3 Install air/vapour barrier membrane in strict accordance with manufacturer's instructions.
- .4 Provide girts as recommended by manufacturer in direction to span between supports and orient flutes to match existing direction of cladding profile.

- .5 Provide mineral wool batt insulation to match thickness of existing.
- .6 Install continuous starter strips, inside and outside corners, edgings, soffit, drip, cap, sill and window/door opening flashings as indicated.
- .7 Install outside corners, fillers and closure strips with carefully formed and profiled work.
- .8 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.
- .9 Attach components in manner not restricting thermal movement.
- .10 Caulk junctions with adjoining work with sealant. Do work in accordance with Section 07900 - Sealants.

PART 1 - GENERAL

1.1 Summary

- .1 This Section specifies caulking and sealants not specified in other Sections.
- .2 Refer to other sections for other caulking and sealants.

1.2 References

- .1 CAN/CGSB-19.1-M87, Putty, Linseed Oil Type.
- .2 CAN/CGSB-19.2-M87, Glazing Compound, Nonhardening, Modified Oil Type.
- .3 CGSB 19-GP-5M, Sealing Compound, One Component, Acrylic Base, Solvent Curing.
- .4 CAN/CGSB-19.6-M87, Caulking Compound, Oil Base.
- .5 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
- .6 CGSB 19-GP-14M, Sealing Compound, One Component, Butyl-polyisobutylene Polymer Base, Solvent Curing.
- .7 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
- .8 CAN/CGSB-19.18-M87, Sealing Compound, One Component, Silicone Base, Solvent Curing.
- .9 CAN/CGSB-19.20-M87, Cold-applied Sealing Compound, Aviation Fuel-resistant.
- .10 CAN/CGSB-19.21-M87, Sealing and Bedding Compound Acoustical.
- .11 CAN/CGSB-19.22-M89, Mildew Resistant, Sealing Compound for Tubs and

Tiles.

- .12 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

1.3 Samples

- .1 Submit samples in accordance with Section 01300 - Submittals.
- .2 Submit duplicate samples of each type of material and colour. Colours to be as selected by Consultant from manufacturer's standard and premium colour range.

1.4 Delivery, Storage, and Handling

- .1 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture and water.

1.5 Environmental and Safety Requirements

- .1 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .2 For interior caulking work, ventilate areas as directed by Consultant.

1.6 Compatibility

- .1 Contractor together with manufacturer to recommend materials most appropriate for use intended and to assure compatibility of caulking materials with adjacent materials. Commencement of Work shall be deemed conformance with this Article.
- .2 Examine substrates prior to commencing work and report to Consultant deficiencies which may impede the work of this Section. Commencement of Work shall be deemed acceptance of substrate.

PART 2 - PRODUCTS

2.1 Sealant Materials

- .1 Sealants and caulking compounds must:
 - .1 meet or exceed all applicable governmental and industrial safety and performance standards; and
 - .2 be manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, by laws and regulations including, for facilities located in Canada, the fisheries Act and the Canadian Environmental Protection Act (CEPA).
- .2 Sealant and caulking compounds must not be formulated or manufactured with: aromatic solvents, fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, barium or their compounds, except barium sulfate.
- .3 Sealant and caulking compounds must not contain a total of volatile organic compounds (VOCs) in excess of 5% by weight as calculated from records of the amounts of constituents used to make the product;
- .4 Sealant and caulking compounds must be accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance, and information describing proper disposal methods.
- .5 Caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant shall not be used in air handling units.
- .6 When low toxicity caulks are not possible, confine usage to areas which offgas to the exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off-gas time.
- .7 In the selection of the products and materials of this section preference will be given to those with the following characteristics: Water based, water soluble, water clean-up, non-flammable, Biodegradable, low Volatile Organic Compound (VOC) content, manufactured without compounds which contribute to ozone depletion in the upper atmosphere,

manufactured without compounds which contribute to smog in the lower atmosphere, does not contain methylene chloride, does not contain chlorinated hydrocarbons.

- .8 The manufacturing process must adhere to Lifecycle Assessment Standards as per CSA Z760-94 LCA Standards .
- .9 Sealants acceptable for use on this project except CAN/CGSB-19.1-M87 and CAN/CGSB-19.18-M87 must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.

2.2 Sealant Material Designations

- .1 Sealants for vertical and horizontal non-traffic bearing joints, to Table 1, CGSB 19-GP-23:
 - .1 Normal temperature range, dry conditions, movement range to 25%: CGSB 19-GP-9Ma+Amd- Oct-80, CAN/CGSB-19.13-M87, CAN/CGSB-19.18-M87, Can2-19.24-M80.
 - .2 Normal temperature range, wet conditions, movement range to 25%: CAN/CGSB-19.13-M87, Can2-19.24-M80.
 - .3 Low temperature range, dry conditions, movement range to 25%: CGSB 19-GP-9Ma+Amd- Oct-80, CAN/CGSB-19.13-M87, CAN/CGSB-19.18-M87, Can2-19.24-M80.
 - .4 Low temperature range, wet conditions, movement range to 25%: CAN/CGSB-19.13-M87, Can2-19.24-M80.
- .2 Sealants in interior applications subject to high humidity and dampness to be silicone type with integral fungicide.

2.3 Back-up Materials

- .1 Polyethylene, Urethane, Neoprene or Vinyl Foam
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50%.
- .2 Neoprene or Butyl Rubber
 - .1 Round solid rod, Shore A hardness 70.
- .3 High Density Foam.
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded

polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.

.2 Bond Breaker Tape.

.1 Polyethylene bond breaker tape which will not bond to sealant.

.3 Ensure compatibility with sealants.

2.4 Sealant Selection

- .1 Use sealant as recommended by manufacturer for use intended. Submit sealant schedule to Consultant for review prior to commencement of work.

2.5 Joint Cleaner

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

PART 3 - EXECUTION

3.1 Protection

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

3.2 Preparation of Joint Surfaces

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 Priming

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

3.4 Backup Material

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape.

3.5 Mixing

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

3.6 Application

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's instructions at

all joints between dissimilar materials.

.2 Apply sealant in continuous beads.

.3 Apply sealant using gun with proper size nozzle.

.4 Use sufficient pressure to fill voids and joints solid.

.5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.6 Tool exposed surfaces to give slightly concave shape.

.7 Remove excess compound promptly as work progresses and upon completion.

.2 Curing.

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place.

.3 Cleanup.

.1 Clean adjacent surfaces immediately and leave work neat and clean.

.2 Remove excess and droppings, using recommended cleaners as work progresses.

.3 Remove masking tape after initial set of sealant.

PART 1 - GENERAL

1.1 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 3960-02 93 , Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.

- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.36-M97 97 , General Purpose Interior Varnish.
 - .2 CAN/CGSB-1.38-2000 M91 , Interior Enamel Undercoater.
 - .3 CGSB 1-GP-48M 78 , Primer, Marine, for Steel.
 - .4 CAN/CGSB-1.57-96 96 , Alkyd, Interior, Semigloss, Enamel.
 - .5 CAN/CGSB-1.60-97 97 , Interior Alkyd Gloss Enamel.
 - .6 CAN/CGSB-1.68-M91 M91 , Solvent Type Primer-Sealer for Interior Walls.
 - .7 CAN/CGSB-1.73-97 97 , Exterior and Interior Enamel for Floors.
 - .8 CAN/CGSB-1.100-99 95 , Interior Latex Type, Flat Paint.
 - .9 CAN/CGSB-1.102-M89 M89 , Clear Alkyd Type Sealer.
 - .10 CAN/CGSB-1.118-95 95 , Interior Alkyd, Flat Finish.
 - .11 CAN/CGSB-1.119-2000 95 , Primer-Sealer, Wall, Interior Latex Type.
 - .12 CAN/CGSB-1.121-93 93 , Vinyl Pretreatment Coating for Metals (Vinyl Wash Primer).
 - .13 CAN/CGSB-1.126-M91 M91 , Vinyl Sealer for Wood.
 - .14 CAN/CGSB-1.143-98 M90 , Heat Resistant Aluminum Enamel, Silicone Alkyd.
 - .15 CAN/CGSB-1.145-97 97 , Solvent-Based Pigmented Stain.
 - .16 CAN/CGSB-1.146-99 92 , Cold Curing, Gloss Epoxy Coating.
 - .17 CAN/CGSB-1.150-M91 M91 , Clear Lacquer for Wood Furniture.
 - .18 CAN/CGSB-1.153-2000 M90 , High Build, Gloss, Epoxy Coating.
 - .19 CAN/CGSB-1.165-M89 M89 , Cold Curing Epoxy Primer.
 - .20 CAN/CGSB-1.175-97 97 , Polyurethane Interior Coating, Oil Modified, Clear, Gloss and Satin.
 - .21 CGSB 1-GP-180Ma 96 , Coating, Polyurethane, Two-Package, General Purpose.
 - .22 CAN/CGSB-1.188-96 96 , Emulsion Type Filler Masonry Block.
 - .23 CGSB 1-GP-193Ma 83 , Coating, High-Build Epoxy, Marine.
 - .24 CAN/CGSB-1.195-99 95 , Interior Semigloss Latex Paint.
 - .25 CAN/CGSB-1.198-2001 95 , Cementitious Primer (for Galvanized Surfaces).
 - .26 CAN/CGSB-1.202-96 96 , Interior Low Gloss Alkyd Enamel.
 - .27 CAN/CGSB-1.209-93 93 , Low Sheen Latex Interior Paint.
 - .28 CGSB 85-GP-1M 78 , Painting (New) Exterior Wooden Surfaces.
 - .29 CGSB 85-GP-2M 78 , Painting (Maintenance) of Exterior Painted Wooden Surfaces.
 - .30 CGSB 85-GP-10M 79 , Shop Painting Structural Steel.

- .31 CGSB 85-GP-11M 80 , Painting Steel for Protection Against Continuous Wetting.
 - .32 CGSB 85-GP-13M 80 , Painting Structural Steel for Protection Against Heavy Industrial Atmospheres.
 - .33 CGSB 85-GP-14M 78 , Painting Steel Surfaces Exposed to Normally Dry Weather.
 - .34 CGSB 85-GP-15M 78 , Painting, Maintenance, Exterior Steel Exposed to Normally Dry Weather.
 - .35 CGSB 85-GP-16M 79 , Painting Galvanized Steel.
 - .36 CGSB 85-GP-18M 80 , Painting, Maintenance, Exterior, Steel, for Protection Against Continuous Wetting.
 - .37 CGSB 85-GP-20M 79 , Painting copper and Copper Alloys.
 - .38 CGSB 85-GP-31M 79 , Painting Stucco, Masonry and Brick Surfaces.
 - .39 CGSB 85-GP-32M 79 , Painting Concrete Floors.
 - .40 CGSB 85-GP-33M 79 , Painting Interior Plaster and Wallboard.
 - .41 CAN/CGSB-85.100-93 93 , Painting.
- .3 Canadian Painting Contractors' Association (CPCA).
 - .1 Painting Specifications Manual 1993 .
 - .4 Canadian Standards Association (CSA)
 - .1 CSA Z760-94 94 , Life Cycle Assessment.
 - .5 Environmental Choice Program (ECP)
 - .1 ECP-67- 95 , Recycled Water-Borne Surface Coatings.
 - .2 ECP-76- 98 , Surface Coatings.
 - .6 Environmental Protection Agency (EPA)
 - .1 EPA-SW-846, Test Methods for Evaluating Solid Wastes.
 - .7 International Organization for Standardization (ISO)
 - .1 ISO 14040/14041- 1997 , Environmental Management - Life Cycle Assessment.
 - .8 National Fire Code of Canada 1995 .
 - .9 Steel Structures Painting Council (SSPC).
 - .1 Systems and Specifications Manual 1989
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1.2 Product Data

- .1 Submit product data in accordance with Section 01340.
 - .2 Submit full records of all products used. List each product in relation to finish formula and include the following:
 - .1 Finish formula designation.
 - .2 Product type and use.
 - .3 CGSB number.
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- . 4 Manufacturer's product number.
 - . 5 Colour number s .
 - . 6 Manufacturer's Material Safety Data Sheets (MSDS).
 - . 7 Maximum VOC classification.
 - . 8 Eco-Logo certification.
- . 3 Submit manufacturer's installation and application instructions for each product specified.

1.3 Samples

- . 1 Submit samples in accordance with Section 01340.
- . 2 Submit duplicate 300 x 200 mm sample panels of each paint.
- . 3 Submit full range of available colours where colour availability is restricted.
- . 4 Use 3 mm plate steel for finishes over metal surfaces. Use 12.5 mm birchplywood for finishes over wood surfaces. Use 50 mm concrete block for finishes over concrete or concrete masonry surfaces. Use 12.5 mm gypsum board for finishes over gypsum board and other smooth surfaces.

1.4 Submittals

- . 1 Within a period of 30 days after award of Contract, and before any paint materials are delivered to the job site, submit to the Owner a complete list of all materials proposed to be furnished and installed under this portion of the work including a letter as to the name of the paint manufacturer proposed for the work.
 - . 2 This shall in no way be construed as permitting substitution of materials for those specified or approved for this work by the Consultant.
 - . 3 Accompanying the materials' list, submit to the Consultant two copies of the full range of colours available in each of the proposed products.
 - . 4 After the award of Contract, the Consultant will prepare and issue a Colour Schedule. This Schedule is guidance for the painter in the preparation of samples of colour and finish. The Painter shall not purchase materials on the basis of the Colour Schedule.
 - . 5 Upon receipt of the Colour Schedule, provide materials and prepare samples indicating colours and degree of gloss. The samples shall be submitted on gypsum board, 600 mm square for those areas where the paint is to be applied to a smooth
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finished surface and on Celotex board, 600 mm square where paint is to be applied on finished masonry.

- .6 Meet with the Consultant to consider the samples which will be inspected under the conditions and in the areas to which the colours and finishes are to be applied. Modify the colours as often as may be required for the Consultant's final approval. Upon final approval, the Painter will be authorized to proceed with the purchase of the materials.
- .7 The samples shall be clearly identified and will be maintained clean and in good condition at the site. Upon receipt of such factory pre-mixed paints as purchased by the Painter, he will satisfy himself that the materials in sealed containers matches precisely the samples which have been approved before applying same to the appropriate surfaces.
- .8 Upon commencement of the Work, sample rooms shall be prepared with base and finish coats as specified. This Work shall be executed in the presence of the paint manufacturer's representative to ensure that the materials are applied at the proper coverages. It shall be the responsibility of this trade contractor to advise the paint manufacturer and the Consultant in writing as to time and date which this work will be performed. Sample rooms and finishes when approved shall be a standard for comparison for the remainder of the work. Work subsequently executed which in the Consultant's or paint manufacturer's opinion does not equal the sample finishes, shall be corrected as may be necessary by the painter without additional charge.
- .9 Maintenance Materials: Provide 2% additional matching paint of each type and colour used on project for maintenance purposes. Turn over to General Contractor and obtain receipt.

1.5 Quality Assurance

- .1 Use only qualified painters for the mixing and application of paint on exposed surfaces. In the acceptance or rejection painting work, no allowance will be made for lack of skill on the part of painters.
 - .2 Retain purchase orders, invoices and other documents to prove that all materials utilized in this contract meet requirements of the specifications. Produce documents when requested by Consultant.
 - .3 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.
 - .2 Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.
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. 3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.6 Delivery, Storage and Handling

- . 1 Deliver and store materials in original containers, sealed, with labels intact.
 - . 2 Indicate on containers or wrappings:
 - . 1 Manufacturer's name and address.
 - . 2 Type of paint.
 - . 3 Compliance with applicable standard.
 - . 4 Colour number in accordance with established colour schedule.
 - . 3 Remove damaged, opened and rejected materials from site.
 - . 4 Provide and maintain dry, temperature controlled, secure storage.
 - . 5 Observe manufacturer's recommendations for storage and handling.
 - . 6 Store materials and supplies away from heat generating devices. Use all means necessary to ensure the safe storage and use of paint materials and the prompt and safe disposal of waste. Safeguards to be taken at all times to prevent fire from improperly stored rags, thinners and paints.
 - . 7 Use all means necessary to protect materials before, during and after application to protect the installed work and materials of all other trades.
 - . 8 Store materials and equipment in a well ventilated area with temperature range 7 to 30 °C.
 - . 9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
 - . 10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.
 - . 11 Store only the approved materials at the job site, and store only in a suitable and designated area restricted to the storage of paint materials and related equipment. Provide adequate protection to walls and floors. In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.
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- .12 Provide minimum one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
- .13 Remove only in quantities required for same day use.
- .14 Fire Safety Requirements:
 - .1 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.
 - .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.7 Environmental Requirements

- .1 Ventilation:
 - .1 Provide continuous ventilation during and after application of paint. Run ventilation system 24 hours per day during installation; provide continuous ventilation for 7 days after completion of application of paint.
 - .2 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
 - .3 Substrate and ambient temperature must be within limits prescribed in paint standard and by manufacturer to approval of Consultant.
 - .4 Maintain minimum substrate and ambient air temperature of 5°C for Alkyd and 7°C for latex paints. Maximum relative humidity 85%. Maintain supplemental heating until paint has cured sufficiently.
 - .5 Moisture Content:
 - .1 Check moisture content of substrates to be painted using electronic moisture meter or other approved method. Maximum moisture content shall be:
 - .1 Concrete and Concrete Masonry: Maximum 12% for solvent coatings and as recommended by manufacturer for water based coatings.
 - .2 Gypsum Board and Plaster: Maximum 12%.
 - .3 Wood: Maximum 15%.
 - .6 Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.
 - .7 Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.
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- . 8 Apply paint only when surface to be painted is dry, properly cured and adequately prepared.
- . 9 Painting in occupied facilities to be carried out during silent hours only. Schedule operations to approval of Consultant such that painted surfaces will have dried and cured sufficiently before occupants are affected.
- . 10 Provide minimum 270 lx on surfaces to be painted.

1.8 Scheduling

- . 1 Submit work schedule for various stages of painting to Consultant for approval. Submit schedule minimum of 48 hours in advance of proposed operations.
- . 2 Obtain written authorization from Consultant for any changes in work schedule.
- . 3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.9 Extra Materials

- . 1 Submit maintenance materials.
- . 2 Submit one - four litre can of each type and colour of primer finish coating . Identify colour and paint type in relation to established colour schedule and finish formula.
- . 3 Deliver to Owner and store where directed.

1.10 Waste Management

- . 1 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
 - . 2 Return solvent and oil soaked rags for contaminant recovery and laundering or for proper disposal.
 - . 3 Close and seal tightly all partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
 - . 4 Do not dispose of paints or solvents by pouring on the ground.
Place in designated containers and ensure proper disposal.
 - . 5 Solvent based paints, wood preservatives, stains and finishes which cannot be reused must be treated as hazardous waste and
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disposed of in an appropriate manner in accordance with hazardous waste regulations. Empty paint cans are to be dry prior to disposal or recycling (where available).

- .6 Where paint recycling is available, collect all waste paint by type and provide for delivery to recycling or collection facility.
- .7 Paints, stains, and finishes are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from the Provincial Ministries of Environment and Regional levels of Government.

PART 2 - PRODUCTS

2.1 Materials

- .1 Qualified products: only paint materials listed on the CGSB Qualified Products List are acceptable for use on this project.
 - .2 Top line paints, or approved equal, of each of the individual companies listed below may be used:
 - .1 Benjamin Moore Paints
 - .2 Para Paints
 - .3 Crown Diamond Company
 - .4 Pratt and Lambert Inc.
 - .5 Sherwin-Williams Company of Canada Limited
 - .6 Colour Your World
 - .7 The Glidden Company (Canada)
 - .8 PPG Canada Inc.
 - .3 All products shall be applied to minimum thickness as recommended by the manufacturer and C.G.S.B. Where exact finish coat is not listed, consult supplier's specification sheet.
 - .4 Paint materials for each coating formula to be products of a single manufacturer.
 - .5 Low odour products: Whenever possible, select products exhibiting low odour characteristics. If two products are otherwise equivalent, select the product with the lowest odour.
 - .6 Water-borne surface coatings must:
 - .1 Meet or exceed all applicable governmental and/or industrial safety and performance standards.
 - .2 Manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, by-laws and regulations including, for
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facilities located in Canada, the Fisheries Act and the Canadian Environmental Protection Act (CEPA).

- . 7 Water-borne surface coatings must not be formulated or manufactured with: aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
 - . 8 Water-borne surface coatings and recycled water-borne surface coatings must have a flash point of 61.0 °C or greater.
 - . 9 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - . 1 Matter in the undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - . 2 Total Suspended Solids (TSS) in the undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or
 - a sewage treatment facility lacking secondary treatment.
 - . 10 Water-borne surface coatings and recycled water-borne surface coatings must contain information describing proper disposal methods within their packaging.
 - . 11 Water-borne paints and stains and recycled water-borne surface coatings must not contain VOCs in excess of 250 g/L as determined by ASTM D 3960-02.
 - . 12 Water-borne varnishes must not contain VOCs in excess of 300 g/L.
 - . 13 Recycled water-borne surface coatings must contain 50 % post-consumer material by volume.
 - . 14 Recycled water-borne surface coatings must not contain:
 - . 1 Lead in excess of 600.0 ppm weight/weight total solids.
 - . 2 Mercury in excess of 50.0 ppm weight/weight total product.
 - . 3 Cadmium in excess of 1.0 ppm weight/weight total product.
 - . 4 Hexavalent chromium in excess of 3.0 ppm weight/weight total product.
 - . 5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.
 - . 15 The following must be performed on each batch of consolidated post-consumer material before the surface coating is reformulated and canned. These tests must be performed at a
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laboratory or facility which has been accredited by the Standards Council of Canada.

- .1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
 - .2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
 - .3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.
- .16 The manufacturing process must adhere to Lifecycle Assessment Standards as per ISO 14040/14041 , CSA Z760-94 .

2.2 Colours

- .1 Consultant will provide Colour Schedule after contract award.
- .2 Colour schedule will be based upon the selection of five base colours and three accent colours. No more than eight colours will be selected for the entire project and no more than three colours will be selected in each area.
- .3 Selection of colours will be from manufacturers full range of colours.
- .4 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .5 Perform all colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials allowed only with Consultant's written permission.
- .6 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 Paint Finishes

- .1 Exterior Metal:
 - .1 Galvanized:
 - .1 1 coat Galvanized Metal Primer
 - .2 2 coats acrylic latex enamel
 - .2 Structural Iron and Steel:
 - .1 1 coat Rust Inhibitive Paint
 - .2 2 coats acrylic latex enamel
 - .3 Aluminum:
 - .1 1 coat Rust Inhibitive Paint
 - .2 2 coats acrylic Latex enamel

- .2 Interior Metal:
 - .1 Galvanized:
 - .1 1 coat Galvanized Metal Primer
 - .2 2 coats alkyd enamel
 - .2 Structural Iron and Steel:
 - .1 1 coat Rust Inhibitive Paint
 - .2 2 coats alkyd enamel

 - .3 Wood:
 - .1 Paint:
 - .1 1 coat Latex Enamel Underbody
 - .2 2 coats acrylic latex enamel
 - .2 Natural - Opened Grained Woods
 - .1 1 coat Paste Wood Filler
 - .2 2 coats Urethane Satin Finish
 - .3 Natural - Close Grained Woods
 - .1 3 coats Urethane Satin Finish
 - .4 Stained - Open Grained Woods
 - .1 1 coat Paste Wood Filler Tinted with Stain
 - .2 2 coats Urethane Satin Finish
 - .5 Stained - Close Grained Woods
 - .1 1 coat Interior Stain
 - .2 2 coats Urethane Satin Finish

 - .4 Interior Gypsum Board:
 - .1 Primer:
 - .1 1 coat latex primer
 - .2 Paint:
 - .1 1 coat latex primer
 - .2 2 coats acrylic latex
 - .3 Epoxy:
 - .1 1 coat latex primer
 - .2 2 coats 2-component Waterborne Acrylic Epoxy Enamel

 - .5 Interior Masonry:
 - .1 Primer:
 - .1 1 coat block Filler and primer
 - .2 Paint:
 - .1 1 coat block Filler and primer
 - .2 2 coats alkyd enamel
 - .3 Epoxy:
 - .1 2 coats Block Filler and primer
 - .2 2 coats 2-component Waterborne Acrylic Epoxy Enamel

 - .6 Interior Concrete:
 - .1 Paint (Floors):
 - .1 1 coat concrete floor enamel, thinner as recommended by manufacturer
 - .2 2 coats floor enamel
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2.4 Substitution of Materials

- .1 The Consultant reserves the right to interchange finishes called for in regard to Sealer, Primer, Stain, Paint, etc. without an additional labour cost for application of the item. An extra charge for the difference in material cost would be considered.

PART 3 - EXECUTION

3.1 General

- .1 Perform all painting operations in accordance with CAN/CGSB-85.100-93 except where specified otherwise.
 - .2 Apply all paint materials in accordance with paint manufacturer's written application instructions.
 - .3 Paint or otherwise finish surfaces of building materials, building services and building accessories not otherwise protected or covered, as shown on Room Finish and Door Schedules, Drawings and as specified herein.
 - .4 In addition, and unless otherwise specified, all work which is exposed to view and which is not prefinished shall be finished by this Section.
 - .5 In areas specifically designated as "unfinished", painting is not required except for bare, primed and zinc coated metal surfaces and insulated ductwork and pipes.
 - .6 Where exposed to view paint bare metals, previously primed metals and zinc coated metals unless specified otherwise.
 - .7 Paint behind surface mounted fixtures on walls and ceilings with full coats of paint.
 - .8 Paint walls behind wall mounted heating units with full coats of paint.
 - .9 Paint inside surfaces of light coves white.
 - .10 Finish tops of doors, trim, projections and other work as specified for surrounding work whether above sight lines or not.
 - .11 Paint piping, ducts and conduit in colours matching background wall or ceiling colours, unless otherwise directed by Consultant. Ducts in mechanical rooms require only one finish coat in addition to primer. Other exposed ductwork to receive two finish coats.
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- .12 Unless specifically indicated on Drawings to be painted, all finish carpentry work shall receive transparent finish.
- .13 Paint shall be applied by means of brushes except for wall and ceiling surfaces on which the paint shall be applied by rollers. Spray painting will be permitted for ceilings only and must be done outside normal working hours.
- .14 Paint shall not be applied in rooms or areas where dust, dirt and debris are present. Cleaning is to be carried out by others to the approval of this trade before the work is commenced.
- .15 Regardless of the number of coats specified for any surface, apply sufficient paint to completely cover and hide substrate and to produce solid, uniform appearance.
- .16 Where two or more coats of the same paint are to be applied, undercoats shall be tinted in lighter shades of final coat to differentiate from final coat.
- .17 Following completion of painting in each area, promptly reinstall all items removed for painting, using only workmen skilled in the particular trade.
- .18 Previously Painted Items: When items to receive paint have been previously painted, lightly sand surface and touch up any defective areas with primer. Apply two coats of finish compatible with existing paint. Paint surfaces to be touched up 'break to break'.

3.2 Inspection

- .1 Condition of Surfaces:
 - .1 Check all surfaces with electric moisture meter and do not proceed if reading is higher than 12-15 without written permission of the Consultant.
 - .2 Proceed with work only when surfaces and conditions are satisfactory for production of a first class job.
 - .3 Remove dust, grease, rust and extraneous matter from all surfaces (except that rust occurring on items specified to be primed under other Sections shall be removed and work reprimed under those Sections).
 - .4 Fine sand all surfaces before starting work of this trade, after filler or primer is applied and between finish coats, where required, so as to eliminate all roughness.
Previously painted surfaces to be fine sanded.
 - .5 Painting shall not be undertaken at temperatures under 10 degrees C, or on surfaces where condensation has or will form due to presence of high humidity and lack of proper ventilation, or under dusty conditions.
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3.3 Preparation

- .1 Remove electrical cover plates, light fixtures, surface hardware on doors, door stops, bath accessories and all other surface mounted fittings and fastenings prior to undertaking any painting operations. Store for re-installation after painting is completed.
- .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
- .3 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Consultant.
- .4 Prime all caulked areas before painting.

3.4 Protection

- .1 Provide metal pans or adequate tarpaulin to protect floors in areas assigned for the storage and mixing of paints.
 - .2 Use sufficient drop cloths and protective coverings for the full protection of floors, furnishings and work not being painted.
 - .3 Leave above areas clean and free from evidence of occupancy upon completion of painting.
 - .4 Protect paint materials from fire and freezing.
 - .5 Keep waste rags in metal drums containing water and remove from building at end of each working shift.
 - .6 Protect existing building surfaces not to be painted from paint spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by Consultant.
 - .7 Cover or mask floors, 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.
 - .8 Protect items that are permanently attached such as Fire Labels on doors and frames.
 - .9 Protect factory finished products and equipment.
 - .10 Protect passing pedestrians, building occupants and the general public in and about the building.
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3.5 Existing Conditions

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Engineer all damage, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Investigate moisture content of surfaces to be painted and report findings to Engineer. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Plaster and wallboard: 12%.
 - .2 Masonry/Concrete: 12%.
 - .3 Concrete Block/Brick: 12%.
 - .4 Wood: 15%.

3.6 Cleaning

- .1 Clean all surfaces to be painted as follows:
 - .1 Remove all dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air .
 - .2 Wash surfaces with solution of T.S.P. bleach and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 To prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.
 - .2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
 - .3 Sand existing surfaces with intact, smooth, high gloss coatings to provide adequate adhesion for new finishes.
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3.7 Surface Preparation

- .1 Prepare new wood surfaces to CGSB 85-GP-1M.
- .2 Where possible, prime all surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
- .3 Prepare previously painted wood surfaces to CGSB 85-GP-2M.
 - .1 Apply vinyl sealer to CAN/CGSB-1.126-M91 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
- .4 Prepare stucco, brick, concrete masonry and concrete surfaces to CGSB 85-GP-31M.
- .5 Prepare concrete floors to CGSB 85-GP-32M. Prepare new concrete floor by acid etching. Rinse with clean water and thoroughly dry.
- .6 Prepare plaster and wallboard surfaces to CGSB 85-GP-33M.

3.8 Surface Preparation -Concrete

- .1 Test surfaces for alkalinity with pink litmus paper or other recognized methods.
- .2 Where extreme alkalinity occurs, wash surfaces with 4% solution tetrapotassium pyrophosphate (5 oz. per gallon of water) where latex base paint is to be used, and with zinc sulphate solution (3 lbs. per gallon water) where other paint bases are to be used.
- .3 Etch normal concrete surfaces to receive alkyd paint with muriatic acid solution (1 part commercial 31.45% to 3 parts water).

3.9 Surface Preparation -Gypsum Board

- .1 Gypsum board shall be bone-dry and all patching complete before the first coat of paint is applied. Surfaces shall be inspected, all "hot spots" properly treated and all rough areas sanded smooth.
-

3.10 Surface Preparation - Woodwork

- .1 Sand smooth all woodwork to be finished and clean surfaces free of dust before applying first coat. With painted woodwork, fill nail holes, splits and scratches with non-shrinking filler after first coat is dry. When these blemishes occur on woodwork surface to receive transparent finish, use putty tinted to match local grain condition. Between coats, sand lightly with No. 00 sandpaper and remove dust.

3.11 Surface Preparation -Metal

- .1 Clean new metal surfaces to be painted by: removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with the following:
 - .1 Solvent cleaning: SSPC-SP-1.
 - .2 Hand tool cleaning: SSPC-SP-2.
 - .3 Power tool cleaning: SSPC-SP-3.
 - .4 Commercial blast cleaning: SSPC-SP-6.
 - .5 Brush-off blast cleaning: SSPC-SP-7.
 - .2 Clean existing metal surfaces to be repainted by: removing loose, cracked, brittle or non-adherent paint, rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with following:
 - .1 Scrape edges of old paint back to sound material. Where remaining paint is thick and sound, feather exposed edges.
 - .2 Commercial blast clean rusted and bare metal surfaces where existing paint system has failed.
 - .3 Solvent cleaning: SSPC-SP-1.
 - .4 Hand tool cleaning: SSPC-SP-2.
 - .5 Power tool cleaning: SSPC-SP-3.
 - .6 Commercial blast cleaning: SSPC-SP-6.
 - .7 Brush-off blast cleaning: SSPC-SP-7.
 - .3 Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air , or vacuum cleaning .
 - .4 Touch up shop primer to CGSB 85-GP-10M with primer as specified in applicable section. Touch-up to include cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas.
 - .5 Prepare galvanized steel and zinc coated steel surfaces to CGSB 85-GP-16M.
 - .6 Prepare copper and copper alloys surfaces to CGSB 85-GP-20M.
 - .7 Prepare new steel surfaces exposed normally to dry conditions to CGSB 85-GP-14M.
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- .8 Prepare previously painted steel surfaces exposed normally to dry conditions to CGSB 85-GP-15M.
- .9 Prepare steel surfaces exposed to industrial environments to CGSB 85-GP-13M.
- .10 Prepare steel surfaces exposed to water or high humidity levels to CGSB 85-GP-11M CGSB 85-GP-18M .
- .11 Do not apply paint until prepared surfaces have been accepted by Consultant .

3.12 Mixing Paint

- .1 Mix ingredients in container before and during use and ensure breaking up of lumps, complete dispersion of settled pigment, and uniform composition.
- .2 Thin paint for spraying according to manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Engineer.
- .3 Do not use kerosene or any such organic solvents to thin water-based paints.

3.13 Application

- .1 Method of application to be as approved by Consultant. Apply paint by brushroller air sprayer or airless sprayer . Conform to manufacturer's application instructions unless specified otherwise.
 - .2 Brush application.
 - .1 Work paint into cracks, crevices and corners. Paint surfaces not accessible to brushes by spray, daubers or sheepskins.
 - .2 Brush out runs and sags.
 - .3 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 either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
-

- .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
- .4 Brush out immediately all runs and sags.
- .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.

- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Engineer.

- .5 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

- .7 Sand and dust between each coat to remove visible defects.

- .8 Finish tops of cupboards, cabinets and projecting ledges, both above and below sight lines as specified for surrounding surfaces.

- .9 Finish inside of cupboards and cabinets as specified for outside surfaces.

- .10 Finish closets and alcoves as specified for adjoining rooms.

- .11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.14 Mechanical Electrical Equipment

- .1 In finished areas: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment. Colour and texture to match adjacent surfaces, except as noted otherwise.

 - .2 In boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.

 - .3 In other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.

 - .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

 - .5 Do not paint over nameplates.
-

- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .9 Paint all fire protection piping red .
- .10 Paint all natural gas piping yellow .
- .11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.15 Restoration

- .1 Clean and re-install all hardware items that were removed before undertaken painting operations.
- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

3.16 Adjusting and Cleaning

- .1 During progress of the work, do not allow the accumulation of empty containers or other excess items except in areas specifically set aside for that purpose.
 - .2 Prevent accidental spilling of paint materials and, in event of such spill, immediately remove all spilled material and the waste of other equipment used to clean up the spill. Wash the surfaces to their original undamaged condition, all at no additional cost to the Owner.
-

- .3 Prior to takeover of the project by Owner, inspect work of this Section and touch-up or refinish damaged finishes and finishes unsatisfactory to Consultant.
- .4 Upon completion of this portion of the work, visually inspect all surfaces and removal all paint and traces of paint from surfaces not scheduled to be painted.

PART 1 - GENERAL

1.1. RELATED WORK

1.1.1. Section 23 21 16 - Hydronic piping

1.2. SUBMITTALS

1.2.1. Shop Drawings

1.2.1.1. Submit shop drawings in accordance with section 23 05 00 "Basic Mechanical Requirements".

1.2.2. Operation and Maintenance Data:

1.2.2.1. Instructions and maintenance data in accordance with section 23 05 10 "Basic Mechanical Requirements".

PART 2 - PRODUCTS

2.1. THERMOMETERS AND PRESSURE GAUGES

2.1.1. General

2.1.1.1. Scale Reading Units:

1. Thermometers to read both Fahrenheit and Celsius scale.
2. Pressure gauges to read both psi and kPa.
3. Gauge stems and separable sockets of sufficient length to provide for proper insertion in piping or equipment in which they are installed.

2.1.1.2. Products are identified by model designations from H.O. Trerice Co. and to be used as a guide to establish standard of construction. Comparable products are acceptable from the following manufacturers:

1. H.O. Trerice Company
2. Weiss
3. Winter's Thermogauges Limited

2.1.2. Direct Reading Thermometers

2.1.2.1. Industrial 230 mm scale length, variable angle type, liquid filled, aluminum case

1. H.O. Trerice Company - A400 series
2. Weiss
3. Winters

2.1.2.2. Bi-metal dial type, 125 mm diameter, variable angle, stainless shell type 300 series case and stem with calibration screw.

1. H.O. Trerice Company - B85600 series
2. Weiss
3. Winter's Thermogauges Limited

2.1.3. Remote Reading Thermometers

2.1.3.1. 115 mm diameter, liquid filled or gas activated type, braided bronze armor over copper capillary, stainless steel bulb and cast aluminum case for surface mounting.

1. H.O. Trerice Company - Series No. L80300 (liquid filled)
2. Weiss

3. Winter's Thermogauges Limited

2.1.4. Thermometer Wells

2.1.4.1. Provide wells in pipelines as follows:

1. For copper pipe: brass.
2. For steel pipe: brass or stainless steel.

2.1.5. Conversion Kit

2.1.5.1. Retrofit kit for converting wells of straight liquid filled thermometers to accept bi-metal dial thermometers.

2.1.6. Direct Reading Pressure Measurement

2.1.6.1. Dial type, 100 mm diameter, glycerine liquid filled

1. Case: stainless steel type 304
2. Movement: stainless steel
3. Tube and socket: stainless steel type 304
4. Adjustable pointer
5. 2-way gauge cock
6. Operating temperature range, glycerine: -17°C to 115°C (0°F to 240°F)
7. Operating temperature range, silicone: -34°C to 240°F (-30°F to 240°F)
8. Accuracy: ASME B40.1 Grade 1A $\pm 1\%$ full scale
9. Approved Manufacturers
 1. H.O. Trerice Company - Series 700
 2. Weiss
 3. Winter's

2.1.7. Differential Pressure Measurement at refrigeration machines and where shown

2.1.7.1. Same as for Direct Reading Pressure Measurement, and:

1. Maximum registering pointer
2. Impulse snubber
3. 3 way switching valve

2.2. **STRAINERS AND FILTERS**

2.2.1. "Y" Pattern Strainers

2.2.1.1. NPS 2 and under:

1. "Y" pattern
2. Class 125 (860 kPa) bronze body
3. Screwed ends and screwed cleanout.

2.2.1.2. NPS 2-1/2 and larger:

1. "Y" pattern
2. Class 125 (860 kPa) cast iron body
3. Flanged ends and bolted cleanout cap or grooved ends with coupled cap

4. Blow-off drain connection.

2.2.1.3. Screen material: Perforated stainless steel with 1/16 or 1/8 inch openings or 20 mesh stainless steel unless otherwise noted

2.2.1.4. Manufacturers:

1. Kitz
2. Victaulic series 732 / w732
3. Erwel
4. Spirax Sarco
5. Streamflo
6. Brooks – Hart

2.3. MISCELLANEOUS

2.3.1. Pressure Relief Valves

2.3.1.1. ASME rated, selected of relieving flow at 25% above the working pressure.

2.3.1.2. Body construction and trim: to suit specific service.

2.3.1.3. Manufacturers

1. STM Specialty Sales
2. Watts
3. Fisher
4. Consolidated

2.3.2. Drain Valves

2.3.2.1. NPS ½ brass sediment faucets with hose outlets

2.3.2.2. Manufacturers

1. Emco 10740
2. Cambridge Brass 32W201

PART 3 - EXECUTION

3.1. INSTALLATION – THERMOMETERS AND PRESSURE GAUGES

3.1.1. General

3.1.1.1. Installation height: not greater than 3 m from floor or platform.

3.1.1.2. Installation heights exceeding 3 m from floor or platform: install remote reading thermometers and gauges, with dial mounted at 1500 mm above floor or platform, on steel or aluminum plate.

3.1.2. Thermometers

3.1.2.1. Install thermometers in wells.

3.1.2.2. Install wells with extension necks in piping or equipment that is to be insulated.

3.1.2.3. Provide thermometers at inlet and outlet of:

1. Water heating coils

2. Domestic hot water heater inlet and outlet
3. and as shown

3.1.2.4. Thermometer Ranges

System	Scale Range
Heating Water	10 °to 115°C

3.1.3. Pressure Gauges

3.1.3.1. Selection

1. Normal operating reading: between ½ and 2/3 of full scale or range and expected maximum and minimum readings are within range.

3.1.3.2. Provide pressure gauges at inlet and outlet of:

1. Pressure reducing valves
2. Pumps (pressure differential)
3. and as shown

3.1.3.3. For direct pressure measurement, provide for each gauge:

1. ¼ turn bronze ball valve complete with lever handle
2. Pressure snubber

3.1.3.4. For differential pressure measurement, provide for each gauge:

1. 3-way 3 position (left-off-right) switching valve with lever handle
2. Pressure snubber
3. Impulse dampener
4. Syphons for gauges in steam service
5. Isolation diaphragms where shown for gauges in corrosive service

3.1.4. Test Plugs

3.1.4.1. Provide test plugs for temporary insertion of thermometers and pressure gauges at locations shown on drawings.

3.2. **INSTALLATION – STRAINERS AND FILTERS**

3.2.1. “Y” Strainers

3.2.1.1. Horizontal installation: install with minimum 300 mm clearance between bottom of strainer and any obstruction.

3.2.1.2. Vertical installation: install with basket drain pointing down, and with minimum 300 mm clearance between bottom of strainer and any obstruction.

3.2.1.3. Provide drain valve complete with chain and cap on all strainers.

3.2.1.4. Remove baskets, clean and replace at time of building handover.

3.3. **INSTALLATION – MISCELLANEOUS**

3.3.1. Pressure Relief Valves

3.3.1.1. Install relief valves downstream of pressure reducing valves, and on pressure vessels where shown.

3.3.1.2. Provide discharge elbow drain, and pipe drain with NPS $\frac{3}{4}$ pipe to nearest floor drain.

3.3.2. Drain Valves

3.3.2.1. Provide at:

1. Low points of water piping systems in order to completely drain each system
2. Other locations as shown.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL REQUIREMENTS

1.1.1. This section shall apply to all other sections of contract documents

1.2. SCOPE OF WORK

1.2.1. This section is intended to provide basic identification of the work for the Contractor to determine upfront, the nature of the work involved in this Contract. In no way shall this article be interpreted as being a full representation of the work of this Contract.

1.2.2. It is intended that the Work supplied under these Contract Documents shall be complete and fully operational in every detail for the purpose required. Include materials not herein mentioned, but which may be found necessary to complete or perfect any portion of the work in accordance with the Contract Documents.

1.2.3. All materials supplied for this project shall be new materials of commercial grade.

1.2.4. Specifications and Contract Drawings are complementary and items mentioned or indicated on one, may not necessarily be mentioned or indicated on the others, but shall in all cases be included in the Contract.

1.2.5. The terms "review", "acceptance", "acceptable", "satisfactory", "selected", "directed", "required", "submit", or similar words or phrases which are used in standards or elsewhere in the Contract Documents, it shall be understood, that words "by (to) the Consultant" follow, unless context provides otherwise.

1.2.6. The terms "exposed" or "exposed to view" refers to surfaces that are within the line of vision of persons from any accessible viewpoint, both within and outside the building. Where any part of a surface is exposed to view, all other portions of that surface to be considered as exposed to view.

1.2.7. This work includes but is not limited to removal of obsolete equipment, piping and accessories and provision and replacement of heating and cooling system and associated works as indicated in Contract Documents and as required.

1.2.8. It is the Contractor's sole responsibility to examine all of the Commercial Documents, Specifications and Drawings issued.

1.2.9. The scope of work for this project shall include all necessary demolition work and provision of proposed equipment, systems, accessories, etc. all as specified and as shown on the project drawings.

1.2.10. The scope of work for this project shall be completed in multiple phases as described below:

1.2.10.1. Phases I:

1. Prior to demolition, install shut-off valves on HWS & HWR and CWS & CWR pipes for the existing air handling unit #201 in penthouse, so the unit can be isolated from the existing piping systems during replacement of this unit without the need for shutdown or draining of the entire system.
2. Prior to demolition, provide differential pressure by-pass valves on main piping of HWS & HWR and CWS & CWR respectively in boiler room as shown on drawings.

1.2.10.2. Phase II: Replacement of existing HVAC and provision of the proposed HVAC system as required and as generally described below:

1. YEAR 1968 AND 1970 FANS:
 1. Replacement of existing fans with proposed as shown on the drawings and as specified herein.
 2. Modification of existing ductwork and piping to match proposed units.
2. YEAR 1970 GYMNASIUM HVAC:
 1. Replacement of existing indoor ductwork and the fan on the roof with the proposed Air Handling Unit on roof, Air Handling Unit completes with gas-fired heating & chilled water cooling as shown on the drawings and as specified herein.
 2. Modification of existing ductwork and piping to match the proposed units.
 3. Modification of existing roof opening to match proposed units; provide roof curb for the proposed unit.
3. YEAR 1970 ADDITION AHU
 1. Replace the existing horizontal, heating & cooling air-handling unit #301 in mezzanine fan room #201 with a proposed air-handling unit.
 2. Replace the existing return fan #302 associated with the existing horizontal, heating & cooling air handling unit #301 in mezzanine fan room #201 with a proposed fan.
 3. Replace the existing exhaust fan of washroom #303 with the proposed in mezzanine fan room #201;
 4. Modification of existing ductwork and piping to match proposed units.
 5. Modification of existing concrete pads to match proposed units.
4. YEAR 1968 MAIN AHU, ADMINISTRATION AHU
 1. Replace the existing horizontal, heating & cooling air handling unit #201 in penthouse with proposed air handling unit;
 2. Replace return fan #203 associated with the existing horizontal, heating & cooling air handling unit #201 in penthouse with proposed fan;
 3. Replace the existing exhaust fan of washroom #204 with proposed in penthouse;
 4. Replace the existing exhaust wall fan #205 with proposed fan in penthouse;
 5. Replace the existing exhaust fan #206 with proposed fan in penthouse;
 6. Replace the existing exhaust fan #209 with proposed fan in penthouse;
 7. Modification of existing ductwork and piping to match proposed units.
 8. Modification of existing concrete pads to match proposed units.
5. Hydronic heating systems
 1. Completely drain, flush and refill systems to facilitate installation of valves and accessories. Multiple flushes will be required for the strainers.
 2. Replace all existing control valves of radiator with propose 2-way control valves and install all proposed 2-way control valves in ceiling, modify existing piping to suit new 2-way control valves.
6. AIR AUDIT
 1. Prior to demolition of the existing air handling units and fans and ordering of proposed units, perform a detailed air audit on all HVAC air distribution systems and exhaust systems (except for the local ventilation system serving the existing

workshop). Submit air audit reports to the consultant for review and to allow for any required adjustment of design values if necessary.

7. HVAC SYSTEM BALANCING

1. Perform Air and Water balancing as specified.
2. Clean all sections of the existing air ductwork system
3. Clean and purge all sections of the existing hydronic heating piping system and the existing chilled water piping systems prior to performing water balancing.

1.2.10.3. BUILDING AUTOMATION SYSTEM (BAS):

1. Demolish all existing BAS components including and not limited to panels, wiring, conduits, pneumatic tubing, air compressors, field devices, etc.
2. Provide a complete BAS system including and not limited to panels, wiring, conduits, field devices, programming, graphics, etc. for the existing HVAC equipment as well as for the proposed HVAC systems including air handling units, heating equipment, chiller, air conditioning units, ERV units, etc.
3. Provide proposed BAS controls to existing and proposed boilers, chillers, pumps, domestic hot heaters.
4. Provide proposed BAS controls to all control valves, VVT, By-pass dampers, By-pass valves.
5. Replace the existing hydraulic control valves for heating, cooling systems, radiators with proposed ;
6. Replace the existing hydraulic control valves for terminal units with proposed ;
7. Integrate the controls and monitoring of the existing Carrier VVT system serving the 2009 school addition into the proposed BAS. The controls functionality of the existing VVT system shall remain unchanged.
8. Provide all necessary electrical power, wiring, and cables to fulfil the requirements of the proposed BAS system.

1.2.11. Start-up, performance testing and balancing of all mechanical and related systems.

1.2.12. All associated electrical power and control wiring.

1.2.13. Cutting, patching and painting of wall/floor as required for installation of recessed/wall mounted heating equipment.

1.2.14. Labelling of all equipment and piping.

1.2.15. Commissioning of mechanical systems as specified,

1.2.16. Refer to BAS standard of Halton District School Board for details of BAS requirements.

1.3. **SCHEDULING OF THE WORK**

1.3.1. Co-ordinate all mechanical work with the work of other trades and with the Owner. Scheduling of all work shall be coordinated with the facilities group and all construction work shall be carefully planned around the facility's activities. Allow for after hours and weekends work. Disruption to existing operations and shutdowns if any, shall be eliminated or minimized. Complete all work as required coinciding with the completion date established for the Project.

1.3.2. Provide a detailed hoisting plan for review and approval. Hoisting plan shall be submitted 2 weeks prior to installation of roof mounted equipment.

- 1.3.3. Provide a minimum of 1 week advance notice to the facility's personnel prior to commencing any shut downs.
- 1.3.4. Provide a detailed project schedule and submit not more than two weeks following Contract issuance. Maintain an updated project schedule and resubmit on the last day of each month. The project schedule is to be in the form of a horizontal bar chart.
- 1.4. **CODES, REGULATIONS AND STANDARDS**
- 1.4.1. Comply with Municipal or Provincial Codes, Rules and Regulations and/or authorities having jurisdiction.
- 1.4.2. Revisions issue: latest version as amended to date.
- 1.5. **PERMITS, CERTIFICATES, EQUIPMENT REGISTRATION AND FEES**
- 1.5.1. Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by the City & local utility companies.
- 1.5.2. Upon substantial completion of work, supply and turn over to the Consultant all required inspection certificates from governing authorities to certify that the work as installed conforms to the rules and regulations of the governing authorities.
- 1.5.3. Permits
- 1.5.3.1. Obtain permits required for the installation of mechanical trades work including but not limited to:
1. Mechanical inspection
 2. Piping inspection
 3. Electrical inspection
- 1.5.3.2. Arrange for inspections and tests and pay all fees and costs for the permits, inspections and tests. Obtain permits immediately after notification of award of Contract.
- 1.5.3.3. Obtain copies of Drawings from the Consultant for submission with application for permits.
- 1.5.4. Material approvals
- 1.5.4.1. Obtain special inspection and approvals by CSA and/or local authorities, for materials and equipment where required or as specified.
- 1.5.4.2. Obtain such approval for the particular installation with the co-operation of the material supplier.
- 1.6. **WORKING DRAWINGS AND DOCUMENTS**
- 1.6.1. Design Drawing Intent
- 1.6.1.1. The design Drawings are schematic in arrangement, and describe the general design intent but do not show the exact details for the installation. They are not fabrication or installation Drawings.
- 1.6.1.2. The overall scope of work is suitably outlined on the Drawings with regard to sizes, locations, general arrangements and installation details, and has been generally coordinated for routing of services. The routing of piping and equipment arrangement are shown more or less in diagrammatic form except where in certain cases the Drawings may include details giving the exact locations and arrangements required.
- 1.6.1.3. The location of equipment, and the associated arrangement of piping and other material describes the general requirements of the work. Final location is dependent on the actual equipment supplied.

April 2021

The Consultant reserves the right to make reasonable adjustment of up to 1 m to the location of equipment, floor drains, routing of major piping at no additional cost to the Owner.

- 1.6.1.4. In order to provide clarity to the arrangement of the work, not all details including valves, thermometers, pressure gauges, etc. are shown on the plan Drawings. Refer to schematic Drawings, standard details and the specification for these requirements. In the absence of specific details, the Contractor is expected to follow generally accepted good installation practices.
- 1.6.1.5. Where specific installation dimensions for location of equipment and access space requirements are indicated on the Drawings, install to these requirements.
- 1.6.1.6. Where Standard Details are provided, these show the general installation requirements, and are applicable to each occurrence in the work, unless otherwise specified or shown.
- 1.6.1.7. Do not proceed with work where an obvious ambiguity is noted between tender documents. Notify the Owner and obtain proper direction prior to proceeding with procurement or related construction work on site.
- 1.6.1.8. Where there is a contradiction with two selected products, materials, means, or methods, the Contractor shall issue a Request for Information (RFI) to the Consultant for clarification, in such circumstances, the Consultant shall be able to select the best option without additional expenses to the Owner.
- 1.6.2. Review before proceeding (HOLD)
- 1.6.2.1. Where the word "HOLD" appears on Drawings and other Contract Documents, the work is included in the Contract.
- 1.6.2.2. Execute such work only after verification of dimensions, verification of materials and obtaining Consultant's written permission to proceed.
- 1.6.3. Coordination and Cooperation with other Trades.
- 1.6.3.1. Review design drawings of all other related disciplines including architectural, electrical, structural and site services. Coordinate scope of work between all trades and allow for adequate costs for all related work. Coordinate work with all trades to ensure a proper and complete installation of fully functioning system that can be properly maintained in future.
- 1.6.3.2. Notify all trades concerned of the requirements for openings, sleeves, insets and other hardware necessary for the installation and, where work is to be integrated with the work of other trades or is to be installed in close proximity with the work of the trades, carefully coordinate the work prior to installation.
- 1.7. **EXISTING SITE CONDITIONS**
- 1.7.1. The Contractor and sub trade to accept sole responsibility for any error or neglect on their part in ascertaining the nature of all existing conditions which will affect the Work of this section. No allowances will be made for any difficulties encountered by the Contractor and sub trades due to any features or peculiarities of the site surrounding property, or building, which exist at the time of tender submission.
- 1.7.2. Report any inconsistencies, ambiguities, discrepancies, omissions, and errors between site conditions and the Contract Documents to the Consultant prior to the commencement of the Work. If inconsistencies, ambiguities, discrepancies, omissions, and errors are not reported and clarified, the most stringent requirement shall govern, as determined by the Consultant.
- 1.7.3. Before commencing the Work of any section or trade, carefully examine the Work of other sections

April 2021

and trades upon which it may depend, examine substrate surfaces, and report in writing to the Consultant, defects which might affect proposed work. Commencement of the Work shall constitute acceptance of conditions and the work of other sections, trades, and other subcontractors upon which the proposed work depends. If repair of surfaces is required after commencement of specific work it shall be included in the Work of the trade providing the specific system or finish.

1.8. **USE OF SITE**

- 1.8.1. Accept full responsibility for assigned work areas from the time of the Contract award until Contract Completion.
- 1.8.2. Check means of access and egress, rights and interests which may be interfered with. Do not block lanes, roadways, entrances or exits. Direct construction traffic and locate access to site as directed by authorities having jurisdiction.
- 1.8.3. Obtain and pay for use of additional storage or work areas needed for operations under this Contract.
- 1.8.4. Remove or alter existing work to prevent injury or damage to portions of existing work which remains.
- 1.8.5. Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, to the satisfaction of the Consultant.
- 1.8.6. At completion of operation condition of existing work, equal to or better than that existed before proposed work started. Make good all damage resulting from the Work.

1.9. **COORDINATION AND EXAMINATION**

- 1.9.1. Examination
 - 1.9.1.1. Carefully examine work and Drawings of all related trades and thoroughly plan the work in advance so as to avoid interferences.
 - 1.9.1.2. Report defects which would adversely affect the work. Do not commence installation until such defects have been corrected.
- 1.9.2. Coordination
 - 1.9.2.1. Coordinate all work such that items will properly interface with work of other Divisions. Prepare installation and interference Drawings of all critical locations and submit to the Consultant for review.
 - 1.9.2.2. Architectural Drawings, or in their absence, Mechanical Drawings govern all locations.

1.10. **SUBMITTALS**

- 1.10.1. Shop Drawings
 - 1.10.1.1. Shop drawing shall be submitted electronically.
 - 1.10.1.2. If the bidders wish to propose alternate products (for equipment and material), a written RFI (Request For information) shall be submitted after a purchase order is awarded to successful bidder. Acceptance of alternates will be at the discretion of the Owner and Consultant.
 - 1.10.1.3. Conform to general conditions of contract and the following.
 - 1.10.1.4. Shop Drawings showing more than one size or model will not be considered unless properly marked up.
 - 1.10.1.5. For electrically driven, and fuel fired appliances, provide the following information:

1. Electrical characteristics including voltage, phase, frequency and power rating.
 2. For motors, NEMA, Class and efficiency ratings
 3. Fuel input ratings, including flow rates and pressures
 4. Equipment performance ratings, including flow rates, pressures, efficiencies, part load values and/or efficiencies (IPLV's), plotted flow characteristics (pump and fan curves) with operating points clearly plotted.
- 1.10.1.6. For other equipment include the following information:
1. Equipment performance ratings, including flow rates, pressures drops.
 2. Electrical control power requirements
- 1.10.1.7. For all equipment, include the following:
1. Equipment dimensions and weights.
 2. Itemized product description with optional items clearly marked as being included.
- 1.10.1.8. Provide wiring Shop Drawings:
1. Wiring diagrams and schematics for all equipment which has electrical controls or devices furnished with the equipment.
 2. Wiring diagrams alone are not sufficient; schematic and interconnecting Detailed Drawings and sequence of operation of all equipment are required for review.
 3. Clearly indicate the materials and/or equipment being supplied:
 1. Details of construction, finish, accurate dimensions, capacities and performance.
 2. Certify Drawings correct for construction by the manufacturer, before submission.
 3. Identify Equipment Shop Drawings with designations as shown on the Drawings or in the Specifications.
 4. If not complied with, Shop Drawings will not be reviewed and will be returned to the Contractor.
 4. Coordinate equipment which attaches to and/or where external wiring provided connects to other equipment.
 1. Do such coordination whether such equipment is supplied under this or other contracts or subcontracts, for which relevant information will be provided by Owner/Consultant.
- 1.11. **"AS-BUILT" RECORD DRAWINGS**
- 1.11.1. Reference
- 1.11.1.1. Maintain an accurate dimensional record of all underground piping and all deviations and changes in aboveground piping and equipment.
- 1.11.1.2. On completion of the project, provide a CD containing as-built drawings in AutoCAD format, as well as a PDF of each drawing to be accurately named and numbered. Include CD's and hard copies of the as-built Drawings in each of the O&M manuals.
- 1.11.1.3. Drawing format to conform to Brock University FMOP 5-2, available on the Facilities Management website.

1.12. **INSTALLATION AND START-UP INSTRUCTIONS**

1.12.1. Reference

1.12.1.1. Submit copies of installation instructions and copies of start-up instructions for any item of equipment when requested by the Consultant.

1.13. **OPERATING AND MAINTENANCE INSTRUCTION MANUALS**

1.13.1. Upon achieving Substantial Completion, submit within one month, two sets of binders to include operating and maintenance instruction manuals, as well as all warranties. Provide a CD containing all in PDF format.

1.13.1.1. Conform to project specifications.

1.13.1.2. In addition, include the following in the manuals:

1. Non-dimensional layout showing location of all electrical devices on mechanical equipment.
2. Operating instructions, including start-up and shut-down procedure.
3. Lubricating instructions and recommended cycle of lubrication for each item of equipment, including various types of lubricants.
4. List of spare parts.

1.13.1.3. All the above applies to component parts of equipment whether they are manufactured by the supplier of the equipment or are supplied as a component part of an item of equipment.

1.14. **CLEANING, TESTING AND APPROVAL RECORDS**

1.14.1. Records

1.14.1.1. Maintain records of all pressure tests and flushing and sterilization tests, glycol/water concentrations, inspections and approvals by the Plumbing Inspector.

1.14.1.2. Forward these tests to the Owner on completion of the work.

1.14.1.3. Forward to the Consultant, copy of records on site on completion of each test, cleaning operation, etc.

1.15. **DIMENSIONS AND QUANTITIES**

1.15.1. Dimensions

1.15.1.1. Dimensions shown on Drawings are approximate.

1.15.1.2. Verify dimensions by reference to Shop Drawings and field measurement.

1.15.2. Quantities

1.15.2.1. Quantities or lengths indicated in any of the Contract Documents are approximate only and shall not be held to gauge or limit the work.

1.16. **PROJECT MANAGER**

1.16.1. Provide a capable Project Manager to oversee and coordinate all administrative aspects of the Project.

1.16.2. The Project Manager is required to participate in construction kick-off meeting upon Contract issuance.

1.16.3. The Project Manager is responsible for conducting bi-weekly construction meetings throughout the construction, as well as maintain meeting minutes and agendas for each meeting, all meeting minutes are to be issued within 3 business days of the meeting date.

1.16.4. The Project Manager is responsible for maintaining up to date and accurate logs for all project documents, included but not limited to Change Orders, Change Directives, Contemplated Changes, Site Instructions, Requests for Information, and Cash Allowance Items.

1.17. **WARRANTY**

1.17.1. All installed equipment, piping, valves, controls, insulation and accessories shall be provided with full parts and labour warranty for a period of 1 year from the date of substantial completion. For specific warranty details, refer to individual specification sections.

PART 2 - PRODUCTS

2.1. **MATERIALS AND EQUIPMENT**

2.1.1. Materials

2.1.1.1. Use new materials and equipment, free from defects impairing strength and durability, as specified or specified equivalent.

2.1.1.2. Labelled or listed as required Code and/or inspection authorities.

2.1.1.3. Design of mechanical systems has been based on the first listed supplier and model number/size stated on the Equipment Schedules on the Drawings. Bear all costs due to physical or performance differences between stated equipment and proposed equipment. These differences include but are not limited to size, layout, arrangement, connection size, location and/or quantity of connections, or performance differences such as noise, power requirements, flow, throw, etc.

2.1.2. Equipment/Structure Coordination

2.1.2.1. Be responsible to verify the actual size requirements of the openings, and notify the Consultant immediately in case the dimension of the unit supplied and the connecting piping, etc. are at variance with the dimensions given on the Drawings.

2.2. **STANDARD SPECIFICATIONS**

2.2.1. Product Quality

2.2.1.1. Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all Products provided comply with the latest issue of applicable Standard Specifications issued by Authorities having jurisdiction.

2.2.1.2. Do not apply such Standard Specifications to decrease the quality of workmanship, products and services required by the Contract Documents.

2.3. **MANUFACTURER'S NAMEPLATES**

2.3.1. Metal Nameplates

2.3.1.1. Provided with raised or recessed lettering, on each piece of equipment and located in a manner to facilitate easy reading by maintenance personnel.

2.3.1.2. Mechanically fasten nameplate on a metal stand-off bracket arranged to clear insulation.

2.3.1.3. Mount on same stand-off Underwriters Laboratories and/or CSA registration plates.

2.3.2. Nameplate Data

2.3.2.1. Indicate:

1. Size
2. Capacity
3. Equipment model
4. Manufacturer's name
5. Serial number
6. Voltage
7. Frequency
8. Phases

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. Execute work in accordance with requirements specified in the various Sections of Division 23.
- 3.1.2. Coordinate all installation details and service requirements of all equipment and accessories with the manufacturer of the equipment and with other trades to eliminate conflicts prior to installation.
- 3.1.3. Mechanical equipment and accessories shall be installed in a manner that provides adequate access to equipment and also assists in reducing the effort for maintenance. Equipment shall only be installed at heights or in spaces that can be easily reached by a standard height ladder (i.e. not exceeding 3 metres). In case space constraints on site require installation of equipment in other locations or heights, contractor shall bring this to the Owner's attention and direction, prior to commencing work.
- 3.1.4. Lay out work of each trade so that it does not interfere with work under other Divisions of Specifications.
- 3.1.5. Make good any damage to Owner's property or other trade's work caused by improperly locating or carrying out of work.
- 3.1.6. Supply anchor bolts and templates for installation by other Divisions.
- 3.1.7. Location of pipes, raceways and equipment may be altered without extra cost provided alteration is made before installation.

3.2. SPARE PARTS

- 3.2.1. Furnish spare parts
- 3.2.1.1. One casing joint gasket for each size pump.
- 3.2.1.2. One glass for each gauge glass
- 3.2.1.3. One set of V-belts for each drive
- 3.2.1.4. One filter cartridge or set of filter media for each filter or filter bank installed.
- 3.2.1.5. One set of strainer mesh for each type and each size of strainer to be installed after cleaning of piping systems.

3.3. PROTECTION

- 3.3.1. Protect work and materials before, during and after erection from weather and other hazards and keep in a clean and orderly manner.
- 3.3.2. Protect pipe ends, valves and parts of equipment left unconnected to prevent damage or intrusion of foreign matter. Provide pipe caps for threaded male connections and plugs for threaded female connections.
- 3.3.3. Protect plumbing fixtures or mechanical equipment having a baked enamel finish by covering with polyethylene sheet securely held in place.
- 3.3.4. Protect finished floor slabs from scuffing, cracking, chipping, staining, cutting and other damage resulting from work of this Contract.
- 3.3.4.1. Place 19 mm thick plywood under laid with 25 mm thick polystyrene insulation board adhered to same, over floor areas when working from, or over, such surfaces. Provide such protection below hoist rigs, ladders, pallets of material, and in other circumstances where the flooring is exposed to potential damage. Work damaged due to failure in providing such protection is to be removed and replaced, or repaired, as directed by the Owner, at no increase in Contract Price.

3.4. PAINTING

- 3.4.1. All paint is to match adjacent colours; The Contractor is responsible for providing colours to the Owner / Consultant for approval prior to painting.
- 3.4.2. With the exception of prime painting of miscellaneous steel or any other specific requirements as specified under the respective Sections of Division 23, all equipment shall be factory painted.
 - 3.4.2.1. Factory applied finish painting:
 - 1. Factory prime and final coats applied to pumps, air moving units, un-insulated pressure vessels and bare metal equipment items, in exposed to view applications such as boiler rooms, mechanical rooms and fan rooms.
 - 2. Use heat resistant paint where conditions require (i.e. equipment/accessories installed in the vicinity of heaters or boilers). Protect factory finished equipment during construction, and clean at completion of work.
 - 3.4.2.2. Factory applied prime painting:
 - 1. Factory prime paint other equipment fabricated from iron or steel including access doors, dampers, metal radiation enclosures, and fire hose cabinets.
 - 2. In occupied areas of the building, touch up any damage to prime coat resulting from shipping or installation and leave ready for final painting under Division 9.
 - 3.4.2.3. Field painting:
 - 1. Mechanical rooms, crawl spaces, pipe tunnels and penthouses: paint exposed galvanized metal surfaces with one coat of zinc dust galvanized primer and one coat of 100% alkyd base enamel.
 - 2. Clean rust and oil from exposed iron and steel work provided under this Division, whether or not it has been factory prime painted. Paint this equipment with one coat of chrome oxide phenolic base primer and one coat of 100% alkyd base enamel in an approved colour.

3.5. SITE SAFETY

- 3.5.1. Provide hoarding and barriers as required to maintain a secure construction area in compliance with

April 2021

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- Ministry of Labour standards and the standards of any other authority having jurisdiction. Remove all hoarding and barriers at project completion and make good any resulting damage
- 3.5.2. Provide traffic control persons for direction of pedestrian and vehicular traffic on site as required to perform the work.
- 3.5.3. Provide dust tight screens to localize dust, smoke, or debris generating activities.
- 3.5.4. Post signs labelled "DANGER DUE TO CONSTRUCTION - AUTHORIZED PERSONNEL ONLY" at each entrance to the construction area. Provide all other way finding signage as required for the construction area.
- 3.5.5. The Contractor shall submit the following to the Consultant within two weeks of Contract issuance:
- 3.5.5.1. The Contractor's site-specific safety plan and associated procedures.
- 3.5.5.2. The Contractor's occupational health and safety policy and procedures.
- 3.5.5.3. The site-specific emergency response plan.
- 3.5.6. Conform to safe Work practices in accordance with regulations and authorities having jurisdiction.
- 3.5.7. Promptly report to Owner all accidents or if any claim is made by anyone against the Contractor or Subcontractor on account of any accident.
- 3.5.8. Provide at the Site, equipment to supply first aid service.
- 3.5.9. Fully indemnify the Owner and Consultant for any charges or convictions as a result of Work performed under this Contract.
- 3.5.10. Ensure that all personnel are adequately equipped to comply with safety regulations and that adequate safety equipment is available.
- 3.5.11. Maintain a copy on Site of the latest edition of the Occupational Health and Safety Act, for Construction Projects as well as Industrial Establishments.
- 3.6. **PERFORMANCE OF WORK**
- 3.6.1. All work to be performed within the hours of 7am to 5pm.

END OF SECTION

PART 1 - GENERAL

1.1. RELATED WORK

1.1.1. Other Divisions

1.1.1.1. Refer to other divisions of the Specifications and the Drawings for the related the mechanical work to avoid interferences with work of other trades (and other contractors) and to ensure proper completion of the work as a whole.

1.2. GENERAL CONSTRUCTION REQUIREMENTS

1.2.1. Applicable Codes and Standards

1.2.1.1. Ontario Building Code-2012

1.2.1.2. Occupational Health and Safety Act and Regulations for Construction Projects, Ontario Regulation 691.

1.2.1.3. Owners Health and Safety Requirements

1.2.2. Measurements and Deviations

1.2.2.1. Where any parts of the mechanical work are specifically located by dimensions on the Drawings, check and verify these dimensions on site prior to installation.

1.2.2.2. Before installing piping, review architectural, structural and electrical Drawings with mechanical Drawings.

1. Where interference may occur and departures from arrangements as shown are required, consult with other trades involved, come to agreement as to changed locations or elevations and obtain approval of the Consultant for proposed changes before proceeding with the work.

1.2.2.3. Examine work of other trades or contractors, prior to commencement of mechanical installations.

1. Report, in writing, to the Consultant any discrepancies which will affect mechanical installations.
2. Failure to do so shall be considered acceptance of the conditions.

1.2.2.4. Where site conditions require minor deviations from indicated arrangements or locations, make such changes on approval of the Consultant without additional cost to the Owner.

1.2.2.5. Should any discrepancies occur during installation of mechanical work which will necessitate major revisions to the mechanical trades work or the work of other trades or contractors, notify the Consultant immediately and obtain written authorization before proceeding with the work.

1.2.3. Building Attachments:

1.2.3.1. Obtain prior written Consultant's approval before drilling, cutting or welding of the building steel or building structure for erection of materials or equipment.

1.2.4. Overloading

1.2.4.1. During installation of mechanical work, do not load any part of the building structure with a load greater than it is capable of bearing.

1. Should any accident occur or damage result through the violation of this requirement, the contractor shall be held solely responsible.

- 1.2.4.2. Design temporary supports used during installation as being equivalent to permanent supports.
- 1.2.4.3. Remove temporary supports at completion of work.
- 1.2.5. Cutting and Patching
 - 1.2.5.1. Do not cut, remove or burn structural parts or sections of the building, whether they are steel, concrete or masonry without the written authorization of the Consultant.
 - 1.2.5.2. Should cutting, repairing, and patching of previously finished work of other trades be required to allow installation of mechanical work, pay all costs for the trade concerned to perform the work.

PART 2 - PRODUCTS

2.1. BUILDING ATTACHMENTS

- 2.1.1. Welding Studs
 - 2.1.1.1. Maximum size: 10 mm (3/8") for attaching miscellaneous materials and equipment to building steel.
 - 2.1.1.2. If the weight of materials or equipment require bolts or studs larger than 10mm (3/8") diameter, use steel clips or brackets, secured to building steel by (welding or) bolting as approved by the Consultant.
 - 2.1.1.3. Acceptable Manufacturers:
 - 1. Graham
 - 2. Omark
 - 3. Nelson
 - 2.1.2. Self drilling expansion type concrete inserts:
 - 2.1.2.1. To secure miscellaneous equipment and materials to masonry or concrete construction already in place.
 - 2.1.2.2. Of sufficient number and size to prevent concrete from breaking away.
 - 2.1.2.3. The use of powder or power actuated fasteners will not be allowed unless prior written approval is obtained from the Consultant.
 - 2.1.2.4. Acceptable Manufacturers:
 - 1. ITW "Redhead"
 - 2. Star "SSS"
 - 3. USM "Parabolt"
 - 2.1.3. Supports for any suspended items:
 - 2.1.3.1. Do not fasten/attach to or extend through steel pan type roofs or through concrete slab roofs.
 - 2.1.4. Beam clamps:
 - 2.1.4.1. 2-bolt design and of such type that the rod load is transmitted only concentrically to the beam web centreline.
 - 2.1.4.2. The use of "C" and "I" beam side clamps, etc., will not be allowed without written consent of the Consultant.

2.1.4.3. Acceptable Manufacturers:

1. Grinnell
2. Myatt
3. Carpenter & Paterson

2.1.5. Truss or steel joist roof or floor framing:

2.1.5.1. Locate hangers at or within 150mm (6") of the joist top or bottom chord panel points

2.1.5.2. Otherwise provide additional structural steel as required where hanger spacing does not coincide with joist spacing.

2.1.5.3. Transmit hanger load only concentrically to the supporting truss or joist.

2.1.6. Secondary structural steel members between trusses and/or joists:

2.1.6.1. Locate at or within 150mm (6") of top or bottom chord panel points.

2.1.6.2. Where the secondary structural steel member cannot be located at or near a truss or joist panel point, provide additional diagonal structural steel web member/members designed for the applicable load to the nearest panel point in the opposite chord member.

1. The above condition may be waived if the load to be suspended between panel points is not in excess of 45kg (100 LB).

2.1.6.3. Diagonal hangers which will induce lateral stresses in the chord members of the joist will not be permitted.

2.2. **DRIVES AND ACCESSORIES**

2.2.1. Drives

2.2.1.1. V-belt drives selection: 150 percent of the motor size rating.

2.2.1.2. Sheaves: cast iron construction with machined grooves.

1. Sheaves 75mm (3") size and larger diameter: taper lock bushings.
2. Multi-belt drives: matched sets.
3. Statically and dynamically balance all sheaves as an operating unit.

2.2.1.3. Adjustable sheaves:

1. Motors less than 1.1Kw (1.5 HP) rating: adjustable pitch motor sheave with diameter range selected to obtain specified RPM of the driven equipment at approximately the mid-point setting of the sheave.

2.2.1.4. Fixed Sheaves:

1. Motors of 1.1Kw (1.5 HP) and greater: solid type.
2. Should such sheaves not provide design requirements under operating conditions, supply and install a new drive sheave of proper size at no increase in Contract Price.

2.2.2. Drive Couplings

2.2.2.1. Acceptable Manufacturers:

1. Falk

2. Fast

3. Thomas

2.2.3. Lubricating Devices

2.2.3.1. Equipment to have oil reservoirs with level indicators, or pressure grease fittings.

2.2.3.2. Inaccessible fittings: provide extended tubes to an accessible location.

2.2.3.3. Grease fittings: Zerk or Alemite

1. All fittings shall be of one type.

2.2.4. Drive Guards

2.2.4.1. To OSHA requirements.

2.2.4.2. Build guards of all welded construction on exposed rotating parts or elements and on all drives including the following:

1. V-belt drives

2. Flexible couplings

3. Gear drives

2.2.4.3. Construction (except fan drives):

1. Total enclosure type fabricated of minimum 1.3mm (18 ga.) black sheet steel.

2. Hinged side to allow access for lubrication, inspection or removal of the drive parts.

3. Maximum clearance of openings in guards to rotating parts: not to exceed 13mm (1/2").

4. Make provision for slide rail adjustment.

2.2.4.4. Construction for fan drives:

1. V-belt drives: total enclosure type as specified above.

2. Enclosure sides: 13mm (1/2") mesh, 2.7mm (0.105") wire screening.

3. Tachometer holes at shaft centres, reinforced as required to maintain rigidity of guard.

2.2.4.5. Flexible drive coupling guards:

1. Location: between motor and driven equipment

2. Minimum 1.3mm (18 ga.) black sheet steel, securely fastened to the equipment base plate and readily removable.

3. Leave a clearance of approx. 13mm to 25mm (1/2" to 1") between the guard and the coupling.

4. Extend the guard to within 13mm (1/2") of both motor and driven equipment housing.

2.2.4.6. Rework any substandard guards supplied with mechanical equipment to conform to the above requirements.

2.3. **SEALANTS, CONCRETE AND GROUTS**

2.3.1. Pipe Sleeve Seals

2.3.1.1. Acceptable Manufacturers:

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1. Thunderline "Link-Seal" Series LS
 2. Century-Line
 3. Metraflex
- 2.3.2. Concrete
- 2.3.2.1. Strength: Unless otherwise noted, 25 MPa concrete: to CSA-A23.1/A23.2
- 2.3.3. Concrete Grouts
- 2.3.3.1. Acceptable Manufacturers:
1. Sternson "M-Bed Standard"
 2. Sika "Sikagrout 212"
 3. Master Builders "Construction Grout"
 4. Meadows "CG-86"
 5. Euclid "Euco NS Grout"
 6. CPD "Non-Shrink Grout"
- 2.3.4. Bonding Agents
- 2.3.4.1. Acceptable Manufacturers:
1. Sika "Sikadur 32" Hi-Mod
- 2.3.5. Caulking Compounds
- 2.3.5.1. Acceptable Manufacturers:
1. Denso-Plast
- 2.3.6. Firestopping
- 2.3.6.1. ULC listed fire stopping assembly
- 2.3.6.2. Rating to suit wall and floor penetrations
- 2.3.6.3. Acceptable Manufacturers:
1. Hilti
 2. Fire Stop Systems
 3. Dow Corning
 4. 3M
 5. Tremco
 6. A/D Fire Protection System
 7. Johns Manville
- 2.4. **MISCELLANEOUS**
- 2.4.1. Access Doors
- 2.4.1.1. Size:

1. Minimum size: 300mm x 300mm (12" x 12") size, unless otherwise specified on the Drawings or in other divisions of the Specifications, or as required to replace or repair said equipment.
2. Provide 600 x 600 size access doors where personnel entry is required.
3. Where access doors are required to be located in fire rated walls, floors and ceilings, provide ULC listed and labelled units having a minimum rating in hours per OBC for the structure being penetrated.

2.4.1.2. Material:

1. Fabricated of 2.5mm (12 ga) bonderized steel.
2. Fabricated of 2.5mm (12 ga) stainless steel in areas finished with tile or marble surfaces.
3. Flush mounted, concealed hinges and screwdriver lock.
4. Plast lock and anchor straps.
5. Doors to be of a type and fire rating to suit the particular type of wall or ceiling construction in which they are to be installed.

2.4.1.3. Acceptable Manufacturers:

1. E.H. Price
2. Titus
3. Controlled Air
4. Williams (S.M.S.)
5. Acudor

2.4.2. Isolating Unions

2.4.2.1. Acceptable Manufacturers:

1. Epco
2. Marpac "Petro"
3. Corrosion Service

2.4.3. Fabricated Equipment Supports (Floor Stands and Ceiling or Wall Mounted Supports)

2.4.3.1. Structural steel members of welded construction or steel pipe and fittings, suitably braced and secured to the floor by mild steel floor pads or pipe flanges with bolts or anchors.

PART 3 - EXECUTION

3.1. **EQUIPMENT**

3.1.1. General

3.1.1.1. Install equipment in a compact, neat and workmanlike manner.

1. Align, level and adjust for satisfactory operation.
2. Install in such a manner that connecting and disconnecting of piping and accessories can be made readily and that all parts are easily accessible for inspection, operation, maintenance and repair.

3.1.1.2. Install and start up items of equipment in accordance with the manufacturer's printed installation and operating instructions.

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- 3.1.2. Noise and Vibration
- 3.1.2.1. Noise and vibration levels of equipment and systems shall be within design intent.
- 3.1.2.2. If noise or vibration levels created by any mechanical equipment and systems and transmitted to occupied portions of building or other mechanical work are over the limits, make all necessary changes and additions as approved by the Consultant without additional cost.
- 3.1.3. Lubrication
- 3.1.3.1. Lubricate all equipment prior to start up in accordance with the manufacturer's printed instructions.
- 3.1.3.2. Supply all lubrication including sufficient quantity for drainage and refilling of oil sumps, etc., when required by manufacturer's instructions.
- 3.1.4. Ceiling or Wall Mounting
- 3.1.4.1. Where ceiling or wall mounting is indicated or required, provide a suspended platform, bracket or shelf.
- 3.1.4.2. Materials: standard steel members and steel plates of welded construction throughout.
- 3.1.4.3. Attach to building steel with rod hangers and beam clamps, or attach to precast structure as the case may be.
- 3.1.4.4. Place additional structural steel as required between building steel where beam spacing does not meet requirements.
- 3.1.4.5. Do not use inserts unless specifically shown on the Drawings or approved by the Consultant / the school board for any particular item of equipment.
- 3.1.4.6. Attach brackets or shelves to vertical member or sections of the building structure as hereinbefore specified.
- 3.1.5. Suspended Equipment Support: Provide double locknuts on suspended equipment supports as follows:
- 3.1.5.1. Upper attachment
1. Beam clamp: provide a double nut on end of beam clamp tie rod.
 2. Supplemental steel: double nut all mechanical fasteners fixing supplemental steel to building structural steel.
- 3.1.5.2. Middle attachment
1. Upper load bearing point, to beam clamp: not applicable.
 2. Upper load bearing point, to supplemental steel: double nut on top of load bearing point, single locknut on underside of bearing point
 3. Lower load bearing point, all: double nut on underside of bearing point, single locknut on top of bearing point.
- 3.1.5.3. Lower attachment
1. Trapeze hanger or equipment fastening: refer to middle attachment requirements above.
- 3.1.5.4. Apply Loctite 242 to the second nut (and matchmark both nuts).

3.2. **MISCELLANEOUS STEEL**

3.2.1. General

3.2.1.1. Hang or support equipment, piping, ductwork etc., with miscellaneous structural supports, platforms, braces as may be required unless Drawings or other Sections of the Specifications state otherwise.

3.2.2. Materials and Fabrication

3.2.2.1. Conform to:

1. CAN/CSA-S16.1-M Limit Status Design of Steel Structures.
2. CSA-G40.20/G40.21 grade 300W for General requirement for rolled or welded Structural Quality Steel CSA W47.1 - for qualification of welders.
3. CSA W48.1-M - for electrodes (only coated rods allowed).
4. CSA W59-M - Welded Steel Construction (Metal Arc Welding).
5. CSA W117.2 - for safety in welding.

3.2.2.2. Construction:

1. Welded construction wherever practicable.
2. Chip welds to remove slag, and grind smooth.
3. Bolted joints allowed for field assembly using high strength steel bolts.

3.2.3. Painting and Cleaning

3.2.3.1. Clean steel to Steel Structures Painting Council SSPC-SP6, Commercial Blast Cleaning.

3.2.3.2. Apply one coat of oil alkyd primer conforming to CISC/CPMA 2.75 to all miscellaneous steel.

3.2.3.3. In the field, touch up all bolt heads and nuts, previously unpainted connections and surfaces damaged during erection with primer as hereinbefore specified.

3.2.3.4. Apply two coats of primer to all surfaces which will be inaccessible after erection.

3.2.3.5. Thoroughly remove all foreign matter from steelwork on completion of installation.

3.3. **CONCRETE INSERTS**

3.3.1. General

3.3.1.1. Install inserts required for attachment of hangers, either for suspension of piping or equipment.

3.3.1.2. For masonry or poured concrete construction use expansion type units. Insert into the concrete after concrete has cured. Do not use anchors or inserts installed by explosive means.

3.4. **FLASHINGS**

3.4.1. Coordination

3.4.1.1. Coordinate with general trades and roofing supplier.

3.4.2. Provide flashing and counter-flashing for all mechanical and related electrical penetrations through roof. Costs resulting from failure to comply with this requirement are the sole responsibility of the contractor.

3.4.3. Acceptable Manufacturer: Thaler Metal.

3.4.3.1. Plumbing Vent: Thaler model MEF-1

3.4.3.2. Flexible steel conduit: Thaler model MEF-2x

3.4.3.3. Hot pipe: MEF-3A with stainless steel collar

3.4.3.4. Type B vents: MEF-4A

3.4.3.5. Rigid conduit: MEF-AE1

3.4.3.6. Gas Piping: MEF-9

3.5. **FIRE STOPPING**

3.5.1. Submittals

3.5.1.1. Submit shop Drawings, including the following information:

1. ULC/CUL listing number
2. Installation Drawings for each type of penetration
3. Installation materials

3.5.2. General

3.5.2.1. Seal piping, ductwork, conduits and miscellaneous support steel penetrating fire separations.

3.5.2.2. Install fire stopping in accordance with manufacturer's instructions and ULC listing requirements.

3.5.2.3. Provide a written report on completion of fire stopping, by area or floor if necessary, indicating the work is completed and ready for inspection. Do not cover over fire stopping, including installation of walls and ceilings, until work is inspected.

3.6. **ACCESS DOORS**

3.6.1. General

3.6.1.1. Access doors in ductwork are specified in Section 23 30 00 "Ductwork Accessories".

3.6.1.2. Supply access doors for installation by other trades in walls or ceilings where accessibility is required for the operation and/or maintenance of:

1. Concealed valves
2. Traps
3. Cleanouts
4. Dampers
5. Fan Coil Units
6. Controls equipment

3.7. **PERFORMANCE AND BALANCING**

3.7.1. Refer to section 23 05 91 Start-up and Performance Testing.

3.8. **ADJUSTMENT AND OPERATION OF SYSTEMS**

3.8.1. General

3.8.1.1. When the work is complete:

1. Adjust equipment items of the various systems for proper operation within the framework of design intent, and the operating characteristics as published by the equipment manufacturer.
2. Complete additional instructions are specified under the respective Sections of Division 23.

3.8.1.2. The Consultant reserves the right to require the services of an authorized representative of the manufacturer in the event that any item of equipment is not adjusted properly.

1. Arrange for such services and pay all costs thereof.
2. After completion of adjustments, place systems in full operating condition and advise the Consultant that the work is ready for acceptance.

3.9. **ACCEPTANCE**

3.9.1. General

3.9.1.1. After all equipment has been installed and adjusted and all systems balanced:

1. Conduct performance tests in the presence of the Consultant and the Owner.
2. Arrange the time for these tests at the convenience of the Consultant and the Owner.
3. Conduct tests under climatic circumstances to ensure complete and comprehensive tests and of such a manner and duration as the Consultant may deem necessary.

3.9.1.2. During these tests:

1. Demonstrate the correct performance of all equipment items and of the systems they comprise.
2. Should any system or any equipment item fail to function as required, make such changes, adjustments or replacements necessary to meet performance requirements.
3. Repeat tests until requirements have been fully satisfied and all systems accepted by the Consultant.

3.10. **COORDINATION WITH TESTING AND BALANCING WORK**

3.10.1. General

3.10.1.1. Review with the Mechanical Contractor before fabrication:

1. Location of balancing devices
2. Test connections
3. Access openings

3.10.1.2. Report conditions which could affect optimum system performance.

3.10.1.3. Inspection:

1. Assure that all testing, balancing and metering devices are installed properly and in pre-selected locations.
2. Report any errors to the Consultant.

-
3. The Mechanical Contractor shall obtain the approval of the Testing and Balancing Firm before relocating these devices due to field conditions.
- 3.10.2. TAB Contractor Coordination
- 3.10.2.1. Cooperate with the Mechanical Contractor giving adequate prior notification of request for services of tradesmen.
- 3.10.2.2. Coordinate efforts so that items requiring replacement and/or delivery time (sheaves, motors, etc.) are tested as early as possible.
- 3.10.3. Mechanical Contractor Coordination
- 3.10.3.1. Cooperate with the Testing and Balancing Firm.
- 3.10.3.2. Provide the following assistance and/or services:
1. Schedule sufficient time so that the initial testing and balancing can be completed before occupancy begins and coordinate with the trades involved.
 2. Keep the Testing and Balancing Company informed of any major changes made during construction and provide same with a set of project Drawings and reviewed Shop Drawings.
 3. Provide balancing devices, test connections access openings, balancing probe inlets and plugs.
 4. Clean and pre-run all equipment, filters, etc. and place all heating, ventilating and air conditioning systems into full operation and continue same during each working day of testing and balancing.
 5. Provide immediate labour from pertinent mechanical trades and tools, equipment and materials to make equipment and system alterations and adjustments, as required including control adjustments.
 6. Make available all equipment data (Shop Drawing performance data and operating instructions) to the Testing and Balancing Firm.
- 3.10.3.3. As part of the coordination effort, the Mechanical Contractor shall be fully responsible for systems constructed, installed and adjusted to Provide optimum performance as required by design intent. Any re-adjusting required as the result of spot checks by the Consultant shall be done at no increase in Contract Price.
- 3.10.3.4. Nothing contained in this Section voids the responsibility of the Mechanical Contractor (Subcontractor) for systems constructed, installed and adjusted to achieve the design intent.

END OF SECTION

PART 1 - GENERAL

1.1. REFERENCE STANDARDS

1.1.1. Standards

1.1.1.1. CSA 390 M (Motor efficiency ratings)

1.1.1.2. IEEE 112 (Motor efficiency ratings) for three phase motors

1.1.1.3. IEEE 114 (Motor efficiency ratings) for single phase motors.

1.1.1.4. ASHRAE 90.1

1.2. CODES AND REGULATIONS; PERMITS, COSTS AND FEES

1.2.1. Codes

1.2.1.1. Electrical Safety Authority (ESA)

1.2.2. Permits

1.2.2.1. Obtain electrical permits and inspections and pay all costs for the portion of the work performed by Division 23.

1.3. QUALITY ASSURANCE

1.3.1. Contractor Qualifications

1.3.1.1. Electrical wiring for Mechanical Trades work performed by a specialist firm with an established reputation in this field.

1.4. SUBMITTALS

1.4.1. Shop Drawings

1.4.1.1. Submit shop drawings in accordance with section 23 05 00 "Basic Mechanical Requirements".

1.4.1.2. Include nameplate data, motor efficiencies, NEMA rating and insulation rating.

1.5. RELATED WORK

1.5.1. The following work will be performed by Division 26.

1.5.1.1. Power wiring between the electrical distribution system and motor or equipment.

1.5.1.2. Motor Control Centres (MCC).

1.5.1.3. Motor starters including variable frequency drives and soft-start starters, except where specified as an integral component of the mechanical equipment.

1.5.1.4. All Fused or un-fused disconnect switches.

1.5.1.5. Motor starters for integration of proposed equipment into the BAS.

PART 2 - PRODUCTS

2.1. MOTORS

2.1.1. General

2.1.1.1. Motor nameplate rating:

1. Not less than input brake horsepower of driven equipment plus 5%, at specified operating conditions, and;
2. Not less than the scheduled minimum horsepower.
3. Premium efficiency.
4. Selected for chemical duty or explosion proof where scheduled.
5. Service factor: 1.15 minimum for three phase motors.

2.1.2. Single Phase Motors

2.1.2.1. Continuous duty, resilient mount.

1. Motor rating: less than 375 W
2. Voltage, frequency and RPM as scheduled.

2.1.3. Three Phase Motors, 350 W to 525 W:

2.1.3.1. EEMAC, Class B, Type F insulation, squirrel cage induction, continuous duty, ball bearing.

1. Voltage, frequency and RPM as scheduled.
2. Motor type: ODP with 90°C temperature rise (TEFC with 80°C temperature rise) unless otherwise scheduled.
3. 1800 RPM or as scheduled.

2.1.4. Grounding Lug

2.1.4.1. Motors less than 15 kW:

1. Ground lug on motor terminal box.

2.1.5. Winding Temperature Thermostat

2.1.5.1. Where required:

1. Single phase, and three phase motors up to 15 kW located in air ducts, plenum chambers or in air stream inside air conditioning equipment.

2.1.5.2. Type:

1. Klaxon Motor winding thermostats or Approved Equivalent

2.2. **WIRING AND CONDUIT**

2.2.1. Wire

2.2.1.1. Refer to DIV 16 specifications.

2.2.2. Conduit

2.2.2.1. Refer to DIV 16 specifications.

2.3. **EQUIPMENT SERVICE LIGHTS**

2.3.1. Service Lights

2.3.1.1. Pyrex globe, wire guard and 100 W incandescent lamp

2.3.1.2. Acceptable Manufacturers:

1. Crouse Hinds - Type ARB-31
2. Killark - Type VOGB-100

2.3.2. Switches

2.3.2.1. 20 ampere, single pole, with neon pilot light, installed in cast metal box.

2.3.2.2. Acceptable Manufacturers:

1. Smith & Stone - No. 4-4901

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Motor and Equipment Control

3.1.1.1. Motor Control Centre, starters and/or disconnect switch for each motor or electrically connected item: provided by Electrical Division 26.

1. Exception: disconnects which are specified as part of the equipment.

3.1.2. Power Conduit and Wire

3.1.2.1. Provided by Mechanical Division 23:

1. Line voltage thermostats, and wiring from thermostat to fan coil units, unit heaters and cabinet unit heaters.
2. Hardwire interlock wiring between control devices (pressure switches, temperature switches, limit switches, etc.) and motor starters.
3. Between junction box provided by Division 26, to switch and equipment service lights.

3.1.2.2. Provided by Electrical Division 26:

1. Power wiring at all voltages 120 VAC and higher to motors or equipment.
2. To junction box on adjacent wall, column or ceiling for equipment service lights (marine lights).

3.1.3. Control Conduit and Wire

3.1.3.1. Provided by Mechanical Division 23:

1. Control wiring, conduit and relays to interlock starters and connect safety and operating controls.

3.1.3.2. Provided by Electrical Division 26:

1. Fan shut-down and start-up relays and wiring for operation by the Fire Alarm System.
2. Thermostats and wiring for electric heaters.

3.1.4. Equipment Service Lights

3.1.4.1. Mount switches in accessible location on outside of plenum.

3.1.4.2. Provide one switch for each fan system.

3.1.4.3. Provide minimum of one marine light per 3 m length of plenum.

3.1.5. Grounding

3.1.5.1. Ground electrical equipment and wiring in accordance with Electrical Safety Authority and Local Authority's Rules and Regulations.

3.1.6. Corrosion Protection Anodes

3.1.6.1. Provide external corrosion protection anodes for:

1. Buried ductile iron water mains, fittings, and hydrants.

2. Metallic services as shown.

END OF SECTION

PART 1 - GENERAL

1.1. **SUBMITTALS**

1.1.1. Shop Drawings

1.1.1.1. Submit Shop Drawings in accordance with 15010 "Basic Mechanical Requirements".

1.1.1.2. Submit layout Drawings showing each type and placement of manufactured, pre-fabricated roof piping support system. Submit details for fixing roofing pad to roof.

PART 2 - PRODUCTS

2.1. **MATERIALS**

2.1.1. Acceptable Manufacturers

2.1.1.1. Hangers:

1. Anvil
2. Myatt
3. Carpenter & Paterson
4. Hunt
5. B-Line

2.1.1.2. Insulation shields:

1. Anvil
2. Myatt
3. Pipe Shields Inc.

2.1.2. Lower Attachment

2.1.2.1. Clevis hanger – steel pipe

1. Standard weight black steel clevis hangers with level adjustment and locknut
2. Anvil figures 260 and 300.
3. For figure 260, provide clevis bolt spacer on insulated piping.

2.1.2.2. Clevis hanger – copper pipe

1. Light weight black steel clevis hangers with copper coloured finish and plastic insert to suit local authority requirements, with level adjustment and locknut.
2. Anvil figure CT-65.

2.1.2.3. Roller hanger

1. Adjustable roller type hangers with locknuts.
2. Rollers of sufficient width to clear the outside diameter of the insulation on the piping.
3. Support rollers at both ends, either by a yoke, swivel type hanger or by two adjustable rods with locknuts (double locknuts).
4. Anvil figure 177 or 171 as applicable.

2.1.3. Insulation Protection

2.1.3.1. Insulation saddles, for welding to pipe:

1. Anvil figure 160-165 as applicable.

2.1.3.2. Insulation shields:

1. Either shop fabricated, or manufactured plates of the size required to properly fit the outside diameter of the pipe insulation.
2. Anvil figure 167, modified with holes at each end to suit 12 mm wide. stainless steel band clamps.
3. Shop fabricate bearing plates conforming to the following table for various pipe sizes:

Pipe Size (NPS)	Length of Plate mm	Thickness of Plate mm
(1/2"-2") 15 to 50	300	1.2
(3"-4") 75 to 110	300	1.52

4. Form the bearing plates to the O.D. of the adjoining pipe insulation and extend the plate up to the horizontal centre line of the pipe.

2.1.4. Middle Attachment

2.1.4.1. Machine threaded rods

1. Black steel finish in concealed areas.
2. Galvanized finish in mechanical rooms and exposed areas.

2.1.5. Upper Attachments

2.1.5.1. Beam clamps:

1. Malleable iron C-Clamp with retaining clip, FM approved: Anvil figure 87, NPS ½ to NPS 2; maximum load: 180 kg.
2. Malleable beam clamp FM approved: Anvil figure 218, NPS 2½ to NPS 8; maximum load: 540 kg.
3. For pipes NPS 10 and larger, provide supplementary steel members supported from structural steel.
4. Do not use top beam clamps.

2.1.5.2. Concrete inserts (new construction):

1. Single hanger: Malleable iron body and nut, universal nut style: Anvil figure 282, to NPS 8.
2. Continuous hanger: cold formed hot dipped galvanized strip steel with end caps: Power-Strut PS 449.

2.1.5.3. Concrete clevis plates (existing concrete):

1. Carbon steel plate, with clevis attachment.
2. Anvil figure 49.
3. Do not use explosive driven anchors.

2.1.6. Rooftop Pipe Supports

- 2.1.6.1. Prefabricated pipe support system:
1. Bases: injection moulded plastic, structurally reinforced.
 2. Framing: fabricated steel to ASTM A570 Grade 33 (stainless steel Type 304 to ASTM A 167), roll formed 2.7 mm (12 ga) thick tubular sections. Tubing perforated with nominal 14 mm diameter holes on nominal 50 mm centres on 3 sides.
 3. Hangers: as specified above.
 4. Clamps, bolts, nuts and washers to suit installation, same material as framing members.
 5. Roof pads to suit roof construction.
- 2.1.6.2. Acceptable Manufacturers:
1. Portable Pipe Hangers
 2. Unistrut
- 2.1.7. Riser Clamps
- 2.1.7.1. Black steel double clamp: Anvil figure 261, supported at floors; Anvil figure 240, supported by hanger rods.
- 2.1.7.2. Or approved equivalent
- 2.1.8. Pipe Guides
- 2.1.8.1. Outer hinged housing with sliding spider clamp.
1. Carbon steel, black steel finish.
 2. Anvil figure 256.

PART 1 - EXECUTION

1.1. INSTALLATION

- 1.1.1. General
- 1.1.1.1. Support or suspend piping with necessary hangers, structural supports and/or brackets, to prevent sagging, warping and vibration and to allow for movement due to expansion and contraction. Provide adequate number of expansion compensators of suitable materials as required to allow movement of pipe work.
- 1.1.1.2. Place hangers and supports close to fittings, elbows, valves and/or other heavy parts.
- 1.1.1.3. Do not allow loads of any nature to be transmitted through the piping connections to equipment not specifically designed for such loads.
1. Where flexible connections are not called for at connections to equipment, support the pipe by stands attached to both pipe and supporting structure so that force in any direction is not transmitted to the equipment.
- 1.1.1.4. Place suitably dampened spring hangers at the first three supports from the equipment connection on piping subject to excessive movement or shock from any source, thermal expansion and contraction.
1. Where it is evident that no undue loads will be transmitted to the equipment by the system concerned, i.e. small bore connections to comparatively large equipment, cold service piping not subject to shock, etc., then spring hangers may be omitted and standard hangers used.
- 1.1.1.5. Do not hang pipe from another pipe unless specifically shown on the Drawings.

1.1.2. Hanger Selection

1.1.2.1. Select lower attachment and insulation protection based on the following, unless otherwise shown on Drawings:

Pipe Size NPS	Operating Temperature		
	Less than 21°C	Between 21°C and 43°C	Greater than 43°C
	Insulated	Non-insulated	Insulated
2" and less, steel	Clevis and Shield	Clevis only	Clevis
2½" to 8", steel	Clevis and Shield	Clevis only	Roller and Saddle
½" to 4", copper	Clevis and Shield	Clevis	Clevis and Shield

1.1.2.2. Install temporary spacers between the insulation Shield and the pipe equal to the thickness of insulation specified. Refer to Section 23 05 60 "Mechanical Thermal Insulation".

1.1.3. Saddles and Roller Supports

1.1.3.1. Place saddles at roller supports for piping carrying liquids at 43°C (110°F) or higher.

1.1.3.2. Weld saddles to black or galvanized steel piping.

1.1.3.3. Refinish galvanized surfaces destroyed by the welding with a zinc rich paint such as W.R. Meadows "Galvafruid", Kerry Industries "ZRC" or Niagara Paint Inc. "PL052898" or Approved Equivalent.

1.1.4. Insulation Shields

1.1.4.1. Place insulation shields at pipe supports for pipes carrying liquids at 21°C (70°F) or less.

1.1.4.2. Field or factory punch a hole at each end of the shield to allow a 12 mm stainless steel band clamp to pass through opening.

1.1.4.3. Secure shields with 2@ 12 mm stainless steel band clamps per shield.

1.1.5. Hanger Spacing - General

1.1.5.1. Horizontal runs of plumbing and drainage piping: to hanger spacing requirements of the Ontario Building Code.

1.1.5.2. Place additional hangers in locations where there are concentrated loads such as valves, specialties, etc.

1.1.6. Hanger Spacing - Black Steel and Galvanized Pipe

1.1.6.1. For horizontal runs of black or galvanized steel pipe, other than for plumbing service:

1.1.6.2. Maximum distances between supports and with minimum diameter rods as follows:

Pipe Size NPS	Rod Size mm	Spacing	
		Water Service m	Gas, Steam or Air m
½" Thru 1"	10	2.0	2.7
1¼"	10	2.0	2.7
1½"	10	2.7	3.6
2"	10	3.0	3.9
2½"	12	3.3	4.2
3"	12	3.6	4.5

Pipe Size NPS	Rod Size mm	Spacing	
		Water Service m	Gas, Steam or Air m
4"	16	4.2	5.0
6"	19	5.0	6.4
8"	22	5	6.8

1.1.7. Hanger Spacing - Copper Tubing

1.1.7.1. For horizontal runs of copper tubing for services other than plumbing:

1.1.7.2. Maximum distances between supports and with minimum diameter rods as follows:

Pipe Size NPS	Rod Size mm	Spacing	
		Water Service m	Gas, Steam or Air m
Thru ¾"	10	1.5	1.8
1"	10	1.8	2.4
1¼"	10	2.0	2.7
1½"	10	2.4	3.0
2"	10	2.4	3.3
2½"	12	2.7	3.9
3"	12	3.0	4.2
4"	16	3.6	4.8

1.1.8. Hanger Spacing - PVC or CPVC

1.1.8.1. For horizontal runs of PVC or CPVC for services other than plumbing.

1.1.8.2. Maximum distances between supports and with minimum rods sizes for un-insulated pipe as follows.

Pipe Size nps	Rod Size mm	Spacing			
		PVC 40	CPVC 40	PVC 80	CPVC 80
½"	6	1.2	1.2	1.2	1.2
¾"	6	1.2	1.2	1.2	1.5
1"	6	1.2	1.5	1.5	1.8
1¼"	6	1.2	1.5	1.5	1.8
1½"	6	1.5	1.8	1.8	1.8
2"	6	1.5	1.8	1.8	2.0
2½"	6	1.8	2.0	1.8	2.4
3"	6	1.8	2.0	2.0	2.4
4"	6	2.0	2.4	2.4	2.7
6"	6	2.4	2.4	2.7	3.0

1.1.8.3. For insulated pipe, reduce spacing by 30%.

1.1.8.4. Do not restrain axial movement

1.1.8.5. Spacing based on fluids with specific gravity of 1.0 and 26°C 80°F. For other conditions, use other published data approved by the Consultant.

1.1.9. Anchors and Guides

-
- 1.1.9.1. Provide anchors as required to maintain permanent location of pipe lines.
1. Construct anchors for steel or galvanized pipe of approved steel straps and/or rods.
 2. For anchoring copper lines, use copper plated anchors, or use insulation bands between tubing and clamps if steel straps or rods are used.
- 1.1.9.2. Provide minimum two (2) pipe guides on each side of an expansion joint and expansion compensator.
1. 1200 mm between each guide.
 2. Not more than 900 mm between last guide and start of expansion joint or expansion compensator.
- 1.1.9.3. For special expansion joint/compensator or for special applications, where more than two guides on each side are required, follow manufacturer recommendations for location of guides.
- 1.1.10. Inserts
- 1.1.10.1. In new construction, set inserts onto formwork prior to pouring of concrete.
1. Provide a 200 mm length of rebar and wire through insert.
- 1.1.10.2. Mechanical rooms and other areas of multiple pipe runs.
1. Provide continuous type insert channels at 1800 mm intervals along route of piping.
 2. Provide a 200 mm length of rebar and wire through insert.
- 1.1.11. Upper Attachments - Structural Steel
- 1.1.11.1. For pipe size NPS 10 and larger supported from structural steel:
1. Provide supplementary structural steel and weld or bolt to structural steel.
 2. Submit plan Drawings and details to the structural engineer for review.

END OF SECTION

PART 1 - GENERAL

1.1. **SUBMITTALS**

1.1.1. Shop Drawings

1.1.1.1. Submit Shop Drawings in accordance with Section 23 05 00 "Basic Mechanical Requirements".

1.1.1.2. Submit schedule of Equipment Identification Nameplates for review.

1.1.2. Samples

1.1.2.1. Submit samples of piping, valve and ductwork identification markers.

PART 2 - PRODUCTS

2.1. **MATERIALS**

2.1.1. Equipment Identification

2.1.1.1. Laminated phenolic plastic with white finish and minimum 10 mm high black letters.

2.1.1.2. Three rows of text, based as shown in equipment Schedules.

1. Line 1: Equipment ID (e.g. P-1)
2. Line 2: Equipment Name (e.g. Northwest Zone Heating Pump)
3. Line 3: Optional, up to 15 characters (e.g. Standby Pump)

2.1.1.3. This identification is in addition to manufacturer's nameplate data.

2.1.2. Ductwork Identification

2.1.2.1. Painted stencil lettering: 50 mm high.

2.1.2.2. Paint colour:

1. Black paint on canvas covered insulated ductwork
2. White paint on metal covered insulated ductwork
3. White paint on un-insulated ductwork

2.1.2.3. Two levels of text in accordance with designations shown on Schedules:

1. Level 1: Abbreviated name of air handling system for supply systems (e.g. AHU-1), or fan number for exhaust or ventilation only systems (e.g. EF-1)
2. Level 2: System name (e.g. General Supply)

2.1.2.4. Direction arrows: 65 mm high

2.1.3. Pipe Identification – Type 1: Adhesive Labels

2.1.3.1. Pre-printed 6 mil thick vinyl cloth, plastic coated with pressure sensitive self-adhesive backing surface. On insulated pipe, use adhesive suitable for this application.

1. Pipe diameter (including insulation) 75 mm or less: 29 mm width, 25 mm high lettering. Length of labels as dictated by legend.
2. Pipe diameter (including insulation) greater than 75 mm: minimum width of 64 mm and with 50 mm high letters.
3. Primary label colour: to CAN/CGSB-24.3.

4. Pipe label to include service pressure for steam, compressed air, natural gas (if more than one gas service pressure inside of building), and vacuum.
5. Legend: black with the legend printed in full wherever feasible.

2.1.3.2. Direction arrow banding tape: colour coded vinyl tape with pressure sensitive adhesive backing, 50 mm wide, with directional arrows.

2.1.3.3. Acceptable Manufacturers:

1. Brady
2. Safety Supply Co.
3. S.M.S
4. Revere-Seton

2.1.4. Pipe Identification – Type 2: Coil Wrap Labels

2.1.4.1. Reversible direction, semi-rigid plastic vinyl, with subsurface printing, and integral direction arrows.

1. Up to 6" diameter: coil wrap six rows of printing
2. Over 6" diameter: saddle type with two rows of printing, fastened with stainless steel springs
3. Lettering Size:

Outside Dia.	Letter Height
Less than 16mm	6mm
19mm – 32mm	13mm
35mm - 60mm	19mm
64mm – 110mm	32mm

4. Primary label colour: to CAN/CGSB-24.3.
5. Pipe label to include service pressure for steam, compressed air, natural gas (if more than one gas service pressure inside of building), and vacuum.
6. Legend: black with the legend printed in full wherever feasible.

2.1.4.2. Acceptable Manufacturers:

1. Brady
2. Safety Supply Co.
3. S.M.S
4. Revere-Seton

2.1.5. Valve Identification

2.1.5.1. Laminated phenolic plastic with minimum 10 mm high lettering, with brass keychain.

2.1.5.2. Minimum two lines of text:

1. Line 1: valve designation
2. Line 2: valve position instruction

2.1.6. Manufacturers

2.1.6.1. Acceptable manufacturers

1. S.M.S.
2. Brady

3. Safety Supply Co.
4. Revere-Seton

PART 3 - EXECUTION

3.1. INSTALLATION

3.1.1. Equipment Nameplates

3.1.1.1. Identify mechanical and electrical equipment installed under this Division with nameplates describing the function or use of the particular equipment involved.

3.1.1.2. Do not commence fabrication of nameplates until after receipt of the Consultant's review.

3.1.1.3. Equipment includes, but not limited to:

1. Equipment as shown on schedules and specified
2. Motor starters
3. Motor Control Centres
4. Pushbutton stations
5. Control panels
6. Time switches
7. Disconnect switches
8. Contactors or relays in separate enclosures
9. .

3.1.1.4. Securely fasten nameplates to the equipment with round-head cadmium plated steel self-tapping screws.

3.1.2. Ductwork Identification, main ducts (or modified portion of existing ducts) for all HVAC systems.

3.1.2.1. Label ductwork installed under this Division to indicate the content and direction of flow.

3.1.2.2. Locate labels as follows:

1. Within 1.5 m of air handling units and free standing fans.
2. Within 3 m of divisions in exposed ductwork.
3. On each exposed duct passing through a wall, partition or floor (one on each side of such wall, partition or floor).
4. At intervals not to exceed 15 m along every exposed duct run exceeding 15 m in length.
5. On every concealed duct where it enters a floor area that it serves.

3.1.2.3. Labels to be visible from 1.5 m above the adjacent floor or platform.

3.1.2.4. Clean surfaces with a trisodium phosphate solution before application of paint.

3.1.3. Piping Identification

3.1.3.1. Label all piping installed under this Division to indicate the content and direction of flow with Type 1 or Type 2 labelling system.

3.1.3.2. For piping carrying steam, compressed air and vacuum, show on label the pressure or vacuum, and working units as applicable.

3.1.3.3. Locate labels as follows:

1. At every end of pipe run, adjacent to the valve or item of equipment serviced.
2. At valves, tees and changes of direction.
3. On each exposed pipe passing through a wall, partition or floor (one on each side of such wall, partition or floor).
4. At intervals not to exceed 15 m along every exposed pipe run exceeding 15 m in length.
5. At every access point on concealed piping.

3.1.3.4. Labels to be visible from 1.5 m above the adjacent floor or platform.

3.1.3.5. Type 1 Labels;

1. Clean surfaces before application of labels.
2. Secure label with direction arrow banding tape for full circumference of pipe, at each end of label.

3.1.3.6. Natural gas piping: as specified above except provide labels every 6 m.

3.1.4. Valve Tags

3.1.4.1. Provide valve tags on all valves, except as follows:

1. At plumbing fixtures.
2. On heating water shut-off and balancing valves at equipment being served.
3. On isolation valves around control valves

3.1.4.2. Provide a valve identification directory for each system.

1. Quantity: two (2) copies of valve identification directories for each system
2. Documented as follows (example given):

Valve No.	Service	Valve Location	Nearest Column
V-1	Gym Heating Zone	Gymnasium	C-8

END OF SECTION

PART 1 - GENERAL

1.1. **GENERAL**

- 1.1.1. Provide thermal insulation to all ducts (either new and existing modified) that are either located outdoors or indoor.
- 1.1.2. Provide thermal insulation to all hydronic heating piping (new and modified existing), plumbing piping (new and modified existing) and other drain piping as specified and as shown on drawings.

1.2. **WORK NOT INCLUDED**

- 1.2.1. The following items are not to be insulated, or are factory insulated.
- 1.2.1.1. Equipment:
1. Air handling units with internal insulation
- 1.2.1.2. Ductwork:
1. Internal acoustically insulated ductwork, except overlap thermal insulation 300 mm over the adjacent acoustic insulation section of the duct.
 2. Supply ductwork which is exposed to the occupied space, unless otherwise noted.

1.3. **RELATED WORK**

- 1.3.1. The following Work is provided under other Sections or Divisions of the Work:
- 1.3.1.1. Internal acoustic insulation of ductwork: Section 23 30 00 "Ductwork Accessories".
- 1.3.1.2. Section 23 31 13 "Ductwork".

1.4. **REFERENCE STANDARDS**

- 1.4.1. General
- 1.4.1.1. Provide insulation materials and adhesives of fire retardant type with flame spread and smoke developed ratings not exceeding ULC, Government, or Municipal standards.
- 1.4.1.2. Fire retardant materials with flame spread/smoke developed ratings not exceeding 25/50 when tested in accordance with CAN/ULC-S102, and complying with the requirements stated in the building code having jurisdiction.
- 1.4.1.3. Identify insulation, coverings and adhesives where required by Federal and/or Provincial health and safety WHMIS legislation.
- 1.4.1.4. Asbestos-free materials.
- 1.4.2. Reference Standards
- 1.4.2.1. Comply with the latest edition of:
1. NFPA 90-A
 2. NFPA 255, determination of flame spread rating and smoke development
 3. CAN/ULC-S102, determination of flame spread rating and smoke development
 4. ASTM C-411, materials testing
 5. ASHRAE 90.1

1.5. **SUBMITTALS**

1.5.1. Shop Drawings

1.5.1.1. Submit Shop Drawings in accordance with Section 23 05 00 "Basic Mechanical Requirements".

1.6. **PRODUCT DELIVERY, STORAGE AND HANDLING**

1.6.1. General

1.6.1.1. Retain insulation materials in original cartons or containers until immediately prior to application and store in dry location.

1.6.1.2. Keep adhesives in their original containers with manufacturer's name and catalogue number clearly stated. Protect contents against freezing.

1.7. **DEFINITIONS**

1.7.1. For the purposes of this Section, the following definitions apply:

1.7.1.1. "Conditioned supply ducts" - ductwork conveying air which has either been heated or cooled.

1.7.1.2. "Concealed" - mechanical services and equipment located in: ceiling spaces above solid drywall and T-bar ceilings; space beneath raised floors; vertical service shafts; trenches; and non-accessible chases and furred spaces.

1.7.1.3. "Exposed" - mechanical services and equipment in all other spaces not considered to be "concealed" as defined above. Services in tunnels are to be treated as "Exposed".

1.7.1.4. "Cold Piping" - piping carrying fluids at temperatures below 16°C (60°F)

PART 2 - PRODUCTS

2.1. **MATERIALS**

2.1.1. Pipe and duct Insulation: Thermal resistance of all duct and pipe insulation materials shall meet or exceed the requirements specified in ASHRAE 90.1.

2.1.1.1. Type P1

1. Fiberglass: to ASTM C547
2. Rigid, split formed with pressure sensitive longitudinal adhesion strip
3. Reinforced all service vapour retarder jacket:
4. Operating temperatures: -40 to 454°C (-40 to 850°F)
5. *Maximum* k value: 0.042 W/m°C @ 93°C
6. Acceptable Manufacturers
 1. Knauf Pipe Insulation with ASJ-SSI jacket
 2. Johns Manville - Micro-Lok with AP-T plus jacket
 3. Owens Corning - SSL-II
 4. Manson Alley - K with all purposed APT jacket

2.1.2. Ductwork Insulation

2.1.2.1. Type D1

1. Fiberglass: to ASTM C553
2. Flexible blanket
3. Reinforced all service vapour retarder jacket

4. Operating temperatures: 4 to 121°C (40 to 250°F)
5. Density: 24 kg/m³
6. Maximum k value: 0.036 W/m°C @ 24°C
7. Acceptable Manufacturers
 1. Johns Manville - Microlite
 2. Knauf Fibreglass
 3. Owens Corning

2.1.2.2. Type D2

1. Fiberglass: to ASTM C553
2. Semi-rigid board
3. Reinforced all service vapour retarder jacket
4. Operating temperatures: 4 to 121°C (40 to 250°F)
5. Density: 48 kg/m³
6. Maximum k value: 0.044 W/m°C @ 24°C
7. Acceptable Manufacturers
 1. Knauf Fibreglass
 2. Johns Manville - Spin-Glass Series 814
 3. Owens Corning - 703/AF530

2.1.3. Insulation Finish

2.1.3.1. PVC (Polyvinyl Chloride) jacket

1. Minimum thickness: 20 mil
2. Maximum permeability: 0.09 perms
3. Premoulded one-piece fitting covers
4. Tape: vinyl, pressure sensitive, colour matched
5. Acceptable manufacturers:
 1. Johns Manville - Manville Zeston 2000
 2. ACWIL Insulations
 3. Sure Fit Systems

2.1.4. Adhesives

2.1.4.1. Contact bond cement

1. Quick setting for metal surfaces
2. Acceptable manufacturers:
 1. Monsey Bakor - 200-37
 2. Foster - 85-75

2.1.4.2. Lap seal adhesive

1. For joints and lap sealing of vapour barriers
2. Acceptable manufacturers:
 1. Monsey Bakor - 230-39
 2. Foster - 85-75

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- 2.1.4.3. Contact adhesive
 - 1. Acceptable manufacturers:
 - 1. Foster - 85-20
 - 2.1.4.4. Lagging adhesive
 - 1. Acceptable manufacturers:
 - 1. Monsey Bakor - 120-18
 - 2. Foster - 30-36
 - 2.1.5. Mastic
 - 2.1.5.1. Interior:
 - 1. Acceptable manufacturers:
 - 1. Monsey Bakor - 120-19
 - 2. Foster - 30-35
 - 2.1.5.2. Exterior, with vapour barrier:
 - 1. Acceptable manufacturers:
 - 1. Monsey Bakor - 130-11
 - 2. Foster - 65-07
 - 2.1.5.3. Exterior, breather type:
 - 1. Acceptable manufacturers:
 - 1. Childers - CP-10
 - 2.1.5.4. Exterior - aluminum colour finish:
 - 1. Acceptable manufacturers:
 - 1. USE Hickson - Hydrosshield Mastic 451 with "Stormking" aluminum coating
 - 2.1.5.5. Cutback asphalt:
 - 1. Acceptable manufacturers:
 - 1. Monsey Bakor - 700-01
 - 2. Foster - 60-25
 - 2.1.6. Miscellaneous Products
 - 2.1.6.1. Sealants:
 - 1. Acceptable manufacturers:
 - 1. Monsey Bakor - 230-39
 - 2. Foster - 30-80
 - 2.1.6.2. Vapour barrier tape
 - 1. Colour matched, foil faced vapour barrier tape
 - 2. 75 mm wide
 - 3. Vinyl backed or foil backed to suit insulation
 - 4. Acceptable manufacturers:
 - 1. Johns Manville - Zeston Z-tape
 - 2. MacTac Canada Ltd - Vinyl Scrim or Foil Scrim Kraft

3. Compac Corp
4. Fattal Canvas Inc

2.1.6.3. Bands

1. Stainless steel or galvanized metal, 12 mm wide with mechanical cinch locks.

2.1.6.4. Insulation cement

1. Acceptable manufacturers:
 1. Partek – Hilcote

2.1.6.5. Vapour barrier insulation coating

1. Acceptable manufacturers:
 1. Monsey Bakor - 130-11
 2. Foster - 60-38

2.1.6.6. Weld pins, studs and clips

1. Acceptable manufacturers:
 1. Midwest Fasteners Inc
 2. Continental Stud welding
 3. AGM

2.1.6.7. Caulking

1. Fast-drying colour matched flexible butyl elastomer based vapour barrier sealant.

PART 3 - EXECUTION

3.1. **APPLICATION**

3.1.1. General

- 3.1.1.1. Perform insulation work using qualified insulating applicators, in accordance with latest trade application methods and to the Consultant's approval.
- 3.1.1.2. Clean all surfaces to be insulated to remove grime, grease, oil, moisture or other matter to ensure that insulation is applied to clean and dry surfaces.
- 3.1.1.3. Apply insulation under ambient temperature conditions in accordance with insulation or adhesive manufacturer's recommendations.
- 3.1.1.4. Do not apply insulation until such time as installation and testing of piping, ductwork and equipment has been inspected, verified, and accepted by the Contractor.
- 3.1.1.5. Apply insulation neatly and tightly in unbroken lengths and with ends of sections firmly and squarely butted together. Lap canvas (or other specified wrapping) well over joints and cement down well with adhesive.
- 3.1.1.6. At wall sleeves: extend insulation through to make insulation continuous.
- 3.1.1.7. At fire walls: terminate insulation at wall, and pack space between wall sleeve and duct or pipe as specified in Section 23 05 10 "Basic Mechanical Material and Methods".

3.1.2. Piping

3.1.2.1. General

1. Neatly finish insulation at pipe hangers, supports, sensors and interruptions.
2. At expansion joints in piping: apply insulation over sleeve of 1.6 mm metal, fabricated to fit

around expansion joint without restricting movement of joint.

3. Provide sleeves which can be removed without damage to adjoining insulation to allow repacking and lubrication of expansion joint.
4. Provide sleeves minimum of 75 mm longer than expansion joint and fitted with insulation retaining flanges and with means for maintaining position of sleeve over expansion joint.

3.1.2.2. Type P1

1. Lap and seal all joints (longitudinal and transverse). Use vapour barrier tape on transverse joints. Locate longitudinal joints on top of pipe.
2. Insulate fittings, unions, flanges and valves with preformed block insulation or with segments cut from insulation of same type and thickness as pipe insulation.
3. Form insulation on fittings and valves without voids. Secure in place with galvanized metal bands.
4. Seal ends of insulation with mastic matching finish colour of insulation.

3.1.2.3. Insulation termination points:

1. Terminate 75 mm from fittings.
2. Bevel insulation at 45 degree angle away from fitting.
3. Finish exposed face with insulating and finishing cement.

3.1.2.4. Insulation protection inserts - cold piping systems under 15°C

1. Place an insert between support with insulation shield and pipe on cold piping NPS 1½ and larger
2. Fabricate insert from Type P5 insulation
3. Insert length: extending a minimum 150 mm beyond each end of insulation shield
4. Insert circumference: 360 degrees
5. Insulation shield: to Section 23 05 29 "Pipe Hangers"
6. Where insert material actual thickness is different from the actual thickness of the adjacent insulation, shave the insert to an equal thickness of the adjacent insulation
7. Bond the insulation shield to the insulation insert with adhesive and finish and seal complete assembly with vapour barrier insulation coating to form an unbroken vapour barrier, or,
8. Finish insulation insert as part of the main pipe insulation, and provide two metal band clamps for each insulation shield and strap the shield to the finished pipe insulation.

3.1.3. Ductwork

3.1.3.1. General

1. Insulate access doors or removable panels in ductwork as separate units to permit opening or removal without damage to adjoining insulation.

3.1.3.2. Type D1

1. Fasten insulation with adhesive, applied in 150 mm wide strips at 300 mm centres.
2. Tightly butt all edges and joints and seal with interior mastic and scrim foil tape.
3. Tying cord may be used to temporarily hold insulation until adhesive has set.

3.1.3.3. Type D2

1. Secure insulation with welded pins and speed washer type fasteners at 300 mm centres.

Provide a minimum of two rows of fasteners on each side of duct.

2. In addition to mechanical fasteners, adhere insulation with adhesive applied in 150 mm strips on 450 mm centres.
3. Tightly butt all edges and joints and seal with interior mastic and scrim foil tape.
4. Cut off protruding ends of welded pins and cover speed washers with same tape.

3.2. **INSULATION SELECTION**

System	Max. Op. Temp °C (°F)	Pipe Size NPS	Insulation Type	Insulation Thickness mm
Equipment drain lines, safety valve vents, relief valve vents, condensate drain piping etc.	110 (230)	All	P1	25
High temperature heating piping	93 (200)	All	P1	38

3.3. **HVAC DUCTWORK:**

3.3.1. Insulate the following systems:

System	Location	Max. Op. Temp °C (°F)	Insulation Type	Insulation Thickness mm
Conditioned supply air ductwork	Exposed	65 (150)	D2	38
	Concealed		D1	38
Fresh air intake plenums and ductwork	Exposed	38 (100)	D2	38
	Concealed		D1	50
Return air ductwork	Exposed	38 (100)	D2	38
	Concealed		D1	38
Exhaust air plenums and ductwork	Exposed	38 (100)	D1	38
	Concealed		D1	38

3.4. **FINISH**

3.4.1. Piping

3.4.1.1. Finish Indoor piping in accordance with the following:

System	Pipe	Fittings, Valves, etc.
P1	PVC	(PVC)

3.4.2. Ductwork

3.4.2.1. Finish outdoor ductwork with aluminum jacketing.

3.4.2.2. Finish (indoor) exposed ductwork in accordance with the following:

System	Ductwork
D1	PVC
D2	PVC

3.4.3. General

3.4.3.1. Piping insulated with elastomeric foam insulation:

1. Indoors and outdoors - finish with one coat of white acrylic latex as recommended by insulation manufacturer.

3.4.3.2. Outdoor piping:

1. Finish insulated piping with a field or factory applied aluminum jacket. Fasten and caulk butt joints and secure with sheet metal screws. Locate longitudinal joints on bottom of pipe.
2. Alternatively, finish with two coats of outdoor type mastic - aluminum colour finish.

3.4.3.3. Outdoor ductwork:

1. Finish insulated ductwork with one layer of glass fibre fabric applied between two full mop coats of exterior mastic - aluminum colour. Topcoat with aluminum coating in accordance with manufacturer's direction. Store materials in a heated space prior to application.
2. Finish insulated ductwork with a 0.6 mm thick, field applied lock forming quality aluminum jacketing materials with a smooth finish. Provide a minimum overlap of 50 mm on each longitudinal and transverse seam. Do not allow mastic materials to come in contact with single ply membrane roofs.
3. Provide 20 mm wide, 0.38 mm thick S.S. insulation bands to secure aluminum jacketing materials in place. Clean up accidental spills immediately. Provide temporary drop sheets to protect the roof.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL

- 1.1.1. The scope of work for this section shall be jointly completed by the controls contractor, the Tab contractor and the mechanical contractor.
- 1.1.2. Perform the work of this Section including but not limited to the following:
 - 1.1.2.1. Performance testing and balancing of heating, ventilating, air conditioning and hydronic systems.
 - 1.1.2.2. Survey of installed automatic controls and verification of functional performance.
 - 1.1.2.3. Measuring and reporting all specified space noise levels.
 - 1.1.2.4. Test performance of all vibration isolation equipment.
 - 1.1.2.5. Rechecking of testing and balancing during the alternate (heating/cooling) season.

1.2. RELATED WORK IN OTHER SECTIONS

- 1.2.1. Factory testing, and calibrating of equipment or control systems.
- 1.2.2. Testing and checking of equipment supplied by other Divisions, except where such equipment forms an integral part of the mechanical systems.

1.3. COORDINATION

- 1.3.1. The Contractor shall provide the following assistance and/or services to the Testing and Balancing firm.
 - 1.3.1.1. Schedule sufficient time so that initial testing and balancing can be completed before occupancy begins and coordinate with trades involved.
 - 1.3.1.2. Keep Testing and Balancing firm informed of any major changes made during construction and furnish same with a set of Project Drawings and reviewed Shop Drawings.
 - 1.3.1.3. Furnish balancing devices, test connections access openings, balancing probe inlets and plugs.
 - 1.3.1.4. Clean and pre-run all equipment, filters, etc. and place all heating, ventilating and air conditioning systems into full operation and continue same during each working day of testing and balancing.
 - 1.3.1.5. Provide immediate labour from pertinent mechanical trades and tools, equipment and materials to make equipment and system alterations and adjustments, as required including control adjustments.
 - 1.3.1.6. Building Automation System technical representative to operate the BAS during air and water balancing testing.
 - 1.3.1.7. Make available all equipment data (Shop Drawing Performance Data and operating instructions) to the Testing and Balancing Firm.
 - 1.3.1.8. Heating equipment manufacturer service representative, or other qualified service company technical representative, for performance testing of heating equipment. Testing and Balancing Firm witnesses and records all test results.
- 1.3.2. As part of the coordination effort, the Contractor shall be fully responsible for systems constructed, installed and adjusted to provide optimum performance as required by design intent. Any re-adjusting required as the result of spot checks by the Consultant shall be done at no increase in Contract Price.

1.4. SUBMITTALS

- 1.4.1. Submit layout Drawings and Report Format a minimum 10 business days prior to start of air and water balancing on-site.

1.4.1.1. Report Format

1. Submit proposed format of initial report.
2. Include a complete list of instruments and tests for which they are to be used as they relate to this Project, including date of last calibration

PART 2 - PRODUCTS

2.1. **NOT APPLICABLE.**

PART 3 - EXECUTION

3.1. **REQUIRED REPORTS**

3.1.1. Provide the following Start-Up and Performance Testing reports:

3.1.1.1. Equipment start-up signed report (start-up to be performed by manufacturer's authorized representative).

3.1.1.2. Authorities report, as required.

3.1.1.3. Air and water balancing report

3.1.1.4. Controls report

3.1.1.5. Alternate Season test report

3.1.2. Report Format

3.1.2.1. Prepare test forms in MS Excel or Word format. Results of tests may be filled in by hand.

3.1.2.2. Include the following header information for each test report:

1. Owner Name
2. Project Name and reference number
3. Contractor Name
4. Consultant Name
5. Name of Test Report

3.1.2.3. Include the following on the front sheet of the consolidated report:

1. Contractor Company Name
2. Name and signature of the person submitting the report
3. Date of report
4. The following statement: "The undersigned certifies that the test results recorded in this report are correct and that results have been witnessed by the trade responsible for the test" shall be at the bottom of each test report.

3.1.3. Submit the above tests in a hardcopy form, separately bound from the Operations and Maintenance manuals, and in Adobe Acrobat PDF format.

3.2. **EQUIPMENT START-UP REPORT**

3.2.1. Provide a consolidated test report for all equipment to be installed under this contract, including the following start-up tests:

3.2.1.1. Equipment/System Summary tests

3.2.1.2. Equipment/System start-up test.

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- 3.2.1.3. Manufacturer's start-up test
- 3.2.2. Equipment/System Summary Tests
- 3.2.2.1. Provide a test report in spreadsheet format which summarizes the following data for each piece of equipment which is powered or has automatic controls:
1. Equipment ID and name
 2. Motor rotation (bump test) - result and initialled by the Contractor
 3. Equipment Start-Up report status - status and initialled by the Contractor
 4. Manufacturer Start-Up report status – status and initialled by the Contractor
 5. Test completion date
- 3.2.2.2. Provide a test report in spreadsheet format which summarizes the following data for pressure testing of piping systems:
1. System name
 2. System limits (if system is not tested in its entirety)
 3. Type of test (pneumatic, hydrostatic)
 4. Pressure at start of test
 5. Pressure at end of test
 6. Duration of test
 7. Contractor dated and initialled.
- 3.2.2.3. Provide a test report in spreadsheet format which summarizes the following tests for equipment served by liquid, gas or vapour systems
1. Equipment ID and name
 2. Isolation valves are in the open position – status and initialled by the Contractor
 3. Pressure relief valves installed – record setpoint and initialled by the Contractor
- 3.2.3. Equipment/System Start-Up Test Report
- 3.2.3.1. Provide a separate start-up report for each piece of the following equipment. The SMACNA “Systems Ready to Balance Check List”, where applicable, may be used for this report.
1. HVAC Units
 2. Duct Systems
 3. Hydronic piping systems
- 3.2.4. Manufacturer's Start-Up Test
- 3.2.4.1. Provide a separate start-up report for each piece of the following equipment, utilizing the manufacturer's start-up check list. This report may be prepared by the manufacturer's service representative.
1. Packaged AC equipment (RTU and UV)
 2. Hydronic Pumps
- 3.3. **AUTHORITIES REVIEW**
- 3.3.1. Submit copies of authorities-having-jurisdiction inspection and test reports, including:
- 3.3.1.1. Plumbing and drainage municipal inspector reports

3.3.1.2. TSSA pressure vessel and piping inspection reports

3.3.1.3. ESA field certification reports

3.4. **AIR AND WATER BALANCING**

3.4.1. Provide air and water balancing report: to Section 23 05 93 "Air and Water Balancing".

3.5. **CONTROLS / BUILDING MANAGEMENT SYSTEM**

3.5.1. Include in manufacturer's start-up test report that all individual equipment (RTU and UV) are provided with provisions, including terminal details, that would allow future integration of these new equipment control and monitoring through Building Automation System (BAS).

3.6. **ALTERNATE SEASON TESTING**

3.6.1. Provide alternate season test report: to Section 23 05 93 "Air and Water Balancing".

3.7. **DEFICIENCIES**

3.7.1. Immediately report to the Consultant, any deficiencies in the systems or equipment performance resulting in design requirements being unobtainable.

3.8. **DRAFT REPORT**

3.8.1. On completion of the start-up, testing, adjusting and balancing of all systems, submit to the Consultant, two (2) typewritten copies of a full report on all tests, adjustments, and balancing performed, including the following:

3.8.1.1. Summary of all systems

3.8.1.2. Testing methods and instrumentation

3.8.1.3. Start-Up reports

3.8.1.4. Authorities Having Jurisdiction reports

3.8.1.5. Air systems testing and balancing data

3.8.1.6. Liquid systems testing and balancing data

3.8.1.7. Acoustic Survey report

3.8.1.8. Attachments including systems schematics with numbered terminals for referring to data above.

3.8.2. After review by the Consultant and at the Consultants direction, retest up to 10% of all measurements in locations as directed by the Consultant, at no cost extra to the Contract.

3.9. **INTERIM REPORT**

3.9.1. After completion of any retesting described above, submit three (3) typewritten copies of the interim report, in a 3-hole "D" style binder and two (2) CD-R electronic copies in Adobe Acrobat ver.6 PDF format.

3.9.2. This report is required to obtain Substantial Performance of the Contract.

3.10. **FINAL REPORT**

3.10.1. Submit to Consultant following completion of alternate season testing and balancing. Submit three (3) typewritten copies and two (2) CD-R Adobe PDF in the same formats as the initial report specified above.

3.11. **SPOT CHECK**

- 3.11.1. Before acceptance of the air and water balancing report, the Consultant may request to witness spot-checks of the report results.
- 3.11.2. If results indicate unusual testing inaccuracy, omissions, or incomplete balancing/adjustment, in the opinion of the Consultant, re-balance entire affected system(s) at no increase in Contract Price.

3.12. **ACCEPTANCE**

- 3.12.1. The Substantial Performance of the Mechanical Work will be considered reached when the interim Start-Up and Performance Testing report is accepted by the Consultant and in the opinion of the Consultant all systems have been satisfactorily installed, operated tested, balanced, and adjusted to meet the specified and intended performance.
- 3.12.2. The substantial performance will not depend upon alternate season testing as specified hereafter, however, make such relevant repairs or modifications deemed necessary during this re-checking as part of the guarantee of the Work.
- 3.12.3. The total performance of the Contract will not be considered reached until the alternate season testing and balancing is completed and the final report submitted and accepted by the Consultant.

3.13. **ADDITIONAL TESTING**

- 3.13.1. The Consultant may request such additional testing in connection with this Project as deemed necessary.

END OF SECTION

PART 1 -

GENERAL

1.1. **SUMMARY**

1.1.1. Section Includes:

1.1.1.1. Materials and installation for balancing and certification of HVAC air and liquid systems.

1.1.1.2. Sustainable requirements for construction and verification.

1.2. **REFERENCES**

1.2.1. Associated Air Balance Council (AABC).

1.2.2. National Standards for Total System Balance 2002.

1.2.3. Health Canada/Workplace Hazardous Materials Information System (WHMIS).

1.2.4. Material Safety Data Sheets (MSDS).

1.3. **DESIGN REQUIREMENTS**

1.3.1. Perform air and water balancing, to minimum requirements specified in AABC, National Standards manual.

1.3.2. Air and water balancing shall be separately done in the heating season and the cooling season.

1.4. **FLOW RATE TOLERANCE**

1.4.1. Airflow: Minus 5% to plus 5%.

1.4.2. Heating water: Minus 2% to plus 2%.

1.5. **SUBMITTALS**

1.5.1. Co-ordinate submittal requirements and provide submittals.

1.6. **PRODUCT DATA:**

1.6.1. Submit manufacturer's printed product literature, specifications and data sheet for testing and balancing equipment.

1.6.2. Instructions: submit manufacturer's installation instructions.

1.7. **REPORTS:**

1.7.1. Submit 4 copies of Balancing and Certifying Report upon completion of work.

1.7.2. Report Format: AABC Test and Balance Procedures manual. Include recommendations where additional balancing devices should be installed. Include actual test procedure details, initial and final balanced performance figures.

1.8. **QUALITY ASSURANCE**

1.8.1. Engage balancing agency accredited by the Associated Air Balance Council (AABC).

1.8.2. National Building Comfort Testing Association (NBCTA)

1.8.3. Measurement Instruments: calibrated to AABC recommendations.

1.9. **APPROVED TAB AGENTS**

1.9.1. Damper Air Balancing Inc.

1.9.2. Designtest and Balance Co Ltd.

PART 2 - **PRODUCTS**

2.1. **NOT USED**

PART 3 - **EXECUTION**

3.1. **ADJUSTING AND BALANCING**

3.1.1. Balance all air and water systems to provide the specified air and water flow rates.

3.1.2. Perform system balancing to AABC - Test and Balance Procedures.

3.1.3. Permanently mark valve, damper and other adjustment device settings in their balanced position.

3.1.4. Set and lock memory stop balancing devices.

3.1.5. Balance liquid systems only after successful balancing of air systems.

3.2. **FIELD QUALITY CONTROL**

3.2.1. Performance Verification:

3.2.1.1. Perform random flow readings in presence of the Consultant after completion of balancing report. If inconsistencies are noted between balancing report and random readings, re-balance entire system and re-submit balancing report until random readings coincide with report at no additional cost.

END OF SECTION

PART 1 - GENERAL

1.1. SUMMARY

- 1.1.1. The approved Building Automations System Contractor per 2.1, referred to herein as the Contractor, shall provide a Direct-Digital Control System as indicated on the project documents in accordance with the drawings and as described in these specifications.
- 1.1.2. Where existing legacy controls exist, the Contractor shall be responsible for the removal and preservation of existing controls and accessories, and to engineer, permit, provide and install a fully functioning Building Automation System which meets the requirements detailed herein.
- 1.1.3. Where an Owner or Owner's representative provided points / object and equipment list is not provided as part of the bid package, the Contractor shall be responsible to verify existing site conditions and/or review all available drawings so to ensure all existing and/or currently proposed equipment at the facility is identified in accordance with 1.3.2, and is made part of the complete Direct-Digital Control System.
- 1.1.4. The work administered by this Section of the technical specifications shall include all engineering, programming, labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, project specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, warranty, specified services and items required for a complete and fully functional Controls Systems.

1.2. RELATED SECTIONS:

- 1.2.1. General and Supplementary Conditions
- 1.2.2. Division 01 General Requirements
- 1.2.3. Section 23 09 93 Sequences of Operation for HVAC Control
- 1.2.4. Section 23 70 00 Central HVAC Equipment
- 1.2.5. Section 25 00 00 Integrated Automation
- 1.2.6. Section 26 05 00 Common Work Results for Electrical
- 1.2.7. Section 26 09 00 Instrumentation and Control for Electrical Systems
- 1.2.8. Section 26 20 00 Low Voltage Electrical Distribution

1.3. DESIGN INSTRUCTIONS

- 1.3.1. Design shall meet the functional intent of an "open", and interoperable Building Automation System, comprised of a network of stand-alone digital controllers. Incorporating the Niagara 4 Framework®.
- 1.3.2. The Building Automation System is to include, but not limited to, the monitoring and/or control of **ALL** of following equipment instances at each specified site:
 - 1.3.2.1. Boilers
 - 1.3.2.2. Chillers
 - 1.3.2.3. Cooling tower

-
- 1.3.2.4. Air handling units
 - 1.3.2.5. HVAC Equipment
 - 1.3.2.6. Exhaust fans
 - 1.3.2.7. Variable Frequency Drives
 - 1.3.2.8. Supply and Return Air Fans
 - 1.3.2.9. Pumps
 - 1.3.2.10. Motors
 - 1.3.2.11. Valves
 - 1.3.2.12. Unit Heaters
 - 1.3.2.13. Radiant Heaters
 - 1.3.2.14. Electric and Hydronic Duct Heaters
 - 1.3.2.15. Pneumatic Valves and Controls
 - 1.3.2.16. Utility Consumption and Demand Metering
 - 1.3.3. The system shall be modular in nature and designed for future flexibility so to accommodate the addition of functionality, control points or expansion of facility.
 - 1.3.4. The control systems shall be designed such that each mechanical system shall operate under stand-alone mode. The contractor administered by this Section of the technical specifications shall provide controllers for each mechanical system. In the event of a network communication failure, or the loss of any other controller, the control system shall continue to operate independently. Failure of the B-BC shall have no effect on the field controllers, including those involved with global strategies
 - 1.3.5. Coordinate the specifications and equipment schedules in related sections for manufacturer furnished DDC systems to ensure the minimal hardwired points and sequences can be met in accordance with Section 23 09 93. OEM DDC Systems, that meet the minimum hardwired points are preferred and approved for use with the following equipment ONLY; boilers, main air handling equipment and, chillers. The supplier of the equipment is responsible for the configuration, programming, start-up, and testing of that product to meet the sequence of operation and specifications. The supplier shall also provide any licensing, hardware, and software required for interface to the DDC system
 - 1.4. **DEFINITIONS**
 - 1.4.1. Definitions of terms used in this section may differ from those given in general and supplementary conditions and take precedence over them.

BAS	Building Automation System
B-BC	BACnet Building Controller
B-AAC	BACnet Advanced Application Controller
B-ASC	BACnet Application Specific Controller
BACnet / BACnet Standard	Building Automation and Controls Network - ANSI/ASHRAE Standard 135-2012
BACnet/IP	BACnet Annex J – describes how BACnet devices can make use of IP directly for communicating across IP-based terminals
BBMD	BACnet Broadcast Management Device, see BACnet Annex J
BIBB	BACnet Interoperability Building Blocks: A BIBB defines a small portion of BACnet functionality that is needed to perform a particular task
BTL	BACnet Testing Laboratory: A recognized, independent third party laboratory certified to test product for compliance to BACnet standards. BTL Certified products are indicated by a registered seal affixed to the product.
B/I	Binary Input
B/O	Binary Output
COV	Change of Value
cUL	Underwriters Laboratory Canada
DDC	Direct Digital Control
D/I	Digital Input
D/O	Digital Output
Embedded Control	Some OEM's (Original Equipment Manufacturer) equipment have a factory installed controller. These controllers must follow these standards. Examples can be found in chillers, boilers, variable frequency drives, etc. Proprietary communication protocols will not be allowed.
Gateway	A device, which contains two or more dissimilar networks/protocols, permitting information exchange between them (ASHRAE/ANSI 135-2004). Gateways are NOT to be included unless approved by the Owner.
GUI	Graphical User Interface
HVAC	Heating, Ventilation and Air-Conditioning
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input / Output
LAN	Local Area Network (an individual school or site)
MS/TP	Master Slave Token Passing: Data link protocol as defined by the BACnet Standard. Operates over a serial field bus network (RS485)
NEMA	National Electrical Manufacturers Association
PICS	Protocol Implementation Conformance Statement: All devices conforming to the BACnet protocol shall have a documented statement that identifies all portions of BACnet that are implemented in the device.
P.I.D.	Proportional Integral Derivative
Shall	indicate a requirement that, in the view of the Board, must be complied with
UPS	Uninterruptible Power Supply Unit

VFD	Variable Frequency Drive
VLAN	Virtual Local Area Network: Dedicated for Facilities Services equipment
WAN	Wide Area Network (board wide)

1.5. REFERENCE STANDARDS

- 1.5.1. Where edition date is not specified, consider that references to the manufacturer’s data, and published codes, standards and specifications are made to the latest edition or revision, approved by the issuing organization.
- 1.5.2. Reference Standards and specifications are quoted to establish minimum standards. Work in which quality exceeds the specified minimum will be considered to conform.
- 1.5.3. The requirements of the Contract Documents govern over the requirements of reference standards and specifications.
- 1.5.4. Standards, specifications, associations and regulatory agencies are generally referred to throughout the Contract Documents by their abbreviated designations, as listed below:
 - 1.5.4.1. AMCA American Movement and Air Control Association
 - 1.5.4.2. ANSI American National Standards Institute
 - 1.5.4.3. ARI Air Conditioning and Refrigeration Institute
 - 1.5.4.4. ASME American Society of Mechanical Engineering
 - 1.5.4.5. ASTM American Society for Testing and Materials
 - 1.5.4.6. ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers
 - 1.5.4.7. CGA Canadian Gas Association
 - 1.5.4.8. CGSB Canadian General Standards Board
 - 1.5.4.9. CSA Canadian Standards Association
 - 1.5.4.10. NFPA National Fire Protection Association
 - 1.5.4.11. SMACNA Sheet Metal and Air Conditioning Contractors’ National Association
 - 1.5.4.12. ULC Underwriters’ Laboratories of Canada

1.6. SYSTEM ARCHITECTURE AND DESCRIPTION

- 1.6.1. The Building Automation System as detailed in this Section shall be based on a hierarchical architecture incorporating the Niagara 4 Framework® through Tier 1 and 2 inclusive. Systems not developed on the Niagara 4 Framework® platform are unacceptable.
- 1.6.2. All Niagara 4 Framework® components shall have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification.
- 1.6.3. All devices supplied under this specification, excluding sensors, shall be connected to the site LAN and shall communicate natively using the following BACnet/IP, BACnet MS/TP, Peer to Peer, or Ethernet (ISO 8802-3), as defined in the ANSI/ASHRAE Standard 135, latest or Peer-to-Peer using Niagara’s Fox Protocol or SNMP.

- 1.6.4. Program data-bases, data acquisition and all control sequence logic shall reside in the respective B-BC, B-AAC and B-ASC controller. Each device shall, to the greatest extent possible, perform its programmed sequence. Operation of each device shall not be dependent on a connection to a server or master controller.
- 1.6.5. The B-BC and any B-AAC or B-ASC shall be capable of updating firmware without the replacement of any hardware, microprocessors or chips.
- 1.6.6. Each school / site shall be furnished with a single B-BC, which is responsible for and capable of providing fully distributed control including user access control and all necessary site computations at the site, independent of or under the Enterprise Management System and it must be stand-alone, multi-tasking, multi-user with a real-time digital processor. All controlled objects, sequences and associated operational parameters shall be both operator definable and modifiable through the embedded User Interface.
- 1.6.7. The B-BC shall provide a web-based graphical user interface for programming, monitoring, and control, independent of any Enterprise Management System, be accessible remotely from a central site(s) and locally. The web-enabled user interface shall operate on an industry standard web-browser without the requirement of additional plugins.
- 1.6.8. Each Mechanical or Electrical System and/or major piece of mechanical or electrical equipment shall have 1 dedicated B-AAC controller with sufficient I/O capacity such that it shall be connected to ALL field devices and points associated with that system, space and/or piece of equipment. B-ASC use shall be limited to VAV box applications provided the full functional intent can be met within the singular device.
- 1.6.9. Mechanical and Electrical Systems i.e., VFD's, chillers, boilers, unitary equipment, etc. units that are equipped with manufacturers furnished controls shall be BTL certified. Gateways are not to be used unless prior written approval has been acquired. A single B-AAC can be used in combination with the manufacturer supplied controls, only where the manufacturer's controls are unable to meet the functional intent, it shall be implemented in accordance with Section 23 09 93.
- 1.6.10. The use of multiple application controllers used to control a single piece of equipment is strictly prohibited, except those specifically noted in 1.6.9.
- 1.6.11. The system shall include real time monitoring of the following utilities; electricity (main feed), natural gas (main), and water (main). Meters supplied under this division shall communicate BACnet Natively. For existing meters, utility owned, coordinate integration requirements with the respective utility provider.
- 1.6.12. The B-BC shall be connected to the HDSB Facilities VLAN, in accordance with Section 25 00 00, to be supplied by the Owner at the Owners expense.
- 1.6.13. Site workstations, otherwise referred to as Caretaker PC, will be provided by the Board.
- 1.7. **HARDWARE AND SOFTWARE LICENSING**
- 1.7.1. The Owner shall be named license holder of all controllers and components, software and firmware supplied under this specification. The Owner shall receive ownership of all project specific configuration documentation, data files, and application-level software developed for the site.
- 1.7.2. The Owner shall have unrestricted access rights for all network management, operating system server, engineering and programming software required for the ongoing maintenance and operation of the building automation system
- 1.7.3. All software provided shall be full featured and not limited or trial version.

1.8. **USER CONTROL OVER CONFIGURATION**

1.8.1. The intent of this specification is to provide a system which shall allow the Board to independently do its own modifications to all objects, operational parameters and sequences.

1.9. **INTELLECTUAL PROPERTY AND PROPRIETARY MATERIAL**

1.9.1. The Board shall sign a software and hardware licensing agreement, upon review and agreement of terms and conditions, as a condition of contract. Such license will grant use of all programs and application software to the Board and it's representatives, as defined by the agreement, and shall protect the manufacturer's rights to disclosure of intellectual property contained within such software.

1.10. **SYSTEM PERFORMANCE**

1.10.1. The System shall conform to the following minimum:

1.10.1.1. The system shall report values with minimum end-to-end accuracy listed in Table 1.

Table 1 - Reporting Accuracy	
Measured Variable	Reported Accuracy
Space Temperature	1% of range
Ducted Air Temperature	1% of range
Outside Air Temperature	±1°C (±2°F)
Water Temperature	1% of range
Water Flow	±2% of full scale
Airflow (terminal)	±10% of full scale (see note 1)
Airflow (measuring stations)	±5% of full scale
Airflow (pressurized spaces)	±3% of full scale
Air Pressure (ducts)	±25 Pa (±0.1 in. w.g.)
Air Pressure (space)	±3 Pa (±0.01 in. w.g.)
Water Pressure	±2% of full scale (see note 2)
Carbon Dioxide (CO ²)	±50 ppm
Electrical (kW, kVA, kWh, A, V, pF)	±1% of reading (see note 3)

Note 1: 10% - 100% of scale

Note 2: For both absolute and differential pressure

Note 3: Not including utility-supplied meters

1.10.1.2. Control Stability and Accuracy shall maintain measured variable at set-point within tolerances listed in Table 2.

Table 2 – Control Stability and Accuracy		
Controlled Variable	Control Accuracy	Range of Medium Accuracy
Air Pressure	±50 Pa (±0.2 in. w.g.) ±3 Pa (±0.01 in. w.g.)	0-1.5 kPa (0-6 in. w.g.) -25 to 25 Pa (-0.1 to 0.1 in. w.g.)
Airflow	±10% of full scale	
Space Temperature	±1°C (±2°F)	
Duct Temperature	±1.5°C (±3°F)	
Fluid Pressure	±10 kPa (±1.5 psi) ±250 Pa (±1 in. w.g.)	MPa (1-150 psi) 0-12.5 kPa (0-5 in. w.g.) differential

1.11. WORK COVERED BY THE CONTRACT DOCUMENTS

- 1.11.1. The Scope of Work for the Building Automation Systems Contractor shall include, but is not limited to the following:
 - 1.11.1.1. Demolition; all existing Building Automation Controls (as shown and indicated on the drawings and as specified herein) and accessories being replaced shall be removed from site and disposed of in accordance with local regulations. Prior to disposal, provide a list of controllers and accessories to Owner, which will be salvaged and remitted to the Owner for the explicit use of maintaining existing legacy systems at other sites.
 - 1.11.1.2. Furnish and install all necessary controllers, control and/or ancillary devices, sensors, wiring, pneumatic peripherals and tubing, software, licenses, and programming to deliver a complete and functional building automation system, which meets the functional intent of the systems design.
 - 1.11.1.3. The naming and addressing of all objects and devices to be in accordance with the specifications.
 - 1.11.1.4. Configure the web-based user interface embedded in the B-BC in accordance with the specifications.
 - 1.11.1.5. Coordinate equipment specifications for related sections necessary to meet the functional intent including: variable frequency drives, dampers, valves, actuators, and peripheral devices considered to have wet surfaces such as pressure taps, thermal wells, flow switches, flow meters, etc., Preference is given to these devices being furnished by the Original Equipment Manufacturer, where applicable.
 - 1.11.1.6. Review and coordinate with other related sections so to ensure all mechanical and electrical systems and components to be integrated have the necessary hardware and software to meet the points and sequences specified.
 - 1.11.1.7. Coordinate with the Owner, the setup and communication of the B-BC on the Owners supplied VLAN, in accordance with the specifications.
 - 1.11.1.8. Coordinate with the Owner and the respective utility provider, the installation and setup of utility metering equipment or the integration of any existing meters, in accordance with the specifications.
 - 1.11.1.9. Identify and label all controllers and associated devices including but not limited to connected I/O points, address', network id, etc.
 - 1.11.1.10. Verification of existing equipment operation, and notifying Owner of any deficiencies
 - 1.11.1.11. Attain, where required, all necessary permits and inspections
 - 1.11.1.12. Commissioning of new BAS

- 1.11.1.13. Submit the required documentation as described herein, including, but not limited to submittals, project record, start-up, commissioning, testing, acceptance documentation and system warranty
- 1.11.1.14. Operator Training
- 1.12. **PRODUCTS FURNISHED BUT NOT INSTALLED BY THE BUILDING AUTOMATION CONTRACTOR**
- 1.12.1. Hydronic Piping:
 - 1.12.1.1. Control Valves
 - 1.12.1.2. Flow Switches
 - 1.12.1.3. Temperature Sensor Wells and Sockets
 - 1.12.1.4. Flow Meters.
- 1.12.2. Ductwork Accessories:
 - 1.12.2.1. Automatic Dampers
 - 1.12.2.2. Air Flow Switches
- 1.13. **PRODUCTS NOT FURNISHED OR INSTALLED BUT INTEGRATED BY THE BUILDING AUTOMATION CONTRACTOR**
- 1.13.1. Fire Alarm Systems
- 1.13.2. Variable Frequency Drives
- 1.13.3. Boiler and/or Chiller Equipment and Controls (BACnet Points necessary to meet specifications for monitoring and history only)
- 1.13.4. Unitary and Packaged Equipment and Controls (BACnet Points necessary to meet specifications for monitoring and history only)

1.14. **RESPONSIBILITY MATRIX BY DIVISION CONTRACTOR**

Work / Item / System	Furnish	Install	Control Wiring	Power
Control System Communication Wiring	23 09 23	23 09 23	23 09 23	n/a
Controls Equipment, panels, enclosures, and accessories	23 09 23	23 09 23	23 09 23	26
Interface to OEM furnished controllers supplied under Division 23	23	23	23 09 23	26
Air Handling, HVAC, Unitary Manufacturer furnished space mounted control (i.e., thermostat)	n/a	n/a	n/a	n/a
Cooling Tower Level, Make-up Water and Sump Heater Control Devices (local control only)	23	23	23	23
Starters, operator switches			23 09 23	26
Automatic Damper (not OEM installed)			23 09 23	n/a
Automatic Damper Actuators	23 09 23	23 09 23	23 09 23	
Hydronic Valves			23 09 23	n/a
Hydronic Valve Actuators	23 09 23	23 09 23	23 09 23	
Thermo-wells (including accessories considered "wet")			n/a	n/a
Hydronic Flow Switches and Transducers			23 09 23	n/a
Variable Frequency Drives not OEM Furnished			23 09 23	26
Fire Alarm control monitoring relay	28	28	23 09 23	26

1.15. **EXISTING EQUIPMENT**

- 1.15.1. The re-use of existing Building Automation System materials, equipment and accessories is acceptable for the following ONLY:
 - 1.15.1.1. VFD's
 - 1.15.1.2. Non-ASC Actuators (excluding pneumatic)
 - 1.15.1.3. Control Valves (excluding pneumatic)
 - 1.15.1.4. Dampers
 - 1.15.1.5. Starters and Relays
 - 1.15.1.6. Low Voltage Wiring, except those identified in 2.3.2. below
 - 1.15.1.7. Conduit, Raceways, Boxes, Circuit breakers, Grounding, Panel boards, Switchgear Splitters, Field disconnect switches
 - 1.15.1.8. Thermowells
 - 1.15.1.9. Refrigeration Leak Monitoring
- 1.15.2. The re-use of any sensor is prohibited unless approved, in writing, by the Owner or the Owner's

representative.

1.15.3. The re-use of Network Cabling or Signal Cabling (input/output control wiring) is strictly prohibited.

1.16. **QUALITY ASSURANCE**

1.16.1. The Controls Contractor shall be responsible for inspection and quality assurance for all materials and workmanship provided

1.16.2. The Controls Contractor shall have an established working relationship with the proposed BAS manufacturer of not less than 3 years.

1.16.3. The Controls Contractor shall have successfully completed all control system training and certification as required by the manufacturer.

1.17. **PERMITS, INSPECTIONS AND TESTING**

1.17.1. Contractor will arrange for submission to the Electrical Safety Authority (ESA) for review of this project, and pay all associated fees. Provide Certificate(s) of Acceptance from ESA and other Authorities having jurisdiction upon completion of the Work.

1.17.2. Where modification to mechanical or electrical equipment control wiring is necessary to meet the requirements of the specifications, the contractor is responsible for arranging any testing required by the Authority Having Jurisdiction to maintain the required certification and ensure the safe operation of the equipment modified.

1.18. **PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT**

1.18.1. Installed equipment may be subject to performance verification as specified herein if required by Owner or Owner's Representative(s).

1.18.2. When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.

1.18.3. If requested, Contractor shall arrange for services of independent testing agency.

1.18.4. Maintain building comfort condition when equipment removed from service or testing purposes.

1.18.5. Promptly provide Owner, or Owner's Representative(s) with test reports.

1.18.6. Should test results reveal that originally installed equipment meets specified performance requirements, Owner will pay costs resulting from performance verification procedure.

1.18.7. Should test results reveal equipment does not meet specified performance, equipment will be rejected and the following shall apply:

1.18.7.1. Remove rejected equipment. Replace with equipment that meets requirements of Contract Documents, including specified performance requirements.

1.18.7.2. Replacement equipment may be subject to performance verification as well; use same testing procedures as performed on originally installed equipment.

1.18.7.3. Contractor shall pay costs resulting from performance verification procedure.

1.19. **SUBMITTALS**

1.19.1. All submittals and documentation including complete BAS System Engineering Design Submittal & Drawings, Project Record Documents, Application Engineering Documents and Owner's &

Maintenance Manuals shall be submitted electronically in the form of an Adobe Portable Document Format (.pdf). All Control Schematics, Wiring Diagrams, Riser Diagrams, &c. shall be formatted for A3 11" x 17". Floor Plans shall be submitted in CAD format (.dwg). All other documentation may be formatted for 8.5" x 11".

- 1.19.2. Submit in writing and so delineated at the beginning of each submittal, known substitutions and deviations from requirements of Contract Documents.
- 1.19.3. Complete BAS Engineering Design Submittal & Drawings shall be prepared in accordance with Section 1.20 using the following guidelines:
 - 1.19.3.1. Submittal documentation and drawings shall consistently use the same abbreviations, symbols, nomenclature and identifiers. Each control system element shall be assigned a unique identifier pursuant with the Contract Documents
 - 1.19.3.2. Submit the following:
 - 1.19.3.3. A complete bill of materials of all equipment, controllers, devices, sensors, actuators, valves, etc., necessary to meet the requirements detailed herein is to be provided, indicating unique equipment identifier/tag, unique device/controller identifier/tag, manufacturer and model number.
 - 1.19.3.4. Riser diagram of Local Area Network (LAN) shall outline execution and details of all network cabling, BAS & Network Hardware including the following:
 - 1. All BAS/DDC Hardware with controller number, MAC Addresses where required, unique identifier/tag, location, equipment and service
 - 2. All Network Hardware with unique identifier, location and service
 - 3. Network cabling configuration and execution specification
 - 4. Location of all cabling termination points and End of Line (EOL) terminators
 - 5. Location of all network interface jacks
 - 6. A separate riser diagram shall be provided for each network segment
 - 1.19.3.5. Provide manufacturers cut sheets for major system components. When manufacturer's cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include for every BAS component including but not limited to the following:
 - 1. Gateways or BBMD associated networking peripherals
 - 2. Control Valves
 - 3. Dampers
 - 4. Actuators
 - 5. Variable Frequency Drives
 - 1.20. **SUBSTANTIAL COMPLETION REQUIREMENTS.**
 - 1.20.1. Contractor shall provide checklist for completion before Substantial Completion Field Review. Provide written declaration that work is complete. The following items shall be complete before Substantial Completion Field Review:
 - 1.20.1.1. Mechanical and Electrical systems capable of operation with Building Automation System, in operation with alarms functional.

- 1.20.1.2. Tests on systems and equipment completed and certificates of approval obtained from regulating Authorities.
- 1.20.1.3. Fire stopping completed, if required.
- 1.20.1.4. Valve tagging completed and equipment, ductwork and piping identified.
- 1.20.1.5. Escutcheons installed.
- 1.20.1.6. Extended warranty form mailed to manufacturer and copy provided to Owner.
- 1.20.1.7. Ensure access doors suitable located and equipment accessible.
- 1.20.1.8. Ensure electrical connections to mechanical equipment are complete and motor rotation correct.
- 1.20.1.9. Equipment cleaned inside and out, lubricated and paint touched-up
- 1.20.1.10. Commissioning, Testing, Demonstration and Acceptance
- 1.20.1.11. Complete program back-up and system files provided and verified for functionality
- 1.21. **PROJECT RECORD**
- 1.21.1. Upon completion of installation and systems commissioning, submit record documents for review. "As-Built" Project Record Documents should include:
 - 1.21.1.1. Project Record Application Engineering Drawings shall include all BAS System Engineering Design Submittal with Drawings updated to reflect actual field conditions, architecture and execution
 - 1.21.1.2. Electronic Operating & Maintenance (O&M) Manual including:
 - 1. Operator's Manual with Manufacturers' complete operating instructions.
 - 2. Documentation of all project specific Application and DDC programs
 - 3. All necessary system Administrator-Level passwords and/or required access credentials
 - 4. Information required for programming BAS
 - 5. Complete Final Point Schedule including all hardware and software data points and documentation of calibration and configuration values for all Inputs, Outputs, Variables and PID Loops at the conclusion of systems commissioning and functional testing.
 - 6. Routine preventative maintenance procedures, corrective diagnostic troubleshooting procedures and calibration processes
 - 7. Final Bill of Material with all installed parts, manufacturers, manufacturers' part numbers and ordering information
 - 1.21.1.3. Sequence of Operation shall be submitted for every piece of equipment being controlled by and/or associated with the BAS. No operational deviation from specified Sequences of Operation as outlined in Contract Documents shall be permitted without prior written approval. Sequences of Operation shall include and conform to the following:
 - 1. Refer to equipment and control devices by their specific unique identifiers/tags pursuant with the Contract Documents and BAS Submittal package.
 - 2. Clearly represent actual Application Programming methodology and functional control operation. Do not merely provide a copy of Contract Document specified Sequence of Control.

3. Include description of functional system operation under normal and failure conditions.

1.21.1.4. BAS Control Schematics and Wiring Diagrams shall be submitted for every piece of equipment being controlled by and/or associated with the BAS. BAS Control Schematics and Wiring Diagrams shall include and conform to the following:

1. Floor plan showing exact location, MAC addresses where required, including unique identifiers of all hardware supplied under this section.
2. Control Schematic flow diagram of each system (air, water, gas, & etc.) being controlled showing actual physical configuration and control device/sensor location of all fans, coils, dampers, valves, pumps, heat exchangers, control devices, &c. including each hardware point type, controller and associated ancillary devices.
3. Controller termination details showing every controller point termination.
4. Wiring Diagrams of all packaged equipment, motor starters, relay wiring, equipment interlock, safety circuits, & etc. clearly indicating all interconnecting wiring and termination of all conductors and cables including labels of all cables and points.
5. Control Enclosure details for every enclosure including panel identifier, location, physical layout, dimensions, instrumentation, labels, & etc. Also include detail wiring (I/O, network and power) and power source for each panel, transformer and controller.

PART 2 - PRODUCTS

2.1. APPROVED MANUFACTURERS

2.1.1. The following controls hardware and software, in no particular order of preference, are approved for use:

Manufacturer	Tier 2 Product Line	Manufacturer Assigned Vendor
Alerton	AIE Niagara 4	HTS Engineering Ltd (115 Norfinch Drive, North York, ON)
Distech Controls	EC-BOS Niagara 4	Energy Controls & Mechanical Services Inc. (Kitchener)

2.2. SOLE VENDOR SITE DESIGNATION

- 2.2.1. A site or school with an existing B-BC meeting the specifications detailed in 2.3 shall determine the Approved Manufacturer for the respective site.
- 2.2.2. Any minor site additions or upgrades, requiring manufacturer specific products as detailed herein will be that of the Approved Manufacturer for the site, per 2.3.
- 2.2.3. The Board reserves the right to change the status of an Approved Manufacturer at any time should they not meet the performance or requirements detailed herein.

2.3. BUILDING CONTROLLER (B-BC)

- 2.3.1. The B-BC shall be BTL certified, communicate BACnet Natively and incorporate the Niagara 4 Framework®.
- 2.3.2. The B-BC shall have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification and have a value of “*”, it shall be understood to mean that parameter is open to all possible values. Note that this will result in the following entries in the license.dat file:

Specific Feature	license.dat file entry value
Owner	"HDSB"
Project	"HDSB"
BrandId	"*" preferred, "Distech" or "Alerton" acceptable
accept.station.in	"*"
accept.station.out	"*"
accept.wb.in	"*"
accept.wb.out	"*"
Expiration	
All expiration instances	"never"
Limit	
¹ All .limit instances	"none"
Export	
BACnet	"true"
obix	"true"
Import	
rdbSqlServer	"true"
web	
ui	"true"
ui.wb	"true"
ui.wb.admin	"true"

- 2.3.3. ¹ With the exception of limitations defined by hardware configuration
- 2.3.4. The B-BC shall function in a real-time, multi-tasking networked operating environment. It must complete all necessary site computations based on information from any object in the internetwork and locally execute global strategies and supervisory control for all field devices supplied under this specification, without additional hardware or software and independent of or under a B-AWS. It shall be capable of executing application control programs to provide the following:
 - 2.3.4.1. Calendar Functions
 - 2.3.4.2. Scheduling
 - 2.3.4.3. Trending and Data Management
 - 2.3.4.4. Alarm Monitoring and Routing
 - 2.3.4.5. Real-Time Clock and Network Time Synchronization
 - 2.3.4.6. Network and User Management functions for all devices on the LAN
- 2.3.5. The B-BC shall be equal to a JACE 8000 and be supplied with the following hardware features as a minimum
 - 2.3.5.1. two (2) Ethernet ports
 - 2.3.5.2. one (2) RS-485 BACnet MS/TP port
 - 2.3.5.3. one (1) USB port

- 2.3.5.4. Wi-Fi connectivity
- 2.3.5.5. expansion capability
- 2.3.5.6. a battery backup and/or non-volatile memory. If battery backup or non-volatile memory is not available an Uninterruptable Power Supply must be provided to maintain program file and data base for a minimum 24 hours.
- 2.3.6. The B-BC shall contain sufficient memory to support its own operating system, User Interface, all specified control strategies and objects, energy management applications, data storage and trending, alarm annunciation, and network management.
- 2.3.7. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Google Chrome™. Systems requiring additional software (to enable a standard Web browser) to be resident on the client machine, or manufacturer-specific browsers shall not be acceptable.
- 2.3.8. The B-BC must enable access to the complete BAS system installed under this section, via web-browser. Access includes but is not limited to comprehensive programming capabilities for all controllers and real-time operational values via an embedded web-browser Graphical User Interface (GUI). The GUI shall support the latest version of standard web-browsers, without the requirement of additional plugins or software, and must be configured in accordance with these specifications.
- 2.3.9. The B-BC shall provide alarm management to monitor, buffer, and direct alarms and messages to operator devices and memory files, to be assigned in accordance with these specifications. Each B-BC shall perform distributed, independent alarm analysis and filtering to minimize operator interruptions due to non-critical alarms, minimize network traffic, and prevent alarms from being lost.
- 2.3.10. The B-BC shall have the ability to collect and archive any data, for any property of any object on the LAN, in accordance with these specifications. The embedded UI shall be capable of configuring the collection of data. The data shall be accessible in either the following formats, XML or CSV from the WAN Server Supervisory Software or through a standard web-browser.
- 2.3.11. The B-BC shall be capable of maintaining an Audit log that tracks and archives all activities performed.
- 2.3.12. The B-BC shall provide, a minimum of four (5) levels of local access privileges. The highest level, Administrator Level, shall allow the BAS administrator to perform application, database, and user management functions. Each login credentials shall be assigned to a pre-defined level of access.
- 2.3.13. The B-BC shall provide WAN access privileges, including a comprehensive list of accessibility/functionality items, to be enabled or disabled for each user according to the level of access granted. Operators shall be able to perform only those commands available for the access level assigned to their login credentials. Login credentials are to be looked up using the Lightweight Directory Access (LDAP) through the BAS server.
- 2.4. **ADVANCED APPLICATION CONTROLLERS (B-AAC)**
- 2.4.1. B-AAC's shall be BTL Certified.
- 2.4.2. B-AAC objects, sequences and operational parameters must be configurable via the B-BC's embedded graphical user interface.
- 2.4.3. Each B-AAC shall contain sufficient memory to support its own operating system, data storage and programming requirements.

- 2.4.4. The B-AAC shall share and use data between all controllers on the network and shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.
- 2.4.5. Controllers that perform scheduling shall have a real-time clock.
- 2.4.6. The B-AAC shall continuously check the status of its processor and memory circuits and in the event an abnormal operation is detected, the controller shall initiate a predetermined failure mode and generate an alarm notification.
- 2.4.7. Each B-AAC shall be supplied with a minimum 3 spare Universal I/O's.

2.5. **APPLICATION SPECIFIC CONTROLLERS (B-ASC)**

- 2.5.1. B-ASC use is limited to VAV box and will not be accepted for use in any other application.
- 2.5.2. B-ASC's shall be BTL Certified.
- 2.5.3. B-ASC objects, sequences and operational parameters must be configurable via the B-BC's embedded graphical user interface.
- 2.5.4. Each B-ASC shall contain sufficient memory to support its own operating system, data storage and programming requirements.
- 2.5.5. The B-ASC shall share and use data between all controllers on the network and shall manage the input and output communication signals to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms.
- 2.5.6. Controllers that perform scheduling shall have a real-time clock.
- 2.5.7. The B-ASC shall continuously check the status of its processor and memory circuits and in the event an abnormal operation is detected, the controller shall initiate a predetermined failure mode and generate an alarm notification.
- 2.5.8. Each B-ASC shall be supplied with a minimum 3 spare Universal I/O's.

2.6. **ROOM AND SPACE CONTROL DEVICES**

- 2.6.1. Room sensors, associated with each "Room Controller" detailed in Section 23 09 93, are to be communicating type complete with integral override button, configurable set-point / offset adjustment and without a display. Only the following room sensors, associated with occupant comfort, are approved for use:

DisTech Controls - Allure EC-Smart-Comfort-SO
Alerton - Microtouch Wall Sensor

PART 3 - EXECUTION

3.1. **INSTALLATION**

- 3.1.1. The BAS contractor is responsible to verify that equipment can be installed in accordance with the manufacturer's instructions and as detailed within these specifications, as such the contractor shall inspect the site and report any discrepancies, conflicts or omissions to the Owner or it's representative, for resolution prior to the commencement of work.
- 3.1.2. Unless otherwise specified, meet manufacturer's latest printed instructions for materials, planned maintenance and installation methods.

3.2. OBJECT AND POINT NAMING

- 3.2.1. Where the first four segments of the object / point name are configured by virtue of the Niagara Network Device Addressing, only the 5th segment shall be defined as the Object / Point Name herein and must be programmed in accordance with Schedule A of Section 23 09 93. It must be demonstrated, by way of the Niagara Enterprise Software instance, that the individual points are searchable by the School's Unique Identifier, or Controller/Equipment Identifier, or Point Name Abbreviation, or any combination of, across the Board's WAN, without interruptions and/or collisions.
- 3.2.2. All BACnet objects and points programmed under these specifications, shall conform to the following case sensitive convention:
- 3.2.3. First five characters = School's unique identifier
- 3.2.4. Sixth character = Network number
- 3.2.5. Seventh and eighth characters = Device number
- 3.2.6. Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier
- 3.2.7. Last segment = Point name abbreviation
- 3.2.8. Example: S1156_2_15_HP10_RmTemp (S1156 = Forest Trail, 2 = Network 2, 15 = 15th device on network, HP10 = heat-pump 10, RmTemp = Room Temperature)
- 3.2.9. Object name segment shall be delimited by (_) character, however must be consistent by Vendor across all Board sites
- 3.2.10. Where a BACnet object or point name is not explicitly detailed in Schedule A of these Specifications, the Owner shall supply the required information including, but not limited to, device name, instance number, point name, units, meta tag, etc.,

3.3. CONTROLLER AND DEVICE ADDRESSING

- 3.3.1. Where the first four segments of the Controller and Device Addressing are configured by virtue of the Niagara Network Device Addressing, only the 4th segment shall be defined as the Object / Point Name herein and must be programmed in accordance with Schedule A of Section 23 09 93. It must be demonstrated, by way of the Niagara Enterprise Software instance, that the individual points are searchable by the School's Unique Identifier, or Controller/Equipment Identifier, or Point Name Abbreviation, or any combination of, across the Board's WAN, without interruptions and/or collisions.
 - 3.3.2. Each device or network installed and programmed under these specifications, shall be addressed and/or named as follows:
 - Device Instance
 - 3.3.2.1. First five characters = School's unique identifier
 - 3.3.2.2. Sixth character = Network number
 - 3.3.2.3. Seventh and Eighth character = Device number
 - 3.3.2.4. Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier
- Example: S1156_2_15_HP10 (S1156 = Forest Trail, 2 = Network 2, 15 = 15th device on network, HP10)

BACnet Network Number

3.3.2.5. First five characters = School's unique identifier

3.3.2.6. Sixth character = Network number

3.3.2.7. Seventh = Network and Type

Example: S1156_2_1 (S1156 = Forest Trail, 2 = Network 2, 1 = 1st MS/TP network)

MAC Addresses

3.3.2.8. B-BC

3.3.2.9. Maintenance Connection

3.3.2.10. Reserved

3.3.2.11. – 127. Master Range

3.3.2.12. 128. – 254. Slave Range

3.3.2.13. 255. - Broadcast

3.3.3. Object name segment shall be delimited by () character, however must be consistent by Vendor across all Board sites

3.4. CONTROLLER / DEVICE NAMING

3.4.1. Each device or network installed and programmed under these specifications, shall be addressed and/or named as follows:

Device Instance

3.4.1.1. First five characters = School's unique identifier

3.4.1.2. Sixth character = Network number

3.4.1.3. Seventh and Eighth character = Device number

3.4.1.4. Ninth up to required not to exceed nineteen characters = Controller / Equipment Identifier

Example: S1156_2_15_HP10 (S1156 = Forest Trail, 2 = Network 2, 15 = 15th device on network, HP10)

BACnet Network Number

3.4.1.5. First five characters = School's unique identifier

3.4.1.6. Sixth character = Network number

3.4.1.7. Seventh = Network and Type

3.4.1.8. Example: S1156_2_1 (S1156 = Forest Trail, 2 = Network 2, 1 = 1st MS/TP network)

MAC Addresses

3.4.1.9. B-BC

- 3.4.1.10. Maintenance Connection
- 3.4.1.11. Reserved
- 3.4.1.12. – 127. Master Range
- 3.4.1.13. 128. – 254. Slave Range
- 3.4.1.14. 255. Broadcast
- 3.4.2. Object name segment shall be delimited by () character, however must be consistent by Vendor across all Board sites
- 3.5. **SCHOOL'S UNIQUE IDENTIFIER**
- 3.5.1. The School's Unique Identifier will be provided by Owner and must be used in the first segment, for all device, network, object, and point names.
- 3.6. **CONTROLLER / EQUIPMENT IDENTIFIER**
- 3.6.1. The Controller / Equipment Identifiers are restricted to dedicated B-AAC and B-ASC controllers. Identifiers are limited those listed below. Where an identifier is not listed below the Owner shall supply the required information.
- 3.6.1.1. AC# = Air Conditioning Unit
- 3.6.1.2. AHU# = Air Handling Unit
- 3.6.1.3. Blr# = Boiler
- 3.6.1.4. BPB# = By-Pass Box (constant volume)
- 3.6.1.5. Chiller# = Chiller
- 3.6.1.6. CU# = Condensing Unit
- 3.6.1.7. HVAC# = HVAC Unit
- 3.6.1.8. HVAC#VAV# = HVAC Unit (associated with) Variable Air Volume Box
- 3.6.1.9. HP# = Heat pump
- 3.6.1.10. HWLoop# = Heating Water Loop
- 3.6.1.11. HpLoop# = Heat-pump Loop
- 3.6.1.12. HX# = Heat Exchanger
- 3.6.1.13. MAU# = Make-up Air Unit
- 3.6.1.14. Tower# = Cooling Tower
- 3.6.1.15. UV# = Unit Ventilator
- 3.6.1.16. VRF# = Variable Refrigerant Flow Condensing Unit
- 3.6.1.17. VRF#AC# = Variable Refrigerant Flow Unit (associated with) Air Conditioning Unit
- 3.6.1.18. VRF#AC# = Variable Refrigerant Flow Unit (associated with) Air Conditioning Unit

3.6.2. Where a dedicated B-AAC or B-ASC is not configured specific to a system or unit, controller identifier is to be approved by Owner.

3.7. **POINT NAME ABBREVIATION**

3.7.1. The Object / Point Name convention must be followed for the objects / points as listed in Schedule A of this Section, note abbreviations are case sensitive.

3.7.2. Where an identifier is not listed below the Owner shall supply the required information.

3.8. **PROGRAMMING**

3.8.1. Sequences of Operation are to be programmed in accordance with Section 23 09 93

3.8.2. Programs for like equipment i.e, heat-pump, unit heater, etc. shall be consistent by controls vendor across the facility and all Board sites.

3.9. **HISTORY AND TRENDING**

3.9.1. A minimum of 7 days history shall be maintained within the B-BC for the points identified in Schedule A of this Section.

3.9.2. Data stored in the B-BC shall be uploaded to the B-AWS in accordance with Section 25 00 00.

3.9.3. Default Graphical trends, Navigation button per 3.9, shall be pre-configured.

3.10. **SCHEDULING**

3.10.1. Scheduling feature shall include seven-day schedule, plus holiday or event schedule, each with start time and stop time. Schedules shall be individually editable for each day and holiday.

3.10.2. The scheduling feature shall allow for each individual equipment to be assigned to one of the Schedule Groups which includes, but is not limited to:

3.10.2.1. Administration

3.10.2.2. Gymnasium

3.10.2.3. First Floor Classrooms

3.10.2.4. Second Floor Classrooms

3.10.2.5. Kindergarten

3.10.2.6. Library

3.10.2.7. Daycare

3.10.2.8. Theatre

3.10.2.9. Cafeteria

3.10.2.10. Refuge

3.10.3. The Areas, associated schedule, and equipment grouping will be provided by Owner.

3.10.4. Timed override feature shall allow a temporary change of the scheduled equipment. An override command shall be selectable by an individual unit, all units assigned to a given schedule group, or to

all units in a building. Timed override shall terminate at the end of the event. Timed override feature shall be allowed by a password level.

3.11. **DEMAND LIMITING**

3.11.1. Programming or schedules shall incorporate a delay such that there is a delay between the start-up of each Schedule Group.

3.11.2. Equipment within the Schedule Group shall incorporate a delay such that there is a delay between the start-up of individual equipment within the Schedule Group.

3.12. **ALARMS**

3.12.1. Logical and consistent alarm strategy must be used as defined within these specifications. The alarm strategy detailed herein applies to those objects identified in Schedule A of this section. It is expected that additional alarms be added when applicable, Owner to determine class.

3.12.2. Alarms, not classified as Emergency or Communication / Network, shall have the following values adjustable: threshold, limit and time delay.

3.12.3. Alarm actions, defined by Alarm Class, shall be annunciated as follows:

3.12.3.1. Emergency (E): email, header button red, graphic with flashing alarm object, Alarm Portal B-BC record

3.12.3.2. High Priority (H): graphic with flashing alarm object, header button red, Alarm Portal B-BC record

3.12.3.3. General (G): Alarm Portal B-BC Record

3.12.4. The complete object / point name shall be included in every alarm message, refer to "Object and Point Naming" within this specification section.

3.12.5. The minimum shall be recorded by the B-BC for each alarm:

3.12.5.1. Time and Date

3.12.5.2. Complete object / point name

3.12.5.3. Acknowledge time, date, and user who issued acknowledgement

3.13. **USER ACCESS**

3.13.1. Set up the following 5 password levels to include the specified capabilities.

3.13.1.1. Level 1: (The Board's BAS Administrator)

Level 2 capabilities.

All administrative rights

View, add, change and delete user names, passwords, password levels.

All unrestricted system capabilities including all network management functions.

3.13.1.2. Level 2: (TBD)

Level 3 capabilities.

Configure system software.

Modify control unit programs.

Modify graphic software.

Unrestricted except for viewing or modifying user names, passwords, password levels.

3.13.1.3. Level 3: (Approved Facilities Staff and Board's HVAC Maintenance Technicians)

Level 4 capabilities.

Temporary override of designated objects and/or points.

Temporary set-point value change.

Change selected equipment schedules.

3.13.1.4. Level 4: (Approved Facilities Staff)

Level 5 capabilities.

Acknowledge alarms.

Change selected equipment schedules.

3.13.1.5. Level 5: (Read Only)

Display all graphic data.

Trend point data.

3.13.2. Level 1 and 5 will be accounts which reside locally within the B-BC.

3.13.3. Level 2 through 4 will be will use LDAP for login credential authentication.

3.14. **GRAPHICAL USER INTERFACE**

3.14.1. Provide a colour graphic home screen, floor plans, system flow diagrams for each system and summary screens, designed and sized for iPad, with all points indicated on the points list in Schedule A of this Section, and in accordance with these specifications.

3.14.2. All graphics shall be rendered as N4 HTML 5 views. Any graphic page that depends on JAVA-based animated widgets, or in any way depends on any browser-side-applet shall not be acceptable.

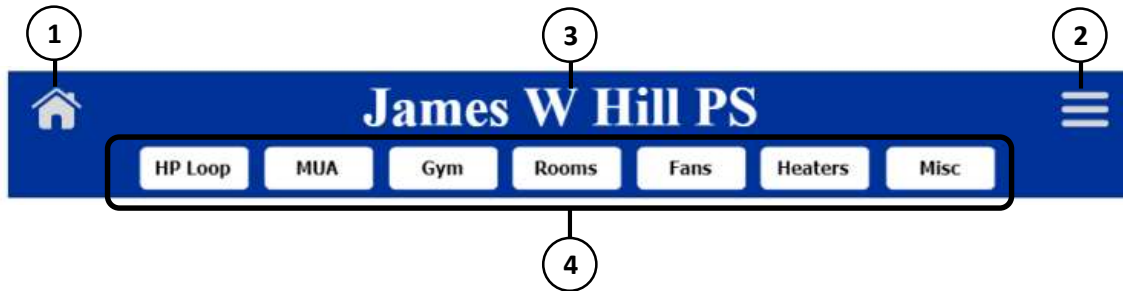
3.14.3. The Graphical User Interface shall not use Red as graphical representation for any of the following: stop, alarm, or fault. Red is used explicitly for graphical representation of heat command and/or enable, with the only exception in text format in charts, the word "fault" can be coloured red.

3.14.4. Graphics not explicitly detailed within this section shall be reviewed and approved by Owner.

3.14.5. Common for all Graphics:

3.14.5.1. Header

The Header is one PX file for the entire project. All links, labels, etc. shall be edited from only one instance of the Header. The following aspects of the Header should appear exactly the same across all Board Facilities: Dimensions, Font Size, Colour(s), Equipment Navigation Buttons' Size, Font, and Colour(s). The following shall be exactly the same 1 - Home Button, 2 - Three Line Menu Navicon. The following aspects are dynamic: 3 - Page title, and 4 - Equipment Navigation Buttons (function and name)

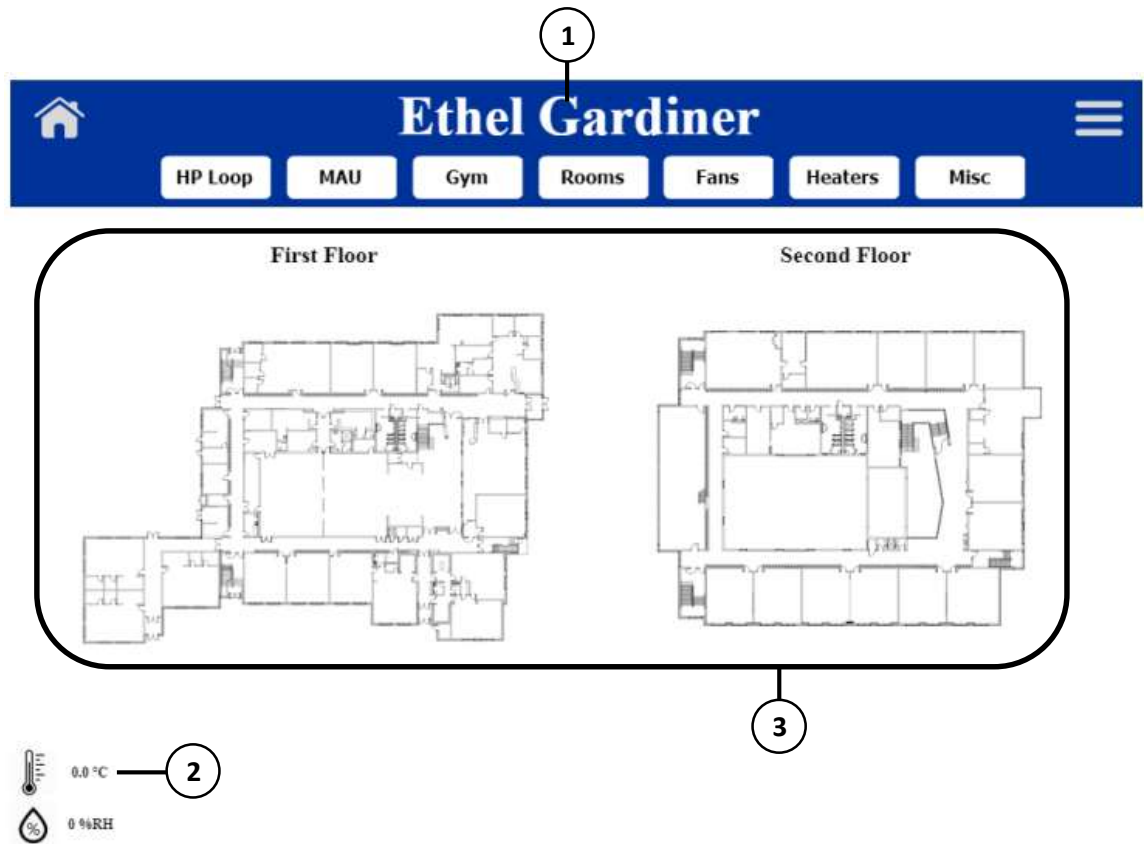


3.14.5.2. Flashing Alarm graphic (a standard Niagara graphic white triangle with red boarder and black exclamation mark) shall be consistent for all alarm annunciations, across all Board facilities, regardless of vendor.



3.14.5.3. Page Title shall be representative of the Navigation name used to link to the page and is to include information identifying area or equipment

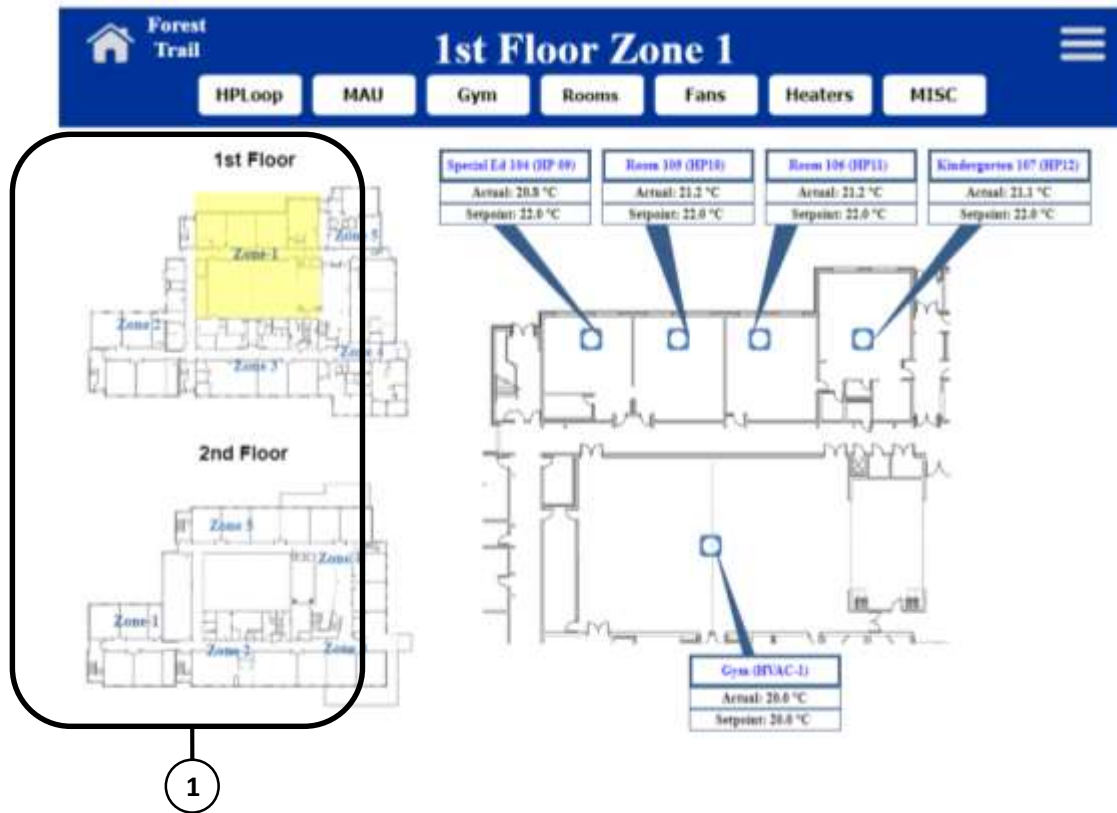
3.14.6. Home Page
The Home Page shall be comprised of the following: 1 – School / Facility name as page title, 2 - Outdoor Air Temperature, 3 - Complete Facility Floor Map (individual floors labelled accordingly).



3.14.7.

Zone Page(s)

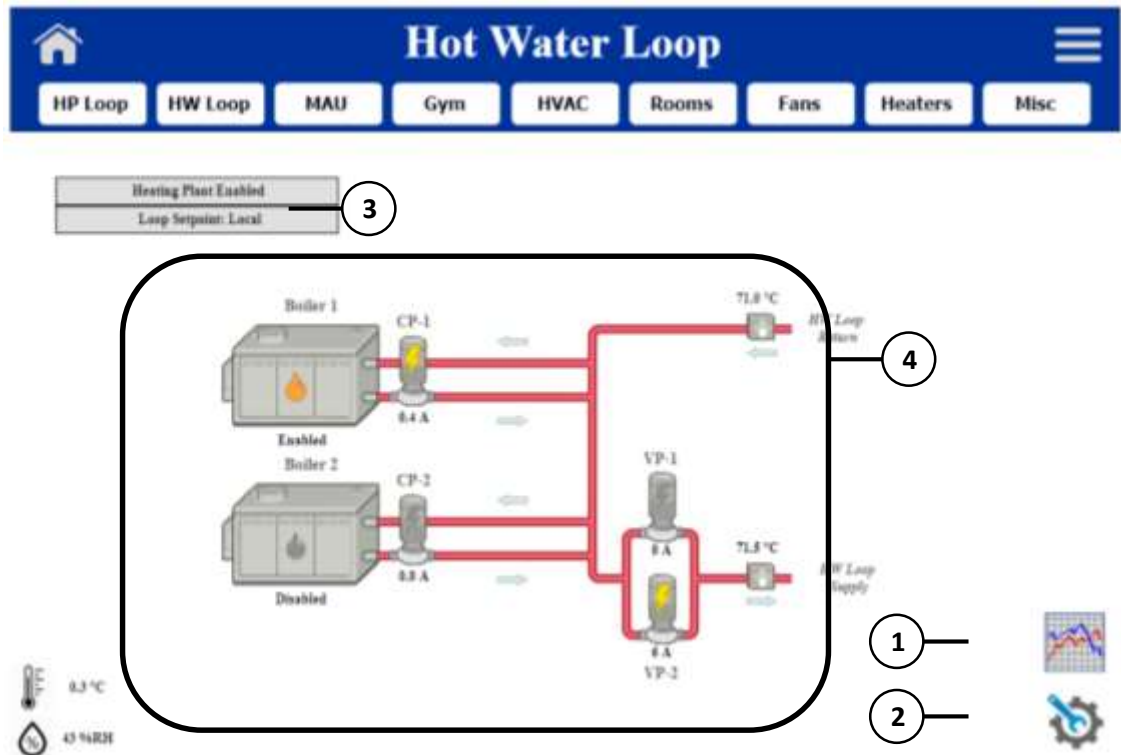
The Zone Page(s) which are scaled portions of the floor plan shall be comprised of 1 – Keyplan indicating respective zone, individual space temperatures and set-points, navigation button to respective equipment



3.14.8.

HWLoop Page

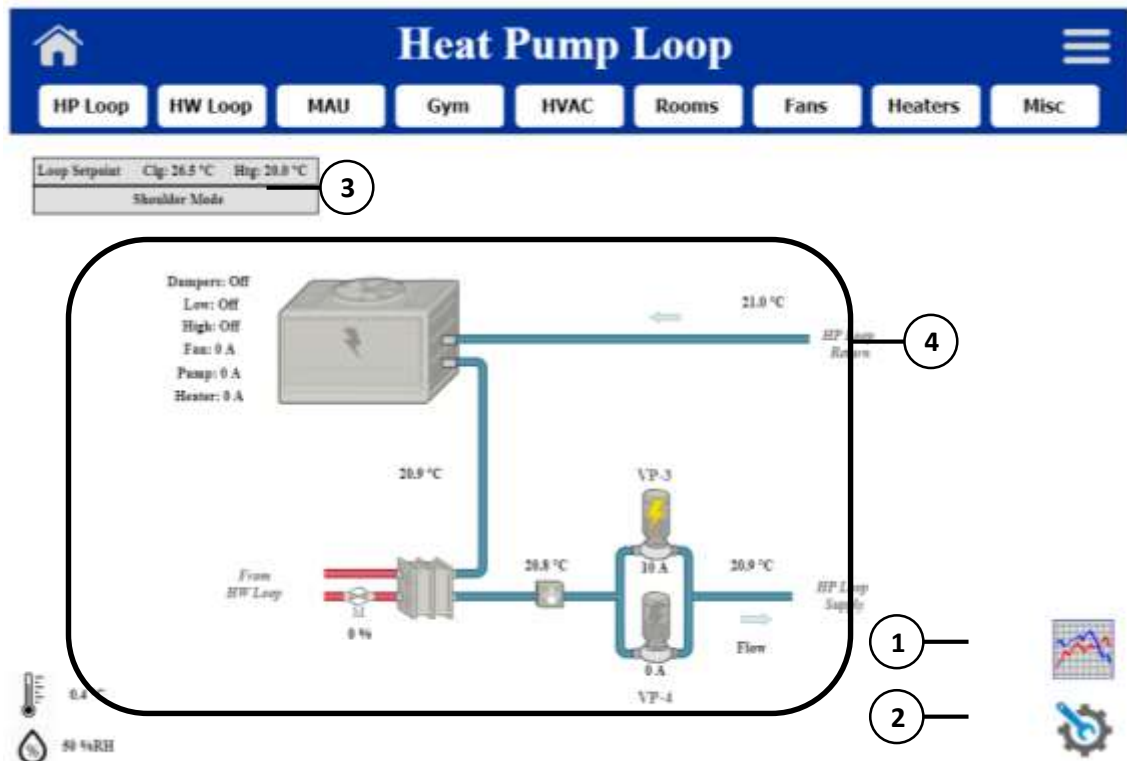
Only include HWLoop Navigation button on Header where Heating Water Loop is present at facility. The HWLoop (Heating Water Loop) Page shall be comprised of the following: 1 - Trend navigation button (trend defaulted to include 7 days history of loop return water temperature (°C), loop supply water temperature (°C), boiler(s) supply water temperature (°C), and loop set-point (°C), 2 - Settings button to be linked to settings page, 3 - a chart with the loop water temperature set-point, and 4 - graphic depicting all associated the equipment and controlled zones. The following shall be graphically presented on the equipment: pump(s) command (green = on, white or no colour = idle), boiler command (red = on, white or no colour = idle). The following status values shall be presented: pump(s) status (amperage), valve(s) position, boiler command and reset signal value or status, boiler supply water temperature (°C), loop return water temperature (°C), loop supply water temperature (°C), zone supply water temperature (°C), zone return water temperature (°C),



3.14.9.

HPLoop Page

Only include HPLoop Navigation button on Header where Heat-pump Loop is present at facility. The HpLoop (Heat-pump Loop) Page shall be comprised of the following: 1 - Trend navigation button (trend defaulted to include 7 days history of loop return water temperature (°C), loop supply water temperature (°C), cooling tower leaving water temperature (°C), and set-point (°C), 2 - Settings button to be linked to settings page, 3 - a chart with the mode, and return water temperature set-point (°C), and 4 – graphic depicting all associated the equipment and controlled zones. The following shall be graphically presented on the equipment: pump(s) command (green = on, white or no colour = idle), boiler command for dedicated Heat-pump loop boilers only (red = on, white or no colour = idle), damper(s) position. The following status values shall be presented: fan status (Amperage), cooling tower pan heater status (Amperage), pump(s) status (Amperage), valve(s) position, boiler command and reset signal value or status, boiler supply water temperature (°C), loop return water temperature (°C), loop supply water temperature (°C), cooling tower leaving water temperature (°C), cooling tower damper(s) status (open or closed), cooling tower low speed fan command, cooling tower high speed fan command, cooling tower percentage speed command where VFD installed.



3.14.10.

Rooms Page

The Rooms page shall be comprised of the following: 1 - Navigation Buttons (left side of Chart) to include but not limited to: equipment by floor (example VAV Boxes 1st Floor), Comfort Heat, By-Pass Boxes, Unit Ventilators, HVAC Units. 2 – Navigation to respective equipment. Chart with live data under the following headers: Unit# (navigation to unit referenced), Area Served, Space Temp, Set-point, Offset, Status, DATemp, Mode, Occupancy, Fault

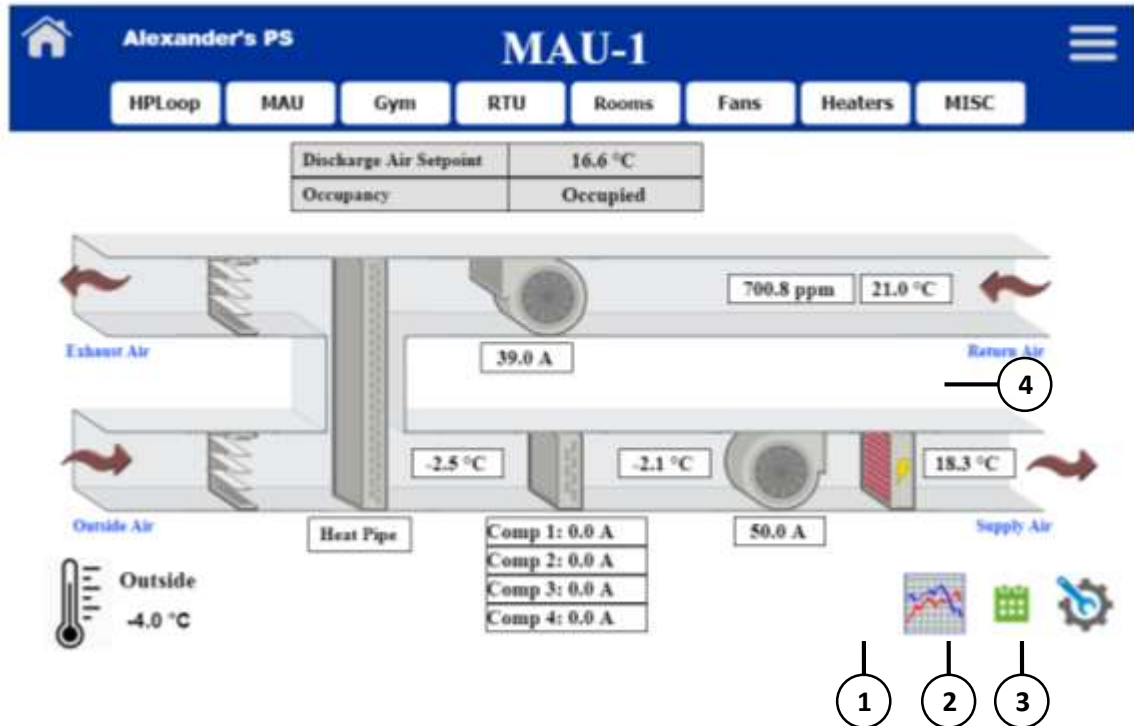
Unit	Area Served	Space Temp	Setpoint	Offset	Status	DATemp	Mode	Occupancy	Fault
HP01	Staff Room	21.3 °C	22.0 °C	0.0 °C	4.0 A	22.8 °C	Idle	Occupied	Normal
HP02	Principal/Admin	21.0 °C	22.0 °C	0.0 °C	4.0 A	22.8 °C	Idle	Occupied	Normal
HP03	Meeting	22.0 °C	22.0 °C	0.0 °C	1.7 A	23.3 °C	Idle	Occupied	Fault
HP04	Comp. 101	22.0 °C	23.8 °C	0.0 °C	11.5 A	22.3 °C	Heat	Occupied	Normal
HP05	Room 102	23.2 °C	23.4 °C	0.0 °C	2.8 A	23.2 °C	Idle	Occupied	Normal
HP06	Music Room 103	21.3 °C	22.0 °C	0.0 °C	5.7 A	22.1 °C	Idle	Occupied	Normal
HP07	Counseling	20.3 °C	22.0 °C	0.0 °C	9.8 A	21.1 °C	Idle	Occupied	Normal
HP08	Workroom	21.3 °C	22.4 °C	0.0 °C	1.5 A	21.3 °C	Idle	Occupied	Normal
HP09	Special Ed 104	21.5 °C	22.0 °C	0.0 °C	2.5 A	22.8 °C	Idle	Occupied	Normal
HP10	Room 105	21.5 °C	22.0 °C	0.0 °C	2.5 A	21.8 °C	Idle	Occupied	Normal
HP11	Room 106	21.1 °C	22.0 °C	0.0 °C	2.8 A	21.7 °C	Idle	Occupied	Normal
HP12	Kindergarten 107	21.6 °C	22.0 °C	0.0 °C	2.6 A	23.6 °C	Idle	Occupied	Normal
HP13	Kindergarten 108	21.4 °C	22.0 °C	0.0 °C	10.7 A	39.9 °C	Heat	Occupied	Normal
HP14	Kindergarten 109	21.8 °C	22.0 °C	0.0 °C	2.6 A	22.0 °C	Idle	Occupied	Normal
HP15	Community	20.9 °C	22.0 °C	0.0 °C	2.4 A	21.6 °C	Idle	Occupied	Fault
HP16	Forum	20.9 °C	22.0 °C	0.0 °C	2.2 A	21.8 °C	Idle	Occupied	Fault
HP17	Room 110	21.5 °C	21.9 °C	0.0 °C	3.6 A	22.5 °C	Idle	Occupied	Normal
HP18	Library	21.2 °C	21.2 °C	0.0 °C	4.0 A	21.9 °C	Idle	Occupied	Normal
HP07	Room 116	21.9 °C	22.0 °C	0.0 °C	2.6 A	22.7 °C	Idle	Occupied	Normal
HP28	Room 114	21.4 °C	22.0 °C	0.0 °C	2.7 A	22.4 °C	Idle	Occupied	Normal
HP28	Room 115	22.3 °C	22.0 °C	0.0 °C	2.7 A	23.2 °C	Idle	Occupied	Normal
HP40	Room 113	22.0 °C	22.9 °C	0.0 °C	2.6 A	23.3 °C	Idle	Occupied	Normal

3.14.11.

MAU Page

The MA (make-up air unit) page shall be comprised shall be comprised of: 1 - Trend navigation button (trend defaulted to include 7 days history of return air temperature, discharge air temperature, set-point), 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, a chart with the discharge air set-point and occupancy, and 4 – template graphic depicting the equipment. The following shall be graphically presented on the equipment: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), exhaust air temperature (°C), discharge air temperature (°C), downstream HRV/ERV air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status

Where more than one make-up air unit exists in a facility, navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner.



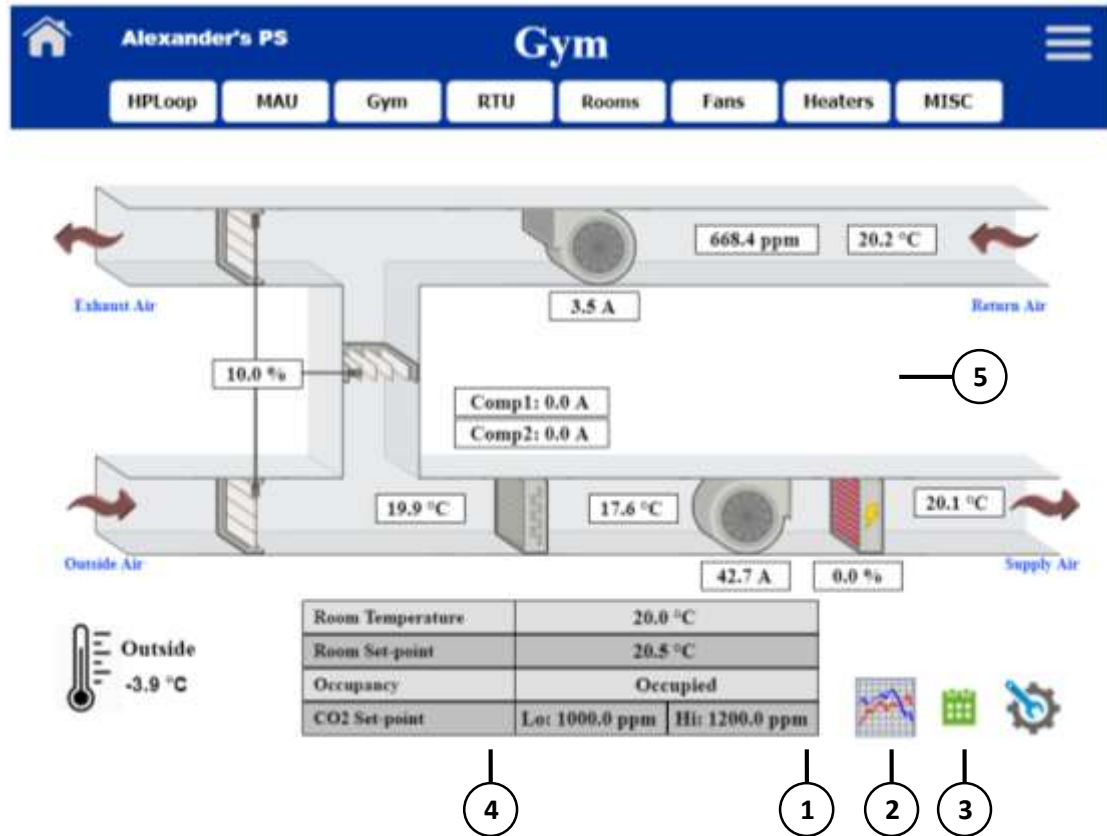
3.14.12.

Gym Page

The Gym page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of return air temperature, discharge air temperature, set-point), 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Room Set-point and Occupancy, and 5 - template graphic depicting the equipment type servicing the space. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), return air temperature (°C), discharge air temperature (°C), mixed air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status,

Where more than one piece of equipment conditions a single gymnasium, the Room Temperature, Room Set-point and Occupancy shall be a single object and programmed as such.

Where more than one gymnasium exists in a facility, navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner.



3.14.13.

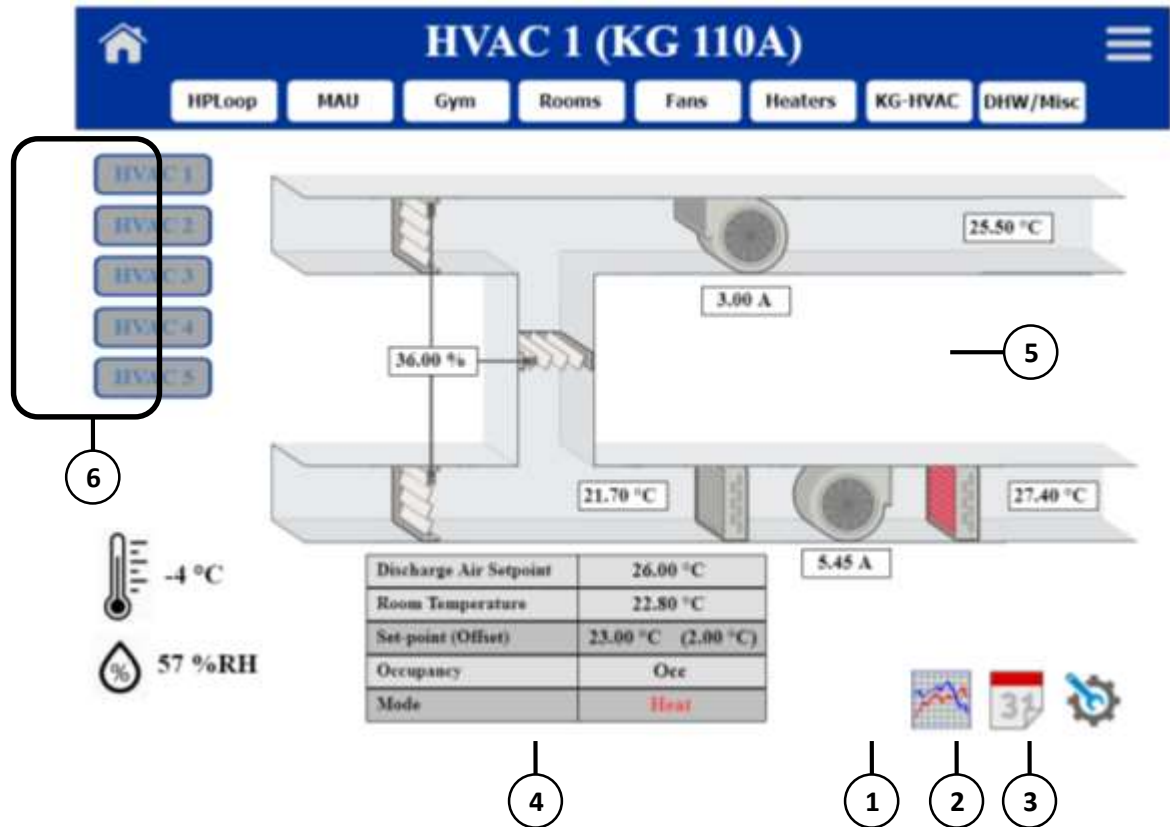
HVAC Page

Where an HVAC Unit serves a classroom or office (which can include 1 by-pass box), an HVAC Header navigation button is not required and the unit operational information can be presented on the Rooms Page. The individual unit, navigation from chart, is to be configured per below.

Where is more than one HVAC Unit serving multiple common spaces, i.e., Library, Shop, etc., there is to be a HVAC Header navigation button used.

The HVAC page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of return air temperature, discharge air temperature, set-point, 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Room Set-point and Occupancy, and 5 - template graphic depicting the equipment type servicing the space. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle), damper(s) position. The following status values shall be presented: fan(s) status (amperage), return air temperature (°C), discharge air temperature (°C), mixed air temperature (°C), heating command reset signal value or status, compressor(s) status (amperage), outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command, HRV/ERV status,

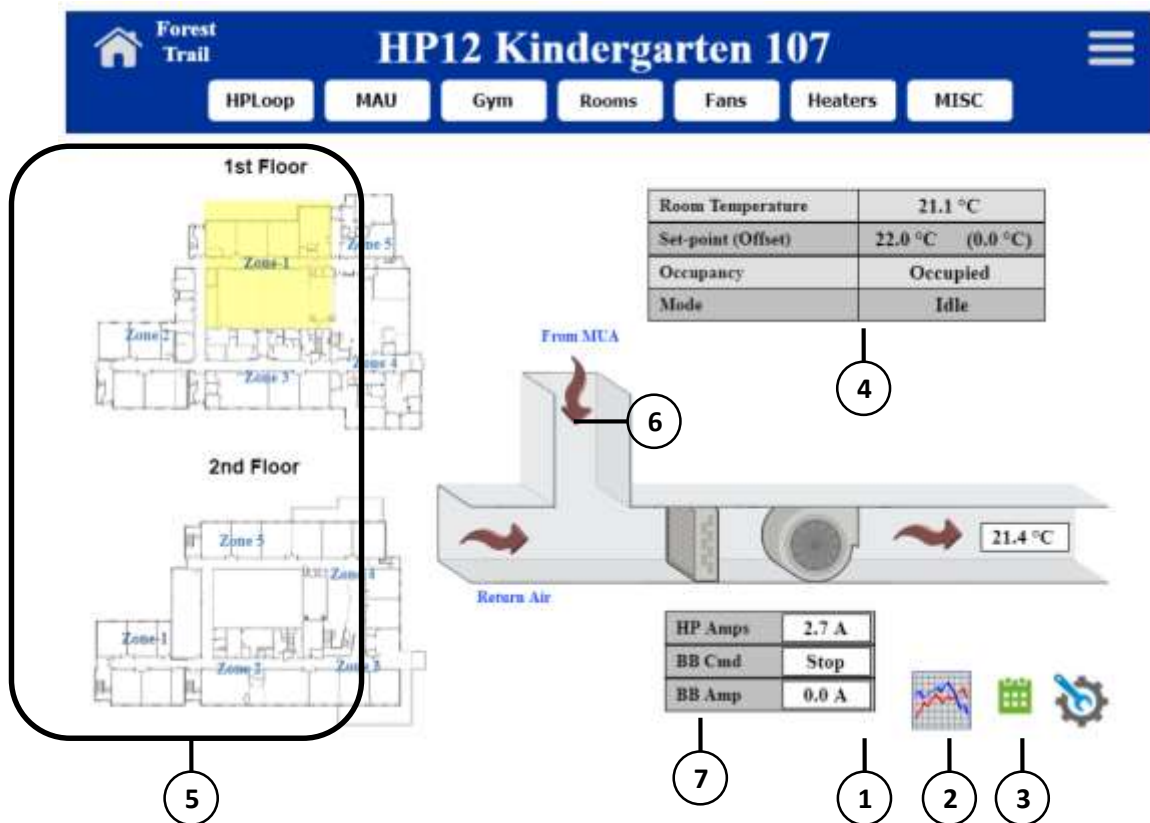
Where more than one HVAC Unit exists in a facility, 6 - navigation buttons located on the left side of the graphic shall be incorporated, labelling to be determined by Owner.



3.14.14.

Heat-pump Page (individual equipment)

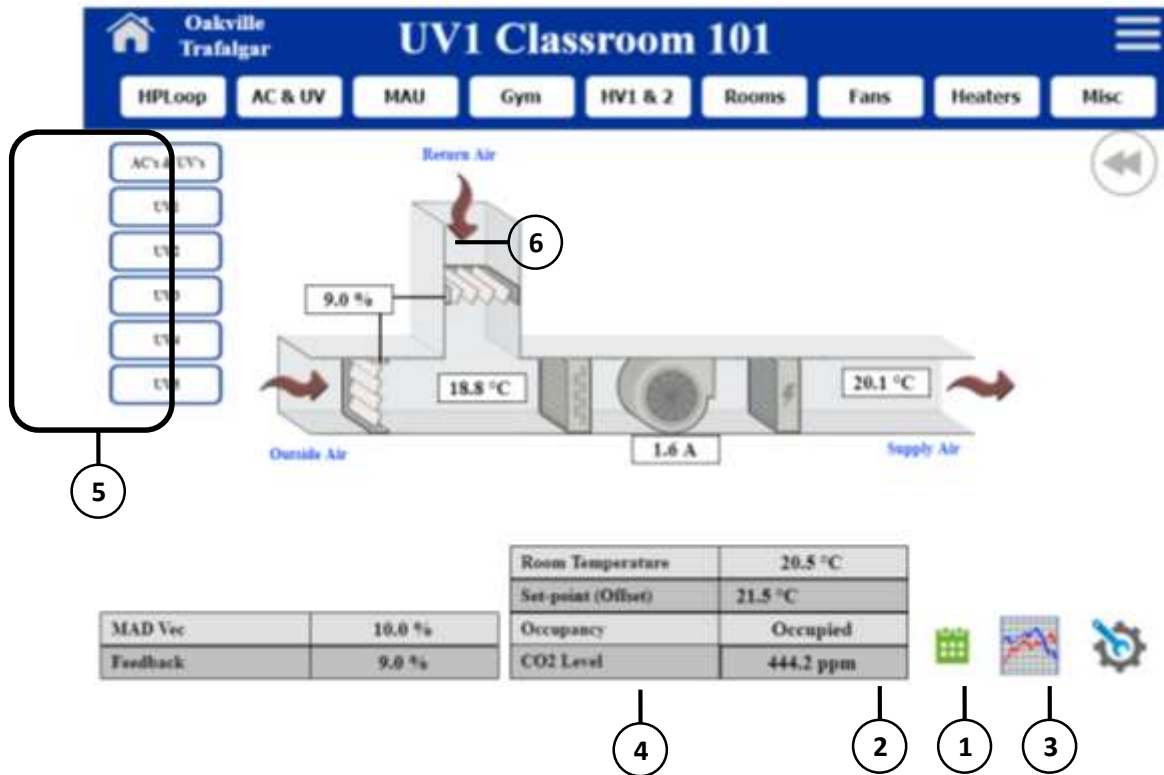
A Heat-pump page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of room temperature, set-point offset value, discharge air temperature (°C), and unit status (amperage), 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Set-point (offset), Occupancy, and Mode, 5 – keyplan indicating zone the respective unit is located, and 6 - template Heat-pump graphic. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle). The following status values shall be presented: 7 - unit status including auxiliary heat (amperage), return air temperature (°C), discharge air temperature (°C), auxiliary heat status (amperage)



3.14.15.

Unit Ventilator Page (individual equipment)

A Unit Ventilator page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of room temperature, set-point offset value, discharge air temperature (°C), and unit status (amperage), outdoor air damper position, 2 - Calendar button to be linked to the respective calendar, 3 - Settings button to be linked to settings page, 4 - a chart with the Room Temperature, Set-point (offset), Occupancy, and Mode, 5 – navigation buttons located on the left side of the graphic, and 6 - template Unit Ventilator graphic. The following shall be graphically presented on the equipment graphic: fan(s) command (fan spinning = on, not spinning = idle), heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle). The following status values shall be presented: unit status (amperage), return air temperature (°C), discharge air temperature (°C), heating command reset signal value or status if hydronic, compressor(s) status (amperage) if remote condensing unit, outdoor air damper position (where mechanically linked to return air and/or exhaust air damper(s) value to be outdoor air damper position), HRV/ERV command and HRV/ERV status where applicable, auxiliary heat status (amperage).

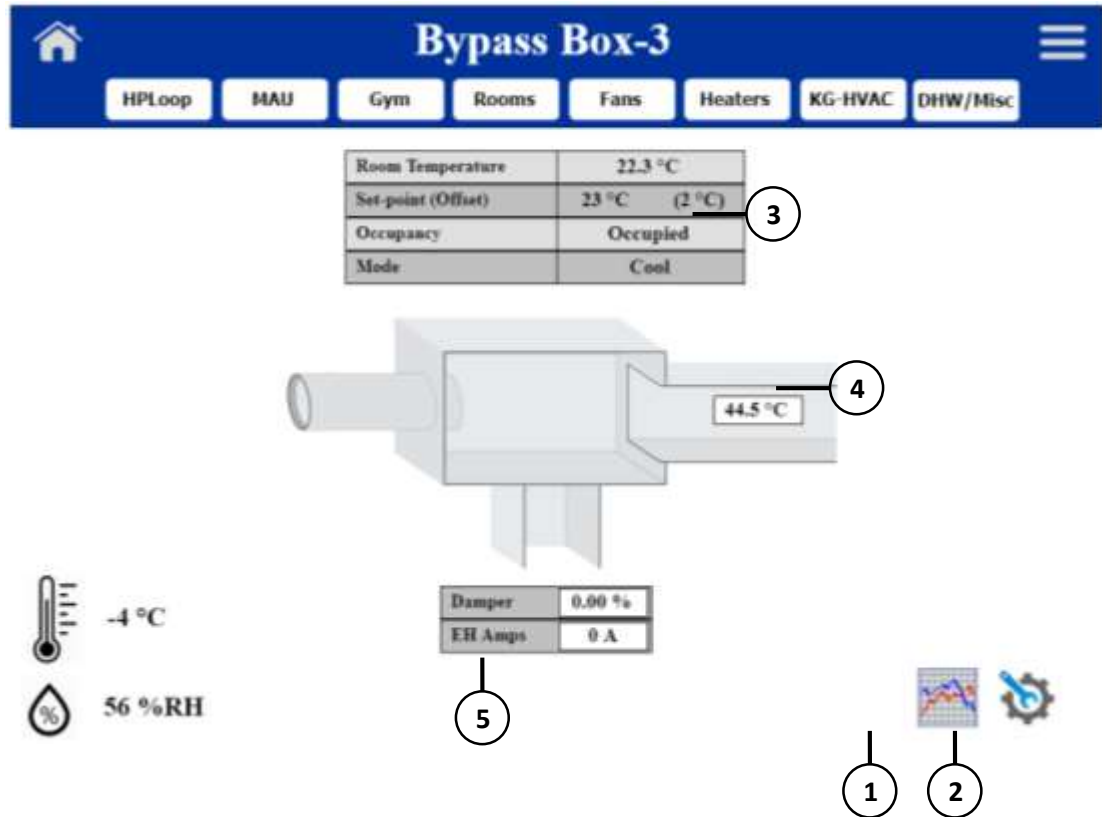


3.14.16.

By-Pass Box or VAV Page (individual equipment)

A By-Pass or VAV Box page name shall include an equipment identifier from which the air is being supply from.

A By-Pass or VAV Box page shall be comprised of: 1 - Trend navigation button (trend to include 7 days history of room temperature, set-point offset value, and damper position, discharge air temperature (°C), 2 - Settings button to be linked to settings page, 3 - a chart with the Room Temperature, Set-point (offset), Occupancy, and Mode, and 4 - template By-Pass or VAV box graphic. The following shall be graphically presented on the equipment graphic: re-heat command (red coil = on, gray coil = idle), cooling command (blue coil = on, gray coil = idle). The following status values shall be presented: damper position, return air temperature (°C), 5 - discharge air temperature (°C) and auxiliary heat status (amperage).



- 3.14.17. Fans and Heaters Page
 The Fans and Heaters page(s) shall be comprised of a Chart with live data under the following headers: Unit Number, Area Served, RmTemp, Set-point, Command, Status, and Occupancy
- 3.14.18. Misc Page
 The Misc page shall comprise operational information for: exterior lighting, domestic hot water status, trap flushing urinal flushing, grouped schedules, network comfort set-point
- 3.15. **LOW-VOLTAGE ELECTRICAL AND CONTROL WIRING**
- 3.15.1. It shall be the System Contractor's responsibility to complete and/or coordinate all wiring, less than 600 V, in accordance with 1.15, required for a complete Control System, including but not limited to:
 - 3.15.1.1. All raceways, boxes, cables, circuit breakers, grounding, relays, motors, starters and wirings from existing panel boards or switchgear through splitters, starters and field disconnect switches to complete power supply required for equipment supplied under this Contract not indicated on the electrical plans and specifications.
 - 3.15.1.2. Power to all actuators and sensors.
 - 3.15.1.3. Provide all wiring and cabling for network communications except for owner provided LAN(s)/WAN(s).
 - 3.15.1.4. All sensor and control device input and output wiring.
 - 3.15.1.5. All interconnecting cabling between and amongst network devices

- 3.15.1.6. Interlock wiring between devices, and between motor starters.
- 3.15.1.7. All other necessary wiring for fully complete and functional system as specified.
- 3.15.1.8. Install piping, wiring/cabling routed parallel to or at right angles with the structure, properly supported every six (6) feet at a minimum and installed in a workmanlike manner.
- 3.15.2. Control system wiring and cabling installed for this project shall be performed by professionals in a workmanlike manner and in accordance with National Electric Code (NFPA 70), CSA C22.2 and latest NEMA standards, FCC, and any/all applicable local codes and/or Authorities Having Jurisdiction (AHJ).
- 3.15.3. All materials must be CSA and NEMA approved. Where this is not possible, arrange and pay for unconditional Electrical Safety Authority approval.
- 3.15.4. The following cabling shall be installed as continuous links, including shielding. Field splices are strictly prohibited.
- 3.15.4.1. Network / Communication
- 3.15.4.2. Signal (input / output control wiring)
- 3.15.5. Maximum allowable voltage for control wiring shall be 120-volts.
- 3.15.6. The Contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site. This Section includes wiring, circuit breakers and accessories rated 600 V and less.
- 3.16. **POWER WIRING AND CABLING**
- 3.16.1. Power wiring for all enclosures and equipment, including branch circuit wiring from circuit breaker panels shall be the responsibility of the System Contractor unless specifically shown on the Plans or Specifications.
- 3.16.2. The B-BC panel shall be served from isolated ground receptacle via UPS by dedicated branch circuits.
- 3.16.3. Power shall NOT be obtained by tapping into miscellaneous circuit that could inadvertently be switched off.
- 3.16.4. Transformers and power supplies for controllers and field devices shall be supplied in accordance with manufacturers recommendations and shall be located within the designated control enclosure.
- 3.16.5. Power for controls equipment shall be from a dedicated circuit. Where a controller is dedicated to controlling a single piece of equipment, power may be obtained directly from that equipment.
- 3.16.6. All other enclosures, sensor and control devices shall be fed from separate circuits in the electrical distribution panels and shall not be served from the typical floor receptacle or lighting circuits.
- 3.17. **NETWORK AND COMMUNICATION CABLING**
- 3.17.1. Network installation shall strictly adhere to the manufacturer's network installation instructions and procedures.
- 3.17.2. All data cabling shall use stranded conductors. Solid core conductors shall not be accepted.
- 3.17.3. Data cabling shall be run separately from power and signal wiring

- 3.17.4. All communications wire shall be externally identified as "Building Automation System Network" in accordance with the HDSB's Building Automation Systems Standards and Design, latest revision.
- 3.17.5. Network installation shall conform to standards for the LAN types and cabling types selected. Specific network rules inherent to the ANSI/AHRAE Standard 135, latest will be followed. Those include but are not limited to:
- 3.17.5.1. Only one path can exist from any BACnet device to another
- 3.17.5.2. The maximum length and cabling type of an MS/TP segment shall be in accordance with manufacturers specifications and shall comply with EIA-485.
- 3.17.5.3. Each internetwork LAN must have a unique Network Number (1 - 65,545).
- 3.17.5.4. The maximum number of nodes per segment shall be 32, as specified in the EIA 485 standard.
- 3.17.5.5. Wire type used for MSTP, RS-485 twisted pair communications must be balanced twisted pair with 100 to 120 Ohms Characteristic Impedance. The wire shall be less than 30 pF per foot, and preferred 20 AWG or lower. A shield wire shall be included for ground connection.
- 3.17.6. Primary LAN Network wire and cable shall be run separately from all other wiring.
- 3.17.7. Other LAN Network wire and cabling shall be installed separate from any wiring over thirty (30) volts.
- 3.17.8. All communications shielding shall be grounded as per Networked System manufacturer's recommendations.
- 3.18. **BACNET ETHERNET COMMUNICATION CABLING**
- 3.18.1. Data cable shall Category 5 or better Ethernet cable.
- 3.18.2. Data cable shall be four twisted pair 24 AWG solid copper, Plenum Rated FT-6 / CMP or Riser Rated FT-4 / CMR (as required by local codes) unshielded twisted cable meeting EIA / TIA 568B.1 Category 5e classification.
- 3.18.3. The maximum cable length for each run shall be limited to 90 meters.
- 3.18.4. All cables must be Power Sum accepted and recognized by the manufacturer.
- 3.18.5. Cable Skew must be specified as 20Ns or less per 100 meters.
- 3.18.6. Cables must display the manufacturer's stamp stating that the cable is included in the latest UL verified publication for respective Category standards.
- 3.19. **SIGNAL (INPUT/OUTPUT CONTROL) WIRING**
- 3.19.1. Minimum #20 AWG stranded copper conductors (larger gauge wire/cable shall be provided where required by BAS equipment and where applications warrant (e.g. rated load, long runs, etc.).
- 3.19.2. All BMS input/output point wire/cable and communication cable shall be shielded.
- 3.19.2.1. Non-shielded cables may be approved for BAS input and output field point wiring following certification from the BAS manufacturer that non-shielded cables will function satisfactorily for the life of the building and that the use of non-shielded cables will not negatively affect other building systems/cabling.
- 3.19.2.2. The manufacturers certification shall guarantee to the Board that should it be determined that BAS system performance is negatively affected or another building system or equipment is negatively

affected due to the non-shielded cable, the BAS manufacturer shall replace the cable at no cost to the Board.

- 3.19.3. All cabling shall be installed in a neat and workman like manner. Follow manufacturer's installation recommendations for all communication cabling.
- 3.19.4. Free air cabling installed in non-combustible rated buildings shall be fire rated cable with a minimum rating of FT-6.
- 3.19.5. Wiring located in combustible rated buildings above T-bar ceiling shall be run in free air using fire rated cable with a minimum rating of FT-6.
- 3.19.6. Note: all free air cabling used in combustible rated buildings to interface to security or fire alarm systems shall be FT-6 rated.
- 3.19.7. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
- 3.19.8. Cables shall follow building lines and be installed in bundles resting in a cabling support system (J-hooks).
- 3.19.9. Cable supports shall be attached to the wall or ceiling of the area they are running through. Cable supports shall not be attached to:
 - 3.19.9.1. Electrical raceways,
 - 3.19.9.2. Duct work,
 - 3.19.9.3. Ceiling suspension systems,
 - 3.19.9.4. Piping,
 - 3.19.9.5. Wilson joists.
 - 3.19.9.6. All wire/cable terminations shall be made at screw type terminal strips. Wire nut terminations and butt splices shall not be acceptable. Wiring runs shall be continuous runs without splices.
- 3.19.10. All BAS equipment and components shall be grounded to building ground facilities.
- 3.19.11. BAS shall only be capable of controlling electric motors when the associated hand/off/auto (HOA) motor control switches are in the "auto" position. BAS control shall be wired into the auto circuit of the hand/off/auto motor control circuit only. Where hand/off/auto switches do not exist they shall be provided by the Controls Contractor.
- 3.19.12. Life safety and equipment protection interlocks shall be wired to override equipment whenever it is in operation.
- 3.19.13. Existing interlocks and override control should typically not be removed or overridden by the application of new BAS control without the specific instruction and/or approval of the Owner.

3.20. **UTILITY MONITORING**

- 3.20.1. The metered systems include the electrical power, natural gas distribution, and water systems. The Controls Contractor is responsible for the integration and/or supply of metering equipment necessary to provide the following:
 - Electricity – real time and historical kWh and KW
 - Gas – real time and historical m³

Water – real time and historical L

- 3.20.2. The Controls Contractor is responsible for coordination with the respective Electricity Provider for integration and/or installation.
- 3.20.3. The Board will coordinate with Union Gas the installation of the Utility provided signal output. The Controls Contractor is responsible for connection, integration and programming.
- 3.20.4. The Controls Contractor is responsible to integrate the water the existing Utility Provider's (Region of Halton) meter.
- 3.21. **COMMISSIONING, TESTING, DEMONSTRATION, AND ACCEPTANCE**
- 3.21.1. The system shall be commissioned in its entirety. All commissioning and tested shall be documented and submitted prior to Demonstration and Acceptance testing. Commissioning and Testing shall include, but not limited to the following:
 - 3.21.1.1. Verify all programming, naming, identification, and....conforms to the HDSB's Building Automation Systems Standards and Design, latest revision.
 - 3.21.1.2. A point-to-point check of the location, installation, and labeling
 - 3.21.1.3. Calibrate all analogue inputs and devices using actual versus the embedded UI
 - 3.21.1.4. Control loops are to be fully set-up and tuned
 - 3.21.1.5. Each control program and sequence shall be fully commissioned and confirmed by an end-to-end test, for the complete design intent compliance and functionality.
 - 3.21.1.6. Verify failsafe conditions
- 3.21.2. The naming and identification of all points, networking instances, objects, meta tags, etc. is to be extracted from the site controls electronically and sent to the Owner or its Authorized representative in one of the following formats .csv, .xls or xlsx, for review and acceptance. The values are not to be edited or formatted prior to sending.
- 3.21.3. Pursuant to 3.8.1, Assist and cooperate with the Owner approved third party commissioning provider in the following manner: using a skilled technician who is familiar with the building, assist in the functional performance testing of the control system as per test requirements developed in the commissioning check sheets (prepared by the commissioning provider).
- 3.21.4. When Commissioning, Testing, Demonstration and Acceptance process has been completed and approved and/or verified by the Owner, and within ten (10) days, the contractor will be provided with a signed letter from the owner indicating acceptance.
- 3.22. **TRAINING**
- 3.22.1. Subsequent to the acceptance, per 3.9., and part of this contract, 1 day of training is to be provided to a maximum 6 individuals responsible for the operation of the site at the sole discretion of the Owner. The training shall provide instruction and demonstration on the operation, adjustment and maintenance of the BAS inclusive of all hardware and software supplied under this and other related specifications necessary to meet the functional intent. The training is to include, but not limited to, the following:
 - 3.22.1.1. Location of all controllers, devices, sensors, peripherals, etc.
 - 3.22.1.2. Equipment layout and dependencies

3.22.1.3. Sequence of operation

3.22.1.4. Preventative maintenance

3.23. **WARRANTY, MAINTENANCE, AND SERVICE**

3.23.1. Provide warranty under provisions of these specifications.

3.23.2. At no cost to the Owner, during the warranty period, the Contractor shall provide maintenance services for software and hardware components as specified below:

3.23.2.1. Normal Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would not result in property damage or loss of comfort control shall be corrected and repaired. Response to any request for service shall be provided within eight (8) working hours of the Owner's initial request for service. In the event that the malfunction, failure, or defect cannot be corrected through telephone support to the Owner, or its representatives, the next step is to attempt to correct the issue through remote site access. In the event the problem persists, a service technician, trained in the system to be serviced, shall be dispatched to the Owner's site within forty-eight (48) hours of the Owner's initial request for service, as specified.

3.23.2.2. Emergency Service: Any malfunction, failure, or defect in any hardware component or failure of any control programming that would result in property damage or loss of comfort control shall be corrected and repaired. Response to any request for service shall be provided within two (2) working hours of the Owner's initial request for service. In the event that the malfunction, failure, or defect cannot be corrected immediately through telephone support or remote site access, a service technician, trained in the system to be serviced, shall be dispatched to the Owner's site within eight (8) hours of the Owner's initial telephone request for service, as specified.

3.23.2.3. Owners Request for Service: Contractor shall specify three telephone numbers and email addresses, including order of contact and procedure in the event a contact fails to respond, for the Owner to use in the event of a need for service.

3.23.3. Provide all labour, associated travel and expenses, materials and equipment necessary for the successful operation of this system for a period of 12 months from the date of final acceptance, per 3.9. In addition, provide three (3) visits for testing and evaluating the performance of the hardware and software installed per this specification, to be coordinated with the HDSB's Building Automation Manager. One visit shall be during the cooling season, one visit shall be during the heating season, and one visit shall be during a shoulder season, either spring or fall. Provide a written report after each visit is complete. This service visit shall include, but not be limited to, the following:

3.23.3.1. Check calibration and re-calibrate if needed instrumentation sensors for air flow, liquid flow, pressure, humidity, temperature, and transducers. Written records shall be kept indicating the performance of such calibrations along with pertinent data.

3.23.3.2. Check the operation of dampers and damper actuators to assure no lock up has occurred and stroke is proper. Written records shall be kept indicating the performance of such calibrations along with pertinent data.

3.23.3.3. Check the overall system field operations by performing a review of all points. Verify that all monitoring and command points are valid and active. Written records shall be kept indicating the performance of such exercises.

3.23.4. If a problem develops at any time during the warranty/service period, the affected BAS point/object shall be monitored and logged for the remainder of the warranty/service period. "A problem" in the above statement will refer to an incident in which any of the following occur:

- 3.23.4.1. An alarm occurs due to a defective control system component(s), improper installation or programming.
- 3.23.4.2. Overall performance of the system is compromised due to a defective control component(s), improper installation or programming.
- 3.23.4.3. Major recalibration (by greater than 5 times the catalogued accuracy) is required for a sensor during one of the service visits.
- 3.23.5. Pursuant to 3.3, changes required to meet design, compliance, and functionality, that were not part of the Demonstration and Acceptance process, will be made at no cost to the Owner.
- 3.23.6. Any changes to programming, inclusive of but not limited to set-points, schedules, sequences, alarms, history, network addressing, object naming, etc. are to be performed in accordance with the Change Management Procedures outlined in the HDSB's Building Automation Systems Standards and Design, latest revision.
- 3.24. **SCHEDULE A**
- 3.24.1. Objects / Points identified in Schedule A as Mandatory ('Y' in Mandatory column) must be included in program of the respective system or equipment. Where an Object or Point is not listed as Mandatory, inclusion within Schedule A does not dictate the requirement for use within a program, and are listed for information purposes only where equipment differs from standard and program variations must be made to meet the sequences per 23 09 93.
- 3.24.2. Objects / Points identified as Mandatory must be adjustable, in accordance with 3.12 of this Section
- 3.24.3. Where a 'G' and/or 'V' is indicated in the User Interface column, the Object or Point shall be represented on the respective graphic page, in accordance with 3.9 of this Section. Mandatory points without a 'G' and/or 'V' indicated in the User Interface column shall be presented in the settings page.
- 3.24.4. Where an Object or Point is identified as a software point with a 'B' in the Software Point column of the table, BACnet value will be an accepted means of data source provided change of value requirements are met. BACnet shall not be used as a writeable point or as a data source for Alarms classified as Emergency.

PART 1 - GENERAL

1.1. **SUMMARY**

1.1.1. Section Includes:

1.1.1.1. Control Sequences for HVAC Systems, sub-systems, and accessories

1.1.2. Related Sections:

1.1.2.1. Section 23 09 00 – Instrumentation and Control for HVAC

1.1.2.2. Section 23 70 00 – Central HVAC Equipment

1.1.2.3. Section 25 00 00 – Integrated Automation

1.2. **GENERAL**

1.2.1. Sequences specified herein indicate the functional intent of the systems operation and do not fully detail the programming required to obtain the indicated operation.

1.2.2. Throttling ranges, proportional bands, and cycle differentials shall be centered on the associated set-point. All modulating feedback control loops shall include the capability of having proportional, integral, and derivative action. Contractor shall apply appropriate elements of integral and derivative gain to each control loop which shall result in stable operation, minimum settling time, and shall maintain the primary variable within the specified maximum allowable variance.

1.2.3. Equipment start-up concluding a power failure shall be provisioned such that there is protection against building reduced voltage resulting from starting multiple inductive loads. Mechanical equipment shall be grouped such that the combined starting current of the defined group will not exceed the electrical distribution system rated capacity less base load. An interval of not less than 3 seconds shall be maintained between starting of the defined groups.

1.2.4. Preference will be given to using OEM furnished controls. OEM furnished controls must have minimum hard-wired points as indicated herein.

PART 2 - PRODUCTS

2.1. **SECTION NOT USED**

PART 3 - EXECUTION

3.1. **HYDRONIC HEATING LOOP**

High Temperature Heating Loop

Hydronic heating loop applications, requiring a high temperature loop, include but is not limited to: radiant heating, hydronic heating coils (air handling units, unit heaters, etc.), heat exchangers.

Note: Hydronic perimeter radiant heat shall be 1st stage of heat

3.1.1. The BAS shall enable and/or command on primary and secondary heating circulating pump(s) between December 15th and March 31st.

3.1.2. Between March 31st and December 14th, primary and secondary heating circulating pump(s) shall be enabled and/or commanded on if the outdoor air temperature is less than 5°C for 12 hours or there is a call for heat for the Heat-pump Loop or any HVAC System furnished with Hydronic Coil which serves an occupied area. The hydronic heating loop shall remain enabled until the outdoor air temperature is greater than 18°C.

- 3.1.3. Where multiple circulation pumps exist for redundancy, the BAS shall rotate the lead pump every Tuesday at 9 am. In the event a pump fails the alternate pump shall start immediately and notification generated. A 5 minute delay prior to release of alternate, upon status of pump reinstatement.
- 3.1.4. All heating system pumps are to run for 15 minutes minimum per week.
- 3.2. **CENTRAL HEATING PLANT (BOILERS)**
- 3.2.1. The Central Heating Plant shall be enabled between December 15th and March 31st.
- 3.2.2. The BAS shall continuously enable and/or command on the boiler plant with any call for heating from the Heat-pump Loop, HVAC System furnished with a hydronic coil, or High Temperature Heating Loop.
- 3.2.3. The boiler return water temperature shall be reset using an outdoor air reset for non-condensing boilers, in accordance with engineered design and/or manufacturer's specifications (minimum RWT to be verified for every installed appliance). Set-points are to adjust to higher set-points to meet the functional intent of all attached appliances.
- 3.2.4. Where redundant boilers are installed, the lead boiler shall be rotated every Tuesday at 9 am.
- 3.2.5. The control of boiler pumps shall be facilitated by the boiler plant OEM furnished controllers, where provisioned. Pump status shall be monitored using an analog signal from a Current Transformer.
- 3.3. **HEAT-PUMP LOOP**
- 3.3.1. The Heat-pump Loop main circulation pump shall be enabled and/or commanded on. For pumps equipped with a VFD, pump speed is to vary based on the design pressure differential between the Heat-pump Loop Supply Pressure and Heat-pump Loop Return Water Pressure.
- 3.3.2. Where redundant circulation pumps exist, lead pump designation shall rotate every Tuesday at 9 am. In the event a lead pump failure occurs the lag pump shall be energized.
- 3.3.3. The heat-pump loop temperature shall be configured to maximize efficiency of the heat-pumps using 5 distinct modes, "High Temperature", "Low Temperature", "Heating", "Shoulder" and "Cooling". No two modes can operate simultaneously.
- 3.3.4. "High Temperature" and "Low Temperature" modes have priority over other modes. An Emergency Class Alarm is to be generated during these events.
- 3.3.5. *NOTE: The program shall be written such that no event enables both the cooling tower and boiler simultaneously.*
- 3.3.6. **High Temperature Mode (Safety):** Enabled when the Heat-pump Loop Return Water Temperature is greater than 31°C. This shall enable and/or command on the first two Stages of the cooling tower. Stages three and four shall be enabled and/or commanded on when the Return Water Temperature is greater than 32°C. This mode is released when the Return Water Temperature is less than 26°C.
- 3.3.7. **Low Temperature Mode (Safety):** Enabled when the Heat-pump Loop Return Water Temperature is less than 14°C. This enables and/or commands on the boiler(s) or opens the heat-exchanger valve. This mode is released when the Return Water Temperature is 22°C.
- 3.3.8. **Shoulder Mode:** Active when no other mode is active.
- 3.3.9. **Heating Mode:** Enabled when the Outdoor Air Temperature is less than 10°C for a period of 45 hours. This mode is released when half (adjustable) of the Heat-pumps enable cooling during the last 24 hour period (counter to be reset at 2 pm) or the Outdoor Air Temperature is above 20°C or in

the event of network failure.

- 3.3.10. **Cooling Mode:** Enabled when the Outdoor Air Temperature is greater than 25°C and should half (adjustable) of the Heat-pumps enable cooling during the last 24 hour period (counter to be reset at 2 pm). This mode is disabled when Outdoor Air Temperature is below 15°C or in the event of network failure.

3.4. **HEATING PLANT FOR HEAT-PUMP LOOP**

- 3.4.1. Pump status shall be monitored using an analog current transformer.
- 3.4.2. Redundant boilers are rotated every Tuesday at 9 am.
- 3.4.3. In “Heating” mode, the boiler(s)/heat injection will modulate the heat pump supply water temperature to a maximum of 32°C to maintain the return water temperature at 29°C.
- 3.4.4. In “Shoulder” mode, the boiler(s)/heat will modulate the heat pump supply water temperature to a maximum of 32°C to maintain the return water temperature at 20°C.

3.5. **COOLING TOWER FOR HEAT-PUMP LOOP**

- 3.5.1. When in the “Cooling” mode, the Cooling Tower shall be staged using the following values:

Return Water Temperature	Stage	Enable
Base set-point + 2°C	4	Ramp Fan Speed to Maintain
Base set-point + 1.5°C	3	Spray Pump
Base set-point + 1°C	2	Fan Minimum Speed
Base set-point + 0.5°C	1	Open Dampers
Base set-point		Off

The base set-point is equal to the Outdoor Air Temperature minus 5°C but is limited between 17°C and 28°C.

- 3.5.2. When in the “Shoulder” mode, the Cooling Tower shall be staged using the following values:

Return Water Temperature	Stage	Stage
28°C	4	Ramp Fan Speed to Maintain
27.5°C	3	Spray Pump
27°C	2	Fan Minimum Speed
26.5°C	1	Open Dampers
26°C		Off

- 3.5.3. The BAS shall disable the Spray Pump when Outdoor Air Temperature is less than 4°C.

3.6. **GYMNASIUM UNIT(S)**

Unit OEM Controller Minimum Hard-wired points

Outdoor Air Damper Position Signal: Analogue input (0 to 10 Vdc, or 4 to 20 mA)

Fan(s) Command and/or Enable: Binary input

Heating Command and/or Enable: Binary input

Mechanical Cooling Command and/or Enable: Binary input

- 3.6.1. Free-cooling is to be enabled when outdoor air is below 12°C
- 3.6.2. In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical

spring, return air dampers shall open by way of mechanical spring.

- 3.6.3. Where the unit is equipped with a hydronic heating coil, the heating valve will keep the unit internal temperature (mixed air temperature) to a minimum of 15°C. When the outdoor air is below 10°C or there is a heating load, any heating coil pump will run.

3.6.4. **Scheduled Occupancy**

Pre-Occupancy: The BAS shall command on and/or enable the supply and return air fans, 30 minutes prior to the start of the *Occupied* period. Outdoor air dampers are to remain closed. The unit is controlled to maintain the space temperature to the occupied set-point.

Occupied: The BAS shall command on and/or enable the unit (and all associated HVAC equipment, i.e. change room exhaust fans) as per Occupancy Appendix. The outdoor air dampers are to be kept to a minimum position or to vary to maintain a return air CO² level equal to or less than 800 ppm. The unit is controlled to maintain the space temperature at 19°C.

Un-Occupied: The BAS shall command off and/or disable the unit as per Occupancy Appendix. All fans are to be commanded off and/or disabled and the outdoor and exhaust air dampers are to be closed by way of mechanical spring return. The return air dampers are to be released and open by way of mechanical spring return. Outdoor air dampers are to remain closed during un-occupied times. The space temperature shall be controlled to maintain between 18°C and 25°C.

3.7. **MAKE-UP AIR UNIT**

Unit OEM Controller Minimum Hard-wired points

Discharge Air Temperature Reset Signal: Analogue input (0 Vdc – 10 Vdc or 4mA to 20 mA)

Outdoor Air Damper Position Signal: Analogue input (0 to 10 Vdc, or 4 to 20 mA)

Fan(s) Command and/or Enable: Binary input

Heating Command and/or Enable: Binary input

Mechanical Cooling Command and/or Enable: Binary input

- 3.7.1. In the event of power loss, the outdoor and exhaust air dampers are to close by mechanical spring.

- 3.7.2. Where the unit is equipped with a hydronic heating coil, the heating valve will keep the unit internal temperature to a minimum of 15°C. When the outdoor air is below 10°C or there is a heating load, any heating coil pump will run.

- 3.7.3. When the supply and exhaust air fans are controlled by VFD, fan speed is programmed to maintain constant static pressure, per engineer or OEM specifications. A service notification is to be generated when either fan increases above design speed.

3.7.4. **Scheduled Occupancy**

Occupied: The BAS shall command on and/or enable the unit 15 minutes prior to scheduled occupancy, per Occupancy Appendix.

The Discharge Air Temperature shall reset between 18°C to 15°C based on outdoor air temperature of 0°C to 20°C respectively.

Un-Occupied: The BAS shall disable the unit according as per Occupancy Appendix. All fans are to be shut-down, the outdoor and exhaust air dampers are to be close by way of mechanical spring return.

3.8. **ROOM CONTROL HEAT PUMP**

Heat-pump Controls Minimum Hard-wired points

Fan Command and/or Enable: Binary input

Heating Command and/or Enable: Binary input

Cooling Command and/or Enable: Binary input

- 3.8.1. Network Occupied Set-point is calculated each scheduled occupancy day at 7 am, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.
- 3.8.2. Heating or Cooling is to be enabled when the room temperature is 1°C away from set-point and will be disabled using a 1°C dead-band.
- 3.8.3. A 1 hour Heating-Cooling Switch Over Delay is to be programmed.
- 3.8.4. The compressor will have minimum run time of 5 minutes.
- 3.8.5. Scheduled Occupancy

Pre-Occupancy: The BAS shall enable the unit 30 minutes prior to the start of the *Occupied* period. The unit is controlled to maintain the space temperature to the occupied set-point.

Occupied: Fan will run continually. Occupancy is to be scheduled as per Occupancy Appendix.

Un-Occupied: Cooling and heating set-points shall be 18°C and 27°C and will be disabled by a 2°C dead-band, fan shall operate on a call for heating or cooling. The room sensor shall be provisioned with an occupancy override button that allows temporary occupancy for 120 minutes.

Perimeter Heat

When a room, conditioned by a heat-pump, is provisioned with perimeter hydronic heat, the perimeter heat shall be enabled as 1st stage heat. For hydronic heating, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).

3.9. ROOM CONTROL TERMINAL OR BY-PASS BOX

- 3.9.1. Room temperature set points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.
- 3.9.2. Heating or Cooling is to be enabled when the room temperature is 1°C away from set-point. Damper to open when there is a minimum 5°C differential between room temperature and the air supplied by the respective unit (Heating call supply air to be 5°C above room temperature, Cooling call supply air to be 5°C below room temperature), otherwise remain at minimum position. Heating or cooling will be disabled using a 1°C dead-band. There shall be a 30 minutes delay between heating and cooling.
- 3.9.3. **Scheduled Occupancy**

Occupied: Occupancy is to be scheduled as per Occupancy Appendix.

Perimeter Heat

When a room, conditioned by a terminal unit or by-pass box, is provisioned with perimeter hydronic heat, the perimeter heat shall be enabled as 1st stage heat. For hydronic heating, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).

3.10. ROOM CONTROL TERMINAL OR BY-PASS BOX WITH RE-HEAT

- 3.10.1. Room temperature set-points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.

- 3.10.2. Heating or Cooling is to be enabled when the room temperature is 1°C away from set-point. On a call for Cooling the damper is to open when there is a minimum 5°C differential between room temperature and the air supplied by the respective unit (supply air to be 5°C below room temperature), otherwise remain at minimum position. Heating or cooling will be disabled using a 1°C dead-band. There shall be a 30 minutes delay between heating and cooling.
- 3.10.3. **Scheduled Occupancy**
Pre-Occupancy: The BAS shall enable the supply and return air fans 30 minutes prior to the start of the *Occupied* period. Outdoor air dampers are to remain closed. The unit is controlled to maintain the space temperature to the occupied set-point.
Occupied: Occupancy is to be scheduled as per Occupancy Appendix.
Perimeter Heat
- 3.10.4. When a room, conditioned by a terminal unit or by-pass box with re-heat, is provisioned with perimeter hydronic heat, the perimeter heat shall be enabled as 1st stage heat. For hydronic heating, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).
- 3.11. **ROOM CONTROL HVAC UNIT (SINGLE ZONE)**
HVAC Unit Controls Minimum Hard-wired points
Outdoor Air Damper Signal (0 Vdc – 10 Vdc or 4mA to 20 mA)
Fan(s) Enable / Disable (10 Vdc to 24Vdc)
Heating Enable (10 Vdc to 24Vdc)
Mechanical Cooling Enable (10 Vdc to 24Vdc)
- 3.11.1. Room temperature set-points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.
- 3.11.2. Heating or Cooling is to be enabled when the room temperature is 1°C away from set-point and will be disabled using a 1°C dead-band. There shall be a 30 minutes delay between heating and cooling.
- 3.11.3. The compressor will have minimum run time of 5 minutes.
- 3.11.4. Free-cooling is to be enabled when outdoor air is below 12°C
- 3.11.5. In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical spring, return air dampers shall open by way of mechanical spring.
- 3.11.6. Where the unit is equipped with a hydronic heating coil, the heating valve will keep the unit internal temperature (mixed air temperature) to a minimum of 15°C. When the outdoor air is below 10°C or there is a heating load, any heating coil pump will run.
- 3.11.7. Where the unit is equipped with a hydronic heating coil, in the event the freeze stat senses a low temperature event, the unit fans are to be disabled, outdoor air dampers close by way of mechanical spring, and the heating valve is to be opened 100% (heating circulation pump, where equipped is to be enabled).
- 3.11.8. **Scheduled Occupancy**
Pre-Occupancy: The BAS shall enable the supply and return air fans 30 minutes prior to the start of the *Occupied* period. Outdoor air dampers are to remain closed. The unit is controlled to maintain the space temperature to the occupied set-point.
Occupied: The BAS shall enable the unit as per Occupancy Appendix. The dampers are to be kept

to a minimum position or to maintain the return air CO² to a level of 800 ppm. The unit is controlled to maintain the space temperature. The exhaust fan and dampers are enabled with the supply and return air fans.

Un-Occupied: The BAS shall disable the unit as per Occupancy Appendix. All fans are to be disabled and the outdoor and exhaust air dampers are to be closed by way of mechanical spring return. The return air dampers are to be released and open by way of mechanical spring return. The space temperature shall be controlled to maintain between 18°C and 27°C.

Perimeter Heat

When a room, conditioned by a HVAC unit, is provisioned with perimeter hydronic heat, the perimeter heat shall be enabled as 1st stage heat. For hydronic heating, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).

3.12. ROOM CONTROL UNIT VENTILATOR

Unit Ventilator Controls Minimum Hard-wired points

Outdoor Air Damper Signal (0 Vdc – 10 Vdc or 4mA to 20 mA)

Fan Enable / Disable (10 Vdc to 24Vdc)

Heating Enable (0 Vdc - 10 Vdc to 4mA to 24Vdc)

Mechanical Cooling Enable (10 Vdc to 24Vdc)

- 3.12.1. Room temperature set-points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.
- 3.12.2. Heating or Cooling is to be enabled when the room temperature is 1°C away from set-point and will be disabled using a 1°C dead-band. There shall be a 30 minutes delay between heating and cooling.
- 3.12.3. The compressor will have minimum run time of 5 minutes.
- 3.12.4. Free-cooling is to be enabled when outdoor air is below 12°C
- 3.12.5. In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical spring, return air dampers shall open by way of mechanical spring and fans, heating, cooling and mechanical energy recovery system are to shut-down.
- 3.12.6. Where the unit is equipped with a hydronic heating coil, the heating valve will keep the unit internal temperature (mixed air temperature) to a minimum of 15°C. When the outdoor air is below 10°C or there is a heating load, any heating coil pump will run.
- 3.12.7. Where the unit is equipped with a hydronic heating coil, in the event the freeze stat senses a low temperature event, the unit fans are to be disabled, outdoor air dampers close by way of mechanical spring, and the heating valve is to be opened 100% (heating circulation pump, where equipped is to be enabled).
- 3.12.8. **Scheduled Occupancy**
Pre-Occupancy: The BAS shall enable the unit 30 minutes prior to the start of the *Occupied* period. Outdoor air dampers are to remain closed. The unit is controlled to maintain the space temperature at the occupied heating and occupied cooling set-point.

Occupied: The BAS shall enable the unit as per Occupancy Appendix. Upon detecting occupancy, by locally connected motion sensor, the outdoor air damper is to be opened and maintained at minimum position (balancer to confirm, adjustable). If no motion is detected for 30 minutes the outdoor air dampers are to be closed. When no heating or cooling call exists, and the unit shall maintain the discharge air temperature at the occupied actual heating set-point with a offset that is

reset from 0°C to -4°C as the outdoor air temperature rises from 10°C to 30°C.

Un-Occupied: The BAS shall disable the unit as per Occupancy Appendix. All fans are to be disabled and the outdoor and exhaust air dampers are to be closed by way of mechanical spring return. The return air dampers are to be released and open by way of mechanical spring return. The space temperature shall be controlled to maintain between 18°C and 27°C.

Perimeter Heat

When a room, conditioned by a Unit Ventilator, is provisioned with perimeter hydronic heat, the perimeter heat shall be enabled as 1st stage heat. For hydronic heating, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).

3.13. **ROOM CONTROL OCCUPANT COMFORT HEAT - INCLUDES DUCT HEATERS**

Occupant comfort heat includes but is not limited to the following instances:

- Perimeter heaters, unit heaters, duct heaters, radiant panels, etc., in all classrooms, administrative areas, work rooms and resource areas.

- 3.13.1. Room temperature set-points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.
- 3.13.2. Heating is to be enabled when the room temperature is 1°C away from set-point and will be disabled using a 1°C dead-band.
- 3.13.3. The BAS shall control room temperature and indicate status with an analog current Transformer or temperature sensor in accordance with Object
- 3.13.4. For hydronic heating, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).

3.14. **ROOM CONTROL VARIABLE REFRIGERANT FLOW INDOOR AIR HANDLING UNIT / CASSETTE**

Indoor Unit ('head') Controls Minimum Hard-wired points

Fan Enable / Disable (10 Vdc to 24Vdc)
Heating Enable (10 Vdc to 24Vdc)
Cooling Enable (10 Vdc to 24Vdc)

- 3.14.1. Room temperature set-points are set to a Network Occupied Set-point, reset at 7 am each occupied period, from 21°C to 24°C based on Outdoor air temperature -10°C to 27°C, respectively. A +/-2°C set-point offset shall be provisioned through the room sensor.
- 3.14.2. Heating or Cooling is to be enabled when the room temperature is 1°C away from set-point and will be disabled using a 1°C dead-band. There shall be a 30 minutes delay between heating and cooling.
- 3.14.3. Scheduled Occupancy

Occupied: Occupancy is to be scheduled as per Occupancy Appendix.

Un-Occupied: Cooling and heating set-points shall be 18°C and 27°C and will be disabled by a 2°C dead-band, fan shall operate on a call for heating or cooling. The room sensor shall be provisioned with an occupancy override button that allows temporary occupancy for 120 minutes.

Perimeter Heat

When a room, conditioned by a VRF unit, is provisioned with perimeter hydronic heat, the perimeter heat shall be enabled as 1st stage heat. For hydronic heating, the heat is to be enabled when the radiant device is equal to or less than 6°C (must enable respective circulation pump).

3.15. **HVAC UNIT INCLUDING V.A.V. OR V.V.T. WITH MORE THAN TWO ZONES**

3.15.1. Unit Sequence of Operations to be detailed by engineer of record must be in accordance with Section 23 09 93 3.9 & 3.10 and include the following:

3.15.2. ***HVAC Unit Controls Minimum Hard-wired points***

Discharge Air Temperature Reset Signal (0 Vdc – 10 Vdc or 4mA to 20 mA)

Outdoor Air Damper Signal (0 Vdc – 10 Vdc or 4mA to 20 mA)

Fan(s) Enable / Disable (10 Vdc to 24Vdc)

Heating Enable (10 Vdc to 24Vdc)

Mechanical Cooling Enable (10 Vdc to 24Vdc)

3.15.3. Free-cooling is to be enabled when outdoor air is below 12°C

3.15.4. In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical spring, return air dampers shall open by way of mechanical spring.

3.15.5. Where the unit is equipped with a hydronic heating coil, the heating valve will keep the unit internal temperature (mixed air temperature) to a minimum of 15°C. When the outdoor air is below 10°C or there is a heating load, any heating coil pump will run.

3.15.6. Where the unit is equipped with a hydronic heating coil, in the event the freeze stat senses a low temperature event, the unit fans are to be disabled and the heating valve is to be opened 100% (heating circulation pump, where equipped is to be enabled).

3.15.7. Scheduled Occupancy

3.15.8. ***Occupied:*** Occupancy is to be scheduled as per Occupancy Appendix.

3.15.9. ***Un-Occupied:*** Cooling and heating set-points shall be 18°C and 27°C and will be disabled by a 2°C dead-band

3.15.10. **Heating or Cooling Call:** In the event the freeze stat senses a low temperature event, the unit fans are to be disabled and the heating valve is to be opened 100% (heating circulation pump, where equipped is to be enabled).

3.16. **DOMESTIC HOT-WATER**

3.16.1. The BAS shall monitor the Domestic Supply Water Temperature and domestic hot water circulating pump(s) using an analog current transformer.

3.17. **ANCILLARY HEAT**

3.17.1. Ancillary Heat shall use a stainless-steel plate sensor include the following areas:

3.17.1.1. Vestibules

3.17.1.2. Above ceiling freeze protection

3.17.1.3. Outdoor storage areas

3.17.1.4. Receiving areas

3.17.1.5. Electrical rooms

-
- 3.17.1.6. Supply storage rooms
 - 3.17.1.7. Stairwells
 - 3.17.2. "Spare" I/O points from a typical room controller are not to be used for Ancillary Heat (i.e. points from Room Controller located within proximity to the Ancillary Heater). I/O point terminations and control points are to be detailed on the drawings.
 - 3.17.3. Stairwells: Ancillary heaters servicing a stairwell and vestibule are to be grouped and controlled using a sensor located within the stairwell (not the vestibule area). Status is required for individual heaters.
 - 3.17.4. Grouping multiple Ancillary Heaters to a single I/O control point is preferred. Status is required for individual heaters.
 - 3.17.5. Ancillary heaters are to be disabled when outdoor air temperatures is above 6°C
 - 3.17.6. The BAS shall indicate status using a temperature sensor located on the unit return water piping (Hydronic heater) or using an analog current transformer (Electric heater).
 - 3.17.7. The room temperature set-point shall use unoccupied set-point as for comfort heaters.
 - 3.17.8. For Hydronic heaters the heat is to be enabled and/or commanded on to maintain heater temperature at a minimum of 6°C. Will enable circulation pump where applicable.
 - 3.18. **EXHAUST FANS**
 - 3.18.1. The BAS shall control exhaust fans and monitor status with an analog current transformer.
 - 3.18.2. Fans are to be enabled in accordance with local, provincial and federal code requirements.
 - 3.18.3. **Group A** fans include but is not limited to the following instances:
 - 3.18.3.1. Gym washrooms / change rooms
 - 3.18.3.2. Laundry room
 - 3.18.4. Fans are to be enabled with the gymnasium HVAC unit occupancy schedule.
 - 3.18.5. **Group B** fans include but is not limited to the following instances:
 - 3.18.5.1. Exterior storage areas
 - 3.18.5.2. Machine room (elevator)
 - 3.18.5.3. Electrical & Sprinkler rooms
 - 3.18.5.4. Hub room
 - 3.18.5.5. Mechanical room
 - 3.18.6. Fans are to be enabled to maintain room temperature below 27°C.
 - 3.18.7. **Group C** fans include but is not limited to the following instances:
 - 3.18.7.1. Staff and Classroom washrooms
 - 3.18.7.2. Interior storage areas
 - 3.18.8. Fans are to be enabled during hours of school occupancy and when the school is occupied by

custodial or cleaning staff.

3.18.9. **Group D** fans include but is not limited to the following instances:

3.18.9.1. Food preparation (excluding staffroom kitchenettes)

3.18.9.2. Kiln rooms

3.18.9.3. Automotive shops

3.18.9.4. Science fume hoods

3.18.9.5. Dust collectors

3.18.10. Fans are to be removed from the BAS and controlled via a switch near their relative equipment.

3.19. **EXTERIOR LIGHTING**

3.19.1. The BAS shall enable or disable exterior lighting using a combination calendar and astronomical clock. Command status shall be verified using an analog Current Transformer.

3.19.2. The lighting is to be grouped as Wall-packs and Pole Lighting.

PART 1 - GENERAL**1.1. DESIGN CRITERIA****1.1.1. Natural Gas Distribution System**

1.1.1.1. Primary and Secondary gas service meter sizing: Gas input requirement shall be as per the schedules.

1.1.1.2. Contractor shall verify gas pressure on site prior to ordering of materials. Include for all pressure reducing and safety relief devices as deemed necessary.

1.2. CODES AND REGULATIONS; PERMITS, COSTS AND FEES

1.2.1. Install, test and purge to current codes:

1.2.1.1. Natural Gas Installation Code CAN/CGA-B149.1.

1.3. PERMITS, EQUIPMENT REGISTRATION AND FEES

1.3.1. General

1.3.1.1. Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA.

1.3.2. Permits

1.3.2.1. Arrange and pay charges for modification of gas service into the building as shown and as required.

1.4. SUBMITTALS

1.4.1. Shop Drawings

1.4.1.1. Submit Shop Drawings in accordance with Section 23 05 00 "Basic Mechanical Requirements".

1.4.2. Operation and Maintenance Data

1.4.2.1. Submit printed operation instructions and maintenance data in accordance with Section 23 05 00 "Basic Mechanical Requirements".

PART 2 - PRODUCTS**2.1. PIPING, JOINTS AND FITTINGS**

2.1.1. Above Ground Piping

2.1.1.1. Steel pipe: to ASTM A 53, Schedule 40 seamless as follows:

1. NPS ½ to 2, screwed
2. NPS 2-½ and over, plain end, welded.

2.1.1.2. Copper tube: to ASTM B 75M.

2.1.2. Jointing Material

2.1.2.1. Screwed fittings: pulverized lead paste

2.1.2.2. Welded fittings: to CSA W47.1

2.1.2.3. Flanged gaskets: non-metallic flat

2.1.2.4. Soldered: to ASTM B 32

2.1.3. Fittings

2.1.3.1. Steel pipe fittings, screwed, flanged or welded:

1. Malleable iron: screwed, banded, Class 150
2. Steel pipe flanges and flanged fittings: to ANSI/ASME B16.5
3. Welding: butt-welding fittings
4. Unions: malleable iron, brass to iron, ground seat, to ASTM A 47M
5. Bolts and nuts: to ANSI B18.2.1
6. Nipples: schedule 40, to ASTM A 53

2.1.3.2. Copper pipe fittings, screwed, flanged or soldered:

1. Cast copper fittings: to ANSI B16.18
2. Wrought copper fittings: to ANSI/ASME B 16.22

2.1.4. Valves

2.1.4.1. Provincial code approved, lubricated type.

2.2. **SPECIALTIES**

2.2.1. Pressure Reducing Regulating Valves

2.2.1.1. Spring loaded, quick response regulator with stabilizer vent, partial internal relief, suitable for service with downstream solenoid valves.

1. Fisher S202
2. or approved equivalent

2.2.2. Pipe supports on roof

2.2.2.1. Provide engineered pipe supporting system on the roof. Pipe supports shall be of rigid fibreglass composite materials, shall be installed on 50 mm thick Styrofoam pads and shall accept standard over-sized gas pipe clamps.

PART 3 - EXECUTION

3.1. **INSTALLATION – GENERAL PIPING**

3.1.1. Piping

3.1.1.1. Exposed piping:

1. NPS 2 and smaller: screwed
2. NPS 2½ and larger: welded with butt weld fittings

3.1.1.2. Concealed piping:

1. NPS 2 and smaller: welded with socket weld fittings
2. NPS 2½ and larger: welded with butt weld fittings

3.1.1.3. Equipment connections:

1. NPS 2 and smaller: screwed unions
2. NPS 2½ and larger: flanges

-
- 3.1.1.4. Branch connections:
 - 1. May be welded directly into main provided main is more than NPS 4 and branch is at least 2 pipe sizes smaller than main
 - 2. Cut openings in main true and bevelled
 - 3. Do not project branch pipes inside main pipe
 - 4. Size openings to prevent entry of welding metal and slag into pipes
 - 3.1.1.5. Saddle type branch welding fittings used on mains:
 - 1. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding
 - 3.1.1.6. Dirt Pockets:
 - 1. At each connection to equipment.
 - 2. At al low points in piping systems.
 - 3.1.1.7. Make-up joints in screwed pipe with joint compound.
 - 3.1.1.8. Provide clearance for maintenance of equipment, valves and fittings.
 - 3.1.1.9. Ream pipe after cutting to length, clean off scale and dirt inside and outside of pipe.
 - 3.1.1.10. Cap ends during construction to prevent entry of foreign matter.
 - 3.1.1.11. Slope piping down in direction of flow to low points.
 - 3.1.1.12. Use eccentric reducers at pipe size change installed FOT to provide positive drainage.
 - 3.1.2. Valves
 - 3.1.2.1. Install valves with stems upright or horizontal.
 - 3.1.2.2. Install valves at branch take-offs to isolate each piece of equipment.
 - 3.2. **INSTALLATION – REGULATING AND CONTROL DEVICES**
 - 3.2.1. Pressure Reducing Stations
 - 3.2.1.1. Provide, pressure reducing stations where required, consisting of pressure regulating valve, relief valve, isolating valves and pressure gauges on both sides of pressure reducing station.
 - 3.2.2. Pressure Reducing Regulators
 - 3.2.2.1. Provide regulator control lines, where required, and connect to downstream piping a minimum of 8 to 10 pipe diameters from the regulator and any elbows.
 - 3.2.3. Vents
 - 3.2.3.1. Run vent piping from relief connection on gas regulator and relief valves up through roof. Provide roof sleeves and flashing. Terminate pipe with turn down bend, and protect opening with stainless steel insect screen, to approval of authorities having jurisdiction.
 - 3.2.3.2. Individual vent line sizes:
 - 1. Equal to relief port connection size where total length of vent is less than 15 metres
 - 2. One size larger than port connection size where total length of vent is between 15 m and 30 m
 - 3. One additional size larger for each additional 15 m of pipe length

3.2.3.3. Combined vent line sizes:

1. Individual vent lines can be combined into common vents, where the variance between the inlet pressures of all relief devices is less than 10%, and the variance between the outlet pressures of all relief devices is less than 10%
2. Size the combined vent to have a cross sectional area equal to the largest relief device opening, plus 50% of the total area openings of all other devices.

3.3. **CONNECTIONS TO MUNICIPAL SERVICES**

3.3.1. Natural Gas Supply

- 3.3.1.1. Include costs levied by the Gas Company for modification of existing gas service and gas meter assembly.

3.4. **EQUIPMENT INSTALLATION**

3.4.1. General Requirements

- 3.4.1.1. Set equipment in place, align, connect and place in operation with:

3.4.1.2. Controls set for efficient, stable operation.

3.4.1.3. Connections and required safety devices installed.

3.4.1.4. Protect equipment from damage during and after installation, and on completion of Work ensure that equipment is free from cracks, scratches, discolouration, tool marks, and other defects.

3.4.1.5. Thoroughly clean finished surfaces before acceptance of the Work.

END OF SECTION

PART 1 - GENERAL

1.1. RELATED WORK

1.1.1. Section 23 05 29 - Pipe Hangers and Supports

1.1.2. Section 23 21 16 - Hydronic Specialities

1.2. REFERENCE STANDARDS

1.2.1. Ontario Plumbing Code: Pressure piping fabrication and installation

1.3. SUBMITTALS

1.3.1. Shop Drawings

1.3.1.1. Submit Shop Drawings in accordance with Section 23 05 00 "Basic Mechanical requirements".

1.3.1.2. Submit shop Drawings for the following items and indicate where they are used and with which system

1. Pipe materials
2. Fittings
3. Valves

1.3.2. Operation and Maintenance Data:

1.3.2.1. Submit printed operation instructions and maintenance data for valves and accessories in accordance with Section 23 05 00 "Basic Mechanical requirements".

PART 2 - PRODUCTS

2.1. THREADED / WELDED PIPE AND FITTINGS

2.1.1. Use pipes, fittings and valves as described below unless specifically shown or specified otherwise:

2.1.1.1. Heating water less than 93.2° C (200° F) at 1139kPa (165 psi).

1. Pipes 65mm (2 ½ ") and larger ASTM A53, Schedule 40, plain ends, ANSI B36.10
2. Pipes 50mm (2") and smaller, black steel ASTM A53, Schedule 40, threaded, ANSI B36.10
3. Fittings 65mm (2 ½ ") and larger black steel ASTM A234, Schedule 40, butt-welding ends, ANSI B16.9.
4. Fittings 50mm (2") and smaller, cast iron ASTM A126.
5. Flanges 65mm (2 ½ ") and larger, ANSI B16.1. Use only weld neck flanges with butterfly valves
6. Flange accessories for heating water gasket, 1.5mm graphite impregnated asbestos, bolts, square head machine with hexagonal nut, steel ASTM A307, ANSI B18.2.

2.1.1.2. Strainers 50mm (2") and smaller, cast iron 1720kPa (250psi) Working Steam Pressure (WSP), threaded

2.2. VALVES

2.2.1. General

2.2.1.1. Gate valves re-packable under pressure, when fully open

2.2.1.2. Plug valves packed with lubricant suitable for service

2.2.1.3. Globe and check valves provided with composition discs suitable for type of service

2.2.1.4. Renewable seats on iron body valves

2.2.1.5. Materials

ASTM B62	Bronze valves - gate, globe and check - steam rated 125 and 150 psig
ASTM B61	Bronze valves - gate, globe and check - steam rated 200 and 350 psig
ASTM B283 C3770	Brass valves - ball valves
ASTM A126 Class B	Iron valves - gate, globe and check

2.2.1.6. Markings

MSS-SP-25	Steam or WOG (water, oil and gas) rated pressure, manufacturer's trademark, size
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2.2.1.7. End Connections

ANSI B2-1	Threaded ends
ANSI B16.18	Soldered ends
ANSI B16.10	Face to face dimensions

2.2.1.8. Testing and Materials

MSS-SP-80	Bronze valves, gate, globe and check
MSS-SP-70	Iron gate valves
MSS-SP-85	Iron globe valves
MSS-SP-71	Iron check valves
MSS-SP-67	Butterfly valves

2.2.2. Gate Valves

2.2.2.1. GTV 1

1. Class 125 bronze body, screwed ends, solid or split wedge disc, rising stem
 1. Crane Fig 1700
 2. Jenkins Fig 990AJ
 3. Kitz Fig 24

2.2.2.2. GTV 2

-
- 1. Class 125 bronze body, screwed ends, rising stem, wedge disc, screw-in bonnet
 - 1. Crane Fig 428
 - 2. Jenkins Fig 990AJ
 - 3. Grinnell Fig 3010
 - 4. Newman Hattersley Fig 608
 - 5. Toyo Red-White Fig 293
 - 6. Kitz Fig 24

 - 2.2.3. Globe Valves
 - 2.2.3.1. GLV 1
 - 1. Class 125 bronze body, screwed ends, solid or split wedge disc, rising stem
 - 1. Crane Fig 7
 - 2. Jenkins Fig 106BJ
 - 2.2.3.2. GLV 2
 - 1. Class 125 iron body, bronze mounted, yoke bonnet, composition disc, renewable and regrindable bronze set ring, flanged
 - 1. Crane Fig 351
 - 2. Jenkins Fig 2342J
 - 3. Kitz Fig 76

 - 2.2.4. Ball Valves
 - 2.2.4.1. BV 1
 - 1. Class 150-600 WOG brass body, screwed ends, teflon ends, teflon seats, teflon packing, bronze or chrome plated, solid ball and lever handle with plastic protector, AGA and CGA approved for gas service
 - 1. Crane Fig F9203-B
 - 2. Jenkins Fig 201J
 - 3. Kitz Fig 58
 - 2.2.4.2. BV 2
 - 1. Class 150-600 WOG brass body, soldered ends, teflon ends, teflon seats, teflon packing, bronze or chrome plated, solid ball and lever handle with plastic protector, AGA and CGA approved for gas service
 - 1. Crane Fig F9223-B
 - 2. Jenkins Fig 201J or 202J
 - 3. Kitz Fig 58 or 59

 - 2.2.5. Plug Valves
 - 2.2.5.1. PV 1
 - 1. Class 175 WOG rating, lubricated plug valve, semi-steel body, tapered plug, screwed ends, wrench operated
 - 1. Rockwell-Nordstrom Fig 142
 - 2. Newman-Milliken Fig 170M
 - 3. Walworth Fig 1796
 - 2.2.5.2. PV 2
 - 1. Class 175 WOG rating, lubricated plug valve, semi-steel body, tapered pug, flat faced flanged ends drilled to 125 lb (862 Pa) ANSI

2. Valves NPS 6 and less: manual lever operated

2.2.6. Check Valves

2.2.6.1. CV 1

1. Class 125 horizontal swing check valve, bronze body, screwed ends, screwed cap and regrindable bronze disc
 1. Crane Fig 1707
 2. Jenkins Fig 996AJ
 3. Grinnell Fig 3300
 4. Newman Hattersley Fig 47
 5. Toyo Red-White Fig 236
 6. Kitz Fig 22

2.2.6.2. CV 2

1. Class 125 wafer type non-slam check valve, cast iron body, bronze plates and Buna-N seals.
2. Install between two flat faced flanges as specified for piping NPS 4 and larger
 1. Mission Valve "Duo-Chek"
 2. Ritepro "Check Rite"
 3. Gestra "RK" Series
 4. Crane Fig R-1-66-4-F-1-X
 5. Centerline 800 Series
 6. Grinnell Fig 300
 7. Jenkins Fig R-1-66-4-F-1-X

2.2.6.3. CV 3

1. Class 125 ULC and FM approved for 175 psig (1200 Pa) WOG, iron body, bronze mounted, horizontal swing check, bolted cap, flanged ends
2. For above ground or in valve pit
 1. Clow

2.2.6.4. CV 4

1. 2"(DN50) through 3"(DN80) Sizes Spring Assisted: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, stainless steel non-slam tilting disc, stainless steel spring and brass shaft, nickel-plated seat surface, 365 psi (2517 kPa).

2.2.7. Circuit Balancing Valves

2.2.7.1. 2" (50 mm) and Smaller Sizes: 300 psi (2065 kPa), y-pattern, globe type with soldered or threaded ends, non-ferrous brass copper alloy body, EPDM O-ring seals. 4-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter.

2.2.7.2. 2-1/2" (65 mm) and Larger Sizes: 300 psi (2065 kPa), y-pattern, globe type with flanged ASTM A536 ductile iron body, all other metal parts of brass copper alloy, EPDM O-ring seals. 8, 12 or 16-turn digital readout handwheel for balancing, hidden memory feature with locking tamper-proof setting, and connections for portable differential meter.

2.2.7.3. Acceptable Manufacturers

1. Armstrong
2. Bell & Gossett
3. Tour and Anderson

2.3. DOMESTIC HOT AND COLD WATER SYSTEMS, WITHIN BUILDING:

- 2.3.1. Above ground: copper tube, hard drawn, type L: to ASTM B88M.
- 2.3.2. Buried or embedded: copper tube, soft annealed, Type-K: to ASTM B88M, in long lengths and with no buried joints.
- 2.3.3. Domestic Water Piping Fittings
 - 2.3.3.1. Bronze pipe flanges and flanged fittings, Class 150 and 300 to ANSI/ASME B16.24.
 - 2.3.3.2. Cast bronze threaded fittings, Class 125 and 250 to ANSI/ASME B16.15.
 - 2.3.3.3. Cast copper, solder type to ANSI/ASME B16.18.
 - 2.3.3.4. Wrought copper and copper alloy, solder type to ANSI/ASME B16.22.
 - 2.3.3.5. NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
 - 2.3.3.6. NPS 1-1/2 and smaller: wrought copper to ANSI/ASME B16.22, cast copper to ANSI/ASME B16.18; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380kPa.
- 2.3.4. Globe Valves
 - 2.3.4.1. NPS 2 and Under, Soldered:
 - 2.3.4.2. To MSS-SP-80, Class 125, 860kPa, bronze body, renewable composition disc, screwed over bonnet.
 - 2.3.4.3. Lockshield Handles: As indicated.
 - 2.3.4.4. NPS 2 and Under, Screwed:
 - 2.3.4.5. To MSS-SP-80, Class 150, 1MPa, bronze body, screwed over bonnet, renewable composition.
 - 2.3.4.6. Lockshield Handles: As indicated.
- 2.3.5. Ball Valves
 - 2.3.5.1. NPS 2 and Under, Screwed:
 - 2.3.5.2. Class 150.
 - 2.3.5.3. Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and TFE seat, steel lever.
 - 2.3.5.4. NPS 2 and Under, Soldered:
 - 2.3.5.5. To ANSI/ASME B16.18, Class 150.
 - 2.3.5.6. Bronze body, stainless steel ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors.

2.4. WEST AND VENT PIPING, WITHIN BUILDING:

- 2.4.1. Cast iron soil pipe components:
 - 2.4.1.1. Pipe: cast iron soil pipe to CAN/CSA-B70.
- 2.4.2. Copper tube components.
 - 2.4.2.1. Pipe: DWV Copper Tube: to ASTM B306.
- 2.4.3. PVC Pipe Components – Buried only.

- 2.4.3.1. Pipe: PVC plastic pipe to CAN/CSA-B181.2.
- 2.4.4. Joint and fitting components:
- 2.4.4.1. Fittings: PVC fittings to CAN/CSA-B181.2.
- 2.4.4.2. PVC solvent cement: to ASTM D2564.
- 2.4.5. DWV Pipe Components:
- 2.4.5.1. Pipe: DWV pipe: to CAN/CSA-B281.
- 2.4.5.2. Mechanical joint and fittings consisting of:
1. Gasket: double ribbed elastomeric gasket to CAN/CSA-B70.
 2. Joint coupling: stainless steel mechanical joint coupling to CAN/CSA-B70.
- 2.4.6. Waste Piping Specialties:
- 2.4.6.1. Clean-outs and clean-out access covers:
1. Provide caulked or threaded type clean-outs extended to finished floor or wall surface. Provide bolted clean-out cover plates on vertical rainwater leaders only. Ensure ample clearance at clean-out for rodding of drainage system.
 2. Provide access covers for floors in unfinished areas: round with nickel bronze serrated frames and plates. Provide round access covers in finished areas with depressed centre section to accommodate floor finish. Provide wall clean-outs with chrome plated caps.
- 2.4.6.2. Floor drains:
1. Typical: lacquered cast iron body with double drainage flange, weep holes, combined two piece body, reversible clamping device and adjustable nickel/bronze strainer. Provide secondary basket/sand trap to all floor drains in shops, repair, service, wash and equipment room.
 2. Shower and washroom floor drains.
 3. Floor drains for mechanical room, sprinkler room, storage etc.
 4. Floor drain at entrances and elevator doors located in tunnels.
 5. Equipment rooms: complete with a polished bronze funnel type strainer and extension for floating floor complete with a removable perforated sediment bucket.

PART 3 - EXECUTION

3.1. JOINTS, UNIONS, FLANGES AND FITTINGS

3.1.1. Pipe Joints

3.1.1.1. Preparation

1. Ream pipe ends and thoroughly clean all dirt, cuttings and foreign matter from pipe after cutting and threading.
2. Thoroughly clean all fittings, valves and equipment before connections are made.
3. Cut copper tubing with a tube cutter and clean the joining surfaces of the tubing and fitting with fine emery cloth. Wipe clean with a dry cloth.

3.1.1.2. Cast iron pipe sleeve joints

1. For cast iron plain end soil pipe, install sleeve type couplings such as Titan Foundry Type MJ, or Bibby MJ Series 2000 in strict accordance with manufacturer's printed instructions.

3.1.1.3. Cast iron bell and spigot joints

1. Make joints either neoprene compression type preformed gaskets such as Bibby "Bi-seal", and caulk in such a manner to produce a permanently tight joint.
2. Cold caulking compound in cord form such as W.R. Meadows PC4 may also be used.
3. Assemble preformed neoprene gaskets to manufacturer's printed instructions.

3.1.1.4. Mechanical joints:

1. Assemble mechanical joint on ductile iron pressure pipe with cast iron gland, rubber sealing gasket and high strength malleable iron bolts in accordance with the manufacturer's recommendations.

3.1.1.5. Soldered joints:

1. Make soldered joints on copper tubing in accordance with the following usage:

	SERVICE	SOLDER TYPE
1.	DOMESTIC HOT AND COLD WATER	95/5 WITH MATCHING FLUX
2.	DRAINAGE, WASTE, VENT	50/50 WITH MATCHING FLUX
3.	COMPRESSED AIR SERVICE	"SIL-FOS" SILVER SOLDER OR BRAZED.

2. Do not use core type solder.

3.1.1.6. Threaded joints:

1. Use Teflon tape or Masters metallic compound with the compound applied to the male threads only and particular care taken to prevent the compound from reaching the interior of the pipe or fittings.

3.1.1.7. Carbon steel welded joints:

1. To ANSI B31.1 Section IX for welding.
2. Fusion welded joints made by electric arc welding, gas metal arc welding, or oxy-acetylene gas welding.
3. Ensure that supervisory staff, fitters and welders are fully conversant with the requirements laid down by that Standard prior to the commencement of welding.
4. Employ qualified welders holding a current up-to-date Provincial Certificate for the process and rating involved as required by the Provincial Regulations.
5. Unless more stringent methods of inspections are specified the Consultant will visually inspect welded joints for fusion of metal, icicles, alignment, etc.
6. Remove any defects and remake the joint to his satisfaction.
7. For welding of materials other than carbon steel, conform to the requirements specified in the relevant section of the Specification.

3.1.2. Unions and Flanges

3.1.2.1. Provide unions or flanges in the following locations:

1. For by-passes around equipment or control valves or devices in piping systems.
2. At connection to steam traps and in by-passes around traps.
3. At connections to equipment. Locate between shut-off valve and equipment.

-
4. In screwed or solder joint drainage tubing at inlet side of trap.
- 3.1.2.2. If unions are concealed in walls, partitions or ceilings, build access thereto.
 - 3.1.2.3. Provide dielectric unions or isolating type companion flanges at all connections between copper tubing and ferrous piping.
 1. Brass body valves between ferrous piping and copper tubing is acceptable as a dielectric union.
 - 3.1.2.4. Flange joints
 1. Assemble joints with appropriate flanges, gaskets and bolting.
 2. Allow clearance between flange faces such that the connections can be gasketed and bolted tight without undue strain on the piping system, with flange faces parallel and bores concentric.
 3. Centre gaskets on the flange faces so as not to project into the bore.
 4. Lubricate bolts before assembly and Provide 2 hardened steel washers under the head of each unit to assure uniform bolt stressing.
 5. Machine off raised face flanges when joining to a flat companion flange and use a full face gasket.
 6. Follow gasket manufacturer's instructions for correct bolting procedure.
 7. Use calibrated torque wrench and tighten bolts in recommended sequence in four equal steps to required final torque value.
 - 3.1.3. Fittings
 - 3.1.3.1. Couplings
 1. Minimize couplings on runs of pipes.
 2. Do not use running couplings in any pipeline.
 3. NPS 2 and smaller: threaded coupling.
 4. NPS 2½ and larger: welded joints.
 - 3.1.3.2. Fittings and ancillary items installed in systems operating at pressures in excess of 103 kPa:
 1. Register in accordance with CSA B51-M.
 - 3.1.3.3. Eccentric reducer fittings
 1. To provide proper drainage or venting of the lines.
 2. At change of pipe sizes.
 3. At connections to equipment and control valves.
 4. Do not use bushings.
 - 3.1.3.4. Tee connections in welded piping
 1. Factory fabricated standard buttweld fittings.
 2. Bonney Forge "Weldolets", "Thredolets" or "Sockolets".
 3. Mitering, notching or direct welding of branches to mains is not permitted.
 - 3.1.3.5. Change of direction
 1. Use standard pipe fittings.
 2. Use long radius welded steel elbows unless short radius elbows are specifically authorized

by the Consultant.

3. Mitered joints or field fabricated pipe bends are not permitted.

3.1.3.6. Tees, copper tubing

1. Direct connection of branch into main using "T-Drill" method may be used where allowed by the Code, in lieu of manufactured tee fittings.

3.2. **VALVES**

3.2.1. Installation

3.2.1.1. General

1. Wherever possible, source valves from one manufacturer.

3.2.1.2. Where required

1. At locations shown on the Drawings.
2. At all piping connections to equipment.
3. At all connections to control valves or control devices.
4. Where required for sectionalizing a system or floor.
5. Check valves wherever required to ensure flow of liquid in one direction.

3.2.1.3. Type

1. Shut-off service: gate, butterfly type, and ball (quarter-turn).
2. Throttling service: double regulating, globe or plug type for throttling purposes.

3.2.1.4. Drain valves

1. Hose thread outlet connection or valve with long nipple on outlet at all low points of each water system and above all riser or branch stop valves for proper drainage of lines.

3.2.1.5. Valve chains

1. Provide chain wheel operators and operating chain for valves located more than 2000 mm above floor or walkway.
2. Provide chain of sufficient length to extend to within 2000 mm of operating platform or floor for free hanging chains, or to within 1500 mm of floor in locations where chain can be secured to wall or column. Secure chain to wall or column with a wall hook.
3. Chain wheels using rustproof chain complete with guide and of size recommended by valve manufacturer for proper operation of valve.

3.3. **INSPECTION AND TESTING**

3.3.1. Pressure Leak Testing

3.3.1.1. Make specified pressure tests on all piping included in this Contract.

3.3.1.2. Furnish all pumps, compressors, gauges and connectors necessary for the tests.

3.3.1.3. Test sections as authorized by the Consultant to accommodate construction schedule. However, test complete systems on completion of the Work.

3.3.1.4. Conduct tests in the presence of:

1. Consultant
2. Personnel of governing authorities having jurisdiction

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- 3.3.1.5. Notify above personnel in ample time to permit them to be present.
- 3.3.1.6. Conduct tests before piping is painted, covered or concealed.
- 3.3.1.7. Disconnect pumps or compressors used for applying the test pressure, during the test period.
- 3.3.1.8. Disconnect and/or remove equipment or specialties not designed to withstand the test pressure during the test and reconnect same after completion of test.
- 3.3.1.9. Promptly correct any defects that develop through tests and re-test to the complete satisfaction of the Consultant and other parties involved.
- 3.3.1.10. Forward copies of all final tests on all pressure and drainage piping and a copy of governing authority approvals to the Consultant immediately on acceptance of tests and/or approvals.
- 3.3.1.11. Final payment for the Work will not be made until the above has been received.
- 3.3.2. Hydrostatic Tests
- 3.3.2.1. Conduct tests for a minimum period of 2 hours, or longer when requested by the Consultant or governing authority at the test pressure specified under the respective Section of the Specifications.
- 3.3.2.2. Test requirements:
1. Pressure to remain constant over test period to a pressure of 1½ times the operating pressure but not to exceed the material pressure class rating.
 2. Exterior surfaces of pipe or fittings free of cracks or other form of leak.
 3. Tests to be performed at a constant ambient temperature.
- 3.3.3. Drainage and Potable Water Testing
- 3.3.3.1. Test drainage piping and potable water piping in accordance with requirements of The Ontario Building Code, latest edition, and any additional requirements of applicable local by-laws.
- 3.3.4. Specific Test Requirements
- 3.3.4.1. Test the following services with compressed air or inert gas at 1½ times the working pressure, but in no event less than 345 kPa.
1. Natural Gas Piping
 2. Distilled Water Piping
 3. Vacuum Piping
- 3.4. **PRE-OPERATIONAL CLEANING**
- 3.4.1. Temporary Connections
- 3.4.1.1. Make temporary cross-overs, blank-off equipment connections, install drain and fill lines for circulating cleaning fluid through piping.
- 3.4.2. Flushing of Piping Systems
- 3.4.2.1. Flush water piping with water flowing at a velocity of not less than 1.8 m/sec, for a period of 15 minutes or longer as required to remove all dirt, scale, and cuttings from the entire length of the piping.
- 3.4.2.2. Thoroughly clean, prior to fabrication, sections of new piping which cannot be isolated for flushing purposes.
- 3.4.2.3. Thoroughly clean, insofar as possible, welded joints by swabbing interior of pipe with swabs soaked

with a caustic solution.

- 3.4.2.4. Flush stainless steel piping with water as described above, then immediately flush with design product fluid. Do not leave city water or chlorinated water in piping.

END OF SECTION

PART 1 - GENERAL

1.1. RELATED WORK

1.1.1. Pipes, Valves and Fittings: to Section 23 21 13 "Pipes, Fittings and Valves".

1.2. REFERENCE STANDARDS

1.2.1. Comply with the following:

1.2.1.1. Technical Standards & Safety Act

1.2.1.2. ANSI/ASME B31.9 - Building Services Piping Code, as specified

1.2.2. Materials

1.2.2.1. To CSA B51 - M1991 with:

1. Cast iron to ASTM A-278-84, Class 30 or ASTM A-126-84 Class B.
2. Bronze to ASTM B62-82a.
3. Stainless steel: to ASTM A351-84b, ASTM A-167-84, ASTM A-276-84 or ASTM A-564-79.
4. Schedule 40 steel pipes with compatible threaded (up to 50 mm) and flanged (65 mm and above) fittings.

1.2.2.2. Bolting requirements:

1. To ASTM A307-84.

1.3. EQUIPMENT CERTIFICATION

1.3.1. Equipment Certification

1.3.1.1. Equipment and fittings designated as pressure vessels or Class "H" fittings as per CSA B51-97, Part 1, require:

1. ASME stamped
2. CRN registration

1.3.2. Registration

1.3.2.1. Register the following pressure vessel and pressure piping systems:

1. Building heating water systems operating at: pressures exceeding 1100 kPa; or temperatures exceeding 121°C.

1.4. DESIGN CRITERIA

1.4.1. Heating Water (Scheduled Temperature)

1.4.1.1. Operating Temperatures:

1. Supply: 71°C (160°F)
2. Return: 60°C (140°F)

1.4.1.2. Design Pressures: 860 kPa (125 psig)

1.5. SUBMITTALS

1.5.1. Shop Drawings

1.5.1.1. Submit Shop Drawings in accordance with Section 23 05 00 "Basic Mechanical Requirements".

1.5.2. Operation and Maintenance Data

1.5.2.1. Submit printed operation instructions and maintenance data in accordance with Section 23 05 00 "Basic Mechanical Requirements".

1.6. **TESTING**

1.6.1. General

1.6.1.1. Test piping in Consultant's presence, in accordance with testing requirements specified in Section 23 21 13 "Pipes, Fittings and Valves" and with tests and test pressures hereinafter specified for various services.

1.6.1.2. Lines may be tested in sections as authorized by the Consultant to accommodate construction schedule. However, test complete systems on completion.

1.6.2. Hydronic Systems

1.6.2.1. Hydrostatically test hydronic (water) piping at 1.5 times the operating pressure or at 862 kPa pressure whichever is greater.

PART 2 - PRODUCTS

2.1. **PIPELINE SPECIALITIES**

2.1.1. Automatic Air Vents

2.1.1.1. Construction:

1. Float operated with brass or cast iron body
2. Rated working pressure: 690 to 1035 kPa

2.1.1.2. Acceptable Manufacturers:

1. Taco Hy-Vent (35 to 150 psi, 240 F)
2. Spirax Sarco 13 WS (150 psi, 200 F)
3. Spirax Sarco 13 W (150 psi, 450 F)
4. Maidomist

2.1.2. Circuit Balancing Valves

2.1.2.1. Construction:

1. Positive shut-off calibrated balancing valves with hand wheel and division ring scale
2. Flow measuring disconnects
3. Metal tag with chain listing design flow rate, metered fluid, and meter reading for design flow rate
4. Minimum working pressure: 1035 kPa
5. Combined accuracy of valve and meter: manufacturer certified to be within $\pm 2\%$ of actual flow
6. NPS 2 and smaller: Ametal (copper-alloy) or brass body with screwed ends
7. NPS 2½ and larger: Ductile iron or cast iron body with flanged or grooved ends

2.1.2.2. Acceptable Manufacturers:

1. Armstrong – CBV
2. Bell and Gossett
3. Tour & Anderson

2.2. **HYDRONIC SPECIALTIES**

2.2.1. Hydronic System Pressure Safety Relief Valves

2.2.1.1. Construction:

1. Brass or iron body
2. ASME stamped
3. Adjustable pressure setting from 55 to 172 kPa above system operating pressure at point of connection
4. Operating differential pressure from open to close not more than 20 kPa

2.2.1.2. Acceptable Manufacturers:

1. Watts
2. Bell and Gossett

2.2.2. Suction Diffuser

2.2.2.1. Construction:

1. NPS 2 and under: cast iron body with screwed connections
2. NPS 2½ and over: ductile iron or cast iron body with grooved or flanged connections
3. Disposable stainless steel fine mesh screen
4. Screen blow down connection
5. Permanent magnet particle trap
6. Full length stainless steel straightening vanes
7. Pressure gauge tapping

2.2.2.2. Acceptable Manufacturers:

1. Bell & Gossett FTP screwed, FLG-flanged
2. Taco Series "SD"
3. Armstrong Suction Guide

2.2.3. Water Pressure Reducing Valves

2.2.3.1. Construction:

1. Self-contained hydraulic pilot controlled type.
2. Single seated with resilient disc in iron body.
3. Bronze seat for pressure drops below 480 kPa.
4. Stainless steel seat for pressure drops 480 kPa and over.
5. Diaphragm suitable for 120°C (250°F) service.

2.2.3.2. Acceptable Manufacturers:

1. Watts
2. Bell and Gossett

2.2.4. Triple duty valve

2.2.4.1. A combination shut-off, center-guided non-slam check valve and calibrated balance valve in one device, sizes as shown on drawings. Valves shall be flanged connections. The triple-duty valve has a

cast iron body, brass seat, cast bronze disc and SS stem. A calibrated nameplate and memory button allow return of the valve to the balanced position after shut-off. The stem shall be back seating type to allow repacking under full-line pressure.

- 2.2.4.2. The valve stem shall be stainless steel with flat surfaces provided for adjustment with open-end wrench.
- 2.2.4.3. For Grooved Piping: The valve body shall be ductile iron with grooved ends and Armstrong anti-rotation Armgrip® lugs on the inlet and outlet of the body.
- 2.2.4.4. Flange adapters shall be ductile iron flanges with anti-rotation lugs and EPT gaskets.
- 2.2.4.5. For ANSI 150 (PN16) Welded Flanged Piping: The valve body shall be Cast Iron with ANSI 125 (PN16) flanged ports.
- 2.2.4.6. For ANSI 300 Welded Flanged Piping: The valve body shall be Ductile Iron with ANSI 250 (PN25) flanged ports.
- 2.2.4.7. The valve shall be selected and installed in accordance with the manufacturer's instructions and be suitable for the pressure and temperature specified.
- 2.2.4.8. Acceptable Manufacturers:
 - 1. Bell & Gossett
 - 2. Taco
 - 3. Armstrong

PART 3 - EXECUTION

3.1. PIPELINE SPECIALITIES

- 3.1.1. Air Vents
 - 3.1.1.1. Install automatic air vents at high points of water piping systems and also in any other location noted on Drawings.
 - 3.1.1.2. Install automatic air vent with 150 mm high, line size or NPS 4 size air pocket, whichever is smaller, and NPS ¾ isolating gate valve and piping to inlet connection of air vent.
 - 3.1.1.3. Connect discharge to nearest funnel or hub drain or as shown on Drawings.
 - 3.1.1.4. Provide manual air vents at all high points in the system and where required for efficient elimination of air from the system.
- 3.1.2. Drain Valves
 - 3.1.2.1. Install drain valves at low points of water and compressed air piping systems in order to completely drain each system, and also in any other location noted on Drawings.
- 3.1.3. Circuit Balancing Valves
 - 3.1.3.1. Provide balancing valves at all locations shown on the Drawings and as required to result in accurate flow balancing.
 - 3.1.3.2. Install valves in accordance with supplier's instructions.
 - 3.1.3.3. Make meters available to the Testing and Balancing Contractor during the balancing of the systems.
 - 3.1.3.4. Turn over meters to the Owner at Substantial Completion.

3.2. **HYDRONIC SPECIALITIES**

3.2.1. Pressure Safety Relief Valves

3.2.1.1. Install on expansion tanks and other pressure vessels in accordance with relevant codes

3.2.1.2. Pipe outlets to drain.

3.2.2. Pressure Reducing Valves

3.2.2.1. Install pressure reducing valve stations with shut-off valve on either side of assembly and 115 mm pressure gauges on upstream and downstream sides of station

3.3. **FLUSHING OF PIPING SYSTEMS**

3.3.1. Applicable Systems

3.3.1.1. Flush water piping systems in accordance with Section 23 21 13 "Pipes, Fittings and Valves".

1. Flush water piping with water flowing at a velocity of not less than 1.8 m/sec, for a period of 15 minutes or longer as required to remove all dirt, scale, and cuttings from the entire length of the piping.

3.3.1.2. Thoroughly clean, prior to fabrication, sections of new piping which cannot be isolated for flushing purposes

3.3.1.3. Thoroughly clean, insofar as possible, welded joints by swabbing interior of pipe with swabs soaked with a caustic solution.

END OF SECTION

PART 1 - GENERAL

1.1. GENERAL

1.1.1. Provide work of this section in accordance with the Contract Documents including, but not limited to, the following:

1.1.1.1. Balancing dampers, motorized dampers, and backdraft dampers

1.1.1.2. Flexible duct connections

1.1.1.3. Turning vanes and extractors

1.1.1.4. Sound attenuation

1.2. RELATED WORK

1.2.1. Automatic control damper operators: provided under Section 23 09 23 & 23 09 93.

1.3. SUBMITTALS

1.3.1. Shop Drawings

1.3.1.1. Submit Shop Drawings in accordance with Section 23 05 00 "Basic Mechanical Requirements".

1.3.1.2. Submit Shop Drawings for all equipment and materials specified.

PART 2 - PRODUCTS

2.1. DUCTWORK ACCESSORIES

2.1.1. Flexible Duct Connections

2.1.1.1. Material:

1. Heavy glass fabric double coated with neoprene and attached to 0.6 mm (24 ga) metal strips 75 mm wide.

2. Fabric length between metal strips:

1. Minimum 75 mm for ducts of maximum size in either dimension or diameter of 750 mm or less

2. 150 mm for ducts of 775 mm size and larger.

2.1.1.2. Acceptable Manufacturers:

1. Duro-Dyne "Grip-Loc Type SMFN"

2. Ventfabrics "Ventglas"

3. DynAir

2.1.2. Turning Vanes

2.1.2.1. Material: Hollow airfoil type, fabricated of same material as duct in which they are installed.

2.1.2.2. Acceptable Manufacturers:

1. Duro-Dyne

2. Dynair

3. Aero-Dyne

2.1.3. Access Doors in Ductwork and Plenums

2.1.3.1. Hand Door:

1. Construction: 0.7 mm (24 ga) galvanized steel, double flanged frame and insulated door complete with insulation backing plate.
2. Fasteners: zinc plated cam-lock fasteners, minimum two per door, with safety retaining chain.

2.1.4. Probe Inlets

2.1.4.1. Material:

1. Ventlok No. 699 or Duro-Dyne IP-1 or IP-2 Test Opening Enclosures complete with locking cap, chain, gaskets, insulating plug and extensions for insulated ductwork.

2.2. **OPERATING DAMPERS**

2.2.1. Automatic Control Dampers

2.2.1.1. General:

1. Modulating control dampers: Opposed blades
2. Two position control dampers: Parallel blades except where indicated otherwise.

2.2.1.2. Damper blades and frames

1. Extruded aluminum 6063-T5
2. Maximum blade length: 1.2 m without internal frame support
3. Maximum blade length: 1.2 m without internal frame support
4. Blade edge seals: EPDM gaskets
5. Frame side seals: extruded TPE or cambered stainless steel
6. Frame style: flanged to duct.
7. Jack shaft: extendable, combination of aluminum, and zinc/nickel coated steel
8. Damper leakage: 50 l/s per m² damper face area at 1 kPa differential static pressure.

2.2.1.3. Bearings:

1. Thermal plastic resin copolymer, nylon or oil impregnated bronze,
2. At blade axles, linkage devices, etc.

2.2.1.4. Damper blades and frame for outside exhaust and intake air applications

1. As above
2. Operating temperature: -40°C to 68°C
3. Thermally broken and insulated blades; expanded polyurethane foam insulation
4. Damper leakage: 21 l/s per m² damper face area at 1 kPa differential static pressure.

2.2.1.5. Acceptable Manufacturer:

1. Tamco - Series 1000
2. Nailor Industries – Series 2000
3. Tamco - Series 9000 SC (exhaust and air intake applications)
4. Nailor – Series 2000IBF (exhaust and air intake applications)

2.2.2. Manual Balancing Dampers

2.2.2.1. Rectangular Ductwork:

1. Galvanized channel type frames, non-binding pre-lubricated type interconnecting and operating linkages
2. Blades: minimum 1.6 mm (16 ga) thick material, opposed blade style
3. Manual operator and locking type quadrant as required for synchronous operation and setting of blades.
4. Blade width: maximum 200 mm.
5. Blade length: length coinciding with frame opening on horizontal plane to maximum length of 1200 mm.
6. Locking quadrant: Galvanized steel locking quadrant with "Open – Closed" labels, 50 mm insulation stand-off.
7. Acceptable Manufacturers:
 1. Nailor – Series 1810/1820 with HL2 quadrant
 2. EH Price
 3. Titus

2.2.3. Volume Extractors in Ductwork:

2.2.3.1. Use where noted on Drawings

2.2.3.2. Acceptable Manufacturers

1. Titus Model AG225 with #3 manual operator.
2. Nailor Model EX-1
3. EH Price

2.2.4. Relief Dampers

2.2.4.1. Acceptable Manufacturers:

1. Farr (American Warming and Ventilating Inc.) Model PR-10
2. Field

2.2.4.2. Counterbalanced type of size shown on Drawings and as specified herein, vertical mounting and horizontal air flow, factory set for static pressure shown on Drawings.

2.2.4.3. Dampers to have parallel blades, 50 mm x 13 mm x 3 mm steel channel frame, 1.6 mm (16 ga) aluminum blades, steel axles with ball bearings, adjustable counterbalances, counterweights, and inter-connecting linkage.

2.3. **FIRE DAMPERS**

2.3.1. Fire Dampers

2.3.1.1. ULC labelled curtain type fire dampers of hinged, fusible link type with channel frames, break away connections, blades and housing and conforming to NFPA 90A and UL555 requirements. Use "Type B" fire dampers for rectangular or square ductwork and "Type C" fire dampers for round ductwork. Type B dampers with a sleeve (Type BS) or any variation is not acceptable.

2.3.1.2. Blades shall be out of air stream.

2.3.1.3. Dampers designed to close while the system fans are operating.

2.3.1.4. Closure link: fusible link which can be released, tested and re-latched for testing.

2.3.1.5. Construct fire dampers and frames of same material as duct in which they are installed.

2.3.1.6. Fire resistance rating shall be at least equal to the fire resistance rating of the fire rated assembly in which it will be installed.

2.3.1.7. Acceptable Manufacturers:

1. E.H. Price Dampers
2. Nailor – “D” series
3. Ruskin

2.4. **ACOUSTIC TREATMENT**

2.4.1. Acoustic Duct Insulation

2.4.1.1. Rigid Board

1. Rigid coated fibreglass duct liner conforming to CAN/ULC S102-M88, CGSB 51-GP-11M, NFPA 90A and 90B
2. Fibreglass firmly bonded with thermosetting resin into a rigid board.
3. Air surface protected with tough reinforced coating including an EPA registered antimicrobial agent
4. Operating temperatures: to 120°C/250°F
5. Density: 48 kg/m³ / 3.00 lb/ft³
6. k value: 0.033 W/m°C @ 24°C / 0.23 BTU•in/ft²°F @ 75°F
7. Acoustical Performance:
 1. 25mm thick; 0.7 NCR
 2. 38mm thick; 0.8 NCR
 3. 50mm thick; 0.95 NCR
8. Acceptable manufacturers
 1. John Manville – Permacote Linacoustic R-300
 2. CertainTeed – ToughGard Rigid Liner Board
 3. Knauf – Rigid Plenum Liner
 4. Manson

2.4.1.2. Flexible duct liner

1. Flexible coated fibreglass duct liner conforming to CAN/ULC S102-M88, CGSB 51-GP-11M, NFPA 90A and 90B
2. Fibreglass firmly bonded with thermosetting resin into a flexible blanket.
3. Air surface protected with tough reinforced coating including an EPA registered antimicrobial agent
4. Operating temperatures: to 120°C/250°F
5. Density: 24 kg/m³ / 1.5 lb/ft³
6. k value: 0.035 W/m°C @ 24°C / 0.24 BTU•in/ft²°F @ 75°F
7. Acoustical Performance:
 1. 13mm thick; 0.55 NCR
 2. 25mm thick; 0.7 NCR
 3. 38mm thick; 0.85 NCR
 4. 50mm thick; 0.95 NCR
8. Acceptable manufacturers
 1. John Manville – Permacote Linacoustic HP of RC
 2. CertainTeed – ToughGard R Duct Liner
 3. Knauf – Duct Liner EM

4. Manson

2.4.1.3. Fasteners:

1. Fasten acoustic liner to inside of duct with weld pins with integral heads.
2. Use fasteners of securing pins of size and length as required by insulation weight, thickness, fastener spacing and design.
3. In addition to mechanical type fasteners, adhere insulation to inside of duct with Foster No. 81-99 or Mosney Bakor No. 230-04 fire retardant adhesive. Seal all joints with Foster no. 30-36 of Mosney Bakor No 120-09 mastic sealant.
4. Edge sealing treatment Product recommended by the insulation manufacturer.

2.4.1.4. Acceptable Manufacturers:

1. Owens Corning
2. Manson
3. Knauf
4. Manville

PART 3 - EXECUTION

3.1. GENERAL

- 3.1.1. Refer to and comply with applicable requirements specified in Section 23 05 00 "Basic Mechanical Material and Methods".
- 3.1.2. Install miscellaneous steel framing, supports, braces, etc. as required to hang or support equipment and ductwork as specified herein, and as shown on Drawings.
- 3.1.3. Flexible Duct Connections
 - 3.1.3.1. Use flexible duct connections between fans and/or air handling units and connecting ductwork, between unit components, in ducts at building expansion joints, and in other locations shown on Drawings
 - 3.1.3.2. Install flexible connectors with fabric in folds, not drawn tight.
 - 3.1.3.3. Install internal guides to prevent flexible connection from collapsing on suction side of fans.
 - 3.1.3.4. For installation between sections of air handling units, install flexible connectors suitable for connecting to flanges of casings where so provided.
- 3.1.4. Turning Vanes
 - 3.1.4.1. Provide hollow airfoil type turning vanes in ductwork where shown on Drawings and in 90 degree square duct elbows, fabricated of same material as duct in which they are installed.
- 3.1.5. Access Doors
 - 3.1.5.1. Provide access doors in ductwork and for plenums to allow servicing, maintenance, and inspection of:
 1. Control dampers
 2. Fire dampers
 3. Fire detectors
 4. Control elements
 5. As shown on Drawings
 - 3.1.5.2. Provide "Hand Doors" in ductwork of sizes as follows:

Access Type	Duct Dimension	Access Door Size
One hand and sight	Less than 400 mm	300x150 mm
Two hands and sight	Between 400 mm and 500 mm	450x250 mm
Head and Shoulders	Between 500 mm and 760 mm	530x356 mm
Body plus ladder	Between 760 mm and 1320 mm	635x430 mm

3.1.6. Balancing Dampers

3.1.6.1. Use rectangular opposed blade dampers at the following locations:

1. At floor connections to riser shafts/ducts.
2. In supply and return ductwork where main ducts are split into two more trunks
3. At rectangular branch duct connections to main or trunk ducts.
4. As shown.

3.1.6.2. Do not use splitter dampers.

3.1.6.3. Use low pressure butterfly dampers at the following locations:

1. At branch connections on the downstream side of terminal boxes
2. At individual branch outlets serving grilles or diffusers

3.1.6.4. Dampers supplied with diffusers or grilles are to be used to balance $\pm 10\%$ of indicated airflow, are NOT in lieu of branch dampers

3.1.7. Volume Extractors in Ductwork:

3.1.7.1. Use where noted on Drawings

3.1.8. Relief Dampers

3.1.8.1. Install steel angle or channel frames at wall openings as required to mount relief damper (complete with fire damper) as shown on Drawings.

3.1.9. Probe Inlets

3.1.9.1. Install probe inlets in ductwork at locations as follows:

1. In main supply and return ducts
2. Inlet and outlet side of fans
3. Other locations as required by Testing and Balancing Trade, to permit testing, balancing and measurement of air quantities and static pressure in air handling systems.

3.1.9.2. Locate probe inlets a sufficient distance from elbows or transition sections to ensure stable readings of non-turbulent air and install 75 mm from corners and at 150 mm centres across long side of duct.

3.2. **ACOUSTIC DUCT INSULATION AND SILENCERS**

3.2.1. Install internal acoustic insulation in specific sections of ductwork and/or plenums as shown on Drawings as follows:

3.2.1.1. Install in accordance with the requirements of NAIMA Fibrous Glass Duct Liner standard, and SMACNA

HVAC Duct Construction Standards.

- 3.2.1.2. Adhere insulation to ductwork and plenums using 100% coverage of adhesive
- 3.2.1.3. In addition to adhesive, secure duct liner with welded pins with integral heads spacing in accordance with NAIMA and SMACNA Standards
- 3.2.1.4. Install metal nosing at leading edge of all insulation.
- 3.2.1.5. Seal all edges, not already factory sealed, with sealer recommended by manufacturer of insulation. All factory or field cut edges of insulation such as at spin in locations etc must be buttered, treated and sealed.
- 3.2.1.6. Coat joints and weld pins after installation with two coats of sealant.
- 3.2.1.7. In high velocity ductwork, greater than 20.3 m/sec, install perforated or expanded metal inner liner over acoustic lining.
- 3.2.1.8. Cut off ends of welded impaling pins after application of self-locking washers.
- 3.2.1.9. Failure to follow duct liner construction recommendations will result in ductwork being rejected and must be removed from site.
- 3.2.2. Use silencers in ductwork where shown on Drawings to attenuate airborne noise generated in air distribution systems.
- 3.2.3. Fabricate cross talk silencers:
 - 3.2.3.1. Housing: galvanized steel, to SMACNA pressure class 1" standard.
 - 3.2.3.2. Liner: rigid coated duct liner installed as previously described.
 - 3.2.3.3. Size: as shown on Drawings.
 - 3.2.3.4. Shape: as shown on Drawings.
 - 3.2.3.5. Provide a sheet metal nosing at both open ends of duct to close off cut edge of liner.

END OF SECTION

PART 1 - GENERAL

1.1. **REFERENCE STANDARDS**

1.1.1. Comply with the latest edition of the following:

1.1.1.1. SMACNA Standards

1.1.1.2. ASHRAE Standards.

1.1.1.3. ASTM A 525M, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.

1.2. **SUBMITTALS**

1.2.1. Shop Drawings

1.2.1.1. Submit Shop Drawings in accordance with Section 23 05 00 "Basic Mechanical Requirements".

1.2.1.2. Submit shop Drawings for all products and equipment specified.

1.3. **COORDINATION**

1.3.1. Prepare coordination and fabrication Drawings at a minimum scale of 1:50 ¼"=1'-0" and coordinate with other trades affected by this Work to ensure access to other portions of the Work is not impeded by the ductwork systems.

1.3.2. Maintain these Drawings on site and make them available for review by the Consultant when requested.

1.4. **PROJECT CONDITIONS**

1.4.1. Environmental Requirements

1.4.1.1. Maintain a space work temperature not less than the minimum ambient working temperature as required by the duct sealant manufacturer requirements. Remove and replace all ductwork sealant installed where the space temperature is less than these recommendations.

1.4.2. Protection

1.4.2.1. Temporarily cap-off ductwork openings to protect against dirt accumulation inside the ductwork.

PART 2 - PRODUCTS

2.1. **DUCTWORK**

2.1.1. All ductwork shall be fabricated as per SMACNA.

2.1.2. Materials

2.1.2.1. Galvanized steel sheet:

1. Z275 (G90) for unpainted ductwork
2. ZF075 (A25) designation zinc coating to ASTM A653/A653M for painted ductwork

2.1.2.2. Metal Duct Sealant – High Velocity Duct Sealer

1. 3M EC800
2. Foster #30-02
3. Hardcast Iron Grip #601

4. Duro-Dyne S-2
5. Transcontinental Equipment "MP".

2.2. **ENGINEERED PERFORATED TYPE INDUCTION DUCT DIFFUSERS**

- 2.2.1. Supply and install Engineered NAD Klima RDD Duct Diffusers, comes with factory fabricated duct diffuser sections with engineered perforations. Diffusers shall be designed for Less than NC35 sound level and less than 1-degree temperature differential across the floor. NAD Klima RDD Duct Diffuser sections shall be pre fabricated, pre balanced, pre sealed, pre painted Powder Coated Baked Enamel Finish, Color TBD, pre-drilled for hanging and connecting holes; at the factory. Include Single suspension Unistrut rail, no duct straps allowed. Diffusers shall be manufactured locally in Canada with short lead time. Long Lead times are not permitted. Manufacturer to provide CFD Simulation and report. the Engineer can reject, at any time, previously submitted Alternates, in the event of missing and/or lack of information.
- 2.2.2. Performance
 - 2.2.2.1. The manufacturer shall demonstrate for approval: A diagram of the air flow, illustrating the trajectory of the air jets using software to calculate the holing pattern. The pressure loss generated by the system and duct diffusers supplied by the manufacturer. The pressure loss generated by the entire network. Temperature differential shall be less than 1 Deg. C within 1 feet off the floor. Manufacturer to provide CFD Simulation and report. Diffusers and Plenums shall be manufactured in Canada with lead times less than 4 weeks, manufacturer to be locally available for site visits to provide quick size and paint customizations as per site conditions.
- 2.2.3. Description and physical characteristics
 - 2.2.3.1. The high induction duct diffuser shall be made of 22 gauge brushed steel for duct inferior to 508 mm in diameter, and 20 gauge for diameter superior or equal to 508mm. The circular duct diffuser shall be available in diameter ranging from 203 mm to 1419 mm. The duct diffuser shall be equipped at each end with a groove with a gasket made of EPDM to insure a tight seal between sections. The sections shall be assembled using union sleeves. Steel reinforcements shall be having to be installed inside ducts of more than 433 mm (17 inches) in diameter in order to maintain it's shape. The duct diffuser shall be painted with a Powder Coated Baked Enamel TGIC free polyester powder coat. It shall have a smooth surface for easy cleaning. The colour shall be chosen by the architect or the customer. The paint of the diffuser must be guaranteed against peeling for a minimum period of 5 years. The pattern for the holes shall be determine with the help of a computer program. The holes shall be made with a laser cutter and burr free. When required, the duct diffuser shall be equipped with balancing perforated damper with a self blocking mechanism allowing for air output of between 10% to 100%. The union sleeves shall not exceed the dimensions of the duct by 3 mm, and shall be rounded to facilitate cleaning. The duct shall have as smooth as possible surface to maintain an architectural appearance. The duct diffuser can be passive, without holes. Private Label diffusers are not allowed. Diffusers shall be manufactured locally in Canada with short lead time. Long Lead times are not permitted. Product Manufacturer shall be available for site visits & smoke test on a short notice.
- 2.2.4. Installation and suspension
 - 2.2.4.1. Include Single suspension Unistrut rail, no duct straps allowed.
 - 2.2.4.2. The suspension of the duct shall be done with threaded rods (3/8") supplied by the installer. During acceptance process, the Engineer can reject, at any time, previously submitted Alternates, in the event of missing and/or lack of information.
- 2.2.5. Balancing
 - 2.2.5.1. The balancing of the diffusers shall be done by a ventilation balancing technician, accredited as a qualified professional.

2.2.6. Acceptable manufacturers

2.2.6.1. NAD Klima, model RDD

2.2.6.2. Or approved equal.

PART 3 - EXECUTION

3.1. DUCTWORK

3.1.1. General

3.1.1.1. Install ductwork in arrangement shown on Drawings in accordance with standards and recommended practices of ASHRAE and SMACNA. Provide required offsets and transitions, whether specifically indicated or not, to facilitate duct installation and to avoid interference with building structure, piping, equipment and services.

3.1.1.2. Duct sizes as shown on Drawings. Where ducts are to have internal acoustical liner, adjust duct size to accommodate acoustic liner thickness; clear inside dimensions as shown on Drawings.

3.1.1.3. Fabricate ductwork free from vibration, rattle or drumming under operating conditions; reinforce, brace, frame, place gaskets, etc. to comply with performance criteria.

3.1.1.4. Place galvanized screens of 13 mm x 13 mm mesh x 2.7 mm diameter wire for air intakes, exhausts and open ends of ductwork.

3.1.1.5. Install ductwork in locations and at elevations appropriate to ceiling heights shown on Drawings. Where required to be concealed, install ductwork in furred spaces provided in walls and ceilings. Where there is no provision for concealment install duct as close as possible to walls, partitions and overhead structures to attain maximum headroom and clearance.

3.1.1.6. Where shape of duct changes, install transition piece so that angle of side of transition piece does not exceed 15 degrees from straight run of duct being connected, unless shown otherwise on Drawings. For transitions where more than one side converges or diverges use the following:

1. Converging transition: maximum included angle 30°
2. Diverging transition: maximum included angle 20°

3.1.2. Pressure Class / Seal Class

3.1.2.1. Fabricate ductwork to SMACNA pressure classification as follows unless otherwise noted on Drawings.

3.1.2.2. Seal ductwork in accordance with SMACNA sealing requirements as follows:

1. Seal Class "A": All transverse joints, longitudinal seams, and duct wall penetrations.
2. Seal Class "B": All transverse joints, and longitudinal seams only
3. Seal Class "C": Transverse joints only
4. Seal Class "D": None

System	Pressure Class	Sealing Class
Constant Volume Supply	+3" (750 Pa)	B
Building Exhaust (Washroom exhaust, general exhaust)	+/-2" (500 Pa)	C
Fire Rated (exhaust)	+/-3" (750 Pa)	B

- 3.1.3. Sleeves
- 3.1.3.1. Install sleeves where ducts pass through walls or floors. Pack space between duct and sleeve with mineral wool and seal both ends with non-inflammable fire resistant sealing compound. Install sheet metal closure plates on each side of wall to cover sleeve.
- 3.1.3.2. Sleeves: of the same sheet material as for ductwork and one gauge thicker.
- 3.1.4. Air Intakes and Exhausts
- 3.1.4.1. At air intakes, exhausts and open ends in ductwork install removable galvanized screens securely fastened in place.
- 3.1.5. Equipment Connections
- 3.1.5.1. Install neoprene gasketed flanged joints at duct connections to air conditioning units, coils, etc. Fabricate flanges from mild steel angles to match equipment flanges.
- 3.1.5.2. Install silencers (S) independent of ductwork, with rods or angles of sizes adequate to support load.
- 3.1.6. Paint Finish and Touch-Up
- 3.1.6.1. In office areas paint interior of ductwork for at least 300 mm behind supply and exhaust grilles with matte black paint to render ductwork invisible from occupied space.
- 3.1.6.2. Touch-up galvanized steel damaged as a result of fabrication, including welding, with zinc dust galvanized primer.
- 3.1.7. Supports and Hangers
- 3.1.7.1. Support intervals:
1. Ducts up to 1500 mm in width: minimum 2400 mm centres
 2. Ducts 1500 mm in width and over: 1200 mm centres
- 3.1.7.2. Steel Angle Hangers:
1. Provide steel angle hangers for supporting all ductwork.
 2. Mild steel rod hangers of 10 mm dia. minimum size, with 38 mm x 38 mm x 3 mm steel angle across bottom of duct and attach hanger to angle (not the duct).
- 3.1.7.3. Install miscellaneous steel angles or channels as required between joists or building steel for structural support of duct where building framing spacing does not coincide with the required hanger spacing.
- 3.2. **RECTANGULAR DUCTWORK**
- 3.2.1. General
- 3.2.1.1. Material: galvanized steel for unpainted ductwork, unless otherwise shown on Drawings.
- 3.2.1.2. Metal thickness and construction methods as specified herein for various size ranges of ducts.
- 3.2.1.3. Cross-break flat surfaces of duct between joints, or between joints and intermediate reinforcements, to prevent vibration or buckling.
- 3.2.1.4. Seal joints on all rectangular ductwork with high velocity duct sealer. Duct-tape shall not be allowed.
- 3.2.2. Joints
- 3.2.2.1. Longitudinal joints: Pittsburgh Lock joints tightly closed along full length of seam.

- 3.2.2.2. Transverse joints: Ductmate, Nexus or TDC connections of class to suit size of duct and pressure of system.
- 3.2.3. Fittings
- 3.2.3.1. Elbows, transition sections and take-off fittings: use metal one gauge heavier than thickness specified for duct in which they are installed.
- 3.2.3.2. Radius elbows: standard radius design with inner radius equal to width of elbow unless shown otherwise, Pittsburgh Lock seams, and with ends to match transverse joints of duct.
- 3.2.3.3. Square elbows: where elbows are shown as square type, fit elbows with air turning vanes of double blade construction.
- 3.3. **SPECIALITY DUCT SYSTEMS (OUTDOOR AIR AND WASHROOMS)**
- 3.3.1. Waterproof Ductwork
- 3.3.1.1. Slope fresh air intake ducts down at 1:100 to permit moisture induced by air intake to be drained. Install 38 mm drain flange in bottom of duct at low point. Continuously solder or seal joints in exterior air intake duct to prevent dripping of moisture through joints.
- 3.3.1.2. In areas having high humidity, fabricate exhaust ductwork without seams in bottom of duct for at least 3 m of duct run behind register and slope duct up away from register.
- 3.4. **INSPECTION, TESTING AND BALANCING**
- 3.4.1. Cleaning
- 3.4.1.1. Prior to start-up of fans, blow out complete systems of ductwork with high velocity air for not less than two hours using where possible the installed air handling equipment to full capacity and by blanking off duct sections to achieve required velocity. Do not install air filters prior to blow-out of ductwork systems. Use auxiliary portable blowers for cleaning where installed fan systems are not adequate to blow out complete system free from dust and dirt.
- 3.4.1.2. After duct systems have been blown out, clean interior of plenums, coils, and register, grille or diffuser outlet collars with industrial type vacuum cleaner. On completion of cleaning process, install filters before placing systems in final operation.
- 3.4.2. Balancing of Air Systems
- 3.4.2.1. Balance air handling systems in accordance with Section 23 05 91 "Start-up & Performance Testing".

END OF SECTION

PART 1 - GENERAL

1.1. **GENERAL**

1.1.1. Provide Work of this Section in accordance with the Contract Documents.

1.2. **SUBMITTALS**

1.2.1. Shop Drawings

1.2.1.1. Submit Shop Drawings in accordance with Section 23 05 00 "Basic Mechanical Requirements".

1.2.2. Submit Shop Drawings for all products and equipment specified.

PART 2 - PRODUCTS

2.1. **DIFFUSERS, REGISTERS AND GRILLES**

2.1.1. General

2.1.1.1. Neck size, dimensions and capacity as shown on Drawings. Catalogue numbers of first named supplier are listed on Drawings to show required type and style.

2.1.1.2. Acoustic and airflow performance is based on catalogued information of the indicated manufacturer and model as shown on Drawings or schedules. Other named manufacturer products must match these implied performance criteria.

2.1.1.3. Border and frame as required to suit wall and ceiling construction.

2.1.2. Return Grilles (Type A)

Heavy duty powder coated steel construction, 19mm blade spacing.

2.1.2.1. Register complete with a steel damper

2.1.2.2. Acceptable Manufacturers:

1. E.H. Price
2. Nailor Industries Inc.

2.1.3. Supply Grilles (Type B)

2.1.3.1. Double deflection type, Aluminum construction, 19mm blade spacing.

2.1.3.2. Blade orientation parallel to the long dimension.

2.1.3.3. Opposed blade damper in black steel finish.

2.1.3.4. Acceptable Manufacturers:

1. E.H. Price
2. Nailor Industries Inc.

PART 3 - EXECUTION

3.1. **GENERAL**

3.1.1. Supply grilles to deliver indicated air quantities shown on the drawings with throw to reach intended space limits without increasing the sound level of room. Provide blank-off baffles where required and equalizing deflectors on diffusers and in other locations as shown or required, if applicable.

END OF SECTION

PART 1 - GENERAL

1.1. **GENERAL**

- 1.1.1. Conform to Section 23 05 00 – Basic Mechanical Requirements and all documents referred to therein.
- 1.1.2. Provide all labour, materials, products, equipment and services to replace the existing fans and install all new exhaust fans in the occupied parking garage indicated on the Contract Drawings and specified herein.
- 1.1.3. Meet all the requirements and recommendations of all Municipal, Provincial and Federal Bylaws and Ordinances.

1.2. **PERMITS, EQUIPMENT REGISTRATION AND FEES**

- 1.2.1. General
 - 1.2.1.1. Make application and pay all required fees for permits, registration, inspections, etc. for all equipment and systems installed including those required by TSSA.

1.3. **REFERENCES**

- 1.3.1. ANSI/AHRI Standard 410 - Forced Circulation Air-Cooling and Air-Heating Coils.
- 1.3.2. ANSI/AHRI Standard 430 - Central Station Air Handling Units.
- 1.3.3. ANSI/ASHRAE Standard 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size.
- 1.3.4. ANSI/ASHARE Standard 62.1 - Ventilation for Acceptable Indoor Air Quality.
- 1.3.5. ANSI/ASHARE Standard 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.
- 1.3.6. ANSI/NEMA MG 1 - Motors and Generators.
- 1.3.7. ANSI/UL 900 - Standard for Safety Air Filter Units.
- 1.3.8. AHRI Standard 260 - Sound rating of Ducted Air Moving and Conditioning Equipment.
- 1.3.9. ASHRAE Standard 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems.
- 1.3.10. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilation Systems.
- 1.3.11. UL 1995 - Standard for Safety Heating and Cooling Equipment

1.4. **SUBMITTALS**

- 1.4.1. Shop Drawings:
 - 1.4.1.1. Submit Shop Drawings in accordance with Section 23 05 00 “Basic Mechanical Requirements”.
 - 1.4.1.2. Submit drawings indicating components, assembly, dimensions, weight and loadings, required clearances, and location and size of field connections. Indicate equipment, piping and connections, valves, strainers and thermostatic valves required for complete system.
 - 1.4.1.3. Submit manufacturer’s installation instructions.
 - 1.4.1.4. Any other submittals as reasonably requested by the Consultant.
- 1.4.2. Operation and Maintenance Data:
 - 1.4.2.1. Submit printed operation instructions and maintenance data in accordance with Section 23 05 00 “Basic Mechanical Requirements”.
 - 1.4.2.2. Provide manufacturer's installation, operations, and maintenance manual, including instructions on

installation, operations, maintenance, pulley adjustment, receiving, handling, storage, safety information and cleaning. A troubleshooting guide, parts list, and electrical wiring diagrams.

1.5. **DELIVERY, STORAGE AND HANDLING**

- 1.5.1. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer, material, products included, and location of installation.
- 1.5.2. Store materials in a dry area indoor, protected from damage, and in accordance with manufacturer's instructions. For long term storage follow manufacturer's Installation, Operations, and Maintenance Manual.
- 1.5.3. Handle and lift all equipment in accordance with the manufacturer's instructions. Protect materials and finishes during handling and installation to prevent damage. Follow all safety warnings posted by the manufacturer

PART 2 - PRODUCTS

2.1. **AIR HANDLING UNITS (AHU – 1, AHU-3, AHU-4)**

2.1.1. GENERAL

- 2.1.1.1. Unit layout and configuration shall be as defined in project plans and schedule.
- 2.1.1.2. Manufacturer shall provide a full perimeter integral base frame for support and raise all sections of the unit for proper trapping. Base frame shall either be bolted construction or welded construction. Refer to schedule for base height and construction type. Contractor shall be responsible for providing a housekeeping pad when unit base frame is not of sufficient height to properly trap unit. Unit base frames not constructed of galvanized steel shall be chemically cleaned and coated with both a rust-inhibiting primer and finished coat of rust-inhibiting enamel. Unit base height to be included in total height required for proper trap height.
- 2.1.2. UNIT CASING
 - 2.1.2.1. Manufacturer shall ship unit in segments as specified by the contractor for ease of installation in tight spaces. The entire air handler shall be constructed of galvanized steel. Casing finished to meet ASTM B117 250-hour salt-spray test. The removal of access panels or access doors shall not affect the structural integrity of the unit. All removable panels shall be gasketed. All doors shall have gasketing around full perimeter to prevent air leakage. Contractor shall be responsible to provide connection flanges and all other framework that is needed to properly support the unit.
 - 2.1.2.2. Unit casing panels shall be 2-inch double-wall construction, with solid galvanized exterior and solid galvanized interior, to facilitate cleaning of unit interior.
 - 2.1.2.3. Casing panel inner liners must not extend to the exterior of the unit or contact the exterior frame. A mid-span, no-through-metal, internal thermal break shall be provided for all unit casing panels.
 - 2.1.2.4. Access panels and/or access doors shall be provided in all sections to allow easy access to drain pan, coil(s), motor, drive components and bearings for cleaning, inspection, and maintenance.
 - 2.1.2.5. Access panels and doors shall be fully removable without the use of specialized tools to allow complete access of interior surfaces.
 - 2.1.2.6. Hinges shall be interchangeable with the door handle hardware to allow for alternating door swing in the field to minimize access interference due to unforeseen job site obstructions. Hinges shall be constructed of <<HINGES>>
 - 2.1.2.7. Door handle hardware shall be adjustable and visually indicate locking position of door latch external to the section.
 - 2.1.2.8. All doors shall be minimum 60-inch high.
- 2.1.3. PRIMARY DRAIN PANS
 - 2.1.3.1. All cooling coil sections shall be provided with an insulated, sloped, double-wall, galvanized drain

pans.

- 2.1.3.2. The drain pan shall be designed in accordance with ASHRAE 62.1 being of sufficient size to collect all condensation produced from the coil and sloped in two planes, pitched toward drain connections, promoting positive drainage to eliminate stagnant water conditions when unit is installed level and trapped per manufacturer's requirements. See section 2.07, paragraph F through H for specifications on intermediate drain pans between cooling coils.
- 2.1.3.3. The outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.
- 2.1.3.4. All drain pan threaded connections shall be visible external to the unit. Threaded connections under the unit floor shall not be accepted.
- 2.1.3.5. Drain connections shall be of the same material as the primary drain pan and shall extend a minimum 2-1/2-inch beyond the base to ensure adequate room for field piping of condensate traps.
- 2.1.3.6. The installing contractor is responsible to ensure the unit is installed level, trapped in accordance with the manufacturer's requirements, and visually inspected to ensure proper drainage of condensate.
- 2.1.3.7. Coil support members inside the drain pan shall be of the same material as the drain pan and coil casing.
- 2.1.3.8. If drain pans are required for heating coils, access sections, or mixing sections they shall be indicated in the plans.
- 2.1.4. FANS
- 2.1.4.1. Fan sections shall have a minimum of one hinged and latched access door located on the drive side of the unit to allow inspection and maintenance of the fan, motor, and drive components. Construct door(s) per Section 2.04.
- 2.1.4.2. Provide fans of type and class as specified on the schedule. Fan shafts shall be solid steel, coated with a rust-inhibiting coating, and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. All fans shall be statically and dynamically tested by the manufacturer for vibration and alignment as an assembly at the operating RPM to meet design specifications. Fans that are selected with inverter balancing shall first be dynamically balanced at design RPM. The fans then shall be checked in the factory from 25% to 100% of design RPM to insure they are operating within vibration tolerance specifications, and that there are no resonant frequency issues throughout this operating range. Inverter balancing that requires lockout frequencies inputted into a variable frequency drive to in order to bypass resonant frequencies shall not be acceptable. If supplied in this manner by the unit manufacturer, the contractor shall be responsible for rebalancing in the field after unit installation. Fans selected with inverter balancing shall have a maintenance free, circumferential conductive micro fiber shaft grounding ring installed on the fan motor to discharge shaft currents to ground.
- 2.1.4.3. Belt-driven fans shall be provided with grease lubricated, self-aligning, anti-friction bearings selected for L-50 200,000-hour average life per ANSI/AFBMA Standard 9. Lubrication lines for both bearings shall be extended to the drive side of the AHU and rigidly attached to support bracket with zerk fittings. Lubrication lines shall be a clear, high-pressure, polymer to aid in visual inspection. If extended lubrication lines are not provided, manufacturer shall provide permanently lubricated bearing with engineering calculations for proof of bearing life.
- 2.1.4.4. Fans, including belt driven and direct drive plenum fans with integral frame motors, shall be mounted on isolation bases. Internally-mounted motor shall be on the same isolation base. Fan and motor shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor in order to avoid transmission of noise and vibration through the ductwork and building structure.
- 2.1.4.5. Direct drive plenum fans provided with ECM motors shall be balanced to a G6.3 per AMCA 204. No

vibration isolation base required for these type fans. Motors for these fan types shall included an integral PID controller that shall accept a 0-10VDC input signal for variable speed control.

- 2.1.4.6. Fan belts shall be enclosed as required by OSHA standard 29 CFR 1910 to protect worker from accidental contact with the belts and sheaves.
- 2.1.5. MOTORS AND DRIVES
- 2.1.5.1. All motors and drives shall be factory-installed and run tested. All motors shall be installed on a slide base to permit adjustment of belt tension. Slide base shall be designed to accept all motor sizes offered by the air-handler manufacturer for that fan size to allow a motor change in the future, should airflow requirements change. Fan sections without factory-installed motors shall have motors field installed by the contractor. The contractor shall be responsible for all costs associated with installation of motor and drive, alignment of sheaves and belts, run testing of the motor, and balancing of the assembly.
- 2.1.5.2. Motors shall meet or exceed all NEMA Standards Publication MG 1 - 2006 requirements and comply with NEMA Premium efficiency levels when applicable. Motors shall comply with applicable requirements of NEC and shall be UL Listed.
- 2.1.5.3. Fan Motors shall be heavy duty, open drip-proof operable at 208 volts, 60Hz, 3-phase. If applicable, motor efficiency shall meet or exceed NEMA Premium efficiencies.
- 2.1.5.4. Belt driven fans shall use 4-pole, 1800 rpm, motors, NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.
- 2.1.5.5. Direct driven fans utilizing integral frame motors shall use 2-pole (3600 rpm), 4-pole (1800 rpm) or 6-pole (1200 rpm) motors, NEMA Design B, with Class B insulation capable to operate continuously at 104 deg F (40 deg C) without tripping overloads.
- 2.1.5.6. Motors shall have a +/- 10 percent voltage utilization range to protect against voltage variation.
- 2.1.5.7. V-Belt Drive shall be fixed pitch rated at 1.5 times the motor nameplate. Drives 20 hp and larger or any drives on units equipped with VFDs shall be fixed pitch.
- 2.1.5.8. All belt driven fans with motors 15 hp and larger shall be equipped with multiple belt drives.
- 2.1.5.9. Manufacturer shall provide for each belt driven fan a nameplate with the following information to assist air balance contractor in start up and service personnel in maintenance:a. Fan and motor sheave part numberb. Fan and motor bushing part numberc. Number of belts and belt part numbersd. Fan design RPM and motor HPe. Belt tension and deflection. Center distance between shafts
- 2.1.6. COILS
- 2.1.6.1. Coils section header end panel shall be removable to allow for removal and replacement of coils without impacting the structural integrity of the unit.
- 2.1.6.2. Install coils such that headers and return bends are enclosed by unit casing to ensure that if condensate forms on the header or return bends, it is captured by the drain pan under the coil.
- 2.1.6.3. Coils shall be manufactured with plate fins to minimize water carryover and maximize airside thermal efficiency. Fin tube holes shall have drawn and belled collars to maintain consistent fin spacing to ensure performance and air pressure drop across the coil as scheduled. Tubes shall be mechanically expanded and bonded to fin collars for maximum thermal conductivity. Use of soldering or tinning during the fin-to-tube bonding process is not acceptable due to the inherent thermal stress and possible loss of bonding at that joint.
- 2.1.6.4. Construct coil casings of galvanized steel steel. End supports and tube sheets shall have belled tube holes to minimize wear of the tube wall during thermal expansion and contraction of the tube.
- 2.1.6.5. All coils shall be completely cleaned prior to installation into the air handling unit. Complete fin bundle in direction of airflow shall be degreased and steam cleaned to remove any lubricants used in the manufacturing of the fins, or dirt that may have accumulated, in order to minimize the chance for water carryover.
- 2.1.6.6. When two or more cooling coils are stacked in the unit, an intermediate drain pan shall be installed

between each coil. The intermediate drain pan shall be designed being of sufficient size to collect all condensation produced from the coil and sloped to promote positive drainage to eliminate stagnant water conditions. The intermediate drain pan shall be constructed of the same material as the sections primary drain pan.

- 2.1.6.7. The intermediate drain pan shall begin at the leading face of the water-producing device and be of sufficient length extending downstream to prevent condensate from passing through the air stream of the lower coil.
- 2.1.6.8. Intermediate drain pan shall include downspouts to direct condensate to the primary drain pan. The intermediate drain pan outlet shall be located at the lowest point of the pan and shall be sufficient diameter to preclude drain pan overflow under any normally expected operating condition.
- 2.1.6.9. Coil shall have a flexible epoxy polymer e-coat uniformly applied to all coil surface areas without material bridging between fins. Coating process shall ensure complete coil encapsulation and a uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges. Corrosion durability shall be confirmed through testing to no less than 5,000 hours salt spray per ASTM B117.
- 2.1.7. Hydronic Coils
 - 2.1.7.1. Supply and return header connections shall be clearly labeled on unit exterior such that direction of coil water-flow is counter to direction of unit air-flow.
 - 2.1.7.2. Coils shall be proof-tested to 300 psig and leak-tested to 200 psig air pressure under water.
 - 2.1.7.3. Headers shall be constructed of round copper pipe or cast iron.
 - 2.1.7.4. Tubes shall be 1/2-inch .016 copper, with aluminum fins.
 - 2.1.7.5. Hydronic coils shall be supplied with factory installed drain and vent piping to the unit exterior.
- 2.1.8. FILTERS
 - 2.1.8.1. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter section shall have side access filter guides and access door(s) extending the full height of the casing to facilitate filter removal. Construct doors in accordance with Section 2.04. Provide fixed filter blockoffs as required to prevent air bypass around filters. Blockoffs shall not need to be removed during filter replacement. Filters to be of size, and quantity needed to maximize filter face area of each particular unit size.
 - 2.1.8.2. Filter type, MERV rating, and arrangement shall be provided as defined in project plans and schedule
 - 2.1.8.3. Manufacturer shall provide one set of startup filters.
 - 2.1.8.4. Each filter section shall be provided with a factory-installed, flush-mounted Dwyer dial-type differential pressure gauge piped to both sides of the filter to indicate status. Gauge shall maintain a +/- 5 percent accuracy within operating temperature limits of -20°F to 120°F. Filter sections consisting of pre- and post-filters shall have a gauge for each.
- 2.1.9. DAMPERS
 - 2.1.9.1. All dampers, with the exception of external bypass and multizones (if scheduled), shall be internally mounted. Dampers shall be premium ultra low leak and located as indicated on the schedule and plans. Blade arrangement (parallel or opposed) shall be provided as indicated on the schedule and drawings. Dampers shall be Ruskin CD60 double-skin airfoil design or equivalent for minimal air leakage and pressure drop. Leakage rate shall not exceed 3 CFM/square foot at one inch water gauge complying with ASHRAE 90.1 maximum damper leakage and shall be AMCA licensed for Class 1A. All leakage testing and pressure ratings shall be based on AMCA Standard 500-D. Manufacturer shall submit brand and model of
- 2.1.10. ACCESS SECTIONS
 - 2.1.10.1. Access sections shall be provided where indicated in the schedule and plans to allow additional access for inspection, cleaning, and maintenance of unit components. The unit shall be installed for proper access. Procedure for proper access, inspection and cleaning of the unit shall be provided in the AHU manufacturer's maintenance manual. Access section doors shall be constructed per

Section 2.04.

- 2.1.11. DOUBLE DUCT MULTI-ZONE SECTION (AHU-1 Mezzanine Unit Only)
- 2.1.11.1. Manufacturer to provide dual duct blow-thru coil section with HW heating Coil and Chilled water Cooling Coil. Coil(s) shall be constructed to match existing duct layout. Manufacturer to calculate pressure drop thru each deck, and include baffles if required to balance air pressure drop thru each deck. Drain pan shall be required downstream of cooling coil to capture moisture that may carryover. Airflow discharge from section shall be Top Discharge with Factory Dampers and actuators per zone
- 2.1.12. VARIABLE FREQUENCY DRIVES (VFDS)
- 2.1.12.1. Variable frequency drives shall be provided, mounted and wired by the AHU manufacturer as indicated on the schedule and drawings. All standard and optional features shall be included within the VFD enclosure, including a bypass, unless otherwise specified. The VFDS shall be UL/ULC listed. The listing shall allow mounting in plenum or other air handling compartments.
- 2.1.12.2. The VFD shall convert incoming fixed frequency three-phase AC power into a variable frequency and voltage for controlling the speed of three-phase AC motors. The motor current shall closely approximate a sine wave. Motor voltage shall be varied with frequency to maintain desired motor magnetization current suitable for centrifugal pump and fan control and to eliminate the need for motor derating.
- 2.1.12.3. With the motor's rated voltage applied to the VFD input, the VFD shall allow the motor to produce full rated power at rated amps, RMS fundamental volts, and speed without using the motor's service factor. VFDS utilizing sine weighted/coded modulation (with or without 3rd harmonic injection) must provide data verifying that the motors shall not draw more than full load current during full load and full speed operation.
- 2.1.12.4. The VFD shall include an input full-wave bridge rectifier and maintain a fundamental power factor near unity regardless of speed or load.
- 2.1.12.5. The VFD and options shall be tested to ANSI/UL Standard 508. The complete VFD, including all specified options, shall be assembled by the manufacturer, which shall be UL 508 certified for the building and assembly of option panels. Assembly of separate panels with options by a third-party is not acceptable. The appropriate UL stickers shall be applied to both the VFD and option panel, in the case where these are not contained in one panel.
- 2.1.12.6. The VFD shall have DC link reactors on both the positive and negative rails of the DC bus to minimize power line harmonics. VFDS without DC link reactors shall provide a minimum 3% impedance line reactor.
- 2.1.12.7. The VFDS full load amp rating shall meet or exceed NEC Table 430-150. The VFD shall be able to provide full rated output current continuously, 110% of rated current for 60 seconds and 160% of rated current for up to 0.5 second while starting.
- 2.1.12.8. The VFD shall be able to provide full torque at any selected frequency from 28 Hz to base speed to allow driving direct drive fans without derating.
- 2.1.12.9. An automatic energy optimization selection feature shall be provided standard in the VFD. This feature shall automatically and continually monitor the motor's speed and load and adjust the applied voltage to maximize energy savings and provide up to an additional 3% to 10% energy savings.
- 2.1.12.10. Input and output power circuit switching shall be able to be accomplished without interlocks or damage to the VFD. Switching rate may be up to 1 time per minute on the input and unlimited on the output.
- 2.1.12.11. An automatic motor adaptation test algorithm shall measure motor stator resistance and reactance to optimize performance and efficiency. It shall not be necessary to run the motor or de-couple the motor from the load to run the test.
- 2.1.12.12. Galvanic and/or optical isolation shall be provided between the VFDS power circuitry and control circuitry to ensure operator safety and to protect connected electronic control equipment from damage caused by voltage spikes, current surges, and ground loop currents. VFDS not including

either galvanic or optical isolation on both analog I/O and discrete I/O shall include additional isolation modules.

2.1.12.13. The VFD shall minimize the audible motor noise through the use of an adjustable carrier frequency. The carrier frequency shall be automatically adjusted to optimize motor and VFD efficiencies while reducing motor noise.

2.1.12.14. Protective Features

1. Protection shall be provided against input transients, loss of AC line phase, output short circuit, output ground fault, overvoltage, undervoltage, VFD overtemperature and motor overtemperature. The VFD shall display all faults as words. Codes are not acceptable.
2. The VFD shall be protected from sustained power or phase loss. The VFD shall provide full rated output with an input voltage as low as 90% of the nominal. The VFD shall continue to operate with reduced output with an input voltage as low as 164 V AC for 208/230 volt units, 313 V AC for 460 volt units, and 394 volts for 600 volts units.
3. The VFD shall incorporate a motor preheat circuit to keep the motor warm and prevent condensation build up in the stator.
4. The VFD package shall include semi-conductor rated input fuses to protect power components.
5. To prevent breakdown of the motor winding insulation, the VFD shall be designed to comply with IEC Part 34-17. Otherwise the AHU manufacturer shall ensure that inverter rated motors are supplied.
6. The VFD shall include a "signal loss detection" circuit to sense the loss of an analog input signal such as 4 to 20 mA or 2 to 10 V DC, and shall be programmable to react as desired in such an instance.
7. The VFD shall function normally when the keypad is removed while the VFD is running and continue to follow remote commands. No warnings or alarms shall be issued as a result of removing the keypad.
8. The VFD shall catch a rotating motor operating forward or reverse up to full speed.
9. The VFD shall be rated for 100,000 amp interrupting capacity (AIC).
10. The VFD shall include current sensors on all three output phases to detect and report phase loss to the motor. The VFD shall identify which of the output phases is low or lost.
11. The VFD shall continue to operate without faulting until input voltage reaches 300 V AC on 208/230 volt units, 539 V AC on 460 volt units, and 690 volts on 600 volt units.

2.1.12.15. Interface Features

1. Hand/Start, Off/Stop and Auto/Start selector switches shall be provided to start and stop the VFD and determine the speed reference. On units with bypass, a VFD/Off/Bypass selector switch shall be provided.
2. The VFD shall be able to be programmed to provide a 24 V DC output signal to indicate that the VFD is in Auto/Remote mode.
3. The VFD shall provide digital manual speed control. Potentiometers are not acceptable.
4. A lockable, alphanumeric backlit display keypad shall be provided. The keypad shall be remotely mountable up to 10 feet away using standard 9-pin cable.
5. The keypads for all sizes of VFDs shall be identical and interchangeable.
6. To set up multiple VFDs, it shall be possible to upload all setup parameters to the VFDs keypad, place that keypad on all other VFDs in turn and download the setup parameters to each VFD. To facilitate setting up VFDs of various sizes, it shall be possible to download from the keypad only size independent parameters.

7. The display shall be programmable to display in English, Spanish and French at a minimum.
8. A red FAULT light, a yellow WARNING light and a green POWER-ON light shall be provided. These indications shall be visible both on the keypad and on the VFD when the keypad is removed.
9. A quick setup menu with factory preset typical HVAC parameters shall be provided on the VFD eliminating the need for macros.
10. The VFD shall include a standard EIA-485 communications port.
11. At a minimum, the following points shall be controlled and/or accessible:
 1. VFD Start/Stop
 2. Speed reference
 3. Fault diagnostics
 4. Meter points
12. Four additional Form C 230 volt programmable relays shall be available for field installation within the VFD
13. Two set-point control interfaces (PID control) shall be standard in the unit. The VFD shall be able to look at two feedback signals, compare with two set-points and make various process control decisions.
14. Floating point control interface shall be provided to increase/decrease speed in response to contact closures.
15. Four simultaneous displays shall be available. They shall include frequency or speed, run time, output amps and output power. VFDs unable to show these four displays simultaneously shall provide panel meters.
16. Sleep mode shall be provided to automatically stop the VFD when its speed drops below set ζ sleep ζ level for a specified time. The VFD shall automatically restart when the speed command exceeds the set ζ wake ζ level.
17. The sleep mode shall be functional in both follower mode and PID mode.
18. A run permissive circuit shall be provided to accept a ζ system ready ζ signal to ensure that the VFD does not start until dampers or other auxiliary equipment are in the proper state for VFD operation. The run permissive circuit shall also be capable of sending an output signal as a start command to actuate external equipment before allowing the VFD to start.
19. The following displays shall be accessible from the control panel in actual units: Reference Signal Value, Output Frequency in Hz or percent, Output Amps, Motor HP, Motor kW, kWhr, Output Voltage, DC Bus Voltage, VFD Temperature in degrees, and unit CFM.
20. The display shall be programmed to read in inches of water column (in-wg).
21. The VFD shall be able to be programmed to sense the loss of load and signal a no load/broken belt warning or fault.
22. If the temperature of the VFDs heat sink rises to 80°C, the VFD shall automatically reduce its carrier frequency to reduce the heat sink temperature. If the temperature of the heat sink continues to rise the VFD shall automatically reduce its output frequency to the motor. As the VFDs heat sink temperature returns to normal, the VFD shall automatically increase the output frequency to the motor and return the carrier frequency to its normal switching speed.
23. The VFD shall have temperature controlled cooling fans for quiet operation and minimized losses.
24. The VFD shall store in memory the last 10 faults and related operational data.
25. Eight programmable digital inputs shall be provided for interfacing with the systems control

and safety interlock circuitry.

26. Two programmable relay outputs, one Form C 240 V AC, one Form A 30 V AC, shall be provided for remote indication of VFD status.
27. Three programmable analog inputs shall be provided and shall accept a direct-or-reverse acting signal. Analog reference inputs accepted shall include two voltage (0 to 10 V DC, 2 to 10 V DC) and one current (0 to 20 mA, 4 to 20 mA) input.
28. Two programmable 0 to 20 mA analog outputs shall be provided for indication of VFD status. These outputs shall be programmable for output speed, frequency, current and power. They shall also be programmable to provide a selected 24V DC status indication.
29. Under fire mode conditions, the VFD shall be able to be programmed to automatically default to a preset speed.

2.1.12.16. Adjustments

1. The VFD shall have an adjustable carrier frequency in steps of not less than 0.1 kHz to allow tuning the VFD to the motor.
2. A minimum of sixteen preset speeds shall be provided.
3. Four acceleration and four deceleration ramps shall be provided. Accel and decel time shall be adjustable over the range from 0 to 3,600 seconds to base speed. The shape of these curves shall be automatically contoured to ensure no-trip acceleration and deceleration.
4. Four current limit settings shall be provided.
5. If the VFD trips on one of the following conditions, the VFD shall be programmable for automatic or manual reset: undervoltage, overvoltage, current limit and inverter overload.
6. The number of restart attempts shall be selectable from 0 through 20 or infinitely and the time between attempts shall be adjustable from 0 through 600 seconds.
7. An automatic on delay shall be selectable from 0 to 120 seconds.

2.1.13. Service Conditions

- 2.1.13.1. VFDs shall provide full output in an ambient temperature from -10 to 50°C (14 to 104°F).
- 2.1.13.2. VFDs shall provide full output in a relative humidity from 0 to 95%, non-condensing.
- 2.1.13.3. VFDs shall provide full output up to 3,300 feet elevation without derating.
- 2.1.13.4. VFDs shall provide full output with an AC line voltage variation from -10 to +10% of nominal voltage.
- 2.1.13.5. No side clearance shall be required for cooling of any units. All power and control wiring shall be done from the bottom.

2.1.14. Warranty

- 2.1.14.1. The VFD shall be warranted by the manufacturer for a period of 42 months from date of shipment, or 36 months from start-up, whichever ever occurs first. The warranty shall include parts, labor, travel costs and living expenses incurred by the manufacturer to provide factory-authorized on-site service.

2.1.15. VFD per Fan

- 2.1.15.1. Multiple VFDs on a common panel, shall be provided for each fan array to provide redundancy in case of loss of function of one of the VFDs or motors. Individual VFD shall be sized based on motor FLA to reduce overall panel input current. In the event of a VFD failure, the remaining VFDs must be capable of compensating and maintaining normal fan array operation.
- 2.1.15.2. VFD panel shall have a common disconnect that is accessible from the outside of the unit. Disconnect shall open input power to all VFDs simultaneously. Disconnect shall be lockable in the off position. Disconnect shall utilize circuit breaker to provide overcurrent and short circuit protection.
- 2.1.15.3. VFD panel shall be provided with a common point connection for speed input signal, start/stop signal, fault status, and field interlock connection

- 2.1.15.4. VFD panel shall be provided with a single point of field connection for field input power. Each VFD shall be supplied with independent input fusing, as required. Panel shall be provided with short circuit current of <<SHORT_CIRCUIT_RATING_MULTI_VFD>> RMS symmetrical.
- 2.1.15.5. Externally mounted VFDs shall be provided with independent keypad.
- 2.1.16. Motor Overload Panel for Fan Arrays
- 2.1.16.1. A motor overload panel provides a single unit mounted UL508A listed control panel with all fans in an array pre-wired to it, such that one properly sized VFD may be field connected with no additional provisions required for protection of the individual motors. The control panel enclosure shall be mounted on the exterior of the fan section and shall be NEMA type 1 for indoor units and NEMA type 4 for outdoor units. A single power distribution block shall be provided for connection of the field mounted VFD with one conductor per phase. An electronic motor overload protector with lockable manual isolation switch shall be provided for each motor in the array. Each motor in the array shall be independently grounded with a dedicated green conductor. A minimum of one open ground lug per fan plus one shall be provided for field use. Each motor overload protector shall be provided with an auxiliary contact and all auxiliary contacts shall be wired in series to a terminal block for generic trip signaling. The panel shall be rated for WYE power systems up to 600V.
- 2.2. **GYM AIR HANDLING UNIT (AHU - 2) ON ROOF**
- 2.2.1. General
- 2.2.1.1. The unit shall be Down discharge for both Supply and Return Openings. Cooling performance shall be rated in accordance with ARI testing procedures. All units shall be factory assembled, internally wired, fully charged with R-410A, and 100 percent run tested to check cooling operation, fan and blower rotation, and control sequence before leaving the factory. Wiring internal to the unit shall be colored and numbered for simplified identification. Units shall be ETL listed and labeled, classified in accordance to UL 1995/CAN/CSA No. 236-M40 for Central Cooling Air Conditioners. Canadian units shall be CSA Certified.
- 2.2.2. Casing
- 2.2.2.1. Unit casing shall be constructed of zinc coated, heavy gauge, galvanized steel. Exterior surfaces shall be cleaned, phosphatized, and finished with a weather-resistant baked enamel finish. Unit's surface shall be tested 1000 hours in a salt spray test in compliance with ASTM B117. Unit shall have a 2 inch thick Antimicrobial Insulation. All insulation edges shall be either captured or sealed. The unit's base pan shall have no penetrations within the perimeter of the curb other than the raised downflow supply/return openings to provide an added water integrity precaution, if the condensate drain backs up.
- 2.2.3. Unit Top
- 2.2.3.1. The top cover shall be one piece construction or, where seams exist, it shall be double-hemmed and gasket-sealed. The ribbed top adds extra strength and enhances water removal from unit top
- 2.2.4. Sensors
- 2.2.4.1. A factory installed combination outdoor air sensor located in the outdoor air hood is designed to sense both outdoor air temperature and relative humidity for use by the microprocessor controller to make required ventilation, cooling, dehumidification and heating decisions. Refer to the Sequence of Operations section of the Installation, Operation and Maintenance manual for detailed unit control and operational modes. A factory installed sensing tube is designed to sense the supply air temperature downstream of the indoor fan section.
- 2.2.5. Cooling Coil: Chilled Water
- 2.2.5.1. Chilled Water Coils
The chilled water coil is ARI performance certified and shall bear the ARI symbol. Tubes shall be mechanically expanded into fins (secondary surface) for maximum heat transfer and shall be 6 rows. Materials are to be 1/2 in. diameter x (0.020) wall thickness. Secondary surface (fins) shall be of the plate-fin design using aluminum with die-formed collars. Fin design is waffle in a

staggered tube pattern to meet performance requirements. Collars shall hold fin spacing at specified density, and cover the entire tube surface. Fins shall be free of oils and oxidation. The coil shall have MPT connections constructed of copper. Water valves are field supplied and installed. The optional Cooney Freeze Block is designed to allow ice to form within the tubes, without restriction, by discharging a small amount of water into the drain pan. Each expansion header has a factory installed Cooney Freeze Block Valve that is both pressure and thermally activated. The valve shall open when outside air below 35°F comes in contact with the header or return end of the coil, or when the internal pressure of the coil exceeds 300 psi. The valve shall automatically reset and allow the coil to resume normal operation, when the pressure decreases, or when the temperature increases.

- 2.2.6. Indoor Blower Motor: ECM w/ Backward Curved Plenum Fan
- 2.2.6.1. Supply Fan shall be a high efficiency backward curved impeller. The supply fan motor shall be an electronic commuted motor with integrated power electronics.
- 2.2.7. 439 Stainless Steel Furnace: (10:1 Turndown NG)
- 2.2.7.1. Primary heat is supplied using indirect fired gas heating. The heating section shall have a progressive tubular heat exchanger design using Stainless Steel burners and type 439 Stainless Steel tubes. An induced draft combustion blower shall be used to pull the combustion products through the firing tubes. The heater shall use a direct spark ignition (DS) system. On initial call for heat, the combustion blower shall purge the heat exchanger for 20 seconds before ignition. After three unsuccessful ignition attempts, the entire heating system shall be locked out until manually reset at the thermostat/zone sensor. Units shall be comply with the California requirement for low NOx emissions. Unit shall be suitable for use with Natural Gas. Minimum incoming gas pressure of 7" W.C. and Maximum pressure of 14" W.C. required. Factory provided 25 year heat exchanger warranty.
- 2.2.8. Powered Exhaust: ECM w/ Backward Curved Plenum Fan & Barometric Relief Damper
- 2.2.8.1. Supply Fan shall be a high efficiency backward curved impeller. The supply motor shall be an electronic commuted motor with integrated power electronics.
- 2.2.9. Energy Recovery & Conservation: ERC-4136C
- 2.2.9.1. Energy recovery wheel performance shall be AHRI 1060 certified and bear the AHRI certified label. The rotating wheel heat exchanger is composed of a rotating cylinder in an insulated cassette frame complete with removable energy transfer media, seals, drive motor and drive belt. Energy transfer media shall be constructed of a durable synthetic lightweight polymer. The total energy recovery wheel is coated with a desiccant tat shall be either Type-A silica gel or 3A molecular sieve and permanently bonded to the energy transfer media without the use of binders or adhesives. The lightweight polymer substrate shall not degrade nor require additional coatings for application in marine or coastal environments. Coated segments are cleanable outside of the cabinet with detergent or alkaline coil cleaner and water. Desiccant shall not dissolve nor deliquesce in the presence of water or high humidity.
- 2.2.10. Filters: MERV-8 & MERV-13
- 2.2.10.1. Aluminum Mesh Filters (D, K and N Cabinets) and Galvanized Mesh Bird Screen (B and G Cabinets) shall be installed on the intake of the unit. In addition, one row of 2 inch MERV-8 rated prefilters (30 percent) and 2 inch MERV-13 final filter (80 percent) installed prior to the evaporator coil. Unit shall be equipped with a 6" filter rack upstream of the evaporator. Frame shall be field-adjustable to match any filter combination specified in the attached selection.
- 2.2.11. Electrical Options: Non-Fused Disconnect Switch w/ 115v Outlet (B/G)
- 2.2.11.1. A 3-pole, molded case, HACR circuit breaker with provisions for through the base electrical connections shall be installed. The disconnect switch shall be installed in the unit in a water tight enclosure. Wiring shall be provided from the switch to the unit high voltage terminal block. The switch shall be UL/CSA agency recognized. The disconnect switch shall be sized per NEC and UL guidelines but shall not be used in place of unit overcurrent protection. A powered 120 volt, 10 amp, 2 plug convenience outlet shall be factory installed. A service receptacle disconnect shall be

installed. The convenience outlet is powered from the line side of the disconnect or circuit breaker, and therefore shall not be affected by the position of the disconnect or circuit breaker.

Factory wired Voltage/Phase monitor shall be included as standard. In the event of any of the following, the units shall be shut down and a fault code shall be stored in the monitor for the most recent 25 faults. Upon correction of the fault condition the unit shall reset and restart automatically.

1. Phase Unbalance Protection: Factory set 2%
2. Over/Under/Brown Out Voltage Protection: +/-10% of nameplate voltage
3. Phase Loss/Reversal

2.2.12. Accessories: Condenser Hailguard

- 2.2.12.1. Hail guards shall be installed on the outside of the condenser coil. The guards shall consist of perforated metal, of the same gauge and color as the unit itself. Airflow through the hail guards shall not be restricted due to location or size of the perforations. Guards shall be removable to accommodate coil cleaning.

2.3. **UNIT CONTROLS FOR ALL AIR HANDLING UNITS**

- 2.3.1. Units shall be provided with factory mounted controls, wired and piped, to provide a fully automated start-up and accurately modulated discharge air temperature
- 2.3.2. Burner on/off, modulation or staging control, and all safeties as required, shall be by a unit-mounted micro-processor controller
- 2.3.3. O.E.M. furnished controller, on units equal to or exceeding 5 tons nominal cooling capacity and/or equal to or exceeding 400 MBH nominal heating capacity, must use the following inputs for control:
- 2.3.3.1. 0 Vdc to 10 Vdc (or 4 mA to 20 mA) analogue signal from Building Automation System for Discharge Air Temperature set-point.
- 2.3.3.2. Binary input from Building Automation System to command / enable / disable Mechanical Cooling
- 2.3.3.3. Binary input from Building Automation System to command / enable / disable Heating
- 2.3.3.4. Binary input from Building Automation System to command / enable / disable Supply Air Fan(s)
- 2.3.3.5. 0 Vdc to 10 Vdc (or, 4 mA to 20 mA) analogue signal from Building Automation System for Outdoor Air Damper position
- 2.3.4. O.E.M. furnished controller, on units less than 5 tons nominal cooling capacity and/or less than 400 MBH nominal heating capacity, must use the following inputs for control:
- 2.3.4.1. Binary input from Building Automation System to command / enable / disable Mechanical Cooling
- 2.3.4.2. Binary input from Building Automation System to command / enable / disable Heating
- 2.3.4.3. Binary input from Building Automation System to command / enable / disable Supply Air Fan(s)
- 2.3.4.4. 0 Vdc to 10 Vdc (or, 4 mA to 20 mA) analogue signal from Building Automation System for Outdoor Air Damper position
- 2.3.5. In the event of power loss, the outdoor and exhaust air dampers are to close by way of mechanical spring, return air dampers shall open by way of mechanical spring.
- 2.3.6. Unit Control shall be provided by the Building Automation contractor in accordance with Section 23 09 93.
- 2.4. **BELT DRIVE UTILITY FANS**
- 2.4.1. General
- 2.4.1.1. Performance ratings shall conform to AMCA standard 211 and 311. Fans shall be tested in accordance with ANSI/AMCA Standard 210-99 and AMCA Standard 300-96 in an AMCA accredited laboratory. Fans shall be certified to bear the AMCA label for air and sound performance seal
- 2.4.1.2. Fans shall comply with the National Electrical Manufacturers Association (NEMA), standards for motors and electrical accessories

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- 2.4.1.3. Fans selected shall be capable of accommodating static pressure and flow variations of +/-15% of scheduled values.
 - 2.4.1.4. After fabrication, all carbon steel components shall be cleaned and chemically treated by a phosphatizing process to insure proper removal of grease, oil, scale, etc. Fan shall then be coated with a minimum of 2-4 mils of Permator, electrostatically applied and baked. Finish color shall be Concrete Gray-RAL 7023. Coating must exceed 1,000-hour salt spray under ASTM B117 test method.
 - 2.4.1.5. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number
 - 2.4.2. Wheel:
 - 2.4.2.1. Wheel shall be non-overloading, backward inclined centrifugal wheel
 - 2.4.2.2. Constructed of aluminum
 - 2.4.2.3. Statically and dynamically balanced in accordance to AMCA Standard 204-05
 - 2.4.2.4. The wheel cone and fan inlet shall be matched and shall have precise running tolerances for maximum performance and operating efficiency
 - 2.4.2.5. Single thickness blades shall be welded to a heavy gauge back plate and wheel cone.
 - 2.4.3. Motors:
 - 2.4.3.1. Motor Enclosure shall be totally enclosed fan cooled (TEFC) - no opening in the frame or brackets. Equipped with an external fan to blow air over the motor.
 - 2.4.3.2. Motors shall meet or exceed EISA (Energy Independence and Security Act) efficiencies. Motors to be NEMA T-frame, 690, 870, 1170, 1770 or 3500 RPM in 60 Hz, (720, 950, 1425 or 2900 in 50 Hz) with a 1.15 service factor.
 - 2.4.3.3. Shall be accessible for maintenance
 - 2.4.4. Isolation:
 - 2.4.4.1. Isolator Type: Spring, Free Standing, 1 inch
 - 2.4.5. Fan Housing and Outlet:
 - 2.4.5.1. Fan construction shall be steel
 - 2.4.5.2. Fan housing is to be aerodynamically designed with high-efficiency inlet, engineered to reduce incoming air turbulence.
 - 2.4.5.3. The housings shall be of continuously welded heavy gauge steel. Panels shall be coated with a minimum of 2-4 mils of Permator, electrostatically applied and baked. Finish color shall be Concrete Gray-RAL 7023. No uncoated metal fan parts shall be allowed.
 - 2.4.5.4. Partial wheel and housing widths shall be used to attain specific fan performance requirements.
 - 2.4.5.5. Housing and bearing support shall be constructed of welded structural steel members to prevent vibration and rigidly support the shaft and bearings.
 - 2.4.6. Motor Cover
 - 2.4.6.1. Motor cover shall be constructed of galvanized steel and shall cover motor and drives for safety.
 - 2.5. **DIRECT DRIVE ROOF DOWNBLAST CENTRIFUGAL EXHAUST FANS**
 - 2.5.1. General
 - 2.5.1.1. Downblast fan shall be for roof mounted applications; Maximum continuous operating temperature shall be 180 fahrenheit (82.2 celsius); Fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number; Aluminum housing. Ball bearing motors; Fan shall complete with birdscreen.

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- 2.5.1.2. Wheel shall be backward inclined aluminum.
 - 2.5.1.3. aluminum curb cap with prepunched mounting holes;
 - 2.5.1.4. Control - dial for balancing;
 - 2.5.1.5. standard curb cap size - 30 in. Square; ULc 705 listed - "power ventilators"
 - 2.5.1.6. Switch, nema-1, toggle, shipped with unit
 - 2.5.1.7. Junction box mounted & wired
 - 2.5.1.8. Damper shipped loose, bd-100-pb-18x18, gravity

 - 2.6. **DIRECT DRIVE INLINE FANS**
 - 2.6.1. Construction
 - 2.6.1.1. Galvanized steel housing, backward inclined aluminum wheel-two bolted access panels-integral duct connection flanges; ball bearing motor; corrosion resistant fasteners. Normal operating temperature up to 130 fahrenheit (54.4 celsius). Fan shall bear a permanently affixed manufacture's engraved metal nameplate containing the model number and individual serial number
 - 2.6.2. Motor
 - 2.6.2.1. EC motor; ULc 705 listed power ventilator.
 - 2.6.2.2. Jjunction box mounted and wired.
 - 2.6.3. Isolators & brackets
 - 2.6.3.1. Shall be provided by fan manufacturer.

 - 2.7. **SIDEWALL DIRECT DRIVE FAN**
 - 2.7.1. General
 - 2.7.1.1. Galvanized steel fan panel; die formed, galvanixzed steel drive frame assembly; cast aluminum airfoil blade propeller; ball bearing motor; corrosion resisteant fasters.
 - 2.7.1.2. Control - dial for balancing;
 - 2.7.1.3. Junction box mounted & wired
 - 2.7.1.4. Airflow direction: exhaust
 - 2.7.1.5. Damper mounted: gravity operated
 - 2.7.1.6. Weaterhood: galvanized 45 degree with bird screen.

 - 2.8. **MANUFACTURERS**
 - 2.8.1. Greenheck
 - 2.8.2. Or approved equivalent

 - 2.9. **PUMP P-1**
 - 2.9.1. General
 - 2.9.1.1. The pump shall be Armstrong S&H or S&H ECM Series Circulating Pump, designed for quiet operation and guaranteed by the manufacturer for the intended application. Performance of the pump is shown in pump schedule in mechanical drawing.
 - 2.9.2. Construction
 - 2.9.2.1. Pump shall be lead free bronze; Impeller: Non-ferrous, maintenance free – permanently lubricated; pump shall be equipped with a water-tight, long-life silicon carbide mechanical

seal; maximum operating condition: 863 kPa at 107°C.

PART 3 - EXECUTION

3.1. INSTALLATION

- 3.1.1. All mechanical equipment and their accessories shall be installed as per manufacturer's written instructions.
- 3.1.2. Locate all equipment as indicated on the Contract Drawings, including cleaning and service maintenance clearance per Manufacturer instructions. Adjust and level equipment on support structure.
- 3.1.3. Install flexible pipe connectors on hot water coils for UVs and FCU.
- 3.1.4. Install flexible duct connectors on discharge side of the supply fan of UVs and FCU.
- 3.1.5. Provide all required hot water heating piping. All heating piping shall be mild black steel Schedule 40.
- 3.1.6. Piping up to 50mm diameter shall be screwed. Piping 65mm diameter and larger shall be screwed or welded.
- 3.1.7. Where piping is grooved end type, with mechanical fittings, coupling joints shall be suitable in all respects for the application. Install such fittings and couplings in accordance with the manufacturer's recommendations. If mechanical couplings are used, ensure that all valves and piping accessories are suitable.
- 3.1.8. Slope horizontal mains to provide a minimum continuous up-grade slope to high points. Slope branch supply and return piping connections to equipment a minimum of 25mm in 1.2m.
- 3.1.9. Provide manual/automatic combination air relief vents at the high points of closed loop piping systems, and at equipment. Automatic air vents shall be provided in equipment rooms only.
- 3.1.10. Provide a throttling globe type shut-off valve in the supply connection to and a gate type shut-off valve in the return connection from each piece of apparatus connected with hot water piping. Provide balancing valves where indicated on the schematic drawings or where specified for specific pieces of equipment.
- 3.1.11. At contractor's option, ball valves may be used in lieu of gate valves in piping 50 mm diameter and smaller.
- 3.1.12. Provide circuit balancing valves where shown on the drawings. Co-ordinate exact locations with the personnel providing the system water balancing.
- 3.1.13. Provide unions or flanges at all coil connections to UV and FCU and to valves, strainers, and similar piping system components, which may need maintenance or repair.
- 3.1.14. Install automatic control valves, piping sensor wells and similar piping mounted control components required for automatic temperature control systems specified in Section 23 05 00.
- 3.1.15. Connect heating coils with piping in accordance with requirements of manufacturers detail sheets and schematic diagrams
- 3.1.16. Refer to all other related sections (e.g. identification, motors and wiring, and start-up and commissioning).
- 3.1.17. Cut and finish paint enclosure facia area as deemed necessary to install the field installed accessories.
- 3.1.18. Contractor shall paint damaged and abraded factory finish with touch-up paint matching factory finish.
- 3.2. **ELECTRICAL:**
- 3.2.1. Provide all the electrical requirements and connections for all power feeds.
- 3.2.2. Coordinate all control requirements and connections with Controls Contractors.

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- 3.2.3. Install and wire all accessories shipped loose with units for a fully operational system.
- 3.3. **CONTROL WIRING / BAS WORK:**
- 3.3.1. Coordinate details of controls/BAS with the existing Delta systems and provide all required accessories to integrate the proposed units into the existing BAS.
- 3.3.2. The mechanical contractor shall be responsible for the interconnecting control wiring between remote controllers, centralised control and relevant components. This work shall be co-ordinated with the Electrical / Controls Contractor for the routing and trunking of the cables.
- 3.3.3. All control wiring is to be carried out in 2 core 16 AWG shielded cabling with colour coding and tagged with ID number at 3 metre intervals as per schematics for ease of identification and maintenance.
- 3.3.4. Control wiring shall not be run next to power wiring. A minimum space of 100mm between both control and power cables shall apply.
- 3.4. **START-UP:**
- 3.4.1. Start-up shall be performed by factory trained and authorized servicing technicians conforming equipment has been correctly installed and passes Specification check-list prior to equipment being operational and covered under Original Equipment Manufacturer (OEM) warranty.
- 3.5. **TRAINING**
- 3.5.1. Once the system is tested, commissioned and accepted by the Consultant and the client (HDSB), the Contractor shall provide one session of on-site training to facility operating personal on start-up, operating data, operation and maintenance of all mechanical equipment. The training session shall be of 4 hours minimum duration. Contractor shall co-ordinate with facility personnel and HDSB to determine the date and time of the training session. All training events must be recorded and included in the close out document.

END OF SECTION

PART 1 **GENERAL**

1.1 **GENERAL REQUIREMENTS**

- .1 Conform to all applicable Sections of Division 1.

1.2 **REFERENCES**

- .1 Complete the installation of the Work in accordance with the latest editions of the Ontario Building Code, Ontario Electrical Safety Code, C.S.A., U.L.C., N.F.P.A., O.S.H.A. or other codes as required.

1.3 **APPLICATION**

- .1 This Section applies to and is an integral part of all succeeding Sections of this Division of the Specification.

1.4 **DEFINITIONS**

- .1 The following are definitions of words found in Sections of this Specification and on associated drawings:
- .2 “Concealed”: Hidden from normal sight in furred spaces, shafts, crawl spaces, ceiling spaces, walls and partitions;
- .3 “Exposed”: All work normally visible to building occupants;
- .4 “Provide” (and tenses of “Provide”): Supply, install and connect complete.
- .5 “Install” (and tenses of “install”): Install, and connect complete;
- .6 “Supply”: Supply only.
- .7 “Work”: All equipment, permits, materials and labour to provide a complete electrical installation as required and detailed in Drawings and Specification.
- .8 “Authorities” or “Authorities Having Jurisdiction”: Any and all current laws or by-laws of any federal, provincial or local authorized agencies having jurisdiction over the sum total or parts of the work including, but not restricted to the Municipal Planning and Building Department, Municipal Fire Department, Labour Canada, Provincial Fire Marshall, Local Hydro Supply Authority, Ontario Building Code, Construction Safety Act, Municipal Public Works Department, Canadian Electrical Code with Ontario Supplement, hereinafter referred to as the “Code”, Electrical Safety Authority and all Inspection Bulletins.
- .9 “Drawings and Specifications”: “Contract Drawings and Specifications”.

1.5 **WORK INCLUDED**

- .1 Provide all labour, materials, equipment and services to complete the Work of the Electrical Division as further specified and as shown on the Contract Drawings.
- .2 Should any discrepancy appear between these Specifications and the Contract Drawings or between one part of the Specifications and another, or between one location on the Contract Drawings and another, to cause doubt as to the true meaning and intent of the Contract Drawings and Specifications, the Contractor shall immediately bring this to the

attention of the Consultant. If this is not done prior to Tender close, the Contractor shall provide/install the more expensive alternative under the Contract as recommended by the Consultant.

1.6 SCHEDULING OF PRODUCT DELIVERY

- .1 Every effort must be made to ensure delivery of all materials and products in the Contract Documents on time. At commencement of Contract, assist Contractor in preparation of schedule of order dates for items requiring long delivery periods.

1.7 EXAMINATION OF SITE

- .1 Prior to submitting a tender carefully examine conditions at the site, which may or will affect the work.
- .2 Refer to and examine all contract documents, including room finish schedules to determine finished, partially finished and unfinished areas of the building.
- .3 Ensure that materials and equipment are delivered to the site at the proper time and in such assemblies and sizes so as to enter into the building and to be moved into the spaces where they are to be located without difficulty. Be responsible for every cutting and patching involved in getting assemblies into place.

1.8 QUALITY ASSURANCE

- .1 General Codes and Standards:
 - .1 Comply with the Ontario Building Code and Canada Labour Code, Part 4.
 - .2 Where provisions of pertinent codes or local by-laws conflict with these Specifications and Contract Drawings or each other, comply with the more stringent provisions.
 - .3 Operating voltages shall comply with CAN3-C235-83.
 - .4 Ground system shall comply with CSA Standard C22.1.
- .2 Provide new materials bearing certification marks or labels acceptable under Ontario Electrical Safety Code. Equipment must bear, on manufacturer's label, certification mark or label acceptable under Electrical Safety Authority.
- .3 Provide units of same manufacture where two or more units of same class or type of equipment are required.
- .4 Manufacturer's names are stated in this Specification to establish a definite basis for tender submission and to clearly describe the quality of product that is desired for the work.
- .5 Standard Specifications: Ensure that the chemical and physical properties, design, performance characteristics and methods of construction of all products provided comply with latest issue of applicable standard specifications issued by authorities having jurisdiction, but such standard specifications shall not be applied to decrease the quality of workmanship, products and services required by the Contract Documents.
- .6 Electrical Codes and Permits:
 - .1 The work shall be carried out in accordance with these Contract Drawings and Specifications and shall comply with the essential requirements of the latest editions of the Canadian Electrical Code C.22.1 and the Electrical Safety Code

(together with applicable bulletins issued by the Inspection Department of Electrical Safety Authority). In no instance, however, shall the standards established by the Contract Drawings and Specifications be reduced by any of the codes referred to above. In the event of conflicting requirements, the codes shall take precedence over these Contract Documents and the Consultant's decision shall be final and binding.

- .2 Arrange for and obtain all necessary permits (except Building Permit), inspection and approvals from authorities having jurisdiction, and also pay all applicable fees. The Contractor shall conform to all Municipal Codes and By-laws which affect the work.
- .3 Applicable Codes:
 - .1 Ontario Electrical Safety Code;
 - .2 Canadian Electrical Code, with applicable regional amendments;
 - .3 Ontario Building Code;
 - .4 National Building Code;
 - .5 Ontario Fire Code;
 - .6 National Fire Code and Fire Commissioner Canada requirements.
- .4 Before starting any work, submit the required number of copies of Contract Drawings and Specifications to the Electrical Safety Authority and the local authority for approval and comments. Comply with any changes requested as part of the Contract, but notify the Consultant immediately of such changes for proper processing of these requirements. Prepare and furnish any additional drawings, details or information as may be required by the Consultant.
- .5 On or before the completion of this Contract, obtain at own expense, the necessary certificate of inspection from the Inspection Branch of the Electrical Safety Authority of Ontario and forward same to the Consultant.
- .6 Equipment and material must be acceptable to Electrical Safety Authority.
- .7 Where materials are specified which require special inspection and approval, obtain such approval for the particular installation with the co-operation of the material supplier.
- .8 Supply and install warning signs, nameplates and glass covered Single Line Diagrams as required by Electrical Safety Authority.
- .9 Submit required documents and shop drawings to authorities having jurisdiction in order to obtain approval for the Work. Copies of the Contract Drawings and Specifications may be used for this purpose.

1.9 REQUIREMENTS OF CONTRACT DRAWINGS

- .1 Contract:
- .2 The Contract Drawings are essentially performance drawings, partly schematic, intended to convey the scope of work and extent of work. They only indicate general arrangement and approximate location of apparatus, fixtures and general typical sizes and locations of equipment and connections. The Contract Drawings do not intend to show architectural, structural or mechanical details.
- .3 Do not scale the Contract Drawings, but obtain information involving accurate dimensions to structure from those shown on the Contract Drawings, or by site measurements of existing areas. Follow the Contract Drawings in laying out the work.

- .4 Make, at no additional cost, any changes or additions to materials, or equipment necessary to accommodate structural conditions (runs around beams, columns and suchlike). Alter, at no additional cost, the location of materials or equipment to maximum three meters, or as directed, provided that the changes are made before installation and do not necessitate additional material or labour.
- .5 Leave space clear and install work to accommodate future materials and equipment as indicated and to accommodate equipment and material supplied by other trades. Verify all equipment sizes in relation to space allowed and check all clearances.
- .6 Confirm on the site, the exact location and mounting elevation of equipment and fixtures as related to Architectural or Structural details. Confirm location of outlets or connection points for equipment supplied by other trades.

1.10 COORDINATION WITH MECHANICAL DIVISIONS

- .1 Unless indicated otherwise on the Contract Drawings, Division 16 shall be responsible for the supply and installation of the following if applicable:
 - .1 Starters;
 - .2 Line and load side wiring for starters;
 - .3 Provisions of disconnects to all mechanical equipment;
 - .4 All power wiring (120V and above) to all mechanical equipment;
 - .5 All motorized damper power connections (120V and above);
 - .6 Wiring to electric space heaters.
- .2 Mechanical Divisions will be responsible for the supply and installation of the following if applicable:
 - .1 All control wiring to starters;
 - .2 All fans, motors, pumps and pumps control panel;
 - .3 Gas detection equipment;
 - .4 All interposing relays, relays, contactors and 120V control devices associated with the mechanical systems;
 - .5 All low voltage control wiring and conduits.
- .3 Determine exact location of starters, motors and line voltage controls based on the Contract Documents to coordinate with the locations of all mechanical and electrical equipment to ensure the required clearances are maintained. If no wall location is suitable for the motor starters then mount the starters on a plywood backboard on unistrut supports near the respective equipment to meet the applicable code requirements for motor isolation switches. If a motor or piece of equipment is listed on one of the starter schedules but is not shown on the floor plans, the Contractor is to reference the Contract Documents for the location of the respective piece of equipment. No additional costs will be entertained.
- .4 Should the Contractor change any of the motor or equipment sizes from those identified in the Contract Documents at any stage of the project to aide their installation, the Contractor will incur all extra electrical costs to revise the electrical feeders, breakers, starters and equipment to supply power to the revised piece of equipment.

1.11 SUBMITTALS – SHOP DRAWINGS

- .1 Section 013300 – Submittal Procedures shall include, but not be limited to the following:
 - .1 Submittals/shop drawings shall indicate clearly the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity, operating characteristics and performance. Each shop drawing shall give the identifying number of the specific assembly for which it was prepared (e.g. MCC-1).
 - .2 Each shop drawing for non-catalogue items shall be prepared specifically for this project. Shop drawings and brochures for catalogue items shall be marked clearly to show the items being supplied.
 - .3 Each shop drawing or catalogue sheet shall be stamped and signed by the Contractor to indicate that he has checked the drawing for conformance with all requirements of the Contract Drawings and Specifications, that he has co-ordinated this equipment with other equipment to which it is attached and/or connected and that he has verified all dimensions to ensure the proper installation of equipment within the available space and without interference with the work of other trades. Ensure that electrical co-ordination is complete before submitting shop drawings for review.
 - .4 Contractor to submit all submittals/shop drawings electronically in PDF format. Submittal to come complete with a transmittal bound to the PDF file with the transmittal identifying the total number of pages in the submittal including the transmittal page. For any submittal with pages larger than 27.94cm x 43.18cm (11"x17"), the Contractor is to submit a minimum of three hard copies unless additional copies are identified in the Contract Documents.
 - .5 Installation of any equipment shall not start until after final review of shop drawings by the Consultant has been obtained.
 - .6 When requested, shop drawings shall be supplemented by data explaining the theory of operation. For example: fire alarm controller; the Consultant may also request that this information be added to the maintenance and operating manual.
 - .7 Provide space for shop drawing review stamps for the Contractor and Consultant. This space shall be clear of all technical information and shall not be on the back of any sheets.
 - .8 One original shop drawing will be returned either hard copy or electronically. All copies required for the trades, suppliers or other Consultants will be copied or printed by the Contractor.

1.12 MATERIALS

- .1 Make and quality of materials used in the construction of this work shall be subject to the approval of the Consultant.
- .2 Materials and equipment supplied by this Division shall be new and free from defects and shall be as specified by the manufacturer's name and catalogue reference.
- .3 All equipment, accessories and specified manufacturers within the Contract Documents are preferred Vendors.
- .4 The carrying of alternates will be at Contractor's own risk and will only be approved with written consent by the Consultant after award of the Contract.

- .5 Where a certain manufacturer's equipment has been specified by name or model number, the Contractor shall be responsible for ensuring that the performance and quality of any proposed alternative meets the specified equipment and that the same access or maintenance space is available for the alternative manufacturer's equipment and that piping, duct and electrical connections can be made at no extra cost to the Contract. Prior approval in writing will be required from the Consultant before any alternative is accepted.

1.13 APPROVED MANUFACTURERS

- .1 Where only one name appears in the Specification, the bid shall include for the specified equipment.
- .2 Where two or more names are shown in the specifications as alternates or equal to, this Division can select which manufacturer is to be carried.

1.14 DIMENSIONS AND QUALITIES

- .1 Dimensions shown on the Contract Drawings are approximate. Verify dimensions by reference to shop drawings and field measurement.
- .2 Quantities or lengths indicated in Contract Documents are approximate only and shall not be held to gauge or limit the Work.
- .3 Make necessary changes or additions to routing of conduit, cables, cable trays, and the like to accommodate structural, mechanical and architectural conditions. Where raceways are shown diagrammatically run them parallel to building column lines.

1.15 EQUIPMENT LOCATIONS

- .1 Devices, fixtures and outlets may be relocated, prior to installation, from the location shown on the Contract Drawings, to a maximum distance of 3.0 m without adjustment to Contract price.
- .2 Switch, control device and outlet locations are shown diagrammatically.

1.16 CONTRACT DRAWINGS AND INSTALLATION

- .1 The Contract Drawings are intended to show the general character and Scope of the Work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.
- .2 The location, arrangement and connection of equipment and materials shown on the Contract Drawings represent a close approximation to the intent and requirements of the contract. The right is reserved by the Consultant to make reasonable changes required to accommodate conditions arising during the progress of the work, at no extra cost to the Agency.
- .3 Certain details indicate on the Contract Drawings are general in nature and specific labelled detail references to each and every occurrence of use are not indicated, however, such details shall be applicable to every occurrence on the Contract Drawings.
- .4 The actual location of switches, outlets and luminaries, etc. shall be reviewed by the Consultant before installation.
- .5 The location and size of existing services shown on the Contract Drawings are based on the best available information. The actual location of existing services shall be verified

- in the field before work is commenced. Particular attention shall be paid to buried services.
- .6 Changes and modifications necessary to ensure co-ordination and avoid interference and conflicts with other trades or to accommodate existing conditions, shall be made at no extra cost to the Agency.
 - .7 Leave areas clear where space is indicated as reserved for future equipment, and equipment for other trades.
 - .8 Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to operation of systems.
 - .9 Where equipment is shown to be 'roughed-in only' obtain accurate information from the Consultant before proceeding with the Work.
 - .10 Contractor is to review all Contract Documents to confirm locations of devices and equipment.
 - .11 This Contractor is responsible to mark-out his work, fully co-ordinated with all other trades, in sufficient time for review by the Consultant prior to rough-in. Prepare dimensioned layouts of each room prior to rough-in for review by the Consultant. Do not proceed with any work until the Consultant has reviewed the layout drawings.
 - .12 Contractor may be required to prepare working detail drawings supplementary to the Contract Drawings, when deemed necessary by the Consultant, for all areas where a multiplicity of materials and or apparatus occur, or where work due to architectural and structural considerations involves special study and treatment. Such drawings may be prepared jointly by all trades affected, or by the one trade most affected with due regard for and approval of the other trades, all as the Consultant will direct in each instance. Such drawings must be reviewed by the Consultant before the affected work is installed.
 - .13 Carry out all alterations in the arrangement of work which has been installed without proper study and approval, even if in accordance with the Contract Documents, in order to make such work come within the finished lines of walls, floors and ceilings, or to allow the installation of other work, without additional cost. In addition, make any alterations necessary in other work required by such alterations, without additional cost.
 - .14 Prepare installation drawings for equipment, based upon approved shop drawings, to check required Code clearances, raceway, busway and cable entries, sizing of housekeeping pads and structure openings. Submit installation drawings to Consultant for review.

1.17 RECORD DRAWINGS

- .1 Mark locations of feeder conduits, junction and terminal boxes and ducts or conduits run underground either below the building or outside the building.
- .2 Where conduit and wiring are underground or underfloor, furnish field dimension with respect to building column lines and inverts with respect to finished floor levels or grades.
- .3 Record deviations from branch circuit numbers shown on Record Drawings.
- .4 Prepare diagrams of interconnecting wiring between items of equipment including equipment supplied by the Agency and under other Specification Sections.

1.18 SINGLE LINE DIAGRAM

- .1 Reproduce this diagram in drawing form under glazed frame and mount in Electrical Room and provide copies of these diagrams to the Consultant and include in the close-out documents of the Project.

1.19 TEST REPORTS

- .1 For each check and test performed prepare and submit a Test Report, signed by the Test engineer, and where witnessed, by the Consultant.
- .2 Include record of all tests performed, methods of calculation, date and time of test, ambient conditions, names of testing company, test engineer, witnesses, also calibration record of all test instruments used together with manufacturers name, serial number and model number.
- .3 Include calibration record, percentage error and applicable correction factors.
- .4 Submit a Certified Test Report from each manufacturer, signed by the certifying inspector, confirming correct installation and operation of each product and part of Work. Include name of certifying inspector, date and times of inspection, ambient conditions.

1.20 FACTORY WITNESS TESTS

- .1 Prior to Consultant attendance at factory for witness testing, perform the following:
 - .1 Successfully conduct test to be witnessed.
 - .2 Following successful testing, inform the Consultant, in writing, that tests to be witnessed have been successfully performed.

1.21 OPERATING AND MAINTENANCE MANUALS

- .1 Provide Operating and Maintenance Manuals as per the requirements of Section 01 77 00 – Closeout Procedures.
- .2 Requirements for Manuals:
 - .1 Binders shall be identified on the binding edges as “Maintenance Instructions and Data Book”, for “Erin Mills Twin Arena Ice Rink Replacement”.
 - .2 Terminology used in all the Sections shall be consistent.
 - .3 Include the master index of all systems, the name of the Contractor, Electrical subcontractors and the date of Substantial Performance for the Contract.
 - .4 Include all necessary warranty information.
 - .5 Each binder shall have a complete index for all volumes.
 - .6 Each binder shall be no more than half filled.
 - .7 There shall be a separate section for all materials used on the project which fall under the WHMIS legislation. There shall be a hazard data sheet for each of the materials.
 - .8 There shall be a separate section for all Insurance Certificates, Test Certificates, Verification Forms and Test Forms.
 - .9 All relevant information relating to a system or product shall be contained within one binder.
 - .10 The manual sections shall follow the Specification Sections.

- .11 Any diagrams, installation drawings, single line diagrams charts, etc. shall be mechanically reduced while maintaining full legibility to standard page size. If this cannot be achieved they shall be carefully folded and contained within a clear plastic wallet within the manual.
- .3 Data for Manuals:
 - .1 Equipment data shall contain:
 - .1 Operating instructions;
 - .2 Operating conditions such as temperature and pressure;
 - .3 Location of equipment;
 - .4 Maintenance instructions and schedules for one (1) year routine;
 - .5 Recommended list of spare parts;
 - .6 Maintenance schedule;
 - .7 Troubleshooting table showing where to look for problems under various conditions of malfunction;
 - .8 All wiring diagrams;
 - .9 Equipment operating curves;
 - .10 Equipment nameplate data and serial numbers.
 - .2 System data shall contain:
 - .1 Listing of all systems;
 - .2 All panel schedules and locations;
 - .3 Equipment name tags;
 - .4 Cleaning, maintaining and preserving instructions for all material, products and surfaces. Include warnings of harmful cleaning, maintaining and preserving practices.
 - .3 Other manuals are required for:
 - .1 Power distribution systems;
 - .2 Lighting systems;
 - .3 Emergency power systems;
 - .4 As-Built documentation shall contain:
 - .1 Reviewed As-Built shop drawings;
 - .2 As-Built construction drawings;
 - .3 Originals of test forms;
 - .4 Originals of test certificates.

1.22 PLYWOOD BACKBOARDS AND HOUSEKEEPING PADS

- .1 Provide 19 mm thick fire-retardant treated plywood backboards for mounting all electrical, security, communication and other equipment which are wall mounted. The plywood to be primed and painted. Electrical equipment boxes shall include, but not be limited to electrical panels, LV lighting control, security and communication. Panels are to be grouped on common base wherever practical.
- .2 Provide steel re-enforced concrete housekeeping pads under all floor mounted electrical equipment and where noted on the Contract Drawings. All housekeeping pads to be a

minimum of 100 mm high above finished floor and shall not extend beyond 50 mm beyond the electrical equipment unless shown otherwise on the Contract Drawings.

1.23 FIRESTOPPING

- .1 Firestopping and smoke seal systems shall be in accordance with CAN4 S115 M85.
 - .1 Asbestos free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4 S115 M85 and not to exceed opening sizes for which they are intended.
 - .2 Fire stop system rating for service penetrations to suit Ontario Building Code 1997, 3.1.9.1 Firestopping of Service Penetrations.
 - .3 Firestop system rating for sealing junction of rated walls to rated floors and ceilings to suit Ontario Building Code.
- .2 Service penetration assemblies: Certified by ULC in accordance with CAN4 S115 M85 and listed in ULC Guide No.40 U19.
- .3 Service penetration firestop components: Certified by ULC in accordance with CAN4 S115 M85 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.
- .4 Fire resistance rating of installed fire stopping assembly not less than the fire resistance rating of surrounding floor and wall assembly, and in accordance with Ontario Building Code.
- .5 Firestopping and smoke seals at openings intended for ease of re-entry such as cables. Do not use cementitious or rigid seal at such locations.
- .6 Firestopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: Elastomeric seal. Do not use a cementitious or rigid seal at such locations.
- .7 Primers: Shall meet manufacturer's recommendation for specific material, substrate and end use.
- .8 Water (if applicable): Potable, clean and free from injurious amounts of deleterious substances.
- .9 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.
- .10 Sealants for Vertical Joints: Non-sagging.
- .11 Colour: If range available to Consultant's choice of standard colours, generally to match background colour where visible in finished spaces.
- .12 Through non-fire or non-smoke separations or where waterproof membrane is field applied, where pipes are insulated, sleeves shall be sized to accommodate the insulation and vapour barrier.
- .13 Where holes are core drilled in existing structures, sleeves shall be provided as specified complete with fire stopping as noted above.
- .14 Submit a complete firestopping system shop drawing package, identifying the products that may be used on the project. Prior to submitting data, review with authority having jurisdiction to confirm acceptability of proposed materials and assemblies.

- .15 Installation:
 - .1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
 - .2 Seal holes or voids made by through penetrations, poke through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
 - .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
 - .4 Tool or trowel exposed surfaces to a neat finish.
 - .5 Remove excess compound promptly as work progresses and upon completion.

1.24 MISCELLANEOUS METAL FABRICATIONS

- .1 Conduit and equipment provided under this Division shall be complete with all necessary supports and hangers required for a safe and workmanlike installation.
- .2 Provide "U" type support strut as manufactures by Unistrut.
- .3 It shall be the responsibility of Divisions 3, 5, 7 and 15 of this Specification to supply Contractor with anchor bolts and base diagrams of equipment showing exact location of anchor bolts.
- .4 All drilling for hangers, rod inserts and work of similar nature shall be done by this Division.
- .5 Auxiliary structural members shall be provided under the Section concerned where conduits or equipment must be suspended between the joists or beams of the structure, or where required to replace individual hanger to allow for installation on new services. Submit details for review as requested by the Consultant.
- .6 Depending on type of structure, hangers shall be either clamped to steel beams or joists, or attached to approved concrete inserts.
- .7 Approved type expansion shields and bolts may be used for conduit up to 100 mm diameter where the pre-setting of concrete inserts is not practical. Submit shop drawings as per Section 01 33 00 – Submittal Procedures.
- .8 Suspension from metal deck shall not be allowed unless specifically accepted by the Consultant. Drawings of the proposed method of suspension must be submitted for review as per Section 01 33 00 – Submittal Procedures.
- .9 Hangers, hanger rods and inserts in all parking and ramp areas shall meet the requirements of CAN/CSA-S413-07 and shall be of corrosion-resistant material or have an effective, durable corrosion resistant coating. Submit samples for approval as per Section 01 33 00 – Submittal Procedures.
- .10 Suspending one hanger from another shall not be permitted.
- .11 All hangers, supports, brackets and other devices used outside the building wall shall be galvanized. If galvanized components cannot be used submit samples of proposed substituted for review before installation.

1.25 SLEEVE AND FORMED OPENING LOCATION DRAWINGS

- .1 Sleeves passing through stud partitions shall be 0.75 mm (22 USG) steel.

- .2 Sleeves passing through masonry walls shall be Schedule-40 steel pipe.
- .3 Sleeves passing through floors in finished areas and concealed spaces may be sheet metal or factory fabricated reusable type.
- .4 Sleeves passing through floors in electrical rooms, mechanical rooms, garages or other similar rooms in all areas except slab on grade, shall extend 50 mm above the housekeeping pad and shall be Schedule-40 steel pipe.
- .5 Where a housekeeping pad cannot be installed, sleeves passing through floors with waterproof membrane shall have a flashing collar, 50 mm wide at the membrane level. Flashing collar shall be continuously welded to sleeve. Sleeves shall extend 50 mm above the finished floor and shall be Schedule-40 steel pipe.
- .6 Provide adequate bracing for support of sleeves during concrete and masonry work.
- .7 Where conduits pass through exterior foundation walls 6.00 mm. thick steel sleeve of inside diameter not less the 75 mm greater than the outside diameter of the pipe shall be used and shall be complete with anchor collar. Thunderline Link-Seal wall seal as distributed by Corrosion Service Co. Ltd. shall be used for the annular space between the sleeve and the conduit. A reinforced concrete bridge shall be installed between the wall and the adjacent undisturbed soil.
- .8 Arrange for all chases and formed openings in walls and floors as required by Division 16 for the electrical services. These chases and openings shall not be larger than necessary to accommodate the equipment and services. Advise on these requirements well in advance, before the concrete is poured and the walls are built. All necessary sleeves and inserts shall be supplied by this Division.
- .9 Chases and openings not located in accordance with the above provisions shall be made at the expense of this Division. Cutting of structural members shall not be permitted without specified written acceptance of the Consultant.
- .10 Provide sleeves for all service penetrations through walls, partitions, floor slabs, plenums and similar barriers. At non-rated barriers fill the annular space between the service and the sleeve with fire rated insulation as specified for rated separations and caulk around the edges with a minimum 12 mm thick of fire-rated compound or acoustic non-setting mastic.
- .11 Through all fire or smoke separations, after testing, the annular space between conduit sleeves shall be fire-stopped.
- .12 Where holes are to be installed in existing structure, Contractor is to core drill the holes required. Contractor is required to scan all areas prior to coring and confirm layout with Consultant prior to completing work. When installing sleeves in existing structures, sleeves shall be provided as specified complete with a combination puddle/anchor flange bolted to the floor. Seal watertight between the flange and the floor.
- .13 All sleeves are to extend 100 mm above finished floor to accommodate a 100 mm concrete pad. Contractor to pour the concrete pad with the pad extending 100 mm on all sides of the sleeve.

1.26 SUPERINTENDENCE

- .1 Maintain at the job site, at all times, qualified personnel and supporting staff, with proven experience in erecting, supervising, testing and adjusting projects of comparable nature and complexity.

- .2 The supervising personnel and their qualifications are subject to the approval of the Consultant.

1.27 PATENTS

- .1 Pay all royalties and licence fees, and defend all suits or claims for infringement of any patent right, and save the Agency and Consultant harmless of loss or annoyance on account of suit, or claims of any kind for violation of infringement of any letters, patent or patent rights, by this Subcontractor or anyone directly or indirectly employed by him or by reason of the use by him or them of any part, machine, manufacture or composition of matter on the work, in violation or infringement or such letters, patent or rights.

1.28 RIGHTS RESERVED

- .1 Rights are reserved to furnish any additional detail drawings, which in the judgment of the Consultant may be necessary to clarify the work and such drawings shall form a part of this contract.

1.29 HOISTING

- .1 This Division will be responsible for the hoisting of all the equipment in the Contract. Contractor shall coordinate for use of the general hoisting facilities. If hoist facilities are inadequate then subcontractors must provide their own to be included in the Work.
- .2 Electrical Contractor to include for the qualified millwrights to move and place all equipment over 455 kg (1000 lbs). Contractor to provide proof of millwright certification.

1.30 FLASHING

- .1 Provide sleeves passing through outside walls with lead or copper flashing as directed.
- .2 Refer to mechanical specification for additional information.

1.31 WORKMANSHIP

- .1 Install equipment, ductwork, conduit and cables in a workmanlike manner to best suit space, to present a neat appearance and to function properly to the satisfaction of the Consultant.
- .2 Install equipment and apparatus requiring maintenance, adjustment or eventual replacement with due allowance therefore.
- .3 Include in the work all requirements of manufacturers shown on the shop drawings or manufacturers installation instruction.
- .4 Replace work unsatisfactory to the Consultant without extra cost.
- .5 Make provision to accommodate future plant and equipment indicated on drawings.
- .6 Protect from damage all equipment delivered to the site and during installation. Any damage or marking of finished surfaces shall be made good to the satisfaction of the Consultant.

1.32 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 indicated verify before proceeding with installation.
- .3 Install electrical equipment at the following heights unless indicated otherwise.
 - .1 Local Switches: 1,050 mm
 - .2 Wall Receptacles:
 - .1 General: 450 mm
 - .2 Above top of continuous baseboard heater: 200 mm
 - .3 Above top of counters, back splash or desks: 175 mm
 - .4 In Mechanical room: 1,200 mm
 - .3 Panel boards:
 - .1 2,000 mm to top of panel or as required by Code.

1.33 THE AGENCY'S RIGHT TO RELOCATE ELECTRICAL ITEMS

- .1 The Agency reserves the right to relocate electrical items (light fixtures, battery pack, panel boards, disconnect switches, motor starters, etc.) during construction, but prior to installation, without cost, assuming that the relocation per item does not exceed 3.0 m from the original location. No credits shall be anticipated where relocation per item of, to maximum and including 3 metres reduces materials, products and labour.
- .2 Should relocations per item exceed 3.0 m from the original location the Contract Price will be adjusted accordingly.
- .3 Necessary changes, due to lack of coordination, and as required and when approved, shall be made at no additional cost, to accommodate structural and building conditions. The location of pipes and other equipment shall be altered without charge to the Agency, if approved, provided the change is made before installation.

1.34 SPRINKLERS

- .1 Where the area is sprinklered and electrical distribution equipment is located in sprinklered areas, enclosures shall be louvered and gasketed and provided with water-tight roof assemblies with overhanging drip shields. The equipment shall be fabricated by the manufacturer in such a way as to prevent sprinkler fluid from entering the equipment and interfering with its operation as per the requirements of C.S.A. C22.1 Rule 26-006.
- .2 Weatherproof equipment where noted in the specifications and or drawings shall have EEMAC 4X enclosures in accordance with the requirements of C.S.A. C22.2 Number 94 Standard.

1.35 TRIAL USAGE

- .1 The Consultant reserves the right to use any system, piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same, or for the purpose of learning operational procedures, before the final completion and acceptance of the work. Such tests shall not be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the above due to the aforementioned tests, where such injuries or breakage are caused by a

weakness or inaccuracy of parts, or by defective materials or workmanship of any kind.
Supply all labour and equipment required for such tests.

- .2 Perform and pay for all costs associated with any testing required on the system components where, in the opinion of the Consultant the equipment manufacturer's ratings or specified performance is not being achieved.

1.36 INSTRUCTION TO THE AGENCY

- .1 Instruct the Agency's designated representatives in all aspects of the operation and maintenance of all systems and equipment.
- .2 Arrange for, and pay for services of service engineers and other manufacturer's representatives required for instruction in the operation of systems and equipment.
- .3 Submit to the Consultant at the time of final inspection a complete list of systems stating for each system:
 - .1 Date instruction were given to the Agency's staff;
 - .2 Duration of instruction;
 - .3 Name of persons instructed;
 - .4 Other parties present (manufacturer's representative, consultants).
- .4 Obtain the signature of the Agency's staff verifying that they properly understood the system installation, operation and maintenance requirements, and that they have received the specified manuals and "As-Built" drawings.

1.37 SYSTEM ACCEPTANCE

- .1 Submit original copies of letters from the manufacturers of all systems indicating that their technical representatives have inspected and tested the respective systems and are satisfied with the method of installation, connection and operation.
- .2 These letters shall state the names of persons present at testing, the methods used, and a list of functions performed with location and room numbers where applicable.

1.38 CLEANING

- .1 Before energizing any systems, inspect and clean the inside of panel boards, switchgear, and cabinets to ensure that they are completely free from dust and debris.
- .2 Clean all polished, painted and plated work bright. Clean all lighting fixtures.
- .3 Remove all debris, surplus material and all tools
- .4 Carry out additional cleaning operating of systems as specified in other Sections of this Division.
- .5 Contractor to clean all electrical equipment, inside and out, prior to turn over to the Agency. Equipment is subject to inspection by the Consultant and/or Agency.
- .6 Contractor is responsible to remove own waste from the site. All re-usable materials shall be recycled.

1.39 PAINTING/FINISHES

- .1 Touch up minor chips or damage to electrical equipment, installed in this Division, with standard, factory supplied, enamel finish.

- .2 Colour code, as specified herein, outlet boxes, pull boxes, junction boxes by applying a small dab of paint to inside and outside of each item during installation.
- .3 Colour code, as specified herein, all exposed ducts, conduits, outlet boxes, and similar items by applying a 25 mm wide band of paint around ducts and conduits adjacent to boxes described in above paragraph and on both sides of wall penetration.
- .4 Use following paint colour-code:
 - .1 Red: Fire Detection and Alarm System; Emergency Alarm System (panic, intrusion)
 - .2 Yellow: Emergency Power System
 - .3 Black: Normal Power
- .5 Provide priming and finish painting of exposed unfinished raceways, fitting, outlet boxes, junction boxes, pull boxes and similar items.
- .6 Metal enclosure surfaces are to be finished by the application of rust resistant primer on both the inside and outside, with at least two coats of enamel.
- .7 Clean and touch up all surfaces of equipment scratched or marred during shipment or installation. Match the original paint.
- .8 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.40 SAFETY

- .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 the installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of an electrician.

1.41 CUTTING AND PATCHING

- .1 Include for all cutting and patching for all electrical services.
- .2 All services and materials used for the cutting and patching shall be carried out by experienced workers.
- .3 Cut all openings no longer than is required for the services. Core drill for individual services.
- .4 Obtain approvals from the Consultant before cutting or core drilling any openings or holes.
- .5 Patch all openings after services have been installed to match the surrounding finishes.
- .6 In existing areas all cutting, except for core drilling for individual services or where specifically noted, is part of this Division work.

1.42 TEMPORARY LIGHT FOR CONSTRUCTION

- .1 All temporary light to be fluorescent. Provide adequate lighting to meet all Health and Safety Standards on construction site.

1.43 IDENTIFICATION

- .1 Identify electrical equipment with nameplates as follow:
 - .1 Lamacoid 3.0 mm thick plastic engraved sheet, black or red face, white core, mechanically attached with self-tapping screws.
 - .2 White letters 20 mm high for major switchboards, panel boards and power transformers.
 - .3 White letters 12 mm high for terminal boxes, junction boxes, grid boxes, splitter boxes, disconnect switches starters and contactors.
 - .4 Allow for an average of twenty-five (25) letters per nameplate.
 - .5 Identification to be in English.
 - .6 Black nameplates for normal power.
- .2 Identify electrical equipment with labels as follow:
 - .1 Embossed plastic labels with 6.0 mm high letters unless specified otherwise, for internal components, such as relays, fuses, terminal blocks.
 - .2 Wording on nameplates to be approved by the Consultant prior to manufacture.
 - .3 Identification to be in English.
 - .4 Nameplates for terminal cabinets, grid boxes pull boxes, and junction boxes are to indicate the system and/or voltage characteristics.
 - .5 Disconnects, Starters and Contactors: Indicate equipment being controlled and voltage.
 - .6 Transformers: Indicate capacity, primary and secondary voltages.
- .3 Identification to be permanently fastened to the respective equipment with rivets.
- .4 Wiring Identification:
 - .1 Identify wiring with permanent legible 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 C22.1-1998.
 - .4 Use colour coded wires in communication cables and control wiring, matched throughout system.
- .5 Conduit and Cable Identification:
 - .1 Colour code conduits, boxes and metallic sheathed cables.
 - .2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling or floor, and at 15 m intervals.
 - .3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.
- .6 Receptacle Identification:
 - .1 All receptacles are to be labelled with the respective circuit numbers with a printed label, similar to a Brady label, with 12 mm characters. Circuit number to include full circuit number including panel board identification.

- .2 Label to be placed on wall above cover plate or on cover plate. Location of label to be consistent throughout the Project.
- .3 Roof top receptacle shall be in weatherproof enclosure with cover.
- .7 Wiring Terminations: Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.
- .8 Fuse Size Labelling:
 - .1 Contractor to install a label on all equipment with fuses to identify the fuse sizes that are installed in the respective equipment.
 - .2 Contractor to also install a label on all equipment with fuses to identify the maximum allowable fuse size based on the size of respective feeders.
- .9 Warning Signs: Provide warning signs, as required to meet the requirement of the inspection.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 NOT USED

End of Section

PART 1 **GENERAL**

1.1 **GENERAL REQUIREMENTS**

- .1 Conform to all applicable Sections of Division 1.

1.2 **REFERENCES**

- .1 CSA C22.2 No.0.3-92, Test Methods for Electrical Wires and Cables
- .2 CSA C22.2 No.38-05, Thermoset-Insulated Wires and Cables
- .3 CSA C22.2 No.75-03, Thermoplastic-Insulated Wires and Cables
- .4 CSA-C22.2 No.51-95, Armoured Cables
- .5 ASTM B800 - Standard Specification for 8000 Series Aluminium Alloy Wire for Electrical Purposes – Annealed and Intermediate Tempers
- .6 CSA 2.2.1 – Canadian Electrical Code - Part 1
- .7 CAN/CSA C22.2 No.18 – Outlet Boxes, Conduit Boxes, and Fittings
- .8 CSA C22.2 No.45 – Rigid Metal Conduit
- .9 CSA C22.2 No.56 – Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit
- .10 CSA C22.2 No.83 – Electrical Metallic Tubing
- .11 CSA C22.2 No.211.2 – Rigid PVC (Unplasticized) Conduit
- .12 CAN/CSA C22.2 No.227.3 – Flexible Non-Metallic Tubing
- .13 CSA C22.2 No.227.1 – Electrical Non-Metallic Tubing
- .14 ANSI/NFPA 70 – National Electrical Code
- .15 CSA-C22.1 – Canadian Electrical Code
- .16 ASTM B 633 – Specification for Electrodeposited Coatings of Zinc on Iron and Steel
- .17 ASTM A 653 – Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot Dip Process
- .18 ASTM A 123 – Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel
- .19 ASTM A 510 – Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel
- .20 ASTM A 641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
- .21 ASTM A 580 – Standard Specification for Stainless Steel Wire
- .22 ASTM D 769 – Standard Specification for Black Oxide Coatings

1.3 **SHOP DRAWINGS**

- .1 Unless otherwise noted, shop drawings need not be submitted for standard manufactured items and materials provided they are as specified.

1.4 SUBMITTALS

- .1 Submit the following to the Consultant for review:
- .2 A sample of each proposed type of access door, as well as a Sepia print and three blue line prints of reflected ceiling plan drawings showing proposed ceiling access door locations.
- .3 Location drawings for all required sleeves and formed openings in poured concrete construction.
- .4 Location drawings for all required openings. These locations must be reviewed and accepted by the Consultant prior to the Contractor drilling or core drilling.
- .5 A sample of Lamacoid nameplates and list of proposed nameplate legends.
- .6 Samples of wiring devices and cover plates.
- .7 Submittals to also meet the requirements of Section 013300 – Submittal Procedures.

1.1 Quality Assurance

- .8 All components shall be CSA or ULC approved listed and labelled.

PART 2 PRODUCTS

2.1 CONDUITS AND RACEWAYS

- .1 Conduits and Fittings:
 - .1 Rigid Galvanized Steel Conduit:
 - .1 CAN/CSA C22.2 Number 45-M.
 - .2 Rigid thickwall galvanized steel threaded conduit.
 - .2 Coated Steel Conduit:
 - .1 Corrosive resistant coated rigid thickwall steel threaded conduit, CSA approved.
 - .2 Acceptable Manufacturers:
 - .1 Rob Roy Plastibond PVC coated.
 - .2 Columbex Green Guard II epoxy polyester coated.
 - .3 EMT:
 - .1 CSA C22.2 Number 83-M.
 - .2 EMT galvanized cold rolled steel tubing.
 - .4 Liquid Tight Flexible Steel Conduit Fittings:
 - .1 CSA 22.2 Number 56.
 - .2 Liquid-tight flexible steel conduit with PVC cover.
 - .3 Watertight connectors with nylon insulated throat.
 - .5 Rigid PVC Conduit:
 - .1 CSA C22.2 Number 211.2-M.
 - .2 Rigid PVC conduit.
 - .6 Non-Metallic Flexible Conduit: Non-metallic extra flexible PVC conduit.
 - .7 Rigid Steel Conduit Fittings:

- .1 CAN/CSA C22.2 Number 18.
- .2 Galvanized or polymer coated cast steel fittings.
- .3 Expansion fittings, watertight with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .4 Sealing condulets for hazardous areas.
- .5 Corrosive resistant coated cast steel fittings for corrosive resistant conduit.
- .8 Rigid PVC Conduit Fittings:
 - .1 CSA C22.2 Number 85-M.
 - .2 Rigid PVC fittings of same manufacture as rigid PVC conduit.
- .9 Liquid Tight Flexible Steel Conduit Fittings: Watertight connectors with nylon insulated throat.
- .10 EMT Fittings:
 - .1 Compression type, steel.
 - .2 Gland compression connectors with insulated throats.
 - .3 Compression couplings.
- .11 Set Screw Type:
 - .1 Steel, concrete-tight:
 - .2 Connectors with insulated throats
 - .3 Couplings
- .12 Minimum size conduit will be 21 mm diameter.
- .13 All conduit shall contain a ground conductor.
- .14 All conduit must have adequate support systems complete with approved fittings, outlet boxes, junction boxes, sealing fittings and drains as indicated or as required. Provide hot dipped galvanized steel beam clamps, hot dipped galvanized steel channel type supports where required. Provide 6.00 mm threaded galvanized steel rods to support suspended channels and provide all necessary galvanized steel spring loaded bolts, nuts, washers and lock washers. Support systems shall be Thomas and Betts Superstrut or approved equal.
- .15 Provide all conduit, fittings and ducts necessary to complete the distribution of all power, lighting and control conductors to electrical equipment specified under the corresponding Section. Include that necessary for connecting to mechanical heating and ventilating equipment, also equipment specified under other Divisions.
- .16 Fasten conduit with malleable PVC coated galvanized steel two-hole straps at intervals to suit code requirements and job conditions.

2.2 FASTENINGS, SUPPORTS AND SLEEVES

- .1 Galvanized steel, size and load rating to suit application.
- .2 One hole steel straps to secure surface mounted conduits or surface mounted cables 50 mm diameter and smaller. Two hole steel straps for conduits and cables larger than 50 mm.
- .3 Beam clamps to secure conduits to exposed steel work.
- .4 Channel type supports for two or more conduits.

- .5 6.00 mm minimum diameter threaded rods to support suspended channels.
- .6 6.00 mm minimum diameter U-bolts.
- .7 Sleeves: Schedule-40 steel pipe minimum I.D. 13 mm larger than O.D. of conduit or cable passing through.
- .8 Acceptable Manufacturers: Burndy, Electrovert and Unistrut.

2.3 JUNCTION BOXES

- .1 Code gauge (galvanized) sheet steel EEMAC Type-1 size as required by code for number and size of conduits, conductors and devices, complete with covers, corrosion resistant screws, terminals and mounting channels.
- .2 Screw-on sheet steel covers to match enclosure for surface mounting boxes.
- .3 Covers with 25 mm minimum extension around for flush-mounted junction boxes.

2.4 CONDUIT BOXES – GENERAL

- .1 Size boxes in accordance with latest edition of Electrical Safety Authority (ESA) Electrical Safety Code.
- .2 Code gauge, galvanized pressed steel for EMT.
- .3 Galvanized cast or pressed steel, for rigid thick-wall threaded conduit.
- .4 Corrosive resistant coated: Cast boxes for corrosive resistant coated rigid steel conduit with same finish as conduit.
- .5 200 mm square or larger outlet boxes as required for special devices.
- .6 Gang boxes where wiring devices are grouped except in classified hazardous areas.
- .7 Blank cover plates for boxes without wiring devices.
- .8 50 mm × 100 mm outlet boxes for devices, ganged for grouped devices, barriers where required by code.
- .9 Rigid PVC boxes for rigid PVC conduit.

2.5 SPLITTER BOXES

- .1 Code gauge (galvanized) sheet steel enclosure EEMAC Type-12 welded corners and formed hinged cover suitable for locking in closed position.
- .2 Copper or aluminum main and branch lugs to match required size, type and number of incoming and outgoing conductors.
- .3 At least three spare terminals on each set of lugs in splitters less than 400A.

2.6 PULL BOXES

- .1 Code gauge galvanized sheet steel welded construction, EEMAC Type-1.
- .2 Screw-on galvanized sheet steel covers for surface mounting boxes.
- .3 Covers with 25 mm minimum extension around, for flush mounted pull boxes.

2.7 OUTLET BOXES – SHEET STEEL

- .1 Pressed steel single and multi-gang flush device boxes for flush installation, minimum size 100 mm × 50 mm × 38 mm. 100 mm square outlet boxes where more than one conduit enters one side, with extension rings as required.
- .2 100 mm square or octagonal outlet boxes for lighting fixture outlets.
- .3 119 mm square outlet boxes with extension and plaster rings as necessary for flush mounting devices in gypsum board, plaster or panelled walls.

2.8 MASONRY BOXES

- .1 Pressed steel masonry single and multi-gang boxes for devices flush mounted in exposed masonry walls.

2.9 CONCRETE BOXES

- .1 Pressed steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.10 RIGID CONDUIT BOXES

- .1 Zinc electroplate and polymer enamelled cast, single cast-iron, ferroalloy shallow (FS) boxes with factory-threaded hubs and mounting feet for surface mounted switches and receptacles, with gasketed cover plate for exterior work and wet areas.

2.11 OUTLET BOXES – FITTINGS

- .1 Bushings and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of foreign materials.
- .3 Conduit outlet bodies for conduit to maximum 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings for sheet steel metal boxes.

2.12 BRANCH CIRCUIT CONDUCTORS

- .1 Conductors:
 - .1 ASTM Class-B, soft drawn, electrolytic copper.
 - .2 Stranded.
- .2 Insulation:
 - .1 CSA Type RW90 XLPE (-40°C):
 - .1 Heat and moisture resistant.
 - .2 Low temperature, chemically cross-linked thermosetting polyethylene material.
 - .3 600V rated.
 - .4 For maximum 90°C conductor temperature.
 - .5 For installation at minimum -40°C temperature.
 - .6 CSA C22.2 Number 38.
 - .2 CSA Type RWU90 XLPE (-40°C):
 - .1 Heat and moisture resistant.

- .2 Low temperature, chemically cross-linked thermosetting polyethylene material.
- .3 1000V rated.
- .4 For maximum 90°C conductor temperature.
- .5 For installation at minimum -40°C.
- .6 CSA C22.2 Number 38.
- .3 CSA Type T90 NYLON (-10°C):
 - .1 Heat resistant.
 - .2 Flame retardant.
 - .3 Thermoplastic PVC material with extruded nylon cover.
 - .4 600V rated.
 - .5 For maximum 90°C conductor temperature dry and 75°C in wet locations.
 - .6 For installation at minimum -10°C.
 - .7 SA C22.2 Number 75-M.
- .3 Branch circuit conductors to maximum and including number 3.31 mm² (12AWG) shall be solid. Branch circuit conductors in sizes larger than number 3.31 mm² (12AWG) shall be stranded. All branch circuit conductors shall be constructed of 90 per cent conductive copper, unless otherwise noted, and shall be approved for 600V.
- .4 Electric service, distribution and special conductors are specified in this Section or on the Contract Drawings.
- .5 Aluminum conductors will be used for some services on this Project as shown on drawings.

2.13 WIRE AND CABLE CONNECTORS

- .1 Copper compression type wire and cable terminations for number 3.31 mm² (12AWG) and larger conductors, colour keyed, sized to suit. Long barrel NEMA two-hole lugs for sizes number 53.48 mm² (1/0 AWG) and larger.
 - .1 Acceptable Manufacturers: Thomas and Betts series 54000, Ideal Powr-Connect, Burndy Hylug.
- .2 Twist type splicing connectors shall not be used on this Project.
- .3 Conductor compression splice for number 5.26 mm² (10AWG) or smaller.
 - .1 Acceptable Manufacturers: Thomas and Betts STA-Kon series, Ideal Splices, Burndy.

2.14 HEAT SHRINKABLE TUBING INSULATION, HEAVY WALL

- .1 Acceptable Manufacturers: Thomas and Betts, Shrink-Kon series, Ideal Thermo-Shrink, TS-46, Raychem tubing WCSM, 3M cable sleeve ITCSN.

2.15 RECEPTACLES FOR GENERAL SERVICE

- .1 Receptacles: Specification grade heavy duty industrial series suitable for back and side wiring, black colour complete with grounding terminal, colour as required for type of area for straight blade devices and black colour for twist lock devices.

- .2 Receptacles by one manufacturer on this Project.
- .3 Roof top receptacle shall be 20A-1P in weatherproof enclosure with cover
- .4 Acceptable Manufacturers:
 - .1 15A, 125V, (5-15R) Duplex Straight Blade:
 - .1 Hubbell 5262, or approved equal.
 - .2 15A, 125V, (5-20R) Duplex GFCI, Straight Blade:
 - .1 Hubbell GF-5252, or approved equal.

2.16 WIRING DEVICES – COVER PLATES

- .1 Stainless steel Type 302 alloy, vertically brushed, 0.8 mm thick cover plates.
- .2 Nylon, smooth, high impact strength.
- .3 Pressed steel, galvanized.
- .4 Cast covers for cast boxes with gaskets.
- .5 Cover plates of same manufacture as devices.
- .6 Weather proof cover for wet location.
- .7 Submit samples of each device and cover plate to the Consultant for approval. All devices must be approved prior to installation.

2.17 ESCUTCHEON PLATES

- .1 One-piece chrome plated steel sized to completely cover sleeves and complete with set screws to secure the plates to the conduit. Split plates will not be acceptable.

2.18 INSERTS, BEAM CLAMPS FASTENERS, EQUIPMENT HANGERS AND SUPPORTS

- .1 Inserts for concrete formwork shall be Crane Canada type, number 4-M Unistrut, or approved equal cast iron inserts, multiple type where required.
- .2 Beam clamps for hanging and support to structural steel shall be Crane Canada or equal.

2.19 DUCT DETECTORS

- .1 General: comply with ULC S524. Include the following features:
 - .1 Factory Nameplate: serial number and type identification
 - .2 Operating Voltage: 24 V dc, nominal
 - .3 Self-Restoring: detectors do not require resetting or readjustment after actuation to restore them to normal operation
 - .4 Remote Controllability: individually monitor detectors at the FACP for calibration, sensitivity, and alarm condition, and individually adjust for sensitivity from the FACP.
- .2 Addressable, plug-in, two-wire, multi-sensor or application specific (with the application set for DUCT) detector with both photoelectric and thermal inputs. Each detector shall consist of a dust resistant, field cleanable photo chamber, a solid state non-mechanical thermal sensor, microprocessor-based electronics with a low-profile plastic cover and base. The detector shall utilize surface mount technology for maximum reliability. Every

detector shall be shipped with a protective dust cover to protect against dust during construction.

- .1 The detector shall mount in a duct detector housing, which shall be designed for detection of combustion products and/or smoke in air conditioning and ventilation system ducts. The assembly shall consist of a housing to accommodate sampling tubes that extend into and across the duct of the ventilation system. Provisions shall be made for local or remote indicator lamp and/or auxiliary relay.
- .2 Provide for variations in duct air velocity between 100 and 4,000 feet per minute and include a wide sensitivity range of .79 to 2.46%/ft. Obscuration. Include one Form-C shut down relay rated 2.0 amps @ 30 Vdc and also include slave high contact relays if required. Provide an air exhaust tube and an air sampling inlet tube that extends into the duct air stream up to ten feet. The addressable DUCT housing shall be suitable for extreme environments, including a temperature range of -20 to 158 degrees F (-29 to 70 degrees Celsius) and offer a harsh environment gasket option. Provide remote alarm LED indicators.

PART 3 EXECUTION

3.1 GENERAL CONDUIT AND CONDUCTOR INSTALLATION REQUIREMENTS

- .1 Install conduit and conductors concealed in all finished areas (no exceptions), and concealed to the degree made possible by finishes in partially finished and unfinished areas. All conduits must be concealed in walls (no exceptions) in all areas; conduit may be exposed where run on unfinished ceilings (unless concealment is possible). Refer to and examine the Contract Drawings and room finish schedules to determine finished, partially finished and unfinished areas of the building.
- .2 Where conduits are exposed, arrange same to avoid interference with other work and parallel to the building lines, horizontal conduits can only be exposed where run on exposed ceilings and shall be installed as high as possible. Do not install conduit or conductors within 150 mm of flue or heating pipes or equipment.
- .3 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .4 All conduits must be concealed no exceptions. Conduits to have own support system and are to be supported independently of the ceiling grid or ceiling support system.
- .5 Where vertically run conduit passes through a slab, Contractor to provide a 100 mm high concrete pad with the pad extending 100 mm on all sides of the conduit.
- .6 Use epoxy coated conduit in corrosive areas.
- .7 Use rigid galvanized steel threaded conduit where conduit is subject to mechanical injury.
- .8 Use rigid PVC conduit underground.
- .9 Use flexible metal conduit for connection to motors in dry areas, connection to recessed fixtures without a prewired outlet box, connection to surface or recessed fixtures and work in movable metal partitions.
- .10 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations. Use only liquid tight fittings when using liquid tight

- flexible metal conduit. Liquid tight flexible metal conduit to have a jacket with an FT-6 rating when used in plenums, otherwise provide an FT-4 rating inside the conduit.
- .11 Use explosion proof flexible connection for connection to explosion proof motors.
 - .12 Install conduit sealing fittings in hazardous areas. Fill with compound.
 - .13 Minimum conduit size for lighting and power circuits: 27 mm.
 - .14 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
 - .15 Mechanically bend steel conduit over 21 mm diameter.
 - .16 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
 - .17 Install fish cord in empty conduits.
 - .18 Run 2-NPS 1 spare conduits up to ceiling space from each flush panel. Terminate these conduits in 152 mm × 152 mm × 102 mm junction boxes or in case of an exposed concrete slab, terminate each conduit in flush concrete or surface type box.
 - .19 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
 - .20 Dry conduits out before installing wire.
 - .21 All cutting and patching of masonry/concrete floors, walls, and roof for electrical services shall be by this Division. Obtain approval from the Consultant/Agency before cutting any structural walls or floors. Cutting and drilling shall only be at times allowed by the Consultant/Agency. Check and verify the location of mechanical and electrical services in walls and below the floor slab in all areas requiring core drilling and cutting. Protect all areas where core drilling occurs. Carefully chip top and bottom of slab to expose rebars to minimize cutting of rebars when core drilling. Provide x-ray study before drilling or cutting where required by the Consultant/Agency.
 - .22 Provide sleeves for all conduit passing through floor and roof slabs, beams, concrete walls and slab to slab partitions, etc.
 - .23 Where cables and conduits pass through partitions and through floors that are not fire rated, provide an air-tight seal around the cables and conduits.
 - .24 Where cables and conduits pass through floors and fire rated walls, pack space between conduit (or cable) and sleeve with an approved fire stop as specified in Section 26 05 00 – Electrical General Provisions.

3.2 CONDUIT – GENERAL

- .1 Run parallel or perpendicular to building lines.
- .2 Group raceways wherever possible. Support on channels.
- .3 Install expansion joints as required.
- .4 Run raceways in web portion of structural steel columns and beams.
- .5 Do not drill structural members to pass through.
- .6 Locate raceways not less than 125 mm clear where parallel to steam or hot water lines with a minimum of 75mm at crossovers.

- .7 Use metallic raceway where temperatures exceed 75°C or where enclosed in thermal insulation.
- .8 EMT and non-metallic conduits to contain insulated green ground wire.
- .9 Install 6mm diameter nylon pull cord in empty raceways.
- .10 All un-dimensioned conduits on the Contract Drawings are 21 mm (3/4") minimum.

3.3 CONDUIT AND FITTINGS

- .1 Minimum Conduit Sizes:
 - .1 Surface installation and concealed behind walls 21 mm trade size conduit.
 - .2 Embedded in concrete 27 mm trade size conduit.
 - .3 Directly buried 53 mm trade size conduit.
- .2 Conduit Application and Type:
 - .1 Corrosive Areas: Rigid steel corrosion resistant coated.
 - .2 Hazardous Areas: Rigid steel.
 - .3 Outdoor Areas: Rigid steel coated conduit.
 - .4 Concealed above suspended ceilings and inside walls in office areas, use EMT.
 - .5 Embedded in Concrete:
 - .1 Other than grade slab: Rigid (PVC).
 - .2 In or below grade slab: Rigid (PVC).
- .3 Exposed in unfinished areas to maximum 3 metres above finished floor; use rigid galvanized steel, above 3 metres use EMT.
- .4 Connection to motors and equipment subject to vibration use; liquid tight flexible steel conduit.
- .5 Use field threads on rigid conduit of sufficient length to draw conduits up tight.
- .6 Do not bend coated steel conduit. Use elbows for deflections.
- .7 Use factory "ells" where 90-degree bends are required for 27 mm trade size and larger conduits.
- .8 Bend conduit offsets cold. Do not install crushed or deformed conduits and avoid trapped runs in damp or wet locations. Prevent the entrance of water and lodging of concrete, plaster, dirt, or trash in conduit, boxes, fittings and equipment during course of construction.
- .9 Where conduit joints occur in damp or wet locations, make joints watertight by applying an approved compound on the entire thread area before assembling. Draw up all conduit joints as tightly as possible.
- .10 Cap empty conduits which do not terminate in outlets, panels, cabinets and suchlike, with standard galvanized plumber's pipe caps.
- .11 Plug empty conduits which terminate flush with floors or walls with flush coupling and brass plug.

- .12 Install conduit sleeves for all conduits and cables passing through walls, ceilings or floors, and fill void between sleeve and conduit with caulking. If fire-rated caulking is required by code, use same class as walls, ceilings or floors.
- .13 Terminate conduit stubbed up through concrete floor for connection to free standing equipment with a coupling flush with finish floor, and extend rigid conduit to equipment, except where required, use flexible conduit from a point 150 mm above floor.
- .14 Install double locknuts and bushings on all rigid conduit terminations into thread-less openings. Increase length of conduit threads at terminations sufficiently to permit bushing to be fully seated against end of conduit.
- .15 Mechanically bend steel conduit.
- .16 Install sealing condulets in conduits at hazardous area boundaries.

3.4 CONDUITS IN POURED CONCRETE

- .1 Locate to suit reinforcing steel. Secure firmly to prevent movement during pour.
- .2 Clear each conduit with mandrel and brush before concrete sets.
- .3 Protect conduits from damage where they stub out of concrete.
- .4 Install sleeves where conduits pass through slab or wall.
- .5 Provide oversized sleeve before membrane is installed where conduits pass through waterproof membrane. Use cold mastic between sleeve and conduit.
- .6 Encase conduits completely in concrete; provide 50 mm minimum concrete cover.
- .7 Replace any conduit run found to be obstructed after concrete sets to the satisfaction of the Consultant/Agency.
- .8 Core-line conduit is not allowed and shall not be used.

3.5 EMT AND FITTINGS

- .1 Minimum EMT Size: 21 mm (3/4") trade size conduit.
- .2 EMT Application:
 - .1 Exposed in unfinished areas, above truss level and for drops in column web to 3 metres above finished floor. Use rigid steel conduit below 3 metres.
 - .2 In block walls and stud partitions.

3.6 SPLITTER BOXES

- .1 Install splitters as indicated and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement.

3.7 JUNCTION BOXES

- .1 Install junction boxes in inconspicuous but accessible locations. Secure to structure.
- .2 Install terminal blocks on mounting rails, for termination of each wire and cable regardless of size.
- .3 Only one voltage source is permitted in a junction box.

- .4 Install barriers to separate different auxiliary systems.

3.8 PULL BOXES

- .1 Install pull boxes in inconspicuous but accessible locations. Secure to structure.
- .2 Install pull boxes so as not to exceed 30 metres of conduit run between pull boxes.
- .3 Only one voltage source is permitted in a pull box.
- .4 Install barriers to separate different auxiliary systems.

3.9 OUTLET AND CONDUIT BOXES

- .1 Install conduit outlet boxes for conduit to maximum 32 mm and pull boxes for larger conduits.
- .2 Support boxes independently of connecting conduits.
- .3 Seal boxes during construction to prevent entry of debris, dust and dirt.
- .4 For flush installations mount plaster rings to box, flush with wall surface to permit wall finish to come within 6.00 mm of opening.
- .5 Provide correct size of openings in boxes for conduit, armoured cable connections. Reducing washers will not be acceptable.
- .6 Install switches and other controls close to door lock or latch jambs and other openings, maintaining a minimum of 100 mm from trims of doors (except where installed in door frames of metal partitions) check door swings.
- .7 Install 100mm square or octagonal outlet boxes for lighting fixture outlets.

3.10 MASONRY BOXES

- .1 In block walls use deep boxes to provide clear space around knockout for AC90 cable entry.

3.11 INSTALLATION OF BRANCH CIRCUIT CONDUCTORS

- .1 Install wiring in raceways unless noted otherwise. All wiring to be copper, no exceptions.
- .2 Minimum Wire Sizes:
 - .1 Power and Lighting – Number 3.3mm² (12AWG)
 - .2 Control – Number 2.1mm² (14AWG)
- .3 Wire and Cable Application and Type:
 - .1 Lighting branch circuit where connection to luminaire use T90 nylon.
 - .2 Receptacle branch circuits use T90 nylon.
 - .3 Ceiling boxes to luminaires in suspended ceiling use T90 nylon.
 - .4 Branch circuits other than those covered above use RW90.
 - .5 Equipment feeders and circuits use RW90.
 - .6 Underground and under slab raceways, duct banks, direct burial use RWU90.
- .4 Use lubricant when pulling wires into conduit. Ensure that wires are kept straight and are not twisted or abraded.

- .5 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
- .6 Provide a minimum of one grounding wire for each three ungrounded conductors on all cable runs. Size grounding to Table 16 of the Ontario Electrical Code. Provide separate ground conductors for ground fault circuit interrupter circuits. All ground conductors to be copper and insulated with a green coloured insulation.
- .7 All equipment to be grounded through ground wires.
- .8 Provide separate neutral conductor for each 120V circuit for all circuits feeding receptacles and power outlets.
- .9 All cable terminations to be compression type fittings for wire sizes greater than 8.36 mm² (8AWG). All compression type fittings to be two-hole long barrel type. Where mechanical screw type lugs are allowed by the Consultant, they will be suitable for quantity of parallel runs of wire that are to be terminated under.
- .10 Branch circuit wiring to be upsized as follows to address voltage drop when:
 - .1 The entire length of the circuit wiring exceeds 25 m – branch wiring to be a minimum of 5.26 mm² (10AWG).
 - .2 The entire length of the circuit wiring exceeds 40 m – branch wiring to be a minimum of 8.36 mm² (8AWG).
 - .3 The entire length of the circuit wiring exceeds 60 m – branch wiring to be a minimum of 13.29 mm² (6AWG).
- .11 Wire Splicing:
 - .1 Splice up to and including 13.29 mm² (6AWG) with nylon insulated expandable spring type connectors.
 - .2 Splice larger conductors using compression type connectors wrapped in PVC insulation rated at the respective voltage.
- .12 Maximum voltage drop for 12VDC wiring to remote lighting heads shall be five per cent max at the farthest remote head. Size conductors accordingly.

3.12 CONNECTORS

- .1 Install compression terminations and splices in accordance with manufacturer's written instructions.
- .2 Make splices in junction boxes.
- .3 Make connections in lighting circuits with twist type splicing connectors.
- .4 Terminate and splice conductors Number-8 and larger at terminal blocks in junction boxes.
- .5 Seal terminations and splices exposed to moisture, corrosive conditions or mechanical abrasions with heavy wall heat shrinkable insulation.
- .6 Install fixture type connectors and tighten. Replace insulating cap.

3.13 INSTALLATION OF CONTROL CABLES

- .1 Install all control cables recessed in conduit.
- .2 Ground control cable shield.

3.14 WIRING DEVICES – RECEPTACLES

- .1 Install receptacles vertically, use gang type outlet box where more than one receptacle is required in a location.
- .2 Where split receptacle has a portion switched, mount vertically and switch upper portion.
- .3 Coordinate with the Contract Drawings for final positioning and mounting heights of power and voice/data receptacles.
- .4 Maintain clearances between receptacle outlet boxes and millwork as indicated on the Contract Drawings.
- .5 Align and evenly space outlet boxes that are mounted as a group.
- .6 Install receptacle colours as follows:
 - .1 Area Colour
 - .1 Gypsum board, plaster or panelled: White
 - .2 Office: White
 - .3 Factory, service, exterior: White

3.15 WIRING DEVICES – COVER PLATES – STAINLESS STEEL

- .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .2 Install suitable common cover plates where wiring devices are grouped.
- .3 Do not use cover plates designed for flush outlet boxes on surface-mounted boxes.
- .4 Provide plaster ring where necessary.

3.16 INSTALLATION OF ESCUTCHEON PLATES

- .1 Provide escutcheon plates over all exposed conduit passing through walls, floors, ceilings, partitions, furrings and suchlike in finished areas.

3.17 INSTALLATION OF INSERTS, BEAM CLAMPS, FASTENERS, HANGERS AND SUPPORTS

- .1 Install all inserts, beam clamps, fasteners, and similar hardware required for conduit, duct, raceway, conductor and suchlike and equipment hanger or support materials to best suit structural details.
- .2 Accurately and properly set concrete inserts in the concrete framework.
- .3 For runs of three or more conduits, raceways, or conductors in concrete formwork, use multiple type inserts used for the smallest conduit in the group.
- .4 Where inserts are required in concrete work where concrete inserts have not been installed, drill a neat hole of the proper diameter and depth in the concrete and insert an anchor to accept the hanger rod, bolt and suchlike or where concrete mass permits, use self-drilling concrete anchors.
- .5 Fasten hangers and support provisions to brick or masonry with expansion shields and machine bolts, or for light loads, use plugs and screws.

- .6 In cavity walls and ceilings use two wing toggles and for heavy loads, provide steel anchor plates with two or more toggles to spread the load.
- .7 Provide beam clamps for attaching, hanging or support provisions to the Consultant, weld the hanging and support provisions to the structural steel.
- .8 Explosive power actuated fasteners will not be permitted unless specific approval for their use has been obtained from the Consultant.
- .9 Securely mount plywood backboards to structure or use independent mounting channels, secured to floor.

3.18 INSTALLATION OF ACCESS DOORS

- .1 Install access doors to give access to all junction boxes, pullboxes, conductor joints and other similar electrical work which may need maintenance or repair but which is concealed in inaccessible construction except as otherwise specified herein or on the Contract Drawings.
- .2 Before commencing installation of electrical work, prepare on a set of reflected ceiling plans with complete layouts of all ceiling access door which will be required. Submit these layouts to the Consultant for approval and show the exact sizes and locations of such ceiling access doors. Locate access doors in walls and partitions to the Consultant's approval, and arrange electrical work to suit.
- .3 Access doors will be installed by the Division responsible for the particular type of construction in which the access doors are required. Supply the access doors to the Division installing same at the proper time.
- .4 Access doors shall be, wherever possible, of a standard size, for all applications. Confirm exact dimensions with the Consultant, prior to ordering.
- .5 Submit a sample of each proposed type of access door to the Consultant for approval.

3.19 PAINTING AND FINISHES

- .1 Provide all painting and patching as required.
- .2 All exposed electrical fittings, supports, hangers, frames conduit, racks, boxes, raceways and similar material and apparatus shall be galvanized or finished with corrosion resistant primer ready to accept paint. Take special care when priming work exposed to the elements or in wet areas to prevent rust or corrosion from damaging adjacent surfaces.
- .3 Touch up and repaint any factory finished equipment that has been scratched or otherwise damaged during installations.
- .4 Provide for all patching and painting for all removals and as required. Painting shall be completed to the approval of the Consultant and the Agency. Paint shall match adjacent surfaces and as per Section 099100 – Painting. Include all costs.
- .5 Where cutting, patching, fire stopping and construction involves painted surfaces these must be painted to match the surrounding surfaces or as directed by Consultant and as per Section 099100 – Painting.

3.20 STANDARD IDENTIFICATION

- .1 Identify electrical work as specified below:

- .2 For each piece of electrical equipment from the panelboard to maximum and including battery packs and for any other piece of equipment where specified in this Section, provide engraved Lamacoid identification nameplates. Nameplates shall be Lamacoid black with white letters and with bevelled edges, secured to apparatus with stainless steel screws. Warning signs, if and when required, shall be red with white lettering.
- .3 Exact nameplate wording and sizes must be approved by and confirmed by the Consultant prior to manufacture.
- .4 Clearly identify main pull or junction boxes (excluding obvious outlet boxes) by painting the outside of the covers. Paint colours shall be in accordance with the following schedule:
 - .1 Colour code conductors, throughout to identify phases, neutrals and grounds by means of self-laminating coloured tape, coloured conductor insulation, or properly secured coloured plastic discs. Colours shall be as follows:
 - .1 Phase A: Red
 - .2 Phase B: Black
 - .3 Phase C: Blue
 - .4 Ground: Green
 - .5 Neutral: White

3.21 FIELD FABRICATED METAL WORK

- .1 Clean and prime paint field fabricated metal work.
- .2 After fabrication deburr, scrape, grind smooth, wire brush with power brush and degrease metal work.
- .3 Prime paint steel with one (1) coat of CISC/CPMA 2.75 oil alkyd primer.
- .4 Prime paint aluminum as follows: Wash with detergent solution and wipe down with SSPC-SP1 solvent. Apply Glidden number Y-5229 primer to 1.5 mils DFT.
- .5 For brass and bronze alloy materials, prepare as for aluminum but apply one (1) coat of CAN/CGSB-1.40-M zinc chromate primer.

3.22 TESTS

- .1 Branch circuit balancing: Connect all branch power circuits to panel boards so as to balance the actual loads (wattage) within five (5) per cent. Connect loads to circuits as indicated on the Contract Drawings.

End of Section

PART 1 **GENERAL**

1.1 **REFERENCES**

- .1 Conform to all applicable Sections of Division 1 and Section 26 05 00 – Electrical General Provisions.

1.2 **REFERENCES**

- .1 CSA C22.2 Number 4 – Enclosed Switches
- .2 CSA C22.2 Number 5.1 – Moulded Case Circuit Breakers
- .3 CSA C22.2 No.29 – Panelboards and Enclosed Panelboards
- .4 CSA C22.2 Number 39 – Fuseholder Assemblies
- .5 CSA C22.2 Number 106-M – HRC Fuses
- .6 IEC 947-4-1 1990, Part 4 – Contactors and Motor-Starters
- .7 UL 60950 – Standard for Information Technology Equipment
- .8 NFPA 75 – Standard for the Protection of Information Technology Equipment
- .9 NFPA 70E – Electrical Safety in the Workplace
- .10 ANSI Z535.4 – Product Safety Signs and Labels
- .11 IEEE 1584 – Guide for Performing Arc Flash Hazard Calculation
- .12 IEEE 141 – Recommended Practice for Electric Power Distribution in Industrial Plants
- .13 CSA Z462 – Workplace Electrical Safety

1.3 **SCOPE OF WORK**

- .1 Supply all labour, tools, services and equipment and provide all materials and equipment required to complete service and electrical distribution work in accordance with this Section of the Specification and the Contract Drawings for permanent electrical service to the Facility.

1.4 **QUALITY ASSURANCE**

- .1 All low voltage distribution work shall be executed by skilled tradesmen fully experienced in the installation of electrical power systems.
- .2 All equipment shall be constructed to EEMAC standard and shall carry the CSA label. The Contractor shall obtain Electrical Safety Authority approval and pay the required fee.
- .3 All equipment shall be suitably noted for the system available fault and HRC (High Rupturing Capacity) fuses shall comply with CSA C22.2 Number 106.

1.5 **SUBMITTALS**

- .1 Submit shop drawings for the following as required under Section 013300 – Submittal Procedures:

PART 2 **PRODUCTS**

2.1 **DISTRIBUTION POWER PANELS**

- .1 Distribution power panels are existing
- .2 Modify existing panels to install new breakers.
- .3 Upsize or down size breakers to suit new installation as per motor schedule.
- .4 Modify existing panel directories to suit new installation. Only type written directory is acceptable.

2.2 **BREAKERS GENERAL**

- .1 Bolt-on moulded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common trip breakers with single handle for multipole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3 -10 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated.
- .5 Short circuit rating of 600V breakers to be 50kA rms sym.
- .6 Short circuit rating of 120V breakers to be 22kA rms. sym.

2.3 **MOULDED CASE CIRCUIT BREAKERS**

- .1 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-trip breakers with single handle for multi-pole applications.
- .3 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting. Trip settings on breakers with adjustable trips to range from 3 to 8 times current rating.
- .4 Circuit breakers with interchangeable trips as indicated in the Contract Documents.
- .5 Thermal Magnetic Breakers: Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
- .6 Magnetic Breakers: Moulded case circuit breakers to operate automatically by means of magnetic tripping devices to provide instantaneous tripping for short circuit protection.
- .7 Fused Thermal Magnetic Breakers: Fused thermal magnetic breakers with current limiting fuses internally mounted. Time current limiting characteristics of fuses coordinated with time current tripping characteristics of circuit breaker. Co-ordination to result in interruption by breaker of fault-level currents up to interrupting capacity of breaker. Fuses individually removable and interlocked with breaker. The removal of fuse cover, blowing of a fuse or removal of a fuse, shall trip the breaker.
- .8 Solid State Trip Breakers: Moulded case circuit breaker to operate by means of a solid-state trip unit with associated current monitors and self-powered shunt trip to provide inverse time current

trip under overload condition and long time, short time, instantaneous tripping for phase and ground fault short circuit protection.

- .9 Accessories: Include:
 - .1 Shunt trip, when electrically operated or when indicated.
 - .1 Auxiliary switches, when electrically operated or when indicated.
 - .2 Motor-operated mechanism, when electrical operation indicated.
 - .3 On-off locking device.
 - .4 Handle mechanism.
 - .5 Enclosures
- .10 Provide enclosures suitable for locations as indicated on the Drawings and as described below:
 - .1 EEMAC 3R rain-tight enclosures intended to provide protection against fire protection sprinkler, rain, sleet and damage from external ice formation
 - .2 All enclosed circuit breakers shall have nameplates that contain a permanent record of catalog number and maximum rating.
 - .3 Provide handle mechanisms that are pad-lockable in the "OFF" position.
- .11 Manufacturers:
 - .1 Schneider Electric
 - .2 Eaton Cutler-Hammer
 - .3 Siemens
 - .4 Or approved equal

2.4 DISTRIBUTION PANELBOARDS

- .1 Panelboards: Product shall be of one manufacturer throughout the Project.
- .2 Install circuit breakers in panelboards before shipment.
- .3 In addition to CSA requirements manufacturer's nameplate must show fault current that the panel including all breakers have been built to withstand.
- .4 Panelboards to have the following minimum ratings for interrupting capacity as indicated on the Contract Drawings:
 - .1 120/208V panelboards: 65kA.
- .5 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .6 Panelboards: Mains, number of circuits and number and size of branch circuit breakers as indicated on the Contract Drawings.
- .7 Two keys for each panelboard and key panelboards alike.
- .8 Panelboards to be copper bus.
- .9 Provide a copper neutral bus sized to 200 per cent of the mains rating for panels.
- .10 Mains: Suitable for bolt-on breakers.
- .11 Trim with concealed front bolts and hinges.
- .12 Trim and Door Finish: Baked grey enamel.

- .13 Enclosure to be CSA Type-2, sprinkler proof.
- .14 Series ratings may be acceptable. Panels to be labelled as such. Manufacturing to supply supporting data.
- .15 Moulded Case Circuit Breakers:
 - .1 Bolt-on moulded case circuit breaker: Quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
 - .2 Common-trip breakers with single handle for multi-pole applications.
 - .3 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
 - .4 Main breaker, where indicated in the Contract Documents; separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
 - .5 Lock-on devices for 10 per cent of 15A to 30A breakers installed. Turn over unused lock-on devices to the Agency.
 - .6 Provide one breaker per designated breaker space. Multiple breakers contained in one-housing or twin breakers are not acceptable.
- .16 Acceptable Manufacturers:
 - .1 Eaton Electrical (Cutler-Hammer)
 - .2 Schneider Electric
 - .3 Siemens
 - .4 or approved equal

2.5 GROUNDING EQUIPMENT

- .1 Meet standard of CSA C22.2 No.41-M1987.
- .2 Conductors
 - .1 Bare or insulated, stranded, soft drawn annealed copper wire, for:
 - .1 One Coat – Regal First Coat Interior Latex Primer and Underbody #216 (MPI Listed Product, Category-50).
 - .2 Ground connections;
- .3 Clamps for grounding of conductor: size as required to electrically conductive underground water pipe.
- .4 Rod electrodes: copper clad steel 19 mm dia. by 3 m long.
- .5 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .6 Insulated grounding conductors: green, type RWU.
- .7 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .8 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.

- .3 Bolted type conductor connectors.
- .4 Thermit welded type conductor connectors.
- .5 Bonding jumpers, straps.
- .6 Pressure wire connectors.

PART 3 EXECUTION

3.1 GENERAL

- .1 Protect equipment from dust, debris, moisture, and physical damage, with sealed envelope of plastic or other impervious material until building is enclosed and cleaned and equipment is energized.
- .2 Protect from condensation by maintaining at suitable temperature above 0°C.
- .3 Finish equipment enclosures to ANSI 49 or ANSI 61, baked grey enamel.

3.2 INSTALLATION OF BREAKERS

- .1 Install breakers per the manufacturer's recommendations and the Contract Drawings.

3.3 ELECTRICAL CONNECTIONS FOR MECHANICAL EQUIPMENT

- .1 Provide all required electrical connections to apparatus provided or supplied by Division 23.
- .2 Motor Starters and Motors:
 - .1 All motor starters for mechanical equipment shall be supplied, installed and connected under this Division except where starters are included as part of a mechanical "package" and which will be provided under Division 23 but wired and connected under this Division.
 - .2 Provide line voltage disconnect switches at each piece of electrically operated mechanical equipment to meet Code Requirements.
 - .3 All motors shall be wired and connected under this Division. The Contract Drawings do not necessarily show the exact location of wiring to motors and it shall be the responsibility of this Division to fully coordinate this work with Division 23.
- .3 Mechanical Controls: Be responsible for the provision of 120V line side power connections to all control apparatus where detailed or required to make the system operational.

3.4 GROUNDING INSTALLATION GENERAL

- .1 Install complete permanent, continuous grounding system including, conductors, connectors, accessories and connect to the existing building ground system. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Soldered joints not permitted.

- .7 Install bonding wire for flexible conduit, connected at one end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .8 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .9 Bond single conductor, metallic armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end.

3.5 SYSTEM AND CIRCUIT GROUNDING

- .1 Install system and circuit grounding connections to neutral of secondary 120/600V system.

3.6 GROUNDING FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Electrical General Provisions.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.7 TESTING AND INSPECTION OF POWER DISTRIBUTION SYSTEM

- .1 Include in the tender price the cost of on-site inspection and testing of the following main distribution equipment:
 - .1 Distribution Equipment
 - .2 Grounding System
- .2 This engineering inspection and testing shall be done prior to the system being energized and shall include the following items:
 - .1 Testing, cleaning and where necessary, calibrating all relays and circuit breaker trip devices.
 - .2 Function test of protection and control devices.
 - .3 Megger test interconnecting cables.
 - .4 Replacement of fuses destroyed or damaged during the start-up or testing.
- .3 Acceptance tests shall be conducted in the presence of and to the satisfaction of the Consultant.
- .4 Make good all defects indicated in the equipment and in the installation by the tests.

End of Section

MONTCLAIR PS RENOVATIONS

1285 MONTCLAIR DR,
OAKVILLE, ONTARIO L6H 1Z3

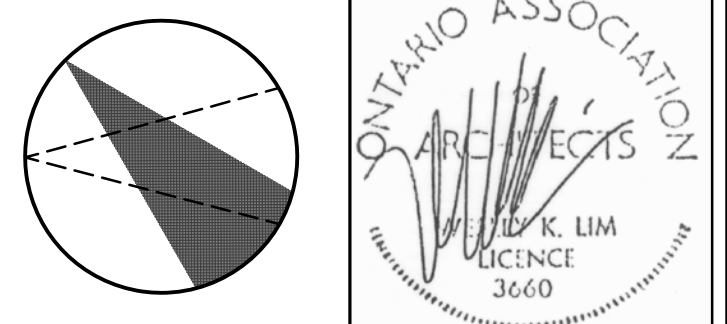


Ref.	No.	Description	Date	Initial
△		CONSULTANTS COORDINATION	2021/01/07	
△		ISSUED FOR PERMIT AND TENDER	2021/04/27	
△		REVISED FOR PERMIT AND TENDER	2021/12/07	

Project:
MONTCLAIR PS RENOVATION
1285 MONTCLAIR DR,
OAKVILLE, ON



Unit 100-706 Euclid Ave
Toronto, Ontario, Canada M6G 2T9
Tel:(416)591-6575 Fax:(416)591-1010



Consultant:

Title:
TITLE SHEET

Drawn by:
M.L.

Date:
JANUARY 2021

Checked by:
W.L.

Plotted:

Scale:
AS SHOWN

Issued:

Job No.:
20144

Drawing No.:

Set No.:

A0

of:

1. VERIFY ALL DIMENSIONS AND EXISTING SITE CONDITIONS. REPORT ANY DISCREPANCIES TO ARCHITECT BEFORE PROCEEDING WITH THE WORK
2. REPORT TO ARCHITECT AT LEAST THREE WORKING DAYS PRIOR TO CONSTRUCTION ALL DISCREPANCIES, OMISSIONS, ERRORS, DEPARTURES FROM BUILDING BY-LAWS, O.B.C. OR GOOD PRACTICE AND POINTS CONSIDERED TO BE OF AMBIGUOUS INTENT, SO THAT THE ARCHITECT MAY, IF NECESSARY, ISSUE INSTRUCTIONS BY ADDENDA. THE ARCHITECT WILL NOT BE RESPONSIBLE FOR ORAL INSTRUCTIONS.
3. DO NOT SCALE DRAWINGS.
4. EXTEND, MAKE GOOD, REPAIR AND CLEAN EXISTING SUBSTRATES, FINISHES, AND COMPONENTS AS REQUIRED TO MATCH EXISTING. PROVIDE ADDITIONAL MATERIALS AND COMPONENTS AS REQUIRED. MAINTAIN CONTINUITY TO EXISTING WORK, FLUSH, PLUMB AND IN ALIGNMENT, AND WITHOUT DETRIMENTS TO VISUAL APPEARANCE. MATCH EXISTING MATERIALS AND METHODS. VARIATIONS WILL BE ACCEPTED BY ARCHITECT'S WRITTEN AUTHORIZATION ONLY, AND WHERE AUTHORIZED MUST MEET OR EXCEED QUALITY AND PERFORMANCE OF EXISTING.
5. PROTECT EXISTING WORK TO REMAIN AS REQUIRED. BE RESPONSIBLE FOR REPAIRS, MAKING GOOD AND CLEANING IN EVENT PROTECTION IS NOT ADEQUATE.
6. PROTECT PUBLIC AND OTHER PRIVATE PROPERTY BEYOND IMMEDIATE WORK AREA. CONTRACTOR TO HOLD OWNER HARMLESS AGAINST ALL CLAIMS ASSOCIATED WITH THIS WORK.
7. MAINTAIN CONTINUITY OF ALL EXISTING FIRE SEPARATIONS, ASSEMBLIES, AND PROTECTIVE CLADDING.
8. ALL WORK IS TO BE PROVIDED AS COMPLETE, OPERATING SYSTEMS EXCEPT AS NOTED.
9. PREPARE ALL EXISTING SUBSTRATES TO RECEIVE NEW FINISHES AS REQUIRED ACCORDING TO RECOMMENDATIONS OF MANUFACTURER OF NEW FINISH MATERIALS.
10. PROVIDE PURPOSE-MADE ALUMINUM REDUCING STRIPS AT ALL DISSIMILAR FLOOR FINISH MATERIALS, INCLUDING JUNCTION OF EXISTING MATERIALS TO NEW MATERIALS. SUBMIT SAMPLES TO ARCHITECT FOR APPROVAL.
11. MOVE MATERIALS AND DEBRIS FROM IMMEDIATE WORK AREA TO EXTERIOR RUBBISH BINS IN CLOSED DUST-TIGHT CONTAINERS. LOCATE BINS TO APPROVAL OF OWNER AND LANDLORD.
12. CO-ORDINATE AND PAY FOR ALL CHARGES AND FEES ASSOCIATED WITH THE WORK TO BE PERFORMED AS LEVIED BY THE AUTHORITIES HAVING JURISDICTION. PROCURE ALL ENCROACHMENT AGREEMENTS AS REQUIRED TO PERMIT WORK TO BE PERFORMED.
13. PROVIDE DUSTTIGHT CONSTRUCTION HOARDING. SUBMIT SHOP DRAWINGS.
14. PERFORM ALL SITE PREPARATIONS AND DEMOLITIONS AS REQUIRED TO PERMIT NEW WORK TO COMMENCE AND BE ACCOMMODATED.
15. THE SCHEDULE AND SEQUENCE OF THE WORK WILL BE SUBJECT TO THE APPROVAL OF THE OWNER. THE OWNER INTENDS TO OCCUPY AND OPERATE IN THE PREMISES DURING CONSTRUCTION.
16. PROVIDE ACCESS TO ALL CONTROL DEVICES AND MAINTAIN ACCESS TO ALL EXISTING CONTROL DEVICES WHICH ARE COVERED BY FINISHES. PROVIDE PRE-MANUFACTURED ACCESS PANELS TO SUIT. SUBMIT SAMPLES TO ARCHITECT FOR APPROVAL.
17. REMOVE ALL EXISTING INACTIVE AND ABANDONED MECHANICAL AND ELECTRICAL SERVICE LINES. MAKE GOOD.
18. CONFORM TO MANUFACTURER'S SPECIFICATIONS AND RECOMMENDATIONS.
19. MAINTAIN ACCESS TO EXITS AT ALL TIMES. PROVIDE ALTERNATE EXITS IN CONSULTATION WITH AND AT APPROVAL OF BUILDING OFFICIAL. PROVIDE TEMPORARY EXIT SIGNS AND ADJUST EXISTING EXIT SIGNS AS REQUIRED. AT COMPLETION OF WORK, REMOVE TEMPORARY SIGNS AND RESTORE SIGNAGE. MAKE GOOD.

INFORMATION FOR THIS SITE PLAN TAKEN FROM DOCUMENTS PROVIDED BY THE HALTON DISTRICT SCHOOL BOARD

GENERAL CONSULTANT: WK LIM ARCHITECT INC.

SP1 SITE PLAN

ARCHITECTURAL CONSULTANT: WK LIM ARCHITECT INC.

A1 WALL TYPE LEGEND, GROUND FLOOR PLAN
A2 SECOND FLOOR PLAN, PARTIAL PENTHOUSE PLAN, PARTIAL PENTHOUSE SECTION

MECHANICAL CONSULTANT: MOON-MATZ LTD.

M-1 DRAWING LIST, LEGEND, SYMBOLS AND DETAILS
M-2 DETAILS
M-3 PROPOSED EQUIPMENT SCHEDULE
M-4 HVAC & BAS DEMOLITION-(GROUND FLOOR YEAR 2009 AND 1970 BUILDING)
M-5
M-6 HVAC & BAS DEMOLITION-(GROUND FLOOR YEAR 1968 BUILDING)
M-7 HVAC & BAS DEMOLITION-SECOND FLOOR
M-8 HVAC & BAS DEMOLITION-ROOF (YEAR 2009 AND 1970 BUILDING)
M-9 HVAC & BAS DEMOLITION-ROOF (YEAR 1968 BUILDING)
M-10 HVAC & BAS PROPOSED-(GROUND FLOOR YEAR 2009 AND 1970 BUILDING)
M-11 HVAC & BAS PROPOSED-(GROUND FLOOR YEAR 1968 BUILDING)
M-12 HVAC & BAS PROPOSED-SECOND FLOOR (YEAR 1968 BUILDING)
M-13 HVAC & BAS PROPOSED-ROOF (YEAR 2009 AND 1970 BUILDING)
M-14 HVAC & BAS PROPOSED-ROOF (YEAR 1968 BUILDING)
M-15 AHU PLAN-GYM ROOF, MECHANICAL ROOMS AND JANITOR'S ROOM
M-16 PENTHOUSE MECHANICAL ROOM, PROPOSED POINT LIST
M-17 COOLING SYSTEM CONTROL DIAGRAM
M-18 CONTROL DIAGRAMS
M-19
M-20 CONTROL DIAGRAMS

ELECTRICAL CONSULTANT: MOON-MATZ LTD.

E-1 ELECTRICAL LEGEND, NOTES, SCHEDULES & DETAILS
E-2 ELECTRICAL GROUND FLOOR DEMOLITION PLAN
E-3 ELECTRICAL ROOF DEMOLITION PLAN
E-4 ELECTRICAL GROUND FLOOR PROPOSED PLAN
E-5 ELECTRICAL ROOF PROPOSED PLAN
E-6 ELECTRICAL MECHANICAL ROOM & JANITOR ROOM DEMOLITION & PROPOSED PLAN
E-7 ELECTRICAL MECHANICAL ROOM & BOILER ROOM PROPOSED PLAN

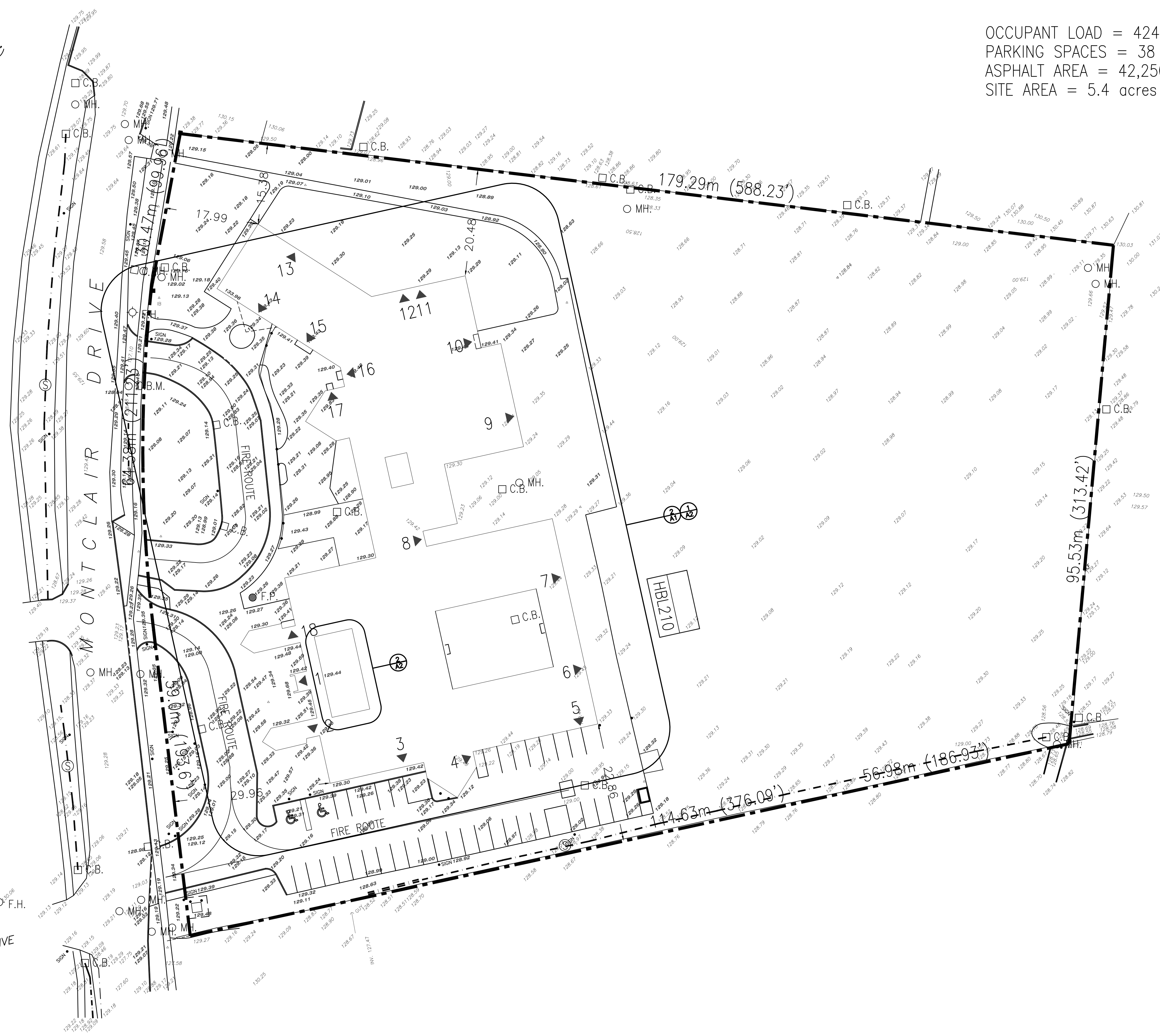
STRUCTURAL CONSULTANT: MOON-MATZ LTD.

S-1 RTU FRAMING PLANS, SECTION, OWSJ REINFORCEMENT AND NOTES
S-2 LOUVER FRAMING PLAN, SECTION, OWSJ REINFORCEMENT AND NOTES

LEGAL DESCRIPTION: CON 3 SDS PT LOT 14, Town of Oakville

OCCUPANT LOAD = 424 PEOPLE
 PARKING SPACES = 38 + 2 H.C.
 ASPHALT AREA = 42,250 sq.ft. (3925m²)
 SITE AREA = 5.4 acres (2.22 ha.)

23.70m (77.77')
 15.24m (50.0')
 15.24m (50.0')



- ▲ EXIT DOORS
- ◇ F.H. FIRE HYDRANT
- F.P. FLAG POLE
- H.P. HYDRO POLE
- [H] HYDRO TRANSFORMER
- L.S. LIGHT STANDARD
- C.B.M. CATCH BASIN MANHOLE
- C.B. CATCH BASIN
- M.H. MANHOLE
- ↔ SIAMSE CONNECTION

1 SITE PLAN

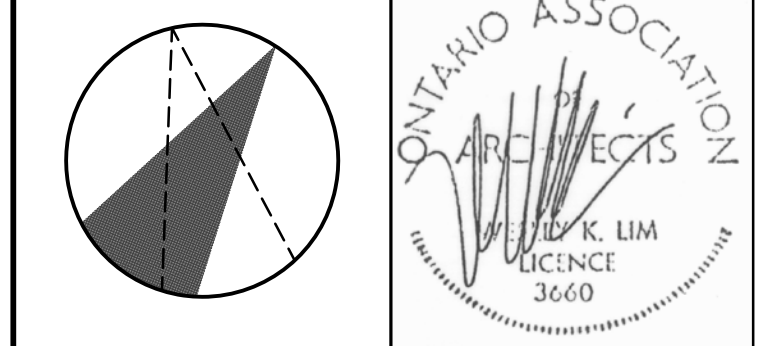
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Ref.	No.	Description	Date	Initial
△		CONSULTANTS COORDINATION	2021/01/07	
△		ISSUED FOR PERMIT AND TENDER	2021/04/27	
△		REVISED FOR PERMIT AND TENDER	2021/12/07	

Project:
 MONTCLAIR PS RENOVATION
 1285 MONTCLAIR DR,
 OAKVILLE, ON



Unit 100-706 Euclid Ave
 Toronto, Ontario, Canada M6G 2T9
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Consultant:

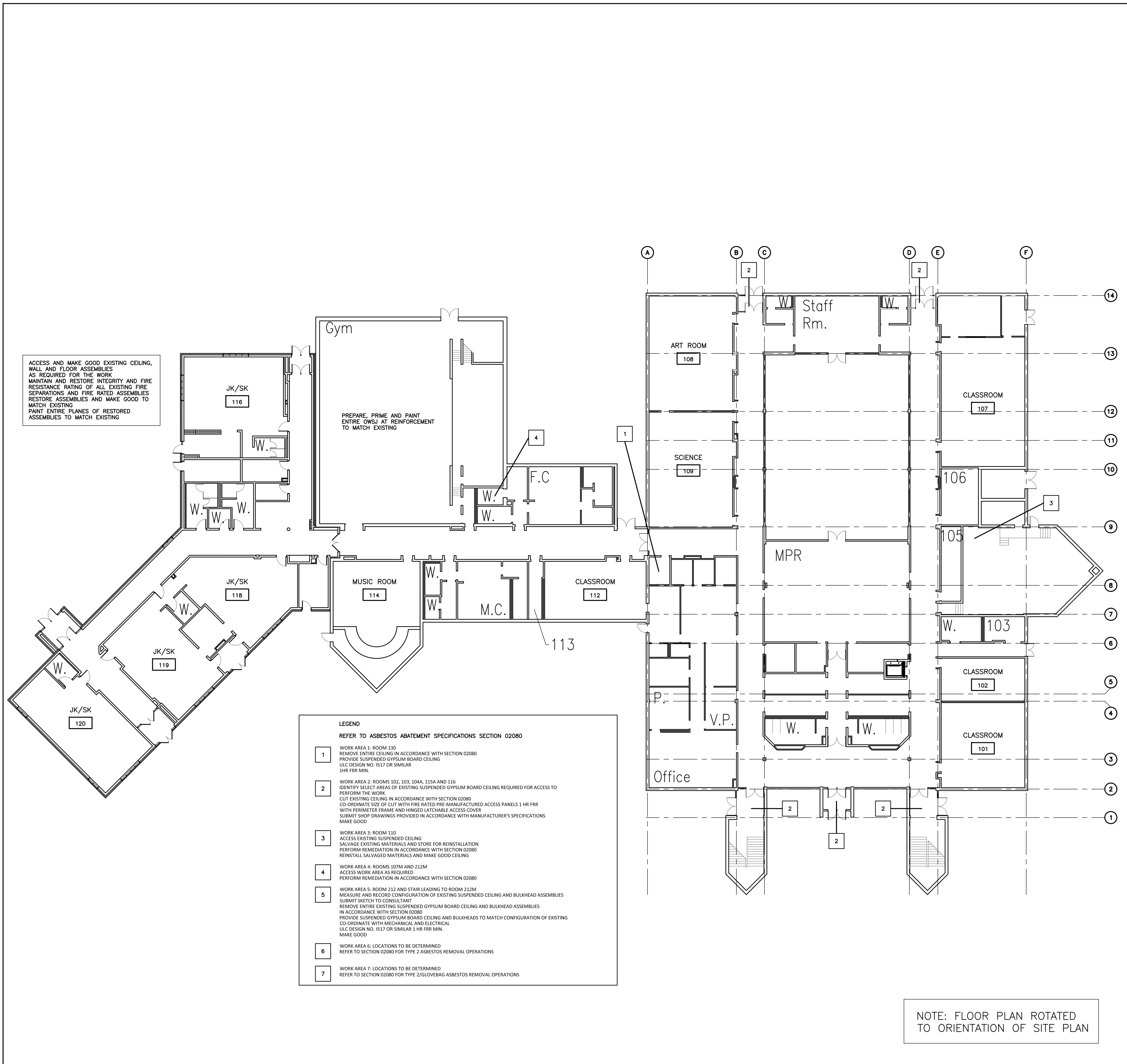
Title:
 SITE PLAN

Drawn by: M.L.	Date: JANUARY 2021
Checked by: W.L.	Plotted:
Scale: 1:400	Issued:
Job No.: 20144	Drawing No.:
Set No.:	SP1

of:

WALL TYPES:	
	EXISTING TO REMAIN
	REMOVE EXISTING WALL, PARTITIONS, PLUMBING FIXTURES AS SHOWN DOTTED, MAKE GOOD, RELOCATE EXISTING SERVICES AS REQUIRED, CAP AND MAKE SAFE ALL SERVICE LINES, SEE MECHANICAL AND ELECTRICAL.
FIRE SEPARATIONS:	
MAINTAIN INTEGRITY OF ALL EXISTING FIRE SEPARATIONS AFFECTED BY THE WORK	
TEMPORARY CONSTRUCTION EXITS:	
BARRICADE AND PROVIDE DUST TIGHT HOARDING TO EXISTING BUILDING. ESTABLISH ALTERNATE EXITS DURING CONSTRUCTION THROUGH EXISTING DOORS TO EXTERIOR. PROVIDE EXIT SIGNS AS REQUIRED AND REMOVE AND MAKE GOOD AT COMPLETION OF WORK. MASK EXISTING SIGNS AS REQUIRED FOR TEMPORARY EXITS. REVIEW EXISTING DURING CONSTRUCTION WITH LOCAL BUILDING DEPARTMENT PRIOR TO COMMENCEMENT OF CONSTRUCTION.	
AT EXISTING PARTITIONS TO BE DEMOLISHED:	
SAWCUT AND MAKE GOOD AT TERMINATIONS WITH MIN. 200 CAP OF SIMILAR MATERIAL TO MATCH EXISTING MAKE GOOD EXISTING CEILING, FLOOR AND WALL BASE TO MATCH EXISTING	
AT PERPENDICULAR WALL JUNCTIONS, GRIND SMOOTH AS REQUIRED REMOVE METAL TIES AS REQUIRED AND MAKE GOOD PAINT ENTIRE AFFECTED WALL PLANES	
REMOVE EXISTING WALL MOUNTED EQUIPMENT RELOCATE AS DIRECTED ON SITE OR TURN OVER TO SCHOOL	
LEGEND:	
	MILLWORK TYPE XX
	DOOR NO. XXX
	ROOM NO. XXX
	PARTITION TYPE XXX
	ELEV. ELEVATION A ELEVATION B ELEVATION C ELEVATION D DETAIL NO. XX DRAWING NO. YYY
	DETAIL DETAIL NO. XXX/REFERENCE DRAWING YYY
	SECTION SECTION NO. XX/REFERENCE DRAWING YYY
	LIMIT OF FLOOR FINISH PROVIDE PURPOSE MADE PRE-FINISHED METAL TRANSITION STRIP TO PROFILE AS SELECTED BY CONSULTANT SUBMIT SAMPLES

1 LEGEND NTS



2 GROUND FLOOR PLAN

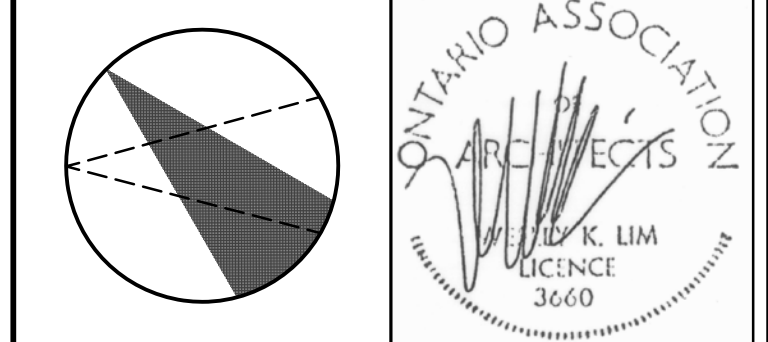
LEGEND	
REFER TO ASBESTOS ABATEMENT SPECIFICATIONS SECTION 02080	
1	WORK AREA 1: ROOM 130 REMOVE ENTIRE CEILING IN ACCORDANCE WITH SECTION 02080 PROVIDE SUSPENDED GYPSUM BOARD CEILING ULC DESIGN NO. IS17 OR SIMILAR 1HR FRR MIN.
2	WORK AREA 2: ROOMS 102, 103, 104A, 115A AND 116 IDENTIFY SELECT AREAS OF EXISTING SUSPENDED GYPSUM BOARD CEILING REQUIRED FOR ACCESS TO PERFORM THE WORK CUT EXISTING CEILING IN ACCORDANCE WITH SECTION 02080 CO-ORDINATE SIZE OF CUT WITH FIRE RATED PRE-MANUFACTURED ACCESS PANELS 1 HR FRR WITH PERIMETER FRAME AND HINGED LATCHABLE ACCESS COVER SUBMIT SHOP DRAWINGS PROVIDED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS MAKE GOOD
3	WORK AREA 3: ROOM 110 ACCESS EXISTING SUSPENDED CEILING SALVAGE EXISTING MATERIALS AND STORE FOR REINSTALLATION PERFORM REMEDIATION IN ACCORDANCE WITH SECTION 02080 REINSTALL SALVAGED MATERIALS AND MAKE GOOD CEILING
4	WORK AREA 4: ROOMS 107A AND 212M ACCESS WORK AREA AS REQUIRED PERFORM REMEDIATION IN ACCORDANCE WITH SECTION 02080
5	WORK AREA 5: ROOM 212 AND STAIR LEADING TO ROOM 212M MEASURE AND RECORD CONFIGURATION OF EXISTING SUSPENDED CEILING AND BULKHEAD ASSEMBLIES SUBMIT SKETCH TO CONSULTANT REMOVE ENTIRE EXISTING SUSPENDED GYPSUM BOARD CEILING AND BULKHEAD ASSEMBLIES IN ACCORDANCE WITH SECTION 02080 PROVIDE SUSPENDED GYPSUM BOARD CEILING AND BULKHEADS TO MATCH CONFIGURATION OF EXISTING CO-ORDINATE WITH MECHANICAL AND ELECTRICAL ULC DESIGN NO. IS17 OR SIMILAR 1 HR FRR MIN. MAKE GOOD
6	WORK AREA 6: LOCATIONS TO BE DETERMINED REFER TO SECTION 02080 FOR TYPE 2 ASBESTOS REMOVAL OPERATIONS
7	WORK AREA 7: LOCATIONS TO BE DETERMINED REFER TO SECTION 02080 FOR TYPE 2/GLOVEBAG ASBESTOS REMOVAL OPERATIONS

Revisions				
Ref.	No.	Description	Date	Initial
△		CONSULTANTS COORDINATION	2021/01/07	
△		ISSUED FOR PERMIT AND TENDER	2021/04/27	
△		REVISED FOR PERMIT AND TENDER	2021/12/07	
△		REVISED FOR PERMIT AND TENDER	2022/01/27	

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Consultant:

Title:
WALL TYPE LEGEND AND
GROUND FLOOR PLAN

Drawn by:
M.L. Date:
JANUARY 2021

Checked by:
W.L. Plotted:

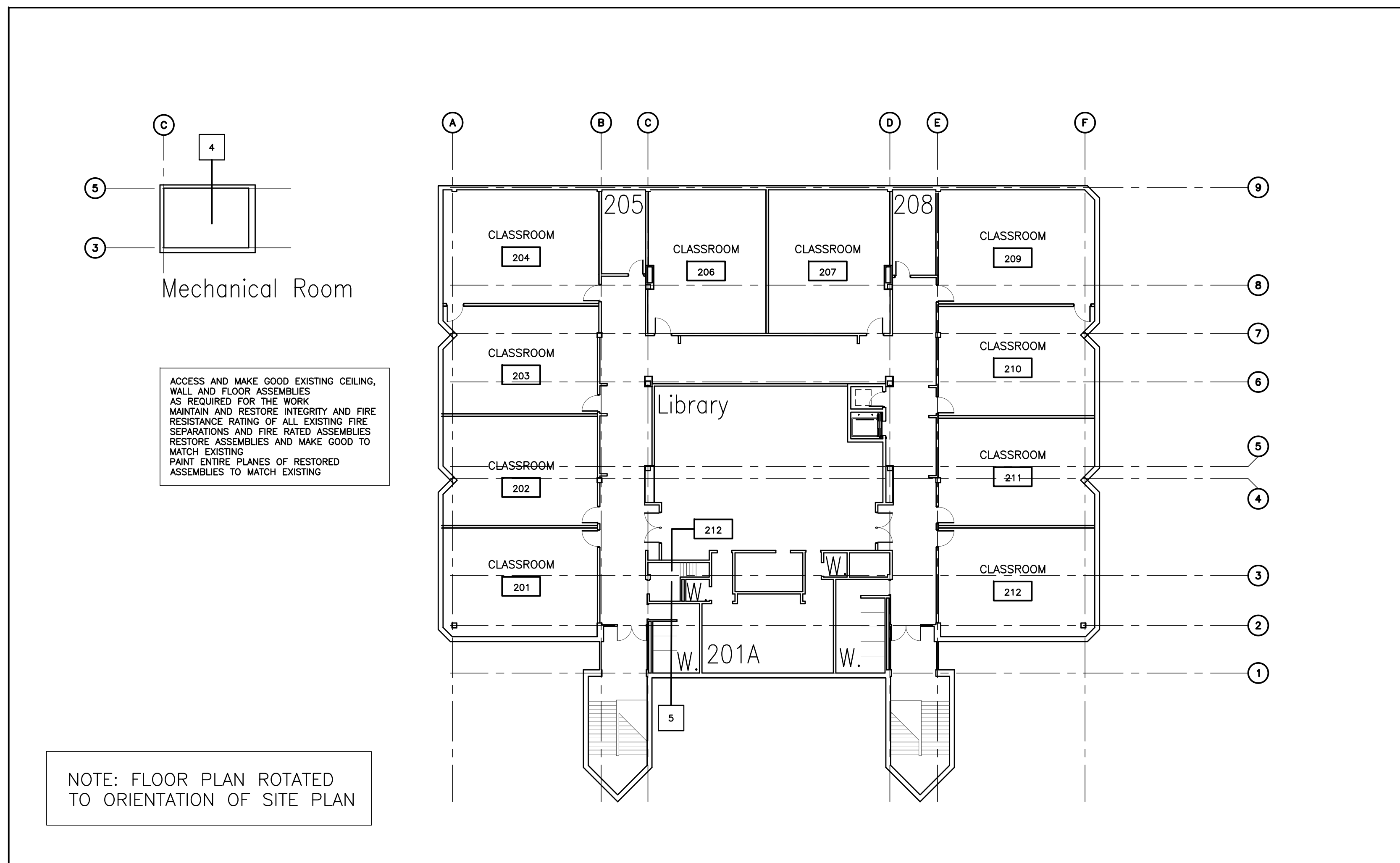
Scale:
AS SHOWN Issued:

Job No.:
20144 Drawing No.:

Set No.:

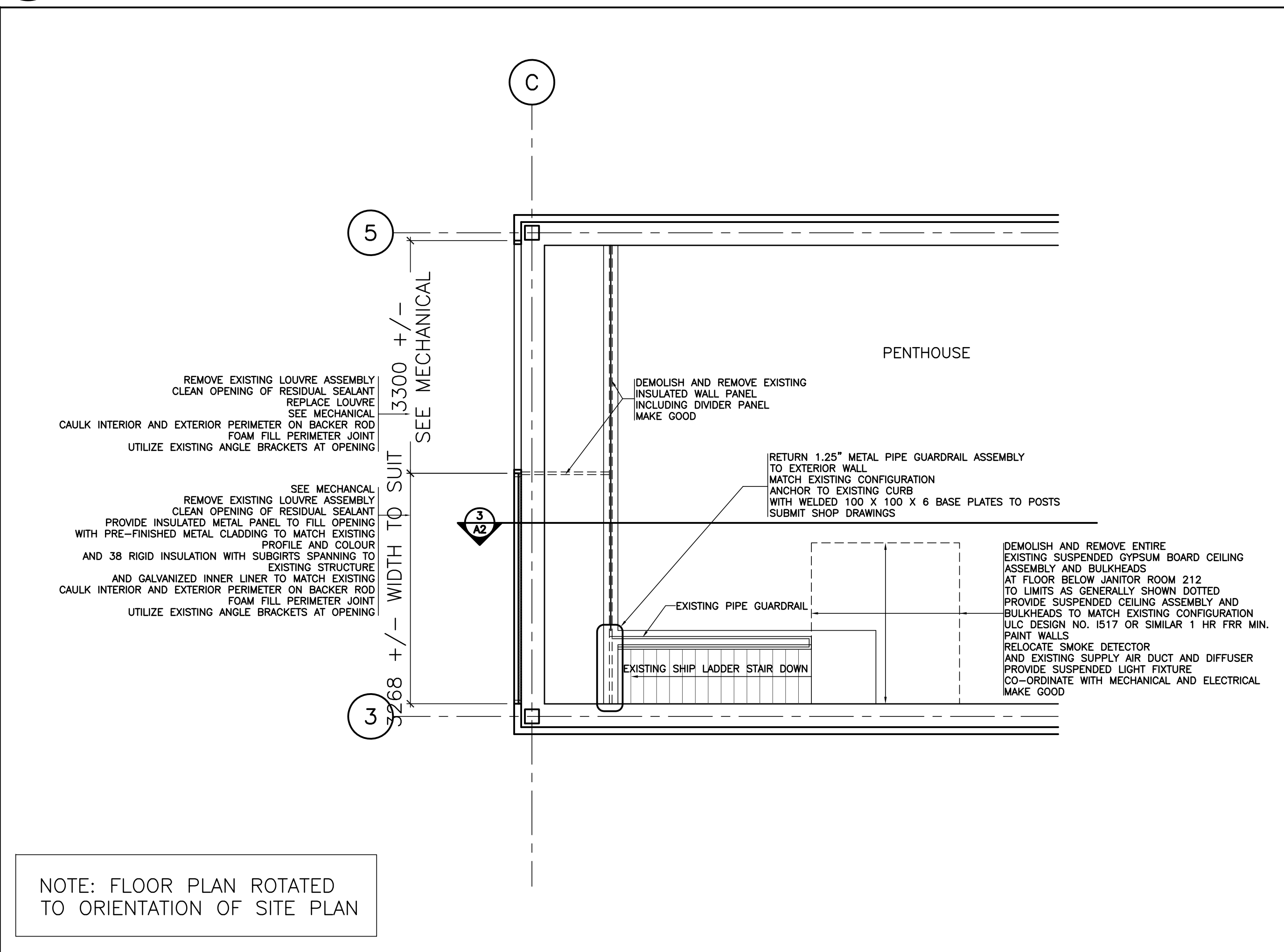
A1

of:



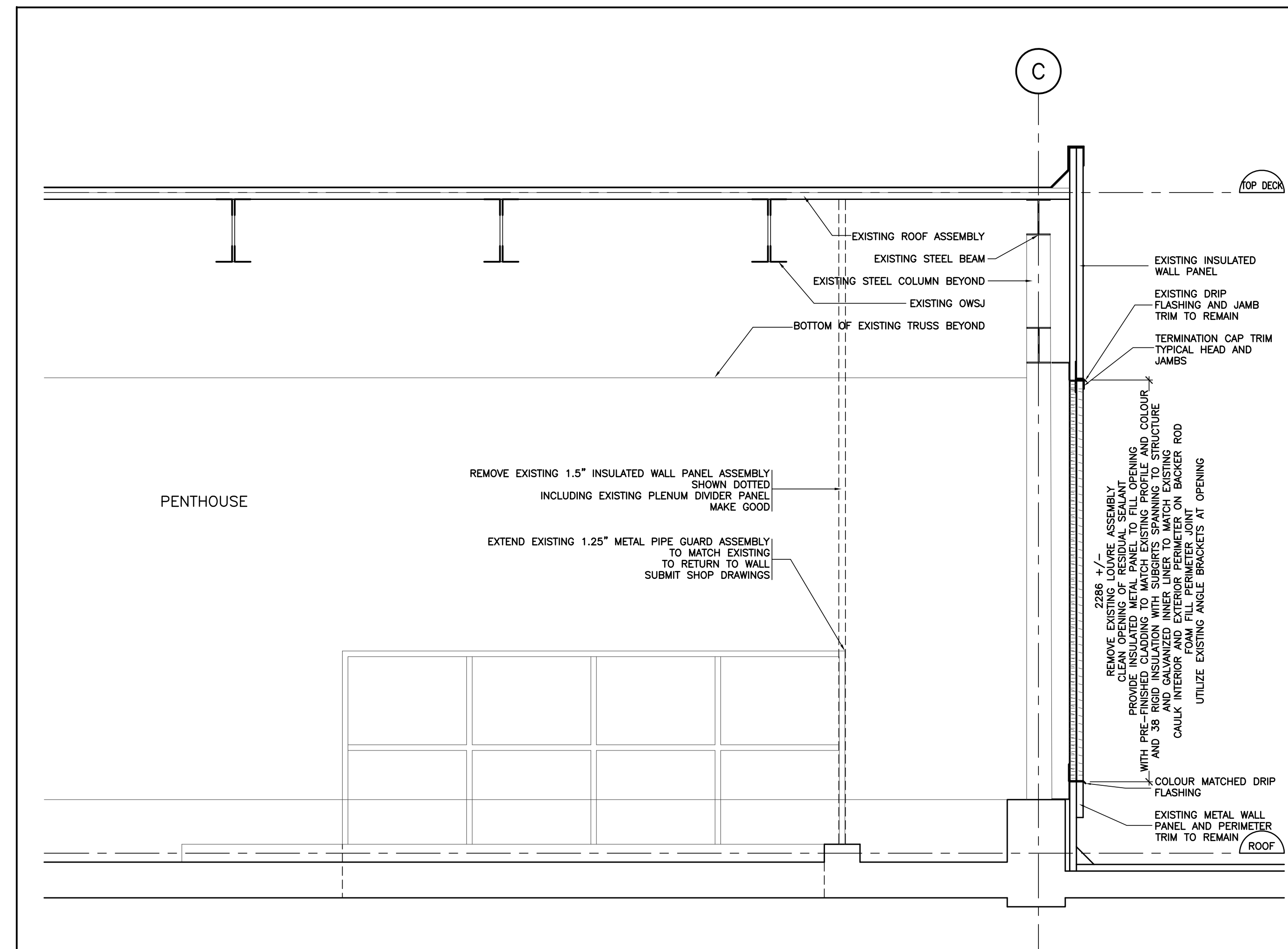
1 SECOND FLOOR SP1 PLAN

1:200



2 PARTIAL PENTHOUSE SP1 ROOF PLAN

1:200



3 PARTIAL PENTHOUSE SECTION

1:200

LEGEND

REFER TO ASBESTOS ABATEMENT SPECIFICATIONS SECTION 02080

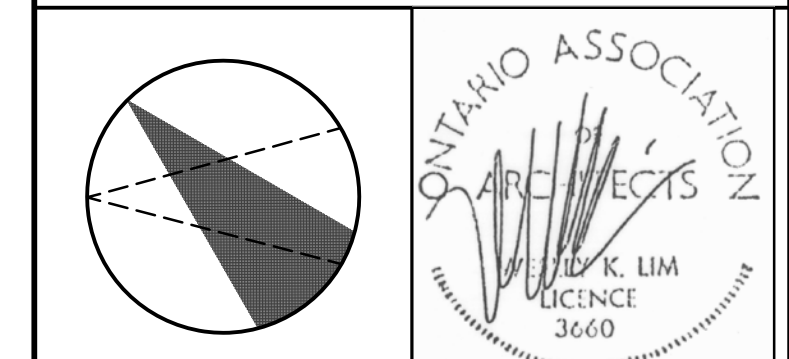
- WORK AREA 1: ROOM 130
REMOVE ENTIRE CEILING IN ACCORDANCE WITH SECTION 02080
PROVIDE SUSPENDED GYPSUM BOARD CEILING
ULC DESIGN NO. 1517 OR SIMILAR
1HR FRR MIN.
- WORK AREA 2: ROOMS 102, 103, 104A, 115A AND 116
IDENTIFY SELECT AREAS OF EXISTING SUSPENDED GYPSUM BOARD CEILING REQUIRED FOR ACCESS TO PERFORM THE WORK
CUT EXISTING CEILING IN ACCORDANCE WITH SECTION 02080
CO-ORDINATE SIZE OF CUT WITH FIRE RATED PRE-MANUFACTURED ACCESS PANELS 1 HR FRR WITH PERIMETER FRAME AND HINGED LATCHABLE ACCESS COVER
SUBMIT SHOP DRAWINGS PROVIDED IN ACCORDANCE WITH MANUFACTURER'S SPECIFICATIONS
MAKE GOOD
- WORK AREA 3: ROOM 110
ACCESS EXISTING SUSPENDED CEILING
SALVAGE EXISTING MATERIALS AND STORE FOR REINSTALLATION
PERFORM REMEDIATION IN ACCORDANCE WITH SECTION 02080
REINSTALL SALVAGED MATERIALS AND MAKE GOOD CEILING
- WORK AREA 4: ROOMS 107M AND 212M
ACCESS WORK AREA AS REQUIRED
PERFORM REMEDIATION IN ACCORDANCE WITH SECTION 02080
- WORK AREA 5: ROOM 212 AND STAIR LEADING TO ROOM 212M
MEASURE AND RECORD CONFIGURATION OF EXISTING SUSPENDED CEILING AND BULKHEAD ASSEMBLIES
SUBMIT SKETCH TO CONSULTANT
REMOVE ENTIRE EXISTING SUSPENDED GYPSUM BOARD CEILING AND BULKHEAD ASSEMBLIES IN ACCORDANCE WITH SECTION 02080
PROVIDE SUSPENDED GYPSUM BOARD CEILING AND BULKHEADS TO MATCH CONFIGURATION OF EXISTING
CO-ORDINATE WITH MECHANICAL AND ELECTRICAL
ULC DESIGN NO. 1517 OR SIMILAR. 1 HR FRR MIN.
MAKE GOOD
- WORK AREA 6: LOCATIONS TO BE DETERMINED
REFER TO SECTION 02080 FOR TYPE 2 ASBESTOS REMOVAL OPERATIONS
- WORK AREA 7: LOCATIONS TO BE DETERMINED
REFER TO SECTION 02080 FOR TYPE 2 GLOVEBAG ASBESTOS REMOVAL OPERATIONS

Ref.	No.	Description	Date	Initial
△		ISSUED FOR PERMIT AND TENDER	2021/04/27	
△		REVISED FOR PERMIT AND TENDER	2021/12/07	
△		REVISED FOR PERMIT AND TENDER	2022/01/27	

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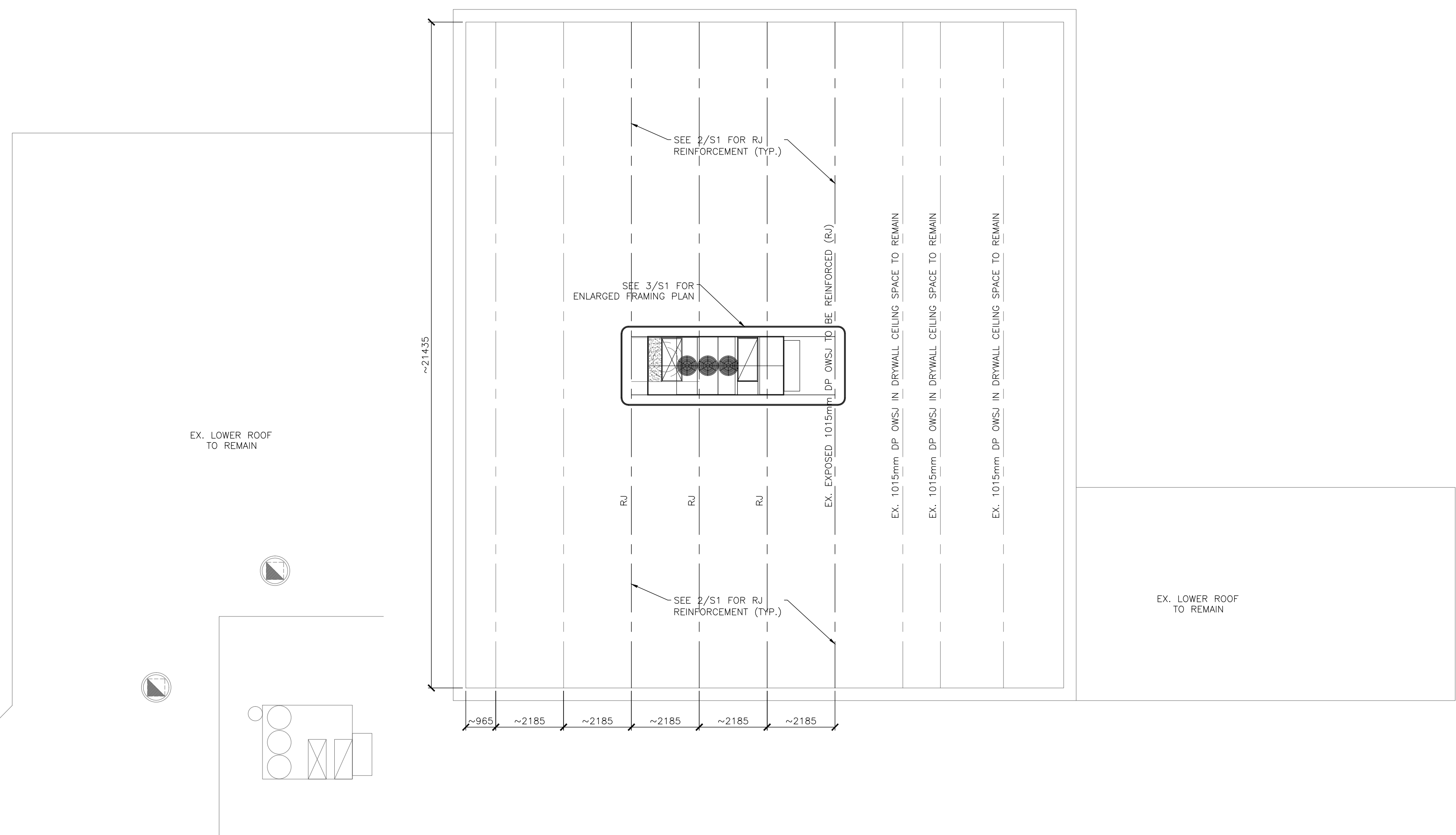


Consultant:

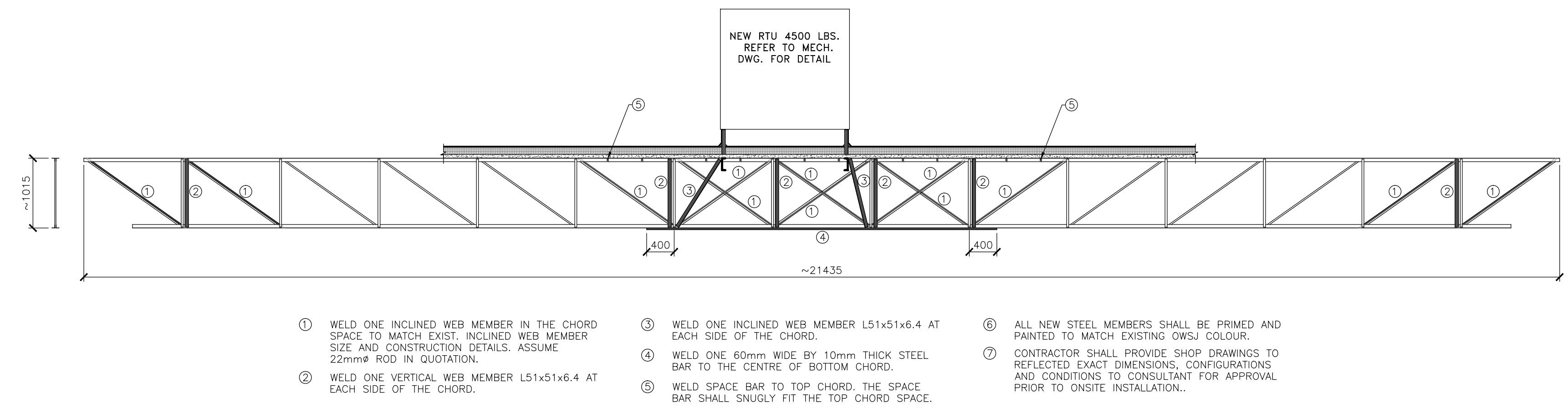
Title:
SECOND FLOOR PLAN,
PARTIAL PENTHOUSE PLAN,
PARTIAL PENTHOUSE SECTION

Drawn by: M.L.	Date: JANUARY 2021
Checked by: W.L.	Plotted:
Scale: AS SHOWN	Issued:
Job No.: 20144	Drawing No.:
Set No.:	A2

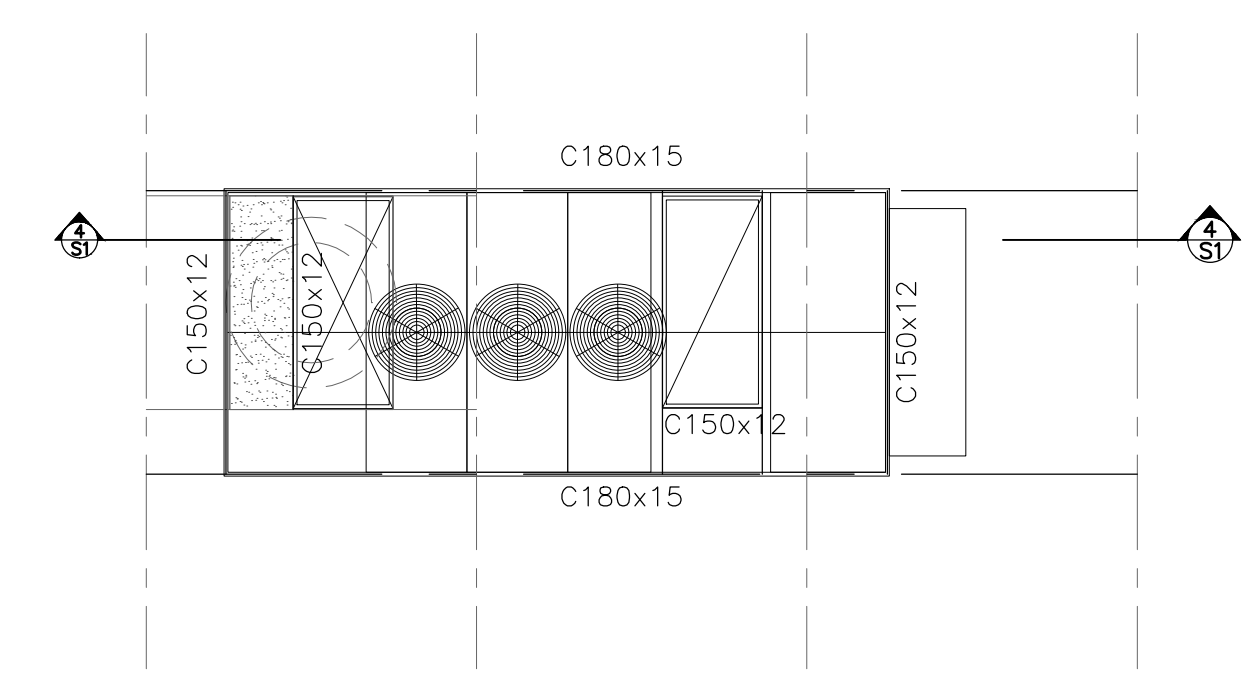
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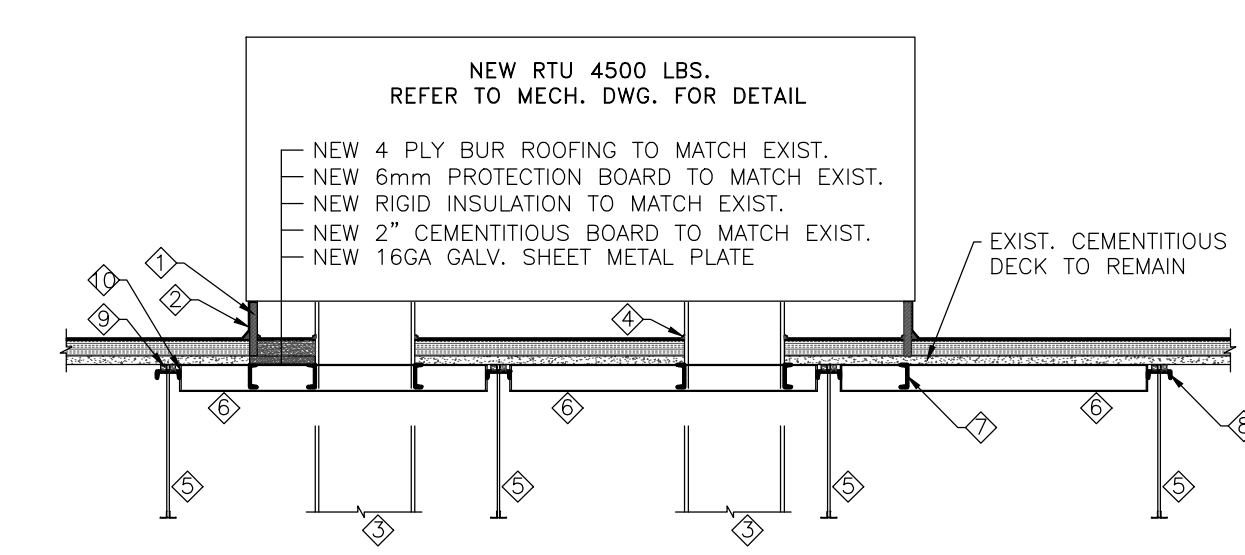
1 PROPOSED RTU FRAMING PLAN
SCALE: 1:100



2 PROPOSED RJ REINFORCEMENT ELEVATION
SCALE: 1:50



3 ENLARGED RTU FRAMING PLAN
SCALE: 1:50



4 ENLARGED RTU FRAMING SECTION
SCALE: 1:50

- ◆ NEW PREFABRICATED CURB. REFER TO MECH. DWGS FOR DETAILS.
- ◆ NEW MODIFIED SBS BASE FLASHING, CAP FLASHING & 22GA. SHEET METAL PROTECTION FLASHING. SBS FLASHING SHALL BE INSTALLED PER CANADIAN ROOFING REFERENCE MANUAL AND SHALL OVERLAP EXIST. FIELD MEMBRANE 8" MINIMUM.
- ◆ NEW S/A OR R/A DUCT OPENING. SEE MECH. DWGS FOR DETAILS.
- ◆ PROVIDE TREMCO DYMNIC 100 SEALANT AT ALL JOINTS INSIDE THE ROOF CURB.
- ◆ EXIST. OWSJ TO BE REINFORCED.
- ◆ NEW C180x15 STEEL CHANNEL C/W PRIMER & PAINT TO MATCH JOIST COLOUR. FULLY WELD C180x15 TO STEEL CHANNEL CONNECTOR PER DESIGN NOTE #8. C180x15 SHALL FIT EXIST. CEMENTITIOUS DECK ABOVE SNUGLY.
- ◆ NEW C150x12 STEEL CHANNEL C/W PRIMER & PAINT TO BE CONNECTED TO C180x15. THE C150x12 SHALL FIT EXIST. CEMENTITIOUS DECK ABOVE SNUGLY.
- ◆ NEW 100mm LONG C150x12 STEEL CHANNEL CONNECTOR C/W PRIMER & PAINT TO BE FULLY WELDED TO TOP CHORD OF OWSJ.
- ◆ NEW 6mm GUSSET PLATE C/W PRIMER & PAINT TO BE FULLY WELDED TO EXIST. STEEL ANGLE.
- ◆ NEW 6mm GUSSET PLATE C/W PRIMER & PAINT TO BE FULLY WELDED TO NEW C180x15 CHANNEL.

GENERAL NOTES

1. THE BUILDING STRUCTURE HAS BEEN DESIGNED IN ACCORDANCE WITH THE ONTARIO BUILDING CODE 2012.
2. THE CONTRACTOR SHALL CHECK ALL DIMENSIONS WITH THE LATEST ISSUE OF ARCHITECTURAL, MECHANICAL AND ELECTRICAL DRAWINGS. REPORT ANY DISCREPANCIES BEFORE PROCEEDING WITH THE WORK.
3. READ STRUCTURAL DRAWINGS IN CONJUNCTION WITH SPECIFICATIONS AND OTHER CONTRACT DOCUMENTS.
4. SEE DRAWINGS FOR DESIGN LOADS. DO NOT EXCEED DURING CONSTRUCTION.
5. ALL REFERENCES TO CODES & STANDARDS ARE TO THE LATEST ISSUE.
6. THE CONTRACTOR IS RESPONSIBLE TO PROVIDE A SAFE SUPPORT PRIOR TO REMOVE ANY EXIST. STRUCTURAL MEMBERS. THE SUPPORT SHALL BE DESIGNED AND CERTIFIED BY THE CONTRACTOR'S ENGINEER.

SHOP DRAWINGS

1. THE CONTRACTOR SHALL FURNISH SHOP DRAWINGS TO THE STRUCTURAL ENGINEER, ONE SET/PA AND TWO PRINTS STAMPED BY A PROFESSIONAL ENGINEER REGISTERED IN THE PROVINCE OF ONTARIO.
 - A) MAJOR ROOF TOP EQUIPMENT ERECTION & DETAILS
 - B) OWSJ REINFORCEMENT.
 - C) ROOFING REPAIR DETAILS

TEMPORARY MEASURES FOR SMOKE REMOVAL

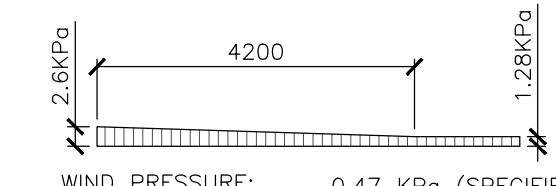
1. CONTRACTOR SHALL TAKE ALL NECESSARY PROTECTION MEASURES TO ELIMINATE DAMAGE TO PROPERTY AND INCLUDE FOR TEMPORARY VENTILATION SYSTEMS (FANS AND DUCTS) TO ELIMINATE RISK OF MIGRATION OF OBJECTIONABLE VAPOURS/SMOKE INTO EXISTING BUILDING DURING REINFORCEMENT OF ROOF STRUCTURES.
2. INCLUDE COST TO RESTORE ALL DISTURBED AREAS (INCLUDING WALL, CEILING, FLOORING, FIXTURES, FURNISHINGS, FINISHING ETC.) TO THEIR ORIGINAL CONDITIONS.
3. REFER TO GENERAL CONSTRUCTION REQUIREMENT FOR ADDITIONAL REQUIREMENTS.
4. CONTRACTOR SHALL TAKE ALL MEASURES NECESSARY (INCLUDING FIRE PREVENTION DURING ONSITE WELDING) TO PROTECT THE EXISTING ROOFING SYSTEM AND EXISTING FINISHES. RESTORE AND/OR REPAIR THE DISTURBED AREAS TO THEIR ORIGINAL CONDITION OR BETTER.
5. CONTRACTOR SHALL INSPECT THE CONDITION OF THE CEILING SPACING PRIOR TO TENDER SUBMISSION AND ALLOW FOR COST RELATED TO REMOVAL, REINSTALLATION AND MODIFICATION OF ELECTRICAL AND MECHANICAL WORK TO ACCOMMODATE THE OWSJ REINFORCEMENT.

STRUCTURAL METAL

1. CONFORM TO CSA STANDARD CAN/CSA S16 LIMIT STATES DESIGN OF STEEL STRUCTURES.
2. CONFORM TO CSA STANDARD W55.3, RESISTANCE WELDING QUALIFICATIONS CODE FOR FABRICATORS OF STRUCTURAL MEMEBERS USED IN BUILDINGS.
3. CONFORM TO W59, WELDED STEEL CONSTRUCTION (METAL ARC WELDING).
4. WELDING ELECTRODES - CSA STANDARD W48 FILLER METALS AND ALLIED MATERIALS FOR METAL ARC WELDING.
5. STRUCTURAL STEEL - CSA STANDARD CAN/CSA G40.20/G40.21, GENERAL REQUIREMENTS FOR ROLLED OR WELDED STRUCTURAL QUALITY STEEL/STRUCTURAL QUALITY STEELS, GRADE 350W FOR GENERAL PURPOSE STRUCTURAL STEELS SHAPES, 300W FOR ANGLES, CHANNELS, RODS AND PLATES, HOLLOW STRUCTURAL SECTIONS SHALL CONFORM TO CSA STANDARD G40.20 GRADE 350W CLASS H.
6. PRIMER: GREY
 - A) STRUCTURAL STEEL NOT EXPOSED: CAN/C508-1.40 OR CISC/CPMA 1-73a OVER NOMINAL CLEANING.
 - B) STRUCTURAL STEEL INTERIOR EXPOSURE: TO RECEIVE A TOP COATING - CISC/CPMA 2-75 OVER BRUSH OFF BLAST CLEANING AS PER SSPC 7.
 - C) STRUCTURAL STEEL TO RECEIVE SPRAY FIRE PROOFING - NO PAINT.
 - D) REGIONS OF STEEL TO RECEIVE FIELD WELDING - NO PAINT.
 - E) PAINT NEW STEEL ELEMENT TO MATCH EXISTING OWSJ COLOUR.
7. PAINT REMOVAL: INCLUDE PRICE TO REMOVE EXISTING PAINT ON OWSJ AS REQUIRED TO ACCOMMODATE JOIST REINFORCEMENT/ONSITE WELDING. ASSUME EXISTING PAINT CONTAINS DESIGNATED SUBSTANCES (LEAD ETC.).
8. CONTRACTOR SHALL PROVIDE 3RD PARTY INSPECTION REPORTS TO CONSULTANT FOR THE ROOFING AND OWSJ WELDING WORK.

DESIGN DATA:

ROOF:	
DEAD LOAD	2.02 KPa (SPECIFIED)
SNOW LOAD	1.28 KPa + ACCUMULATION (SPECIFIED)
WIND PRESSURE:	0.47 KPa (SPECIFIED)
SEISMIC DATA:	
Sa(0.2)=0.26, Sa(0.5)=0.129, Sa(1.0)=0.062, Sa(2.0)=0.029, Sa(5.0)=0.0070, Sa(10.0)=0.0027, PGA=0.167, PGV=0.101.	



2	ISSUED FOR PERMIT/TENDER	APR.02.2021
1	ISSUED FOR 75% SUBMISSION	MAR.18.2021

NO	REVISIONS	DATE

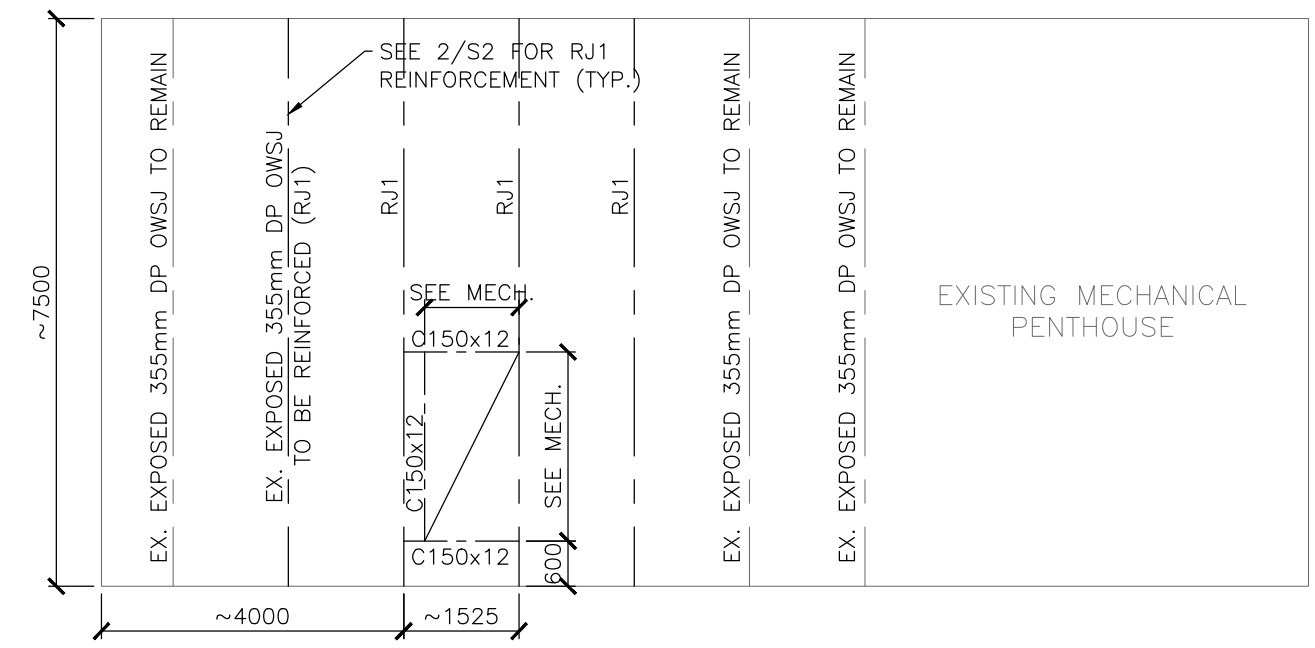


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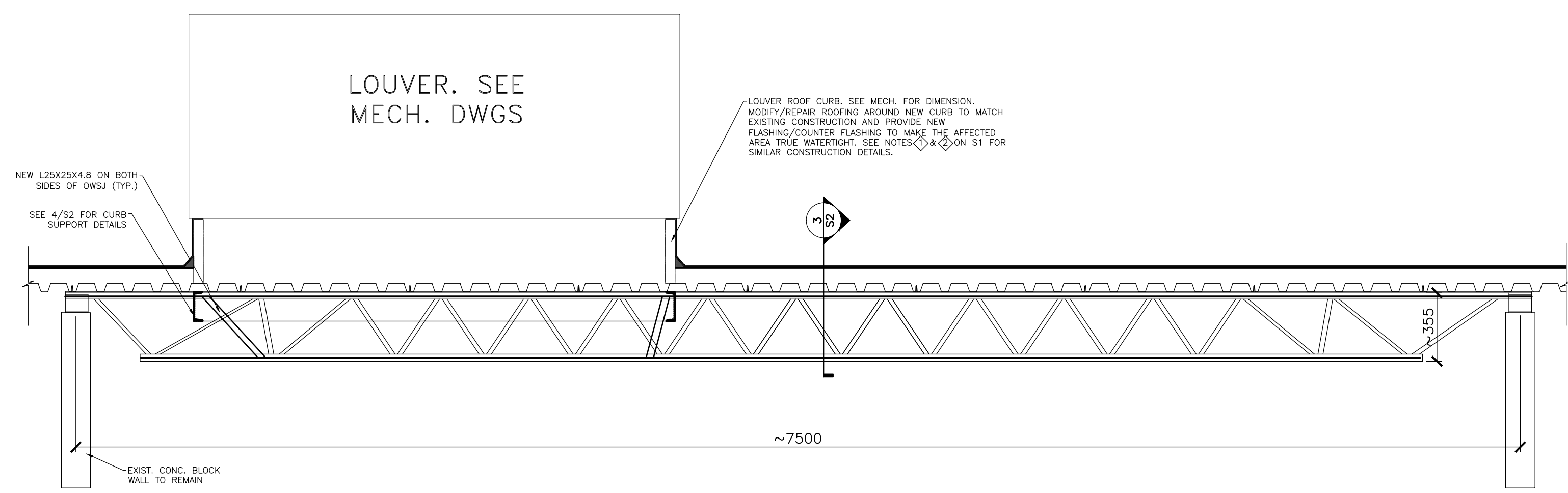
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1285 MONTCLAIR DR, OKVILLE, ON

RTU FRAMING PLANS, SECTION, OWSJ REINFORCEMENT AND NOTES

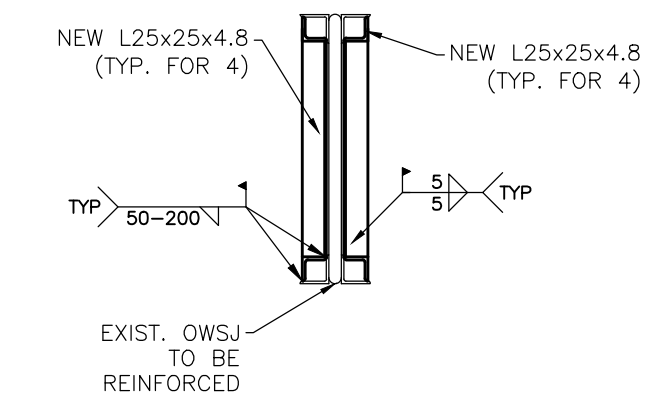
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DATE: MARCH 2021	
DRAWN: H.X.	DRAWING: S-1
CHECKED: H.X.	
PRINT DATE: MAR. 2021	



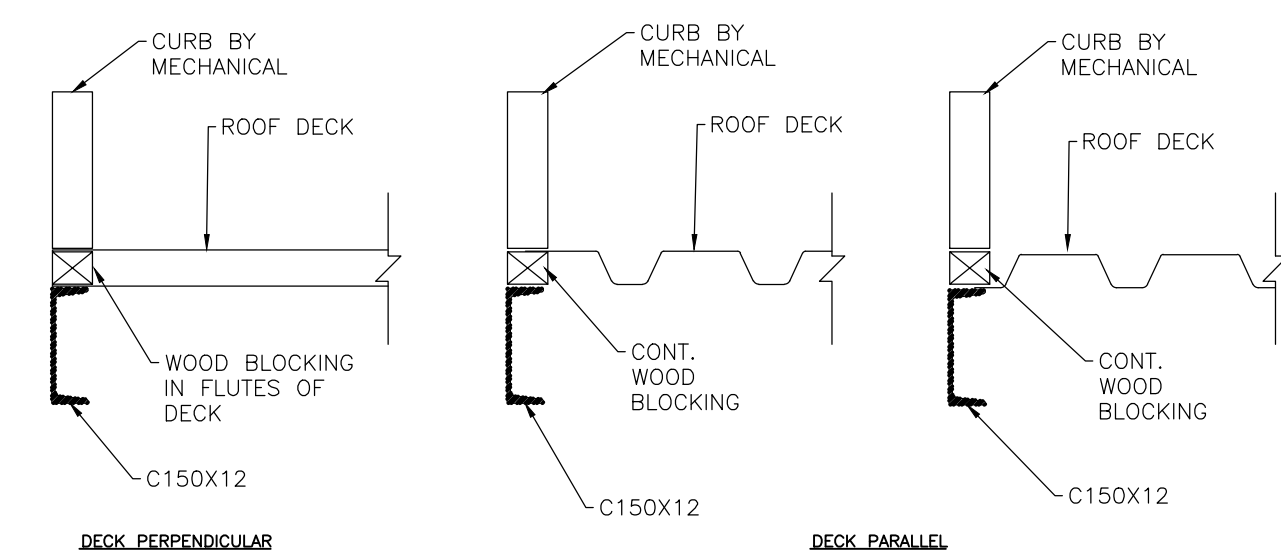
1 PROPOSED PENTHOUSE FRAMING PLAN
 S2 SCALE: 1:100



2 PROPOSED RJ1 REINFORCEMENT ELEVATION
 S2 SCALE: 1:50



3 RJ1 REINFORCEMENT SECTION
 S2 SCALE: 1:10



4 TYP. ROOF CURB DETAILS
 S2 SCALE: 1:10

2	ISSUED FOR PERMIT/TENDER	APR.02.2021
1	ISSUED FOR 75% SUBMISSION	MAR.18.2021

NO	REVISIONS	DATE

DRAWINGS ARE NOT TO BE SCALED. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND CONDITIONS ON THE PROJECT AND MUST REPORT ANY DISCREPANCIES TO THE ARCHITECTS BEFORE PROCEEDING WITH THE WORK. THE USE OF THIS DRAWING OR PART THEREOF IS FORBIDDEN WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECTS.



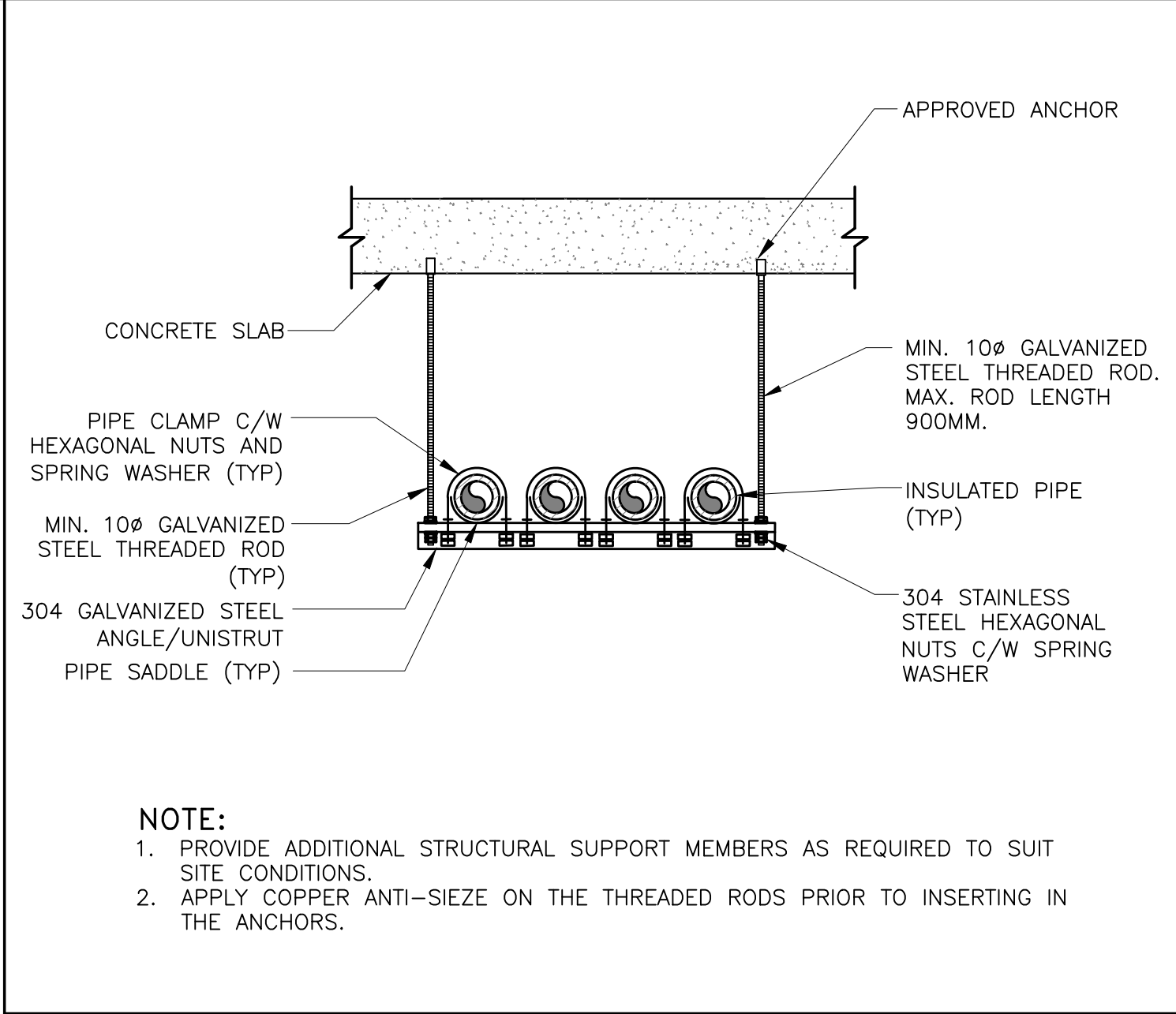
Moon-Matz Ltd.
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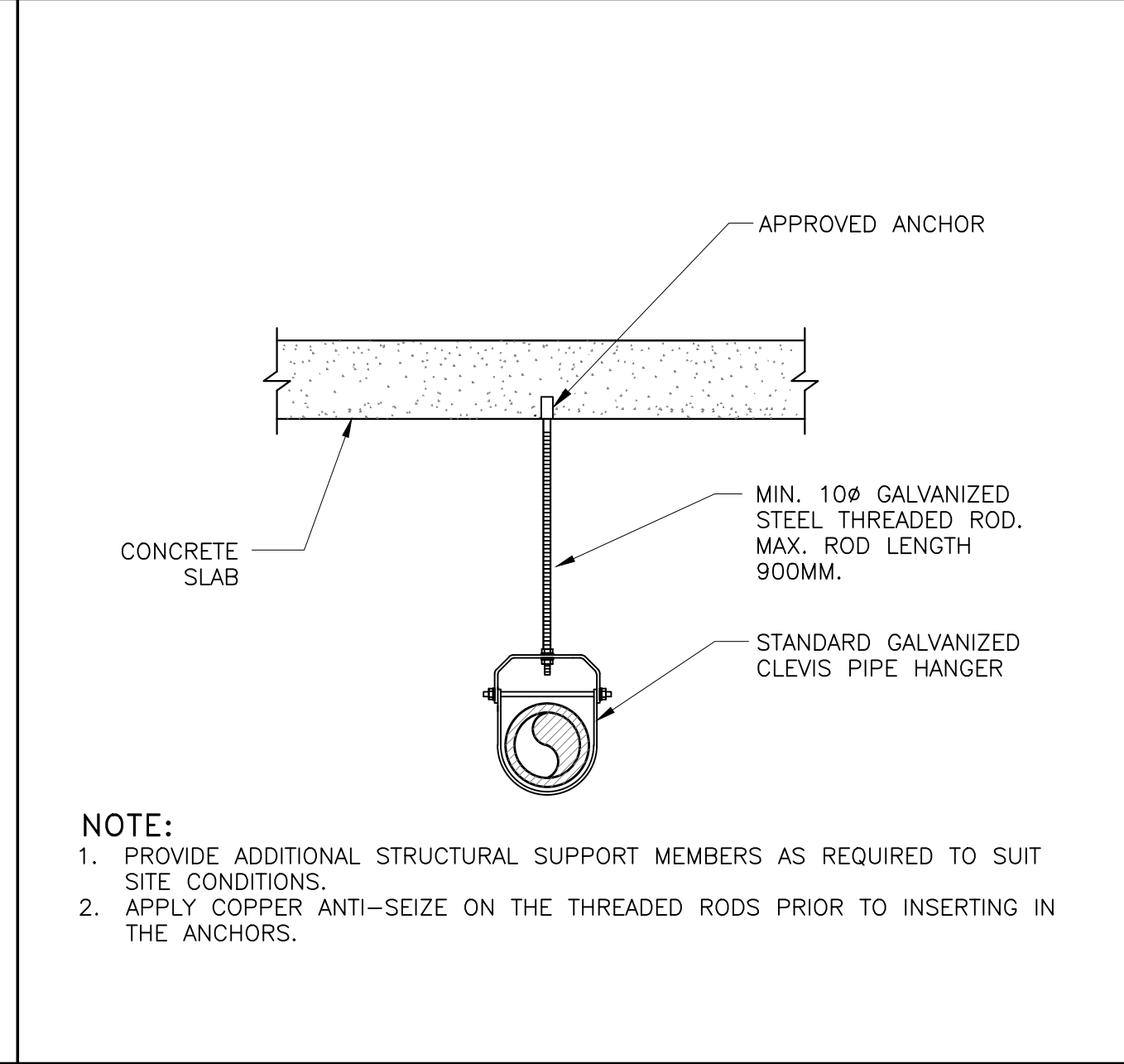
LOUVER FRAMING PLAN, SECTION, OWSJ REINFORCEMENT AND NOTES

SCALE: AS NOTED	PROJECT: MML #6239
DATE: MARCH 2021	
DRAWN: H.X.	DRAWING: S-2
CHECKED: H.X.	
PRINT DATE: MAR. 2021	

MECHANICAL DRAWINGS LIST (OFFICE)	
DRAWING NO.	DRAWING TITLE
M-1	DRAWING LIST, DETAILS LEGEND & SYMBOLS
M-2	DETAILS
M-3	DETAILS
M-4	PROPOSED EQUIPMENT SCHEDULES
M-5	HVAC & BAS DEMOLITION - GROUND FLOOR (YEAR 2009 AND 1970 BUILDING)
M-6	HVAC & BAS DEMOLITION - GROUND FLOOR (YEAR 1968 BUILDING)
M-7	HVAC & BAS DEMOLITION - SECOND FLOOR (YEAR 1968 BUILDING)
M-8	HVAC & BAS DEMOLITION - ROOF (YEAR 2009 AND 1970 BUILDING)
M-9	HVAC & BAS DEMOLITION - ROOF (YEAR 1968 BUILDING)
M-10	HVAC & BAS PROPOSED - GROUND FLOOR (YEAR 2009 AND 1970 BUILDING)
M-11	HVAC & BAS PROPOSED - GROUND FLOOR (YEAR 1968 BUILDING)
M-12	HVAC & BAS PROPOSED - SECOND FLOOR (YEAR 1968 BUILDING)
M-13	HVAC & BAS PROPOSED - ROOF (YEAR 2009 AND 1970 BUILDING)
M-14	HVAC & BAS PROPOSED - ROOF (YEAR 1968)
M-15	AHU PLAN - MECHANICAL ROOMS & JANITOR'S ROOM
M-16	PENTHOUSE MECHANICAL ROOM PLAN, POINT LIST
M-17	PROPOSED BAS SEQUENCE OF OPERATIONS
M-18	CONTROL DIAGRAM
M-19	CONTROL DIAGRAM
M-20	CONTROL DIAGRAM



MULTIPLE PIPE INSTALLATION (1) M-1
SCALE: N.T.S.



SINGLE PIPE INSTALLATION (2) M-1
SCALE: N.T.S.

LEGEND:

✕ ✕ ✕	EXISTING TO BE REMOVED
CVU	CONVECTOR UNIT
WF	WALL-FIN
RCP	RADIANT CEILING PANEL
CUH	CABINET UNIT HEATER
EF	EXHAUST FAN
VT	VARIABLE VOLUME & TEMP.
RHC	REHEAT COIL
CV	CONTROL VALVE
Ⓢ	THERMOSTAT/TEMP. SENSOR
Ⓢ	3-WAY CONTROL VALVE
Ⓢ	2-WAY CONTROL VALVE
Ⓢ	ELECTRIC SHUT-OFF VALVE
Ⓢ	THERMOMETER
—CHS—	CHILLED WATER SUPPLY
—CHR—	CHILLED WATER RETURN
—HWS—	HOT WATER SUPPLY
—HWR—	HOT WATER RETURN
—G—	GAS
FD	FIRE DAMPER
BD	BALANCING DAMPER
BDD	BACK DRAFT DAMPER
EX	EXISTING
CTE	CONNECT TO EXISTING
MD	MOTORIZED DAMPER
SA	SUPPLY AIR
RA	RETURN AIR
FA, OA	FRESH AIR
EA	EXHAUST AIR
HC	HEATING COIL
CC	COOLING COIL
RF	RETURN FAN
SF	SUPPLY FAN
A-XXX	DIFFUSER TYPE "A"; AIRFLOW L/S
⊗	FLEXIBLE CONNECTION
⊗	INTERNAL THERMAL ACOUSTIC INSULATION



NO.	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
3	ISSUED FOR PERMIT	16.04.2021
2	ISSUED FOR 95% REVIEW	08.04.2021
1	ISSUED FOR 75% REVIEW	18.03.2021

NO.	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
3	ISSUED FOR PERMIT	16.04.2021
2	ISSUED FOR 95% REVIEW	08.04.2021
1	ISSUED FOR 75% REVIEW	18.03.2021

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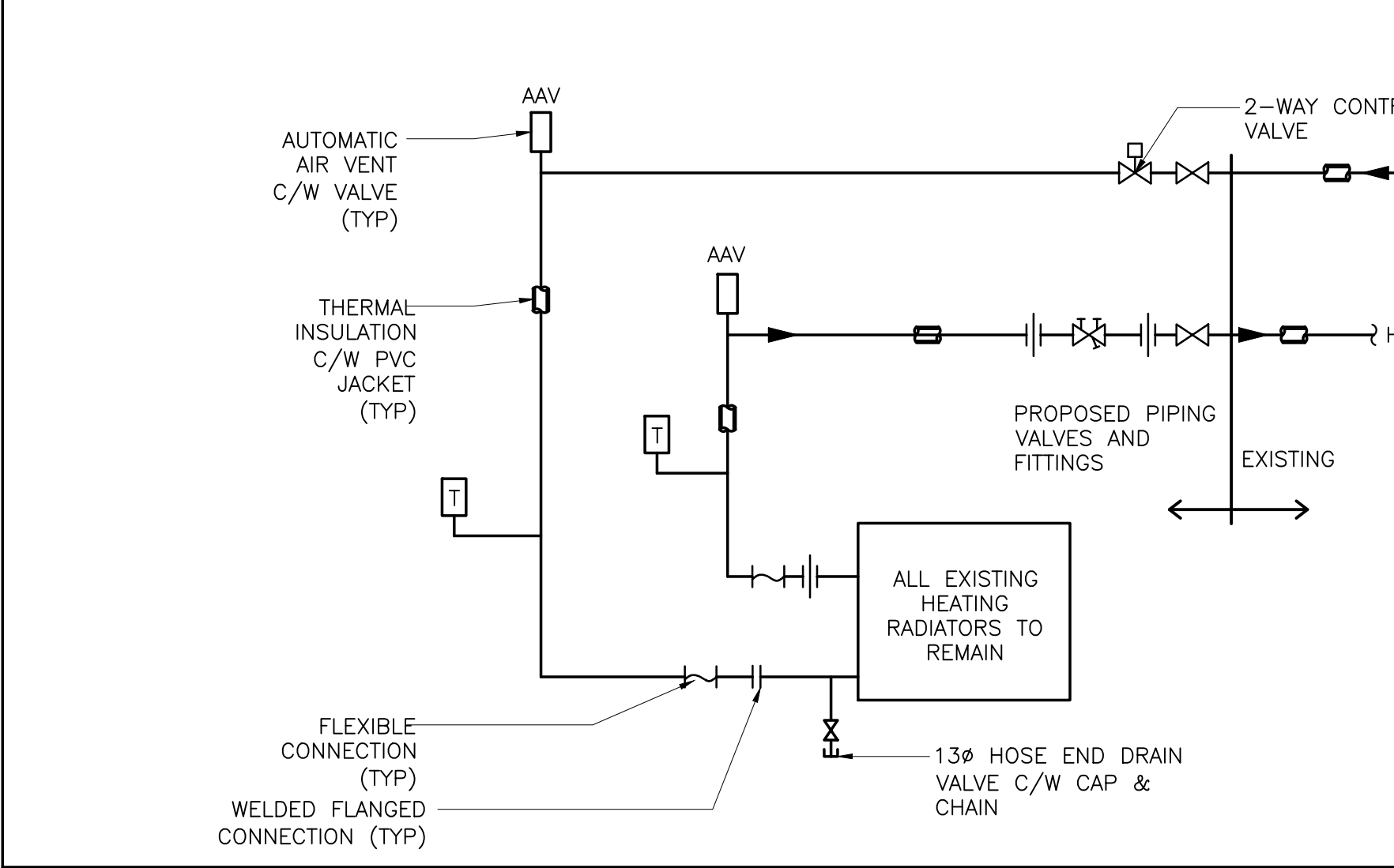


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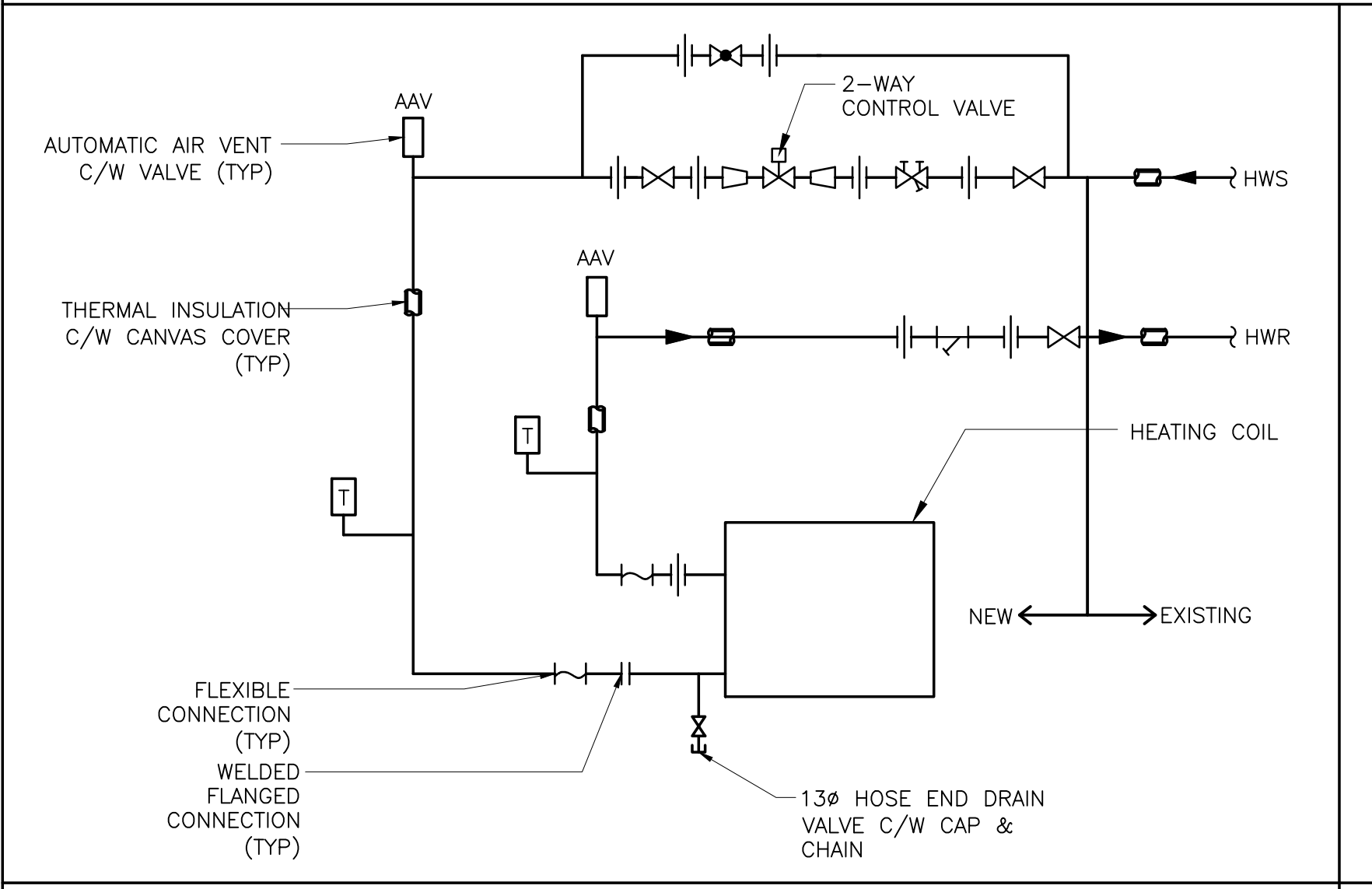
MONCLAIR PS RENOVATION
1285 MONTCLAIR DR, OAKVILLE, ON

DRAWING LIST, LEGEND, SYMBOLS AND DETAILS

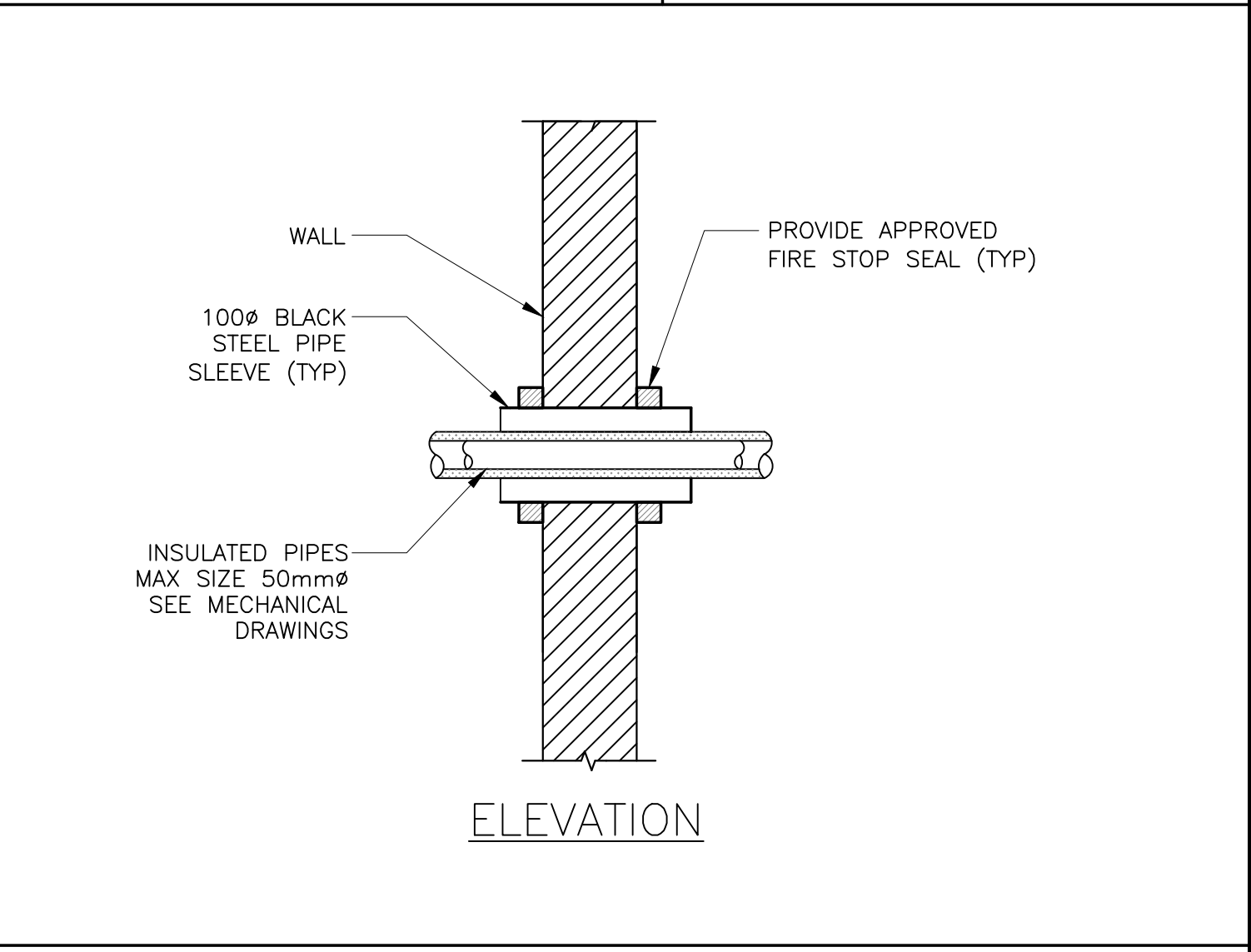
SCALE: AS NOTED	PROJECT: 6239 M-1
DATE: JAN 2021	
DRAWN: V.L.	DRAWING: M-1
CHECKED: P.Y.	
PRINT DATE: JAN, 2021	



HEATING EQUIPMENT PIPING DETAIL (5) M-1
SCALE: N.T.S.

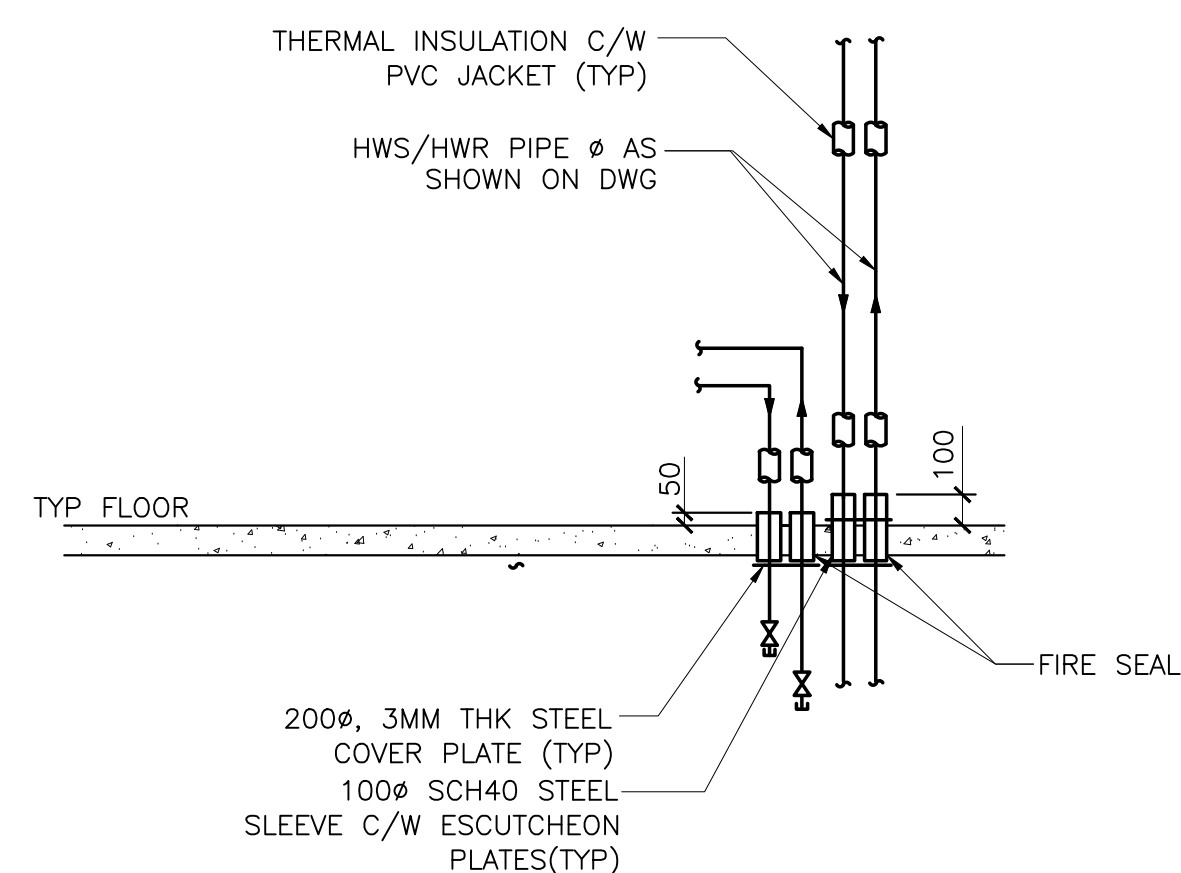


HEATING & COOLING WATER COIL-PIPING DETAIL (2-WAY VALVE) (3) M-1
SCALE: N.T.S.



SINGLE SLEEVE INSTALLATION (4) M-1
SCALE: N.T.S.

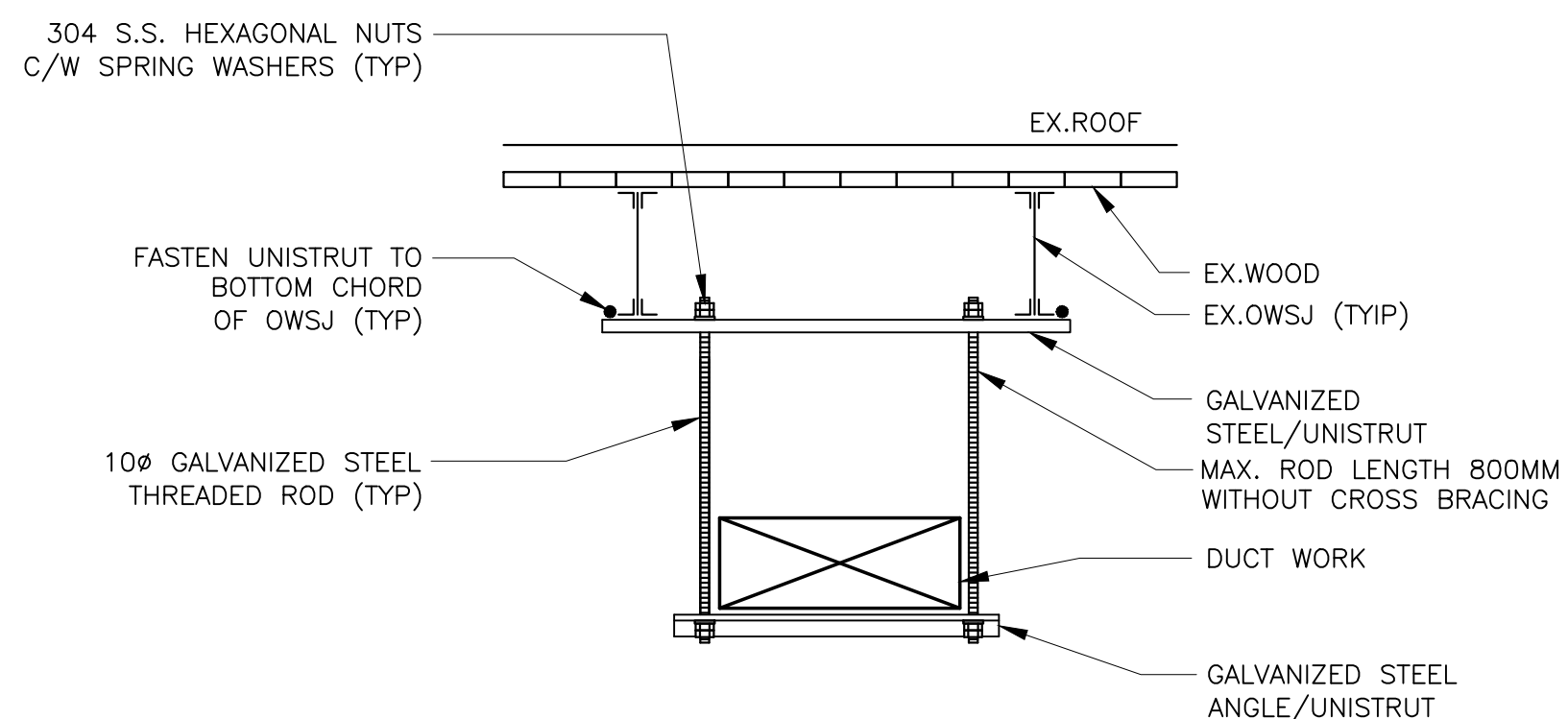
ELEVATION



- NOTE:**
1. SCAN EXISTING SLAB PRIOR TO COMMENCEMENT OF CORING OF HOLES TO LOCATE/AVOID CONCEALED SERVICES.
 2. SEAL AND WATERPROOF ALL PENETRATIONS. APPLY FIRE RATED SEALANT.

PIPE PENETRATION THROUGH FLOOR SLAB
SCALE: N.T.S.

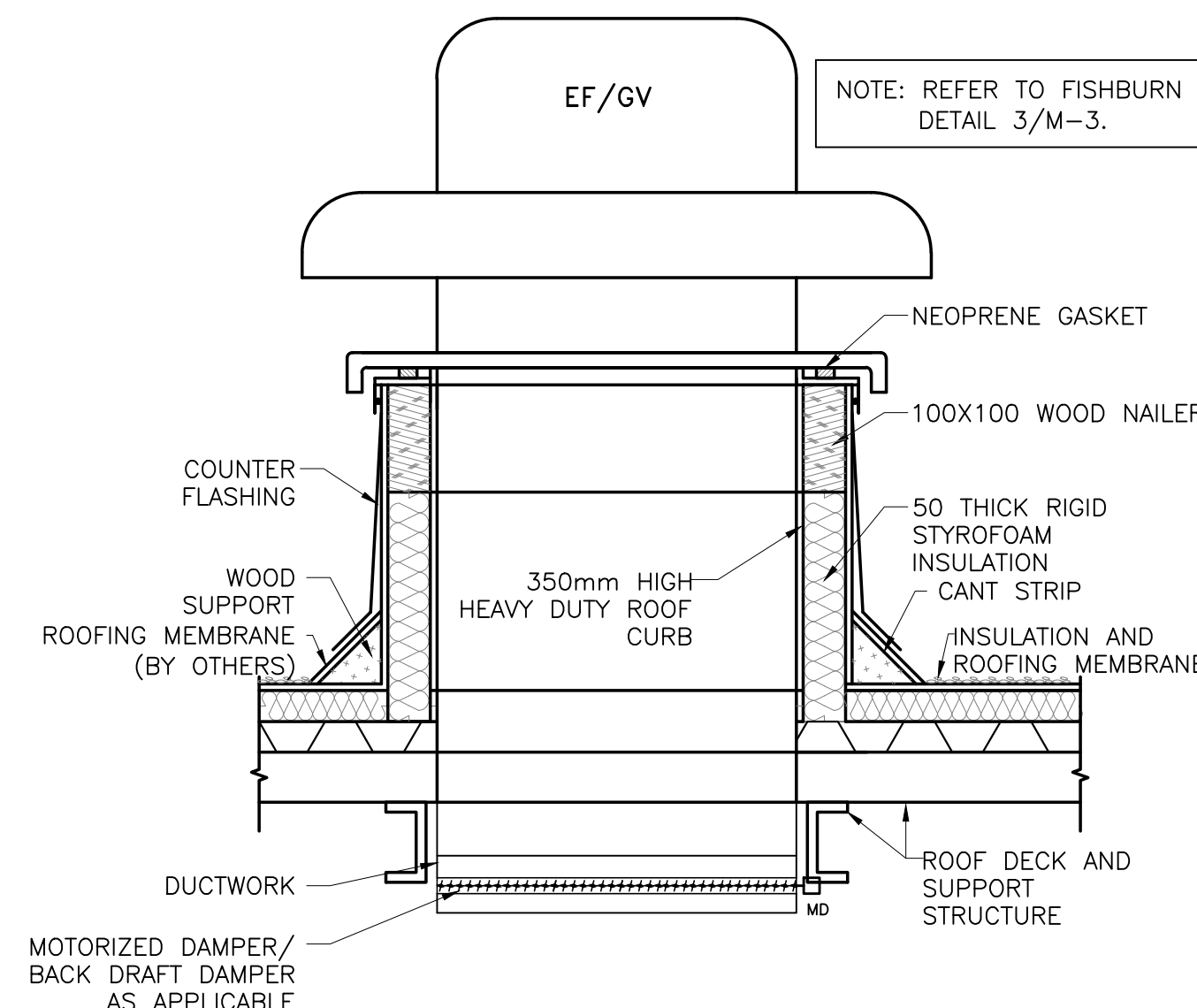
1
M-2



- NOTE:**
1. PROVIDE ADDITIONAL STRUCTURAL SUPPORT MEMBERS AS REQUIRED TO SUIT SITE CONDITIONS.

RECTANGULAR DUCT INSTALLATION DETAIL
SCALE: N.T.S.

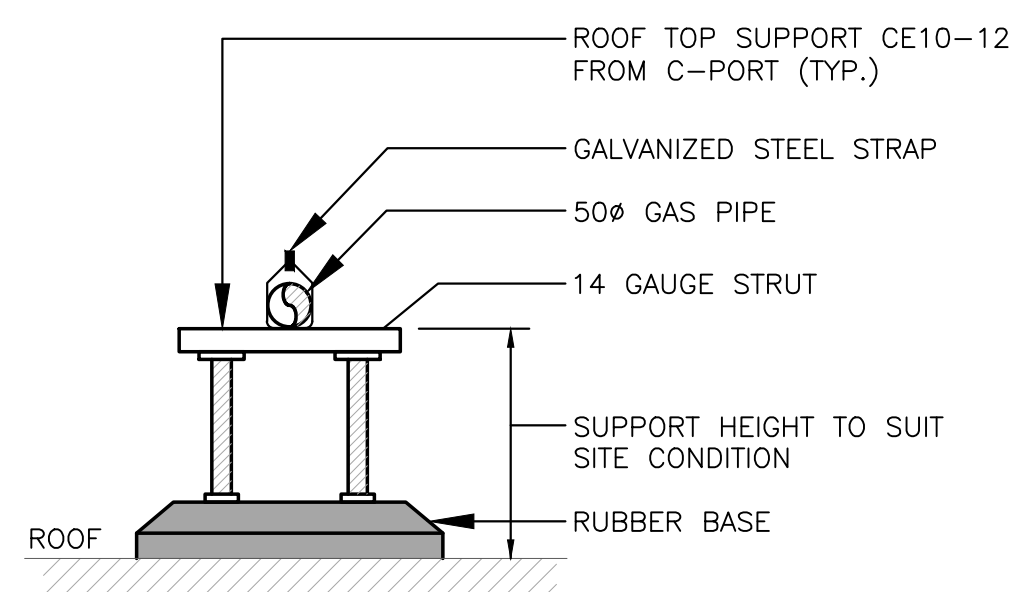
2
M-2



NOTE: REFER TO FISHBURN DETAIL 3/M-3.

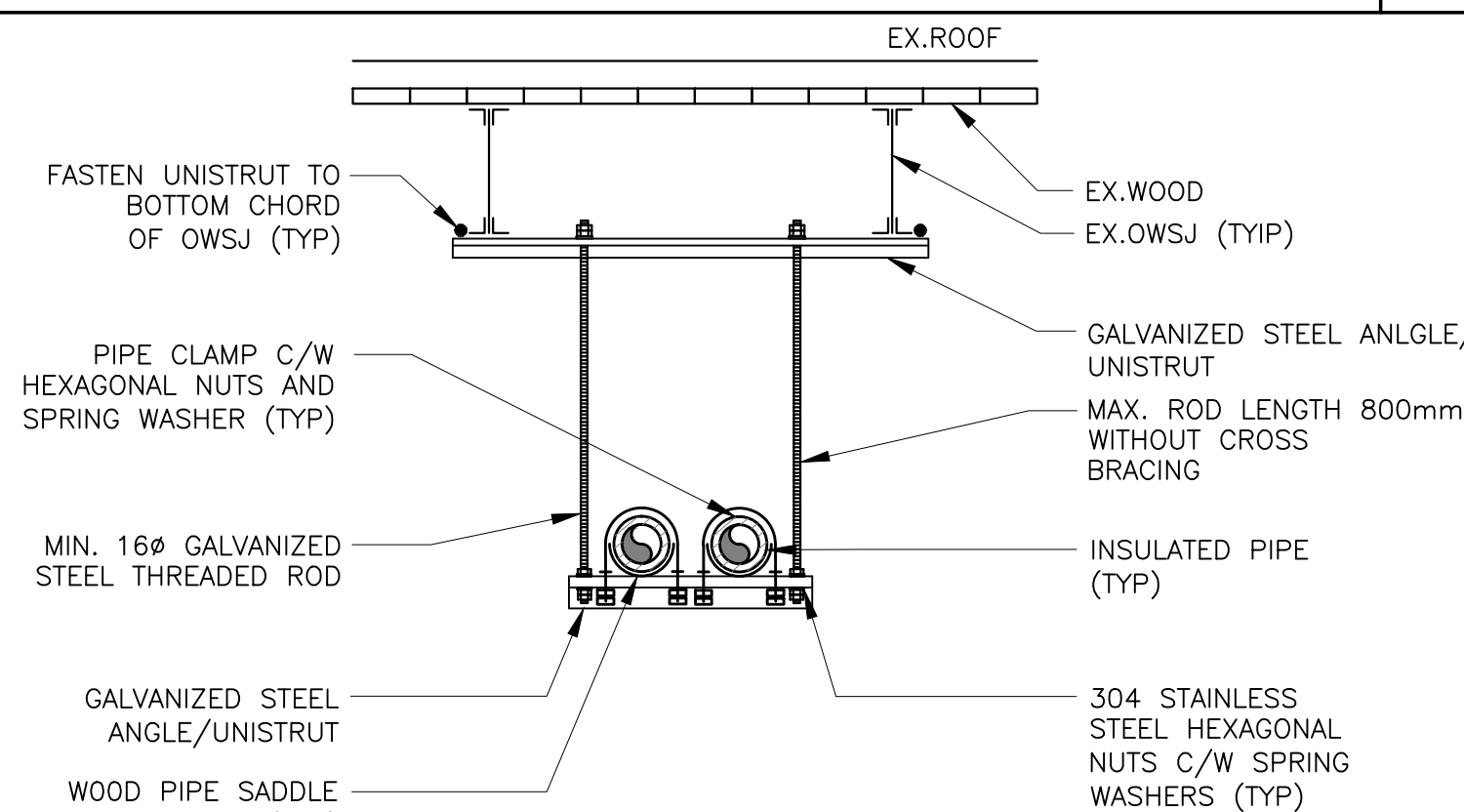
ROOF FAN INSTALLATION DETAIL
SCALE: N.T.S.

3
M-2



GAS PIPING SUPPORT DETAIL
SCALE: N.T.S.

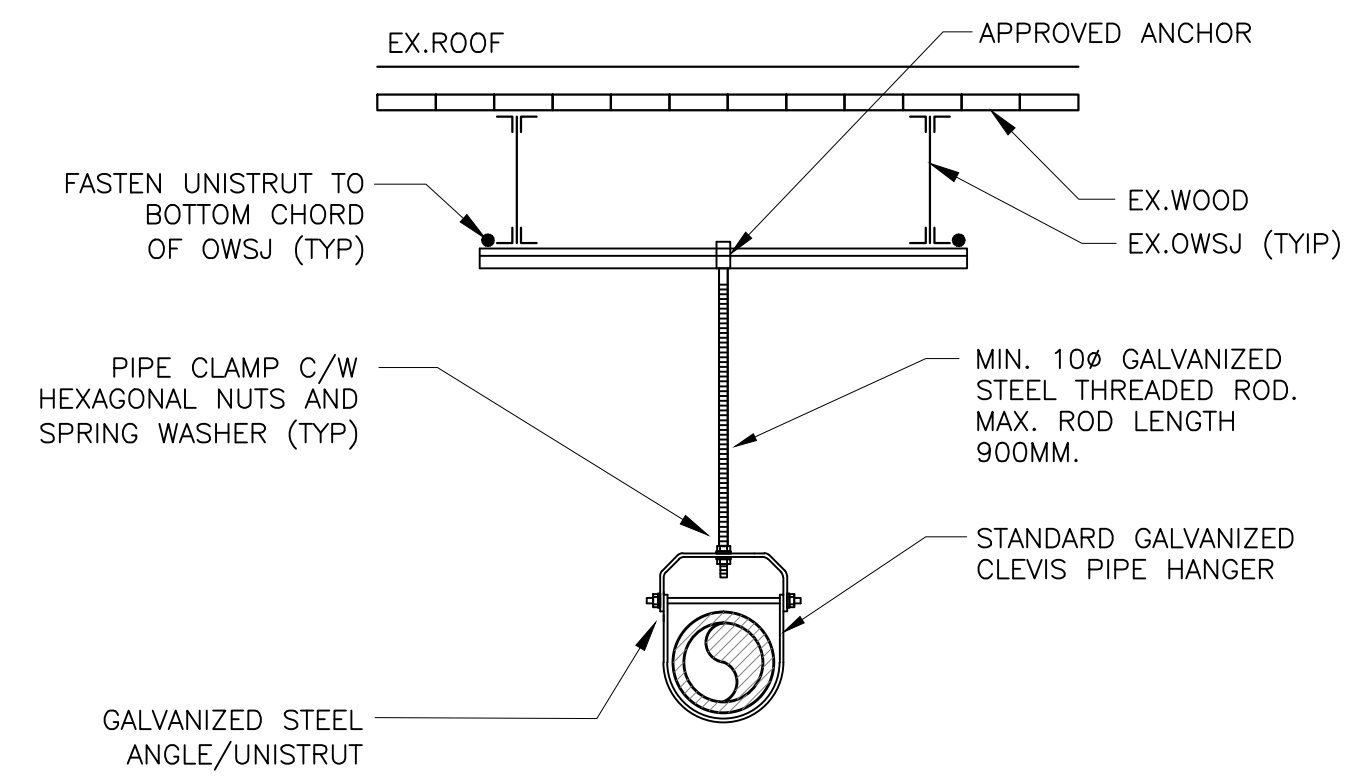
4
M-2



- NOTES:**
1. PROVIDE ADDITIONAL STRUCTURAL SUPPORT MEMBERS AS REQUIRED TO SUIT SITE CONDITIONS.
 2. MODIFY T-BAR CEILINGS AS REQUIRED TO ACCOMMODATE THE PIPE SUPPORTS.

PIPE INSTALLATION
SCALE: N.T.S.

5
M-2

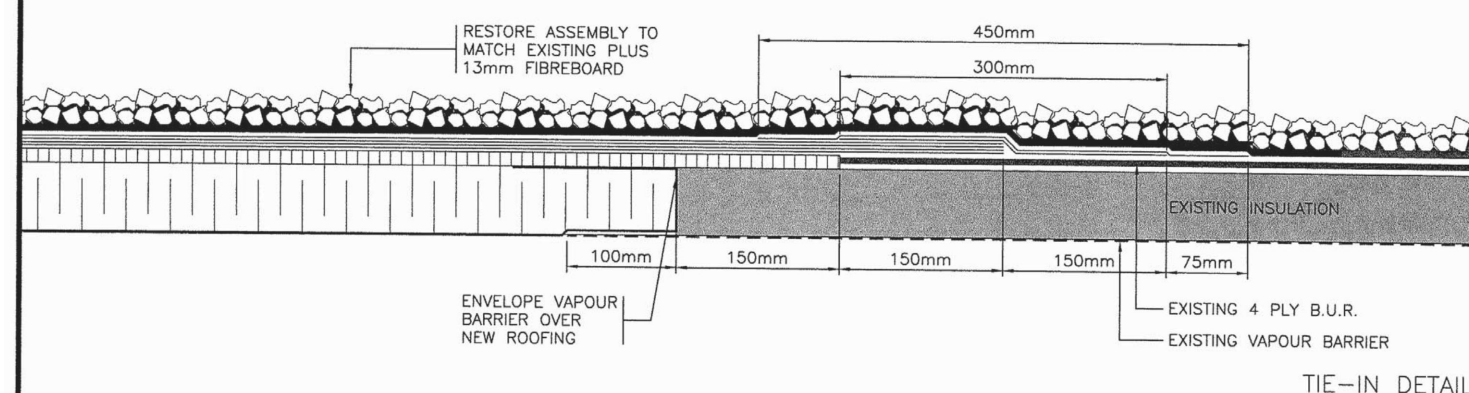


- NOTES:**
1. PROVIDE ADDITIONAL STRUCTURAL SUPPORT MEMBERS AS REQUIRED TO SUIT SITE CONDITIONS.
 2. MODIFY T-BAR CEILINGS AS REQUIRED TO ACCOMMODATE THE PIPE SUPPORTS.

SINGLE PIPE INSTALLATION
SCALE: N.T.S.

6
M-2

- TIE-IN NOTES**
1. AT LOCATIONS SPECIFIED, SHOWN OR AS OTHERWISE REQUIRED, PREPARE BITUMEN MEMBRANE FOR REPAIR BY REMOVING GRAVEL AND BITUMEN POUR A MINIMUM OF 800mm ON EITHER SIDE OF THE PROPOSED TIE-IN AREA.
 2. LEAVE FELTS FREE OF GRAVEL AND CLEAN OFF DUST AND DEBRIS. DISPOSE OF CHIPPINGS AND DEBRIS AWAY FROM SITE.
 3. TORCH EXPOSED MEMBRANE TO FLOW BITUMEN TO AN EVEN BLACK SURFACE PRIOR TO REPAIR TO IMPROVE ADHESION AT POINTS OF CONTACT.
 4. REPAIR ALL DAMAGED ROOFING CAUSED BY THIS OPERATION WITH MATERIAL AND FINISH TO MATCH THE ORIGINAL.
 5. REMOVE EXISTING ROOFING DOWN TO DECK AT LOCATION SHOWN.
 6. INSTALL NEW VAPOUR BARRIER OVERLAPPING EXISTING MINIMUM 100mm EACH SIDE.
 7. RESTORE INSULATION WITH MATCHING THICKNESS OF POLYISOCYANURATE INSULATION. INSTALL ADDITIONAL 13mm FIBREBOARD TO BRING ASSEMBLY EVEN WITH SURFACE OF EXISTING MEMBRANE. RESTORE MEMBRANE WITH NEW 4 PLY B.U.R. USING TYPE II ASPHALT. CARRY THE FOUR PLYS OF FELT ONTO THE EXISTING MEMBRANE 150mm. INSTALL TWO ADDITIONAL PLYS OF FIBREGLASS FELT OVER SPLICE JOINT.
 8. PROVIDE NEW BITUMEN AND GRAVEL POUR.



	PROJECT: B011-01K DATE: JANUARY 2017 SCALE: NTS DRAWN BY: AC FILE NAME: BUR_A	DETAIL No. A
	HALTON DISTRICT SCHOOL BOARD MECHANICAL PROGRAM CONVENTIONAL B.U.R. ASSEMBLY	

TIE-IN DETAIL
SCALE: N.T.S.

7
M-2

5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
3	ISSUED FOR PERMIT	16.04.2021
2	ISSUED FOR 95% REVIEW	08.04.2021
1	ISSUED FOR 75% REVIEW	18.03.2021

NO	REVISIONS	DATE
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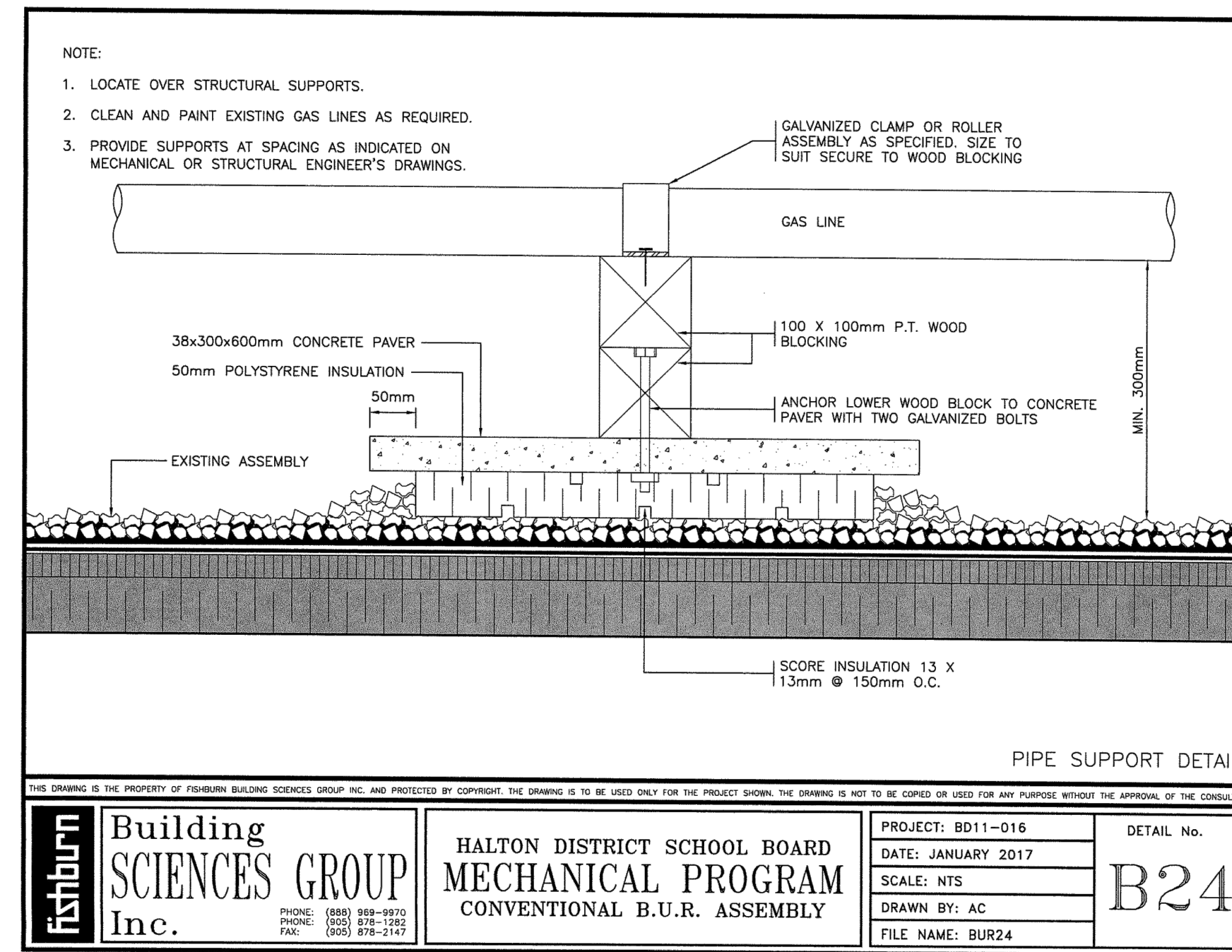
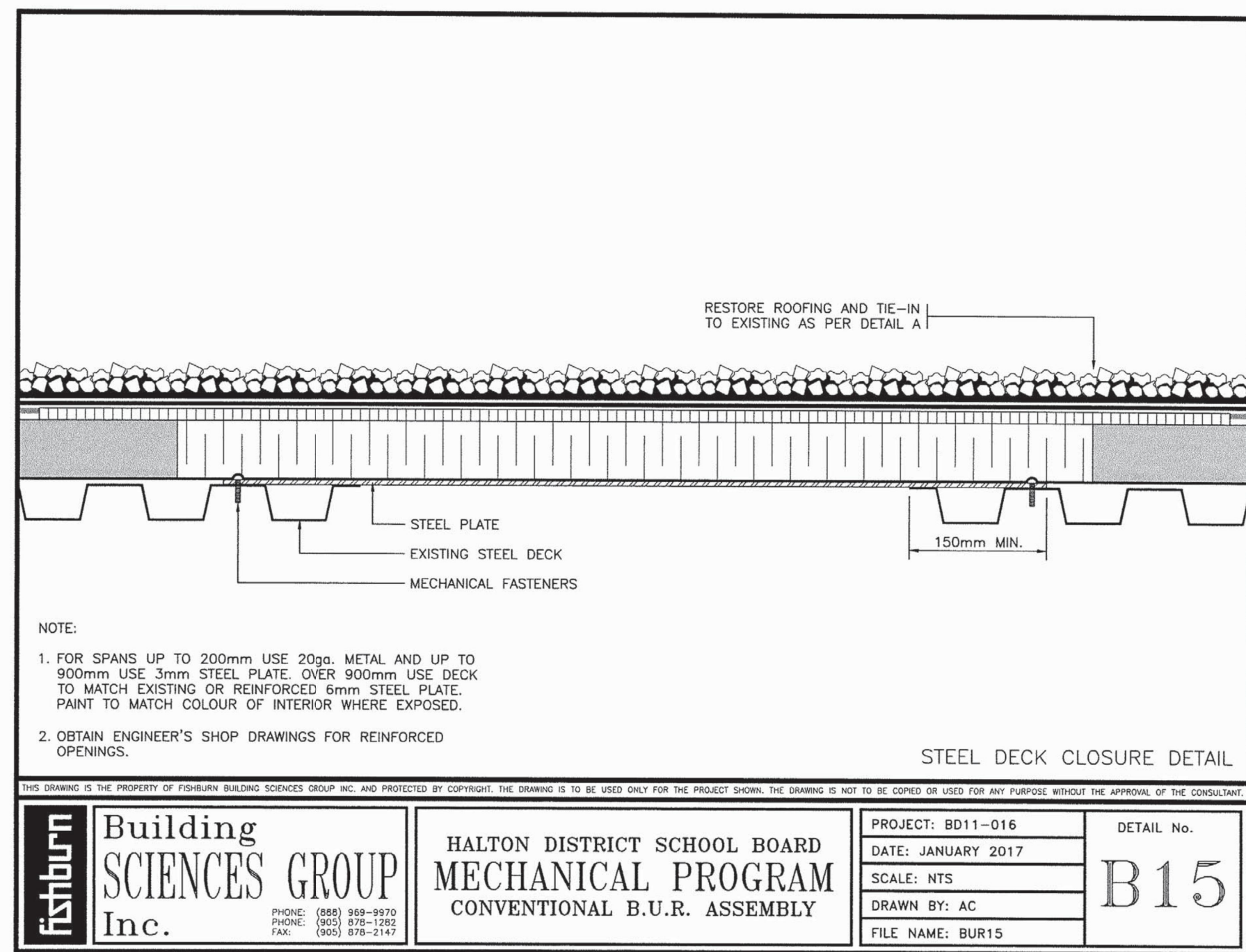


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MONCLAIR PS RENOVATION
1285 MONTCLAIR DR. OAKVILLE, ON

DETAILS

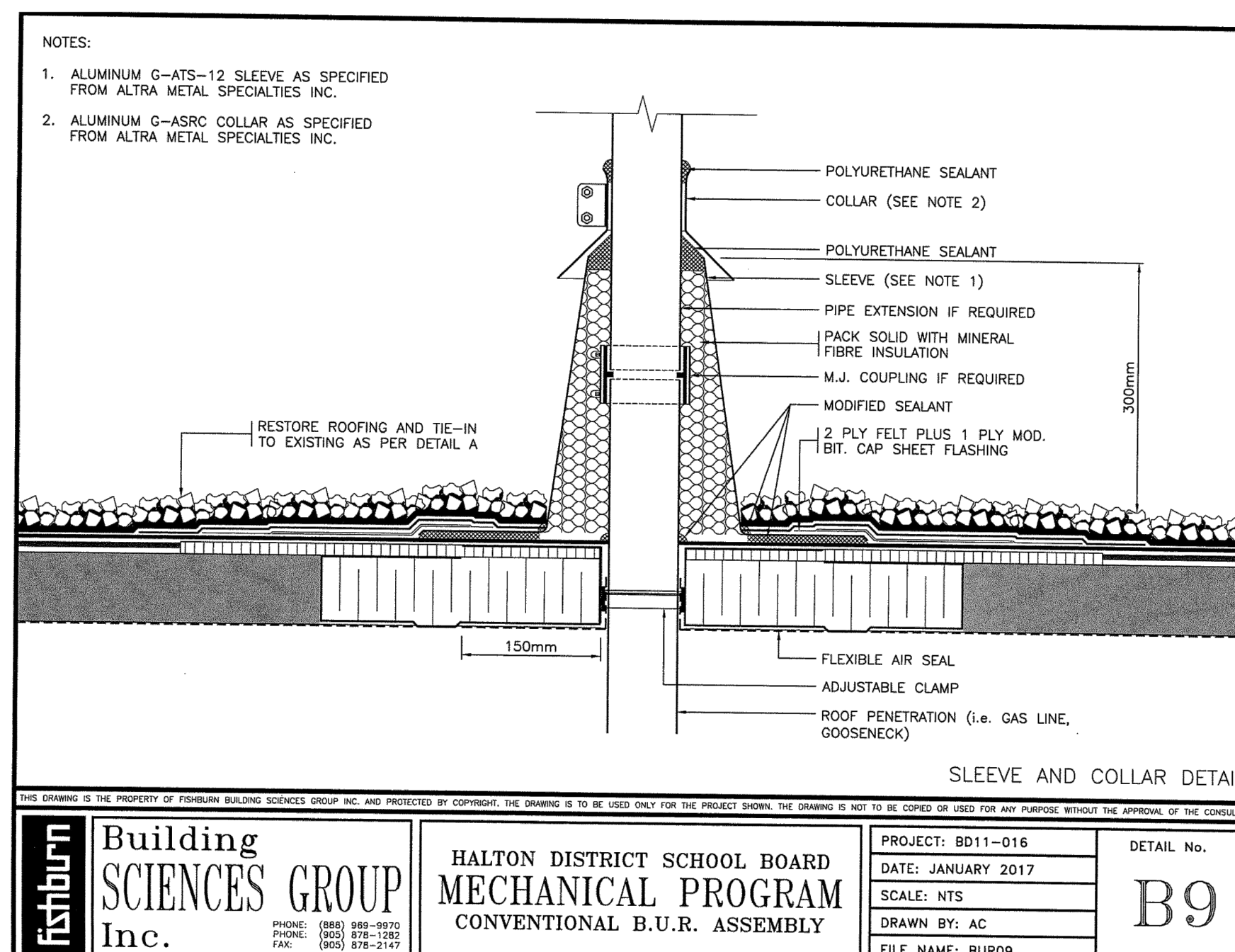
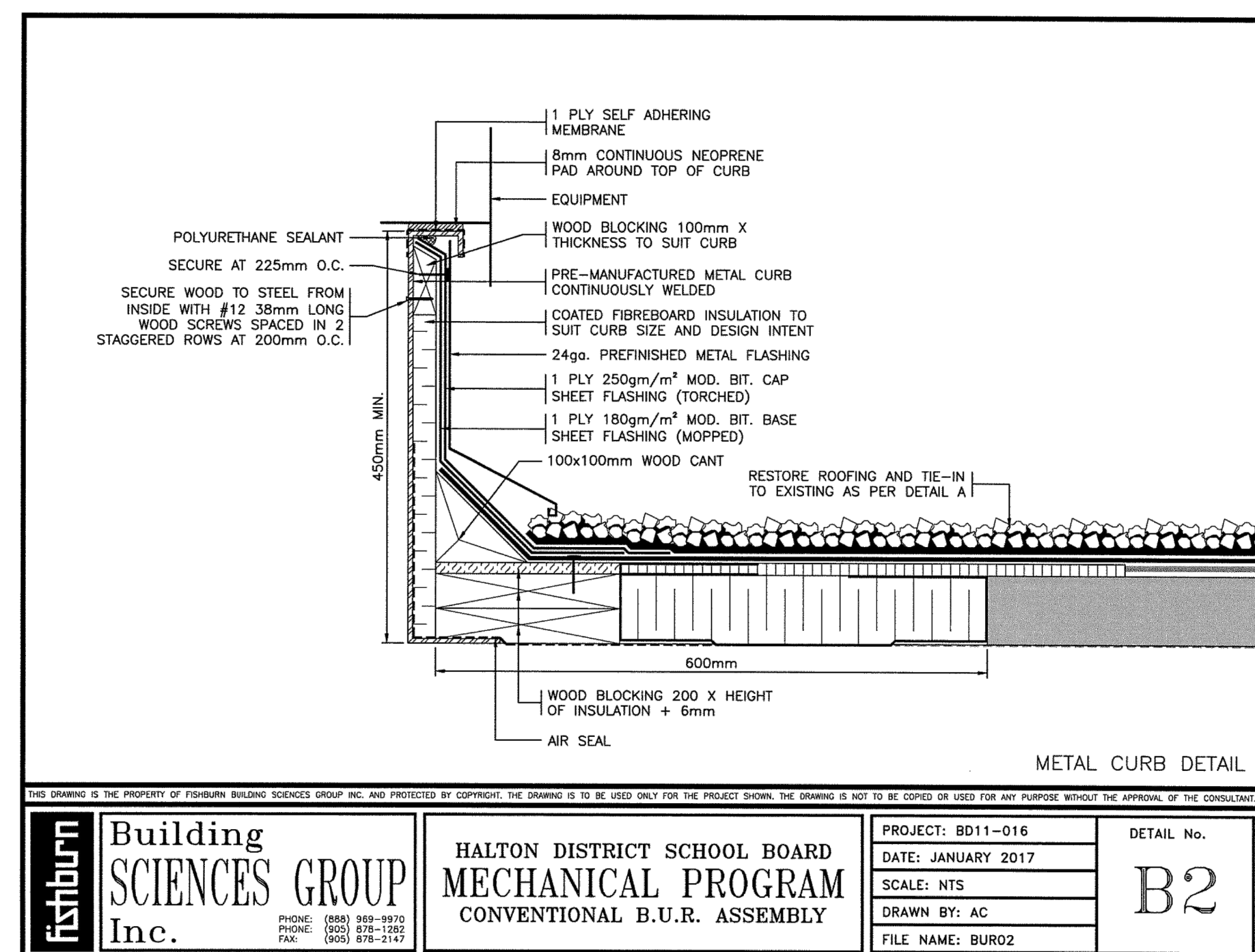
SCALE: AS NOTED	PROJECT: 6239 M-2
DATE: JAN 2021	
DRAWN: V.L.	DRAWING
CHECKED: P.Y.	M-2
PRINT DATE: JAN, 2021	



NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
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STEEL DECK CLOSURE DETAIL 1
SCALE: N.T.S.

PIPE SUPPORT DETAIL 2
SCALE: N.T.S.



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DETAILS

METAL CURB DETAIL 3
SCALE: N.T.S.

SLEEVE AND COLLAR DETAIL 4
SCALE: N.T.S.

SCALE: AS NOTED	PROJECT: 6239 M-3
DATE: JAN 2021	
DRAWN: V.L.	DRAWING
CHECKED: P.Y.	M-3
PRINT DATE: JAN, 2021	

AIR HANDLING UNIT (HYDRONIC HEATING & COOLING)																															
EQUIP. NO.	LOCATION	SERVICE	MAKE & MODEL	SUPPLY FAN VFD			RETURN/EXHAUST FAN			OUTDOOR AIR FLOW CFM	COOLING								HEATING								ELEC. DATA				
				AIR FLOW CFM	ESP IN WC	MOTOR HP	AIR FLOW CFM	ESP IN WC	MOTOR HP		CAPACITY MBH	ENTERING AIR TEMP °F DB/WB	LEAVING AIR TEMP °F DB/WB	MAX. COIL AIR PRESSURE DROP WC IN	ENTERING WATER TEMP °F	LEAVING WATER TEMP °F	MAX. COIL WATER PRESSURE DROP FEET	WATER FLOW GPM	MBH	ENTERING AIR TEMP °F	LEAVING AIR TEMP °F	MAX. COIL AIR PRESSURE DROP WC IN	ENTERING WATER TEMP °F	LEAVING WATER TEMP °F	MAX. COIL AIR PRESSURE DROP FEET	WATER FLOW GPM	V/PH/HZ	MOCP	MCA	POWER	WEIGHT (LBS)
AHU-1	MEZZ. MECH. ROOM	LOCKER ROOMS AND STORAGE OF GYM AREA	TRANE	4000	0.5	7.5	N/A	N/A	N/A	1500	145	80/67	55.9/55.4	0.82	45	55	4.6	28.9	71.12	40	89.5	0.4	160	140	0.9	14.6	600/3/60	N/A	N/A	2.78 KW	1848
AHU-3	JANITOR'S ROOM	GROUND FLOOR OFFICES-1968 BLDG.	TRANE BCVD090	2000	0.5	1	N/A	N/A	N/A	400	80.77	80/67	54.23/53.86	0.279	45	55	4.89	16.10	80.63	63	100.18	0.066	160	140	0.78	8.07	208/3/60	15	5.75		498
AHU-4	PENTHOUSE MECH. ROOM	GR. FL. & 2ND FLOOR OFFICES - 1968 BLDG.	TRANE CSA050	25000	1.0	15	N/A	N/A	N/A	6000	860	80/67	56.83/56.03	0.624	45	55	3.70	171.40	850	48	79.35	0.096	160	140	7.35	85.04	600/3/60	70	42.50		7271

NOTE: AHU-1 & AHU-4 C/W VFD.

AIR HANDLING UNIT (GAS FIRED HEATING & HYDRONIC COOLING)																															
EQUIP. NO.	LOCATION	SERVICE	MAKE & MODEL	SUPPLY FAN VFD			EXHAUST FAN			COOLING SECTION								HEATING SECTION				HEAT RECOVERY SECTION				ELEC. DATA			WEIGHT (LBS)		
				AIR FLOW CFM	ESP IN WC	MOTOR HP	AIR FLOW CFM	ESP IN WC	MOTOR HP	CAPACITY MBH	ENTERING AIR TEMP °F DB/WB	LEAVING AIR TEMP °F DB/WB	MAX. COIL AIR PRESSURE DROP WC IN	ENTERING WATER TEMP °F	LEAVING WATER TEMP °F	MAX. COIL WATER PRESSURE DROP FEET	WATER FLOW GPM	CAPACITY INPUT/OUTPUT MBH	ENTERING AIR TEMP °F	LEAVING AIR TEMP °F	SUMMER		WINTER		V/PH/HZ	MAXIMUM FUZE SIZE (AMP)	MCA (AMP)	OUTDOOR AIR FLOW CFM			
AHU-2	ROOF	GYMNASIUM	TRANE OAB/G - G144	3500	0.6	-	1400	-	-	141.6	75.8/64.6	50.9/50.7	0.2	44	54.1	3.2	28	200/160	67.7	110	38.4	22	16.4	85%	129.4	85%	600/3/60	15	12.3	1400	3750

NOTE: HEAT RECOVERY OUTLET TEMP : DB 77.1 °F; -WB65.4 °F; OUTSIDE AIR TEMP: DP90°F; WB73°F

NEW FAN SCHEDULE																																		
EQUIP. NO.	EXISTING EQUIPMENT TAG	LOCATION	CAPACITY CFM	S.P Pa	MAKE/MODEL	SERVICE	FAN MOTOR KW	POWER SUPPLY V/PH/HZ	MOTOR SPEED RPM	STARTER				CONTROLS				OTHER REQ.	WEIGHT (KG)	REMARKS														
										SUPPLIED BY		INSTALLED BY		AUTO	INTERLOCK BY		DISC. SWITCH BY ELECT																	
EF-1	YEAR 1970 303	GYM MEZZ	1500	0.75	GREENHECK/SFB-10	WRS	0.560	600/3/60	1049	X	-	-	X	X			X	X																
EF-2	YEAR 1968 204	PENTHOUSE	2400	0.75	GREENHECK/SFB-12	WRS	0.745	600/3/60	950	X	-	-	X	X			X	X																
EF-3	YEAR 1968 205	PENTHOUSE	1600	0.25	GREENHECK/AER-EZDC-620-VG	PH	0.376	120/1/60	1136	X	-	-	X	X			X	X																
EF-4	YEAR 1968 206	PENTHOUSE	625	0.75	GREENHECK/SFB-9	SERVERY 149	0.25	120/1/60	960	X	-	-	X	X			X	X																
EF-5	YEAR 1968 209	PENTHOUSE	1000	0.65	GREENHECK/SFB-9	HOME ECONOMICS	0.56	120/1/60	1200	X	-	-	X	X			X	X																
EF-6	YEAR 1968 304	ROOF	2000	0.5	GREENHECK/C-180-VG	SCIENCE RM 125	0.56	600/3/60	806	X	-	-	X	X			X	X																
EF-7	YEAR 1968 307	CEILING	820	0.5	GREENHECK/SQ-100-VG	SCIENCE RM 125	0.187	115/1/60	1456	X	-	-	X	X			X	X																
EF-8		BOILER ROOM	820	0.5	GREENHECK/SQ-100-VG	SCIENCE RM 125	0.187	115/1/60	1456	X	-	-	X	X			X	X																
RF-1	YEAR 1970 302	GYM MEZZ.	2900	0.75	GREENHECK/SFB-15	WRS	1.5	600/3/60	715	X	-	-	X	X			X	X															VFD	
RF-2	YEAR 1968 203	PH MECH	21000	0.8	GREENHECK/SFB-30	OLD BLDG. CLASSROOMS	15	600/3/60	500	X	-	-	X	X			X	X																VFD

NOTES:
- FOR ALL ROOF PLANS REUSE EXISTING ROOF CURBS & INCLUDE ROOF CURB ADAPTERS.

PUMPS																		
EQUIP. NO.	TYPE	FLUID	SERVICE	PUMP		MOTOR			STARTER				CONTROLS				OTHER REQ.	REMARKS
				FLOW L/S	HEAD KPα	RPM	KW	POWER SUPPLY V/PH/HZ	SUPPLIED BY		INSTALLED BY		AUTO	INTERLOCK BY				
P-1	ARMSTRONG SS7	WATER	AHU-4 CIRCULATION PUMP	5.36	68	1800	0.56	115/1/60	X	-	-	X	X			X		

GRILLES, DIFFUSERS AND LOUVERS					
TYPE NO.	TYPE	E.H.PRICE MODEL No.	MATERIAL	FINISH	REMARKS
A	ROUND DIFFUSER	'E. H. PRICE ARCD	ALUMINUM	-	C/W VOLUME CONTROL DAMPER
B	DRAINABLE LOUVER	'E. H. PRICE DE635	ALUMINUM	-	
C	NOZZLE DIFFUSER	'E. H. PRICE ANR-10	ALUMINUM	-	THROAT SIZE 2509

GRAVITY VENTILATORS							
EQUIP. NO.	DUCTED STATIC PRESSURE DROP (IN. W.G.)	CAPACITY CFM	THROAT AREA FT²	THROAT WIDTH X LENGTH	MAKE/MODEL	APPROX. WEIGHT KG	REMARKS
GV-1	0.06	21000	32	1220X2440	GREENHECK/FGR OR APPROVED EQUAL	350	C/W 450 HIGH CURB

NO	REVISIONS	DATE
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2	ISSUED FOR 95% REVIEW	08.04.2021
1	ISSUED FOR 75% REVIEW	18.03.2021

DRAWINGS ARE NOT TO BE SCALED. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND CONDITIONS ON THE PROJECT, AND MUST REPORT ANY DISCREPANCIES TO THE ARCHITECTS BEFORE PROCEEDING WITH THE WORK. THE USE OF THIS DRAWING OR PART THEREOF IS FORBIDDEN WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECTS.



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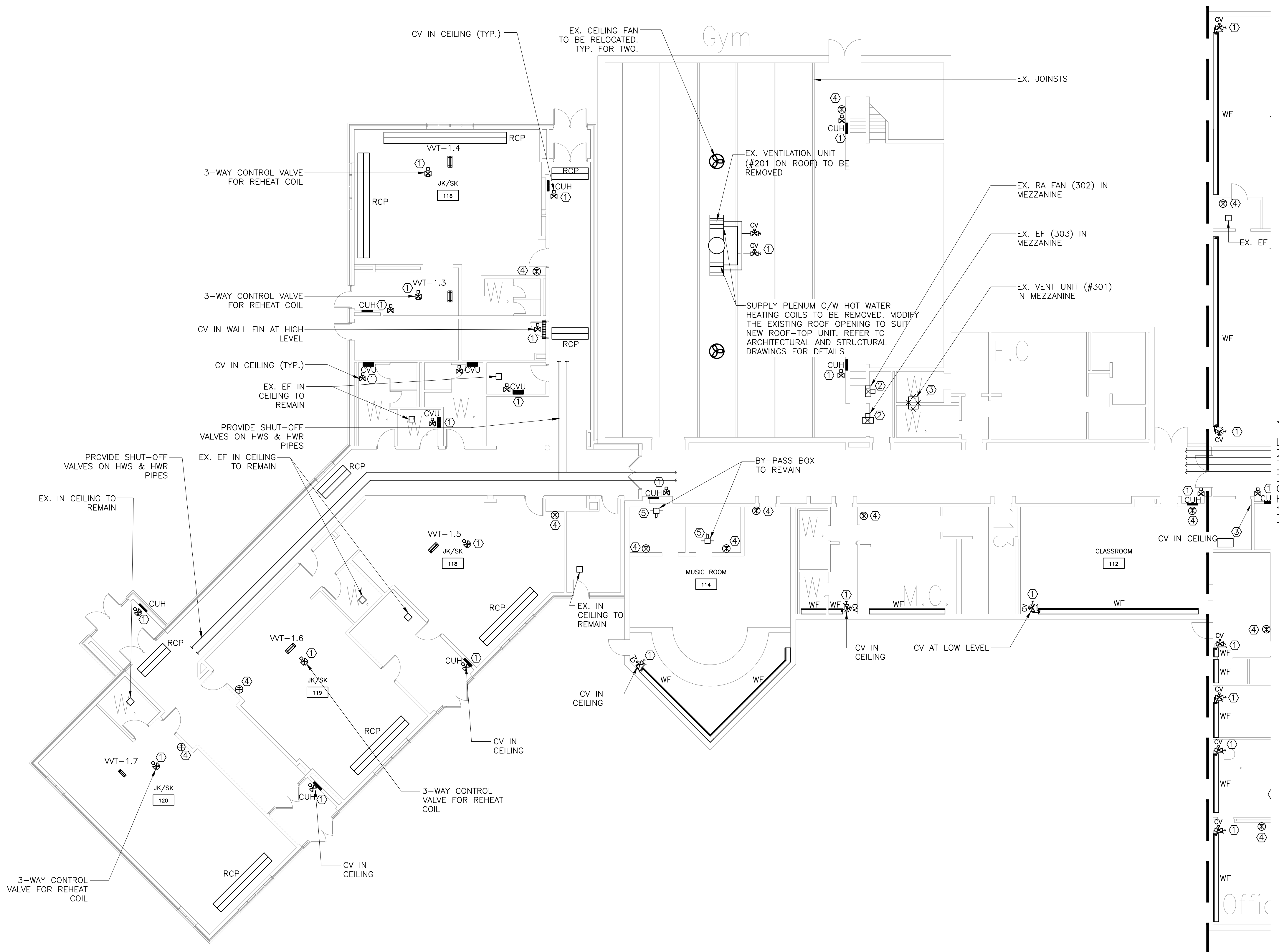
PROPOSED EQUIPMENT SCHEDULES

GENERAL NOTES:

1. ALL EXISTING HVAC SYSTEMS, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
2. FOR ALL ARCH WORK SUCH AS REMOVAL & REPLACEMENT OF CEILING, WALL OPENINGS, ROOF OPENINGS, ENCLOSURES FOR PIPING & CONTROLS, REFER TO ARCHITECTURAL DRAWINGS.
3. LOCATION OF ALL CONTROL VALVES SHOWN ON DRAWING IS APPROXIMATE. CONTRACTOR SHALL LOCATE ALL EXISTING CV'S & INSTALL NEW CV'S AT EITHER THE CURRENT LOCATION OR IN THE CEILING SPACE. INCLUDE COST OF ASSOCIATED PIPING & ALL OTHER REQUIRED WORK.
4. LOCATIONS OF THE EXISTING EQUIPMENT, CONTROL VALVES, HEATING COILS, THERMOSTATS ARE APPROXIMATE LOCATIONS. THE CONTRACTOR SHALL VERIFY THE EXACT LOCATIONS ON THE SITE.

DRAWING NOTES:

- ① VERIFY DETAILS OF EXISTING VALVE/DAMPER AND ACTUATOR AND REPLACE THEM WITH NEW VALVE/DAMPER AND ACTUATOR WHICH SHALL BE COMPATIBLE WITH PROPOSED BAS.
- ② REMOVE EXISTING EXHAUST FAN
- ③ REMOVE EXISTING VENTILATION UNIT
- ④ REMOVE EXISTING WALL MOUNTED TEMPERATURE SENSOR/THERMOSTAT
- ⑤ VERIFY DETAILS OF EXISTING BYPASS BOX & REPLACE THE EXISTING ACTUATOR WITH A NEW ACTUATOR COMPATIBLE WITH NEW BAS



NO	REVISIONS	DATE
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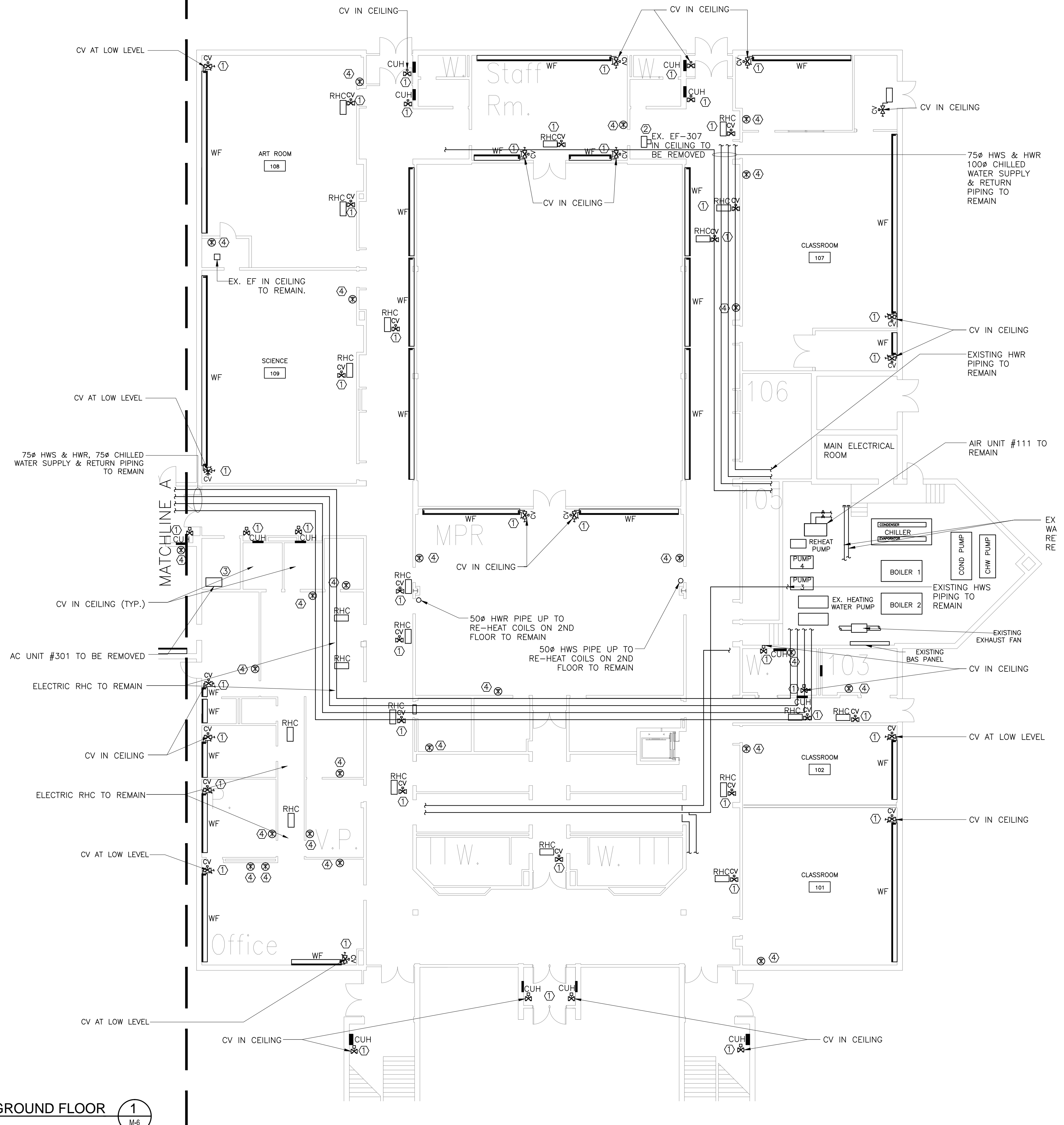


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MONCLAIR PS RENOVATION
 1285 MONTCLAIR DR, OAKVILLE, ON

HVAC & BAS DEMOLITION - GROUND FLOOR (YEAR 2009 AND 1970 BUILDING)

SCALE: AS NOTED	PROJECT: 6239 M-5
DATE: JAN 2021	
DRAWN V.L.	DRAWING M-5
CHECKED P.Y.	
PRINT DATE	JAN, 2021



- GENERAL NOTES:**
1. ALL EXISTING HVAC SYSTEM, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
 2. FOR ALL ARCH WORK SUCH AS REMOVAL & REPLACEMENT OF CEILING, WALL OPENINGS, ROOF OPENINGS, ENCLOSURES FOR PIPING & CONTROLS, REFER TO ARCHITECTURAL DRAWINGS.
 3. LOCATION OF ALL CONTROL VALVES SHOWN ON DRAWING IS APPROXIMATE. CONTRACTOR SHALL LOCATE ALL EXISTING CV'S & INSTALL NEW CV'S AT EITHER THE CURRENT LOCATION OR IN THE CEILING SPACE. INCLUDE COST OF ASSOCIATED PIPING & ALL OTHER REQD WORK.
 4. LOCATIONS OF THE EXISTING EQUIPMENT, CONTROL VALVES, HEATING COILS, THERMOSTATS ARE APPROXIMATE LOCATIONS, THE CONTRACTOR SHALL VERIFY THE EXACT LOCATIONS ON THE SITE.
- DRAWING NOTES:**
- ① VERIFY DETAILS OF EXISTING CONTROL VALVE/DAMPER AND ACTUATOR AND REPLACE THEM WITH NEW VALVE/DAMPER AND ACTUATOR WHICH SHALL BE COMPATIBLE WITH PROPOSED BAS.
 - ② REPLACE EXISTING EXHAUST FAN WITH NEW.
 - ③ REMOVE EXISTING VENTILATION UNIT
 - ④ REMOVE EXISTING WALL MOUNTED TEMPERATURE SENSOR/THERMOSTAT.

5	RE-ISSUED FOR TENDER	06.12.2021
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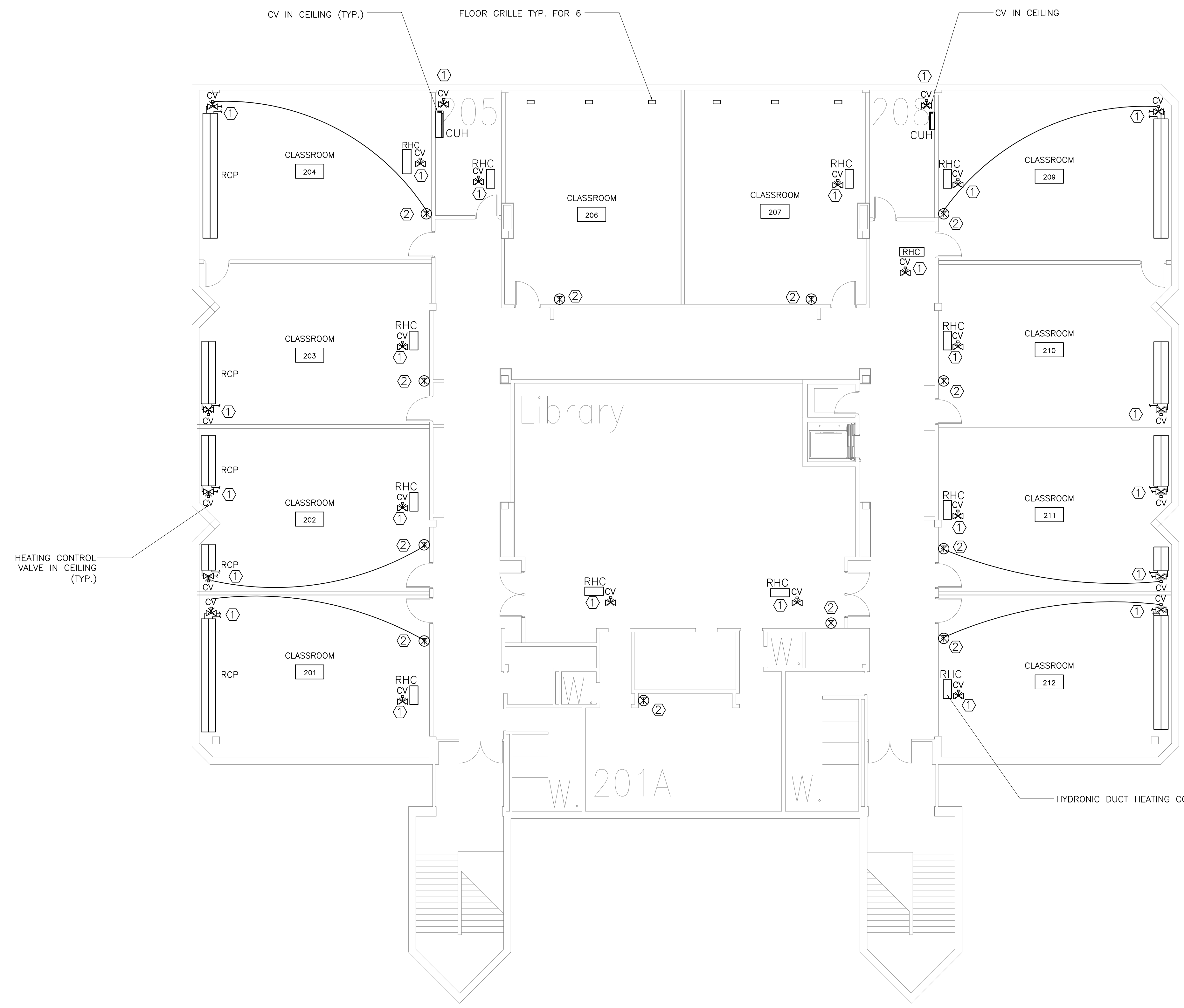


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HVAC & BAS DEMOLITION - GROUND FLOOR (YEAR 1968 BUILDING)

SCALE: AS NOTED	PROJECT: 6239 M-6
DATE: JAN 2021	
DRAWN: V.L.	DRAWING: M-6
CHECKED: P.Y.	
PRINT DATE: JAN, 2021	



GENERAL NOTES:

1. ALL EXISTING HVAC SYSTEM, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
2. FOR ALL ARCH WORK SUCH AS REMOVAL & REPLACEMENT OF CEILING, WALL OPENINGS, ROOF OPENINGS, ENCLOSURES FOR PIPING & CONTROLS, REFER TO ARCHITECTURAL DRAWINGS.
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DRAWING NOTES:

- ① VERIFY DETAILS OF EXISTING CONTROL VALVE/DAMPER AND ACTUATOR AND REPLACE THE SAME WITH NEW VALVE/DAMPER AND ACTUATOR WHICH SHALL BE COMPATIBLE WITH PROPOSED BAS.
- ② REMOVE EXISTING WALL MOUNTED TEMPERATURE SENSOR/THERMOSTAT.

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HVAC & BAS DEMOLITION - SECOND FLOOR

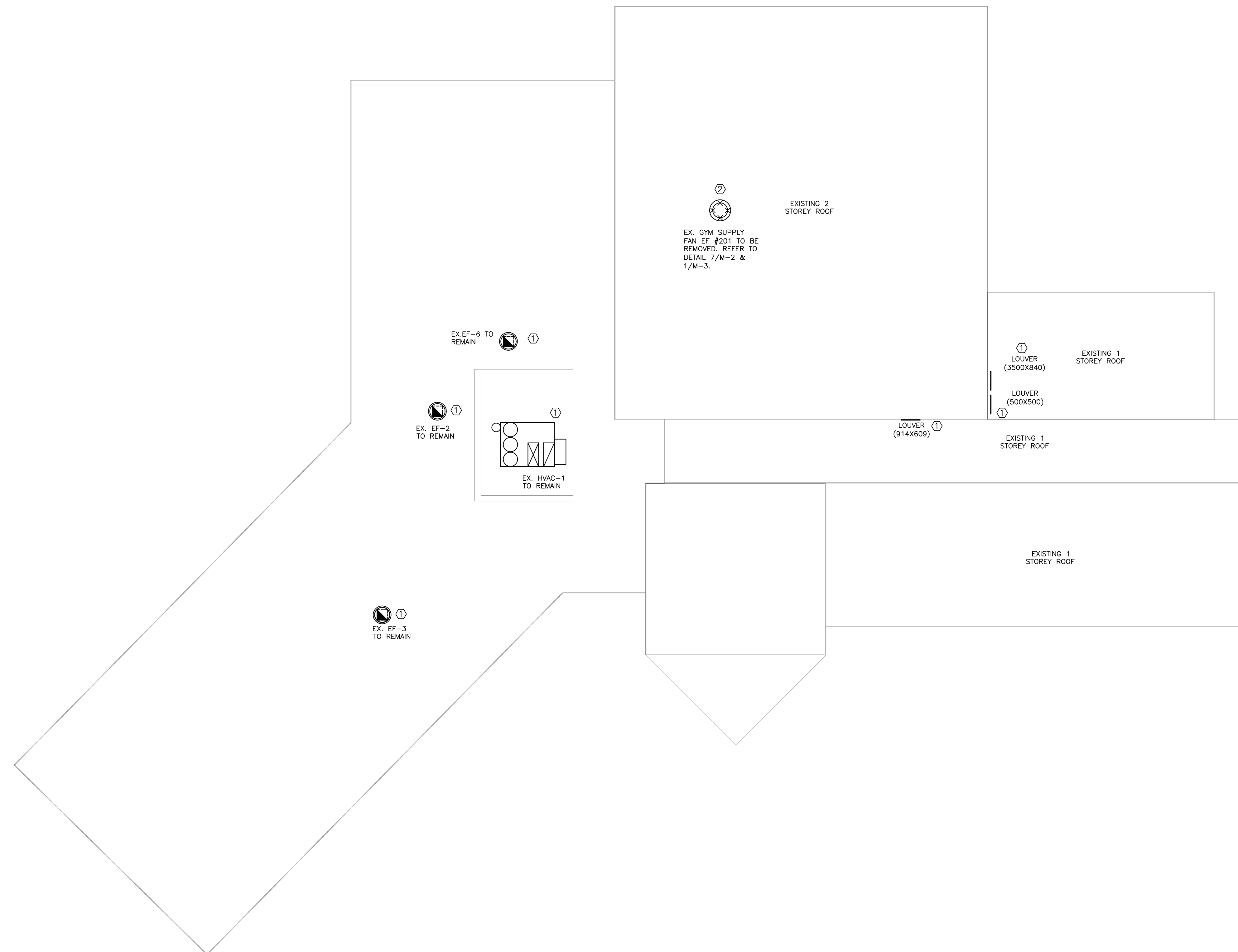
SCALE: AS NOTED	PROJECT: 6239 M-7
DATE: JAN 2021	
DRAWN V.L.	DRAWING M-7
CHECKED P.Y.	
PRINT DATE	JAN, 2021

GENERAL NOTES:

1. ALL EXISTING HVAC SYSTEM, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
2. FOR ALL ARCH WORK SUCH AS REMOVAL & REPLACEMENT OF CEILING, WALL OPENINGS, ROOF OPENINGS, ENCLOSURES FOR PIPING & CONTROLS, REFER TO ARCHITECTURAL DRAWINGS.
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DRAWING NOTES:

- ① EXISTING HVAC EQUIPMENT, EXHAUST FANS & LOUVERS TO REMAIN.
- ② REMOVE EXISTING FAN.



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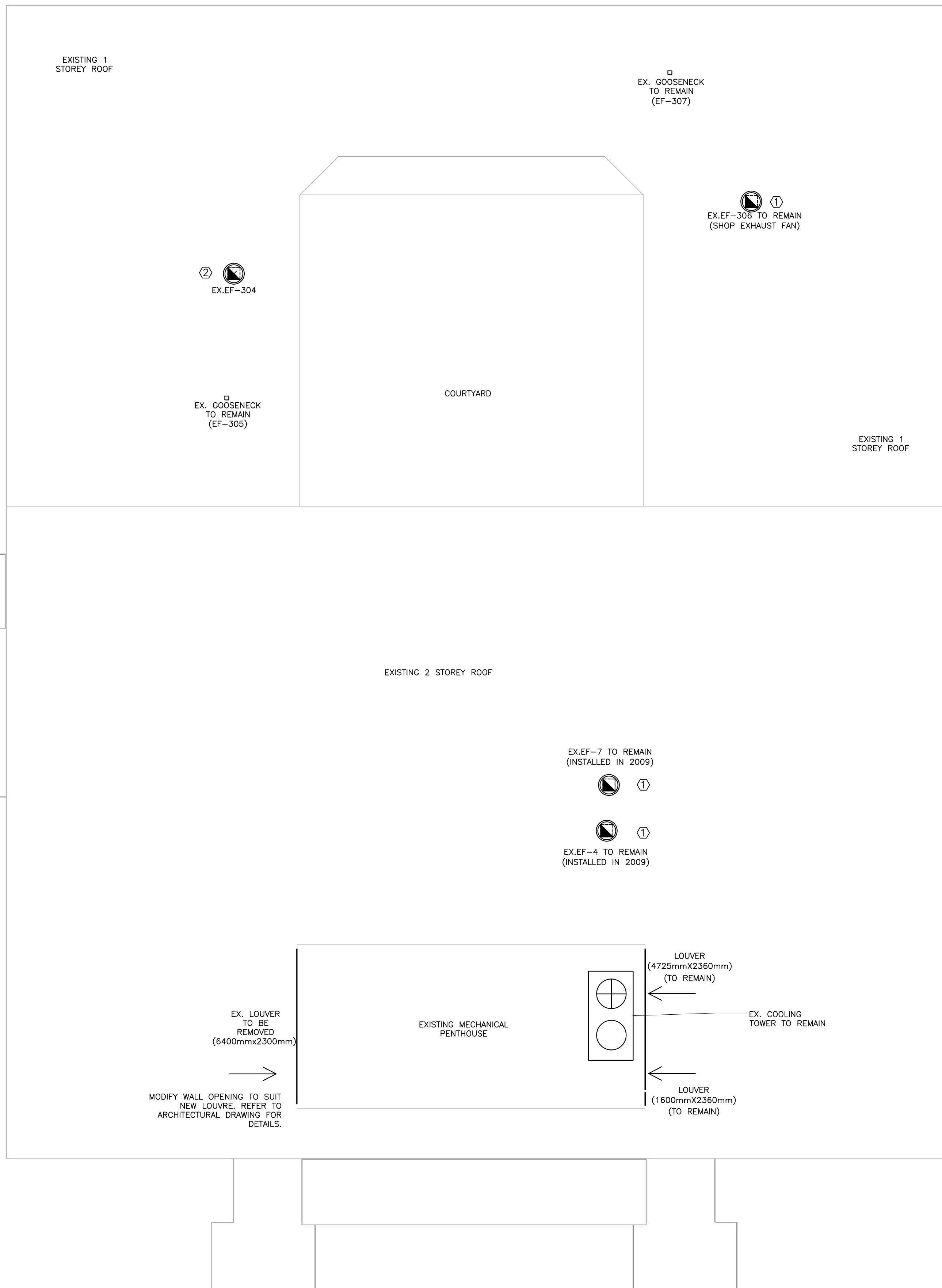
Moon-Matz Ltd.
Consulting Engineers
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**MONCLAIR PS
RENOVATION**

1285 MONTCLAIR DR, OAKVILLE, ON

HVAC & BAS DEMOLITION - ROOF
(YEAR 2009 AND 1970 BUILDING)

SCALE: AS NOTED	PROJECT: 6239 M-8
DATE: JAN 2021	
DRAWN V.L.	DRAWING M-8
CHECKED P.Y.	
PRINT DATE	JAN, 2021



GENERAL NOTES:

1. ALL EXISTING HVAC SYSTEM, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
2. FOR ALL ARCH WORK SUCH AS REMOVAL & REPLACEMENT OF CEILING, WALL OPENINGS, ROOF OPENINGS, ENCLOSURES FOR PIPING & CONTROLS, REFER TO ARCHITECTURAL DRAWINGS.
3. LOCATIONS OF THE EXISTING EQUIPMENT, CONTROL VALVES, HEATING COILS, THERMOSTATS ARE APPROXIMATE LOCATIONS, THE CONTRACTORS SHALL VERIFY THE EXACT LOCATIONS ON THE SITE.

DRAWING NOTES:

- ① EXISTING HVAC EQUIPMENT, EXHAUST FANS & LOUVERS TO REMAIN
- ② REMOVE EXISTING FAN

NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
3	ISSUED FOR PERMIT	16.04.2021
2	ISSUED FOR 95% REVIEW	08.04.2021
1	ISSUED FOR 75% REVIEW	18.03.2021

DRAWINGS ARE NOT TO BE SCALED. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND CONDITIONS ON THE PROJECT, AND MUST REPORT ANY DISCREPANCIES TO THE ARCHITECTS BEFORE PROCEEDING WITH THE WORK. THE USE OF THIS DRAWING OR PART THEREOF IS FORBIDDEN WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECTS.



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MONCLAIR PS RENOVATION

1285 MONTCLAIR DR, OAKVILLE, ON

HVAC & BAS DEMOLITION - ROOF (YEAR 1968 BUILDING)

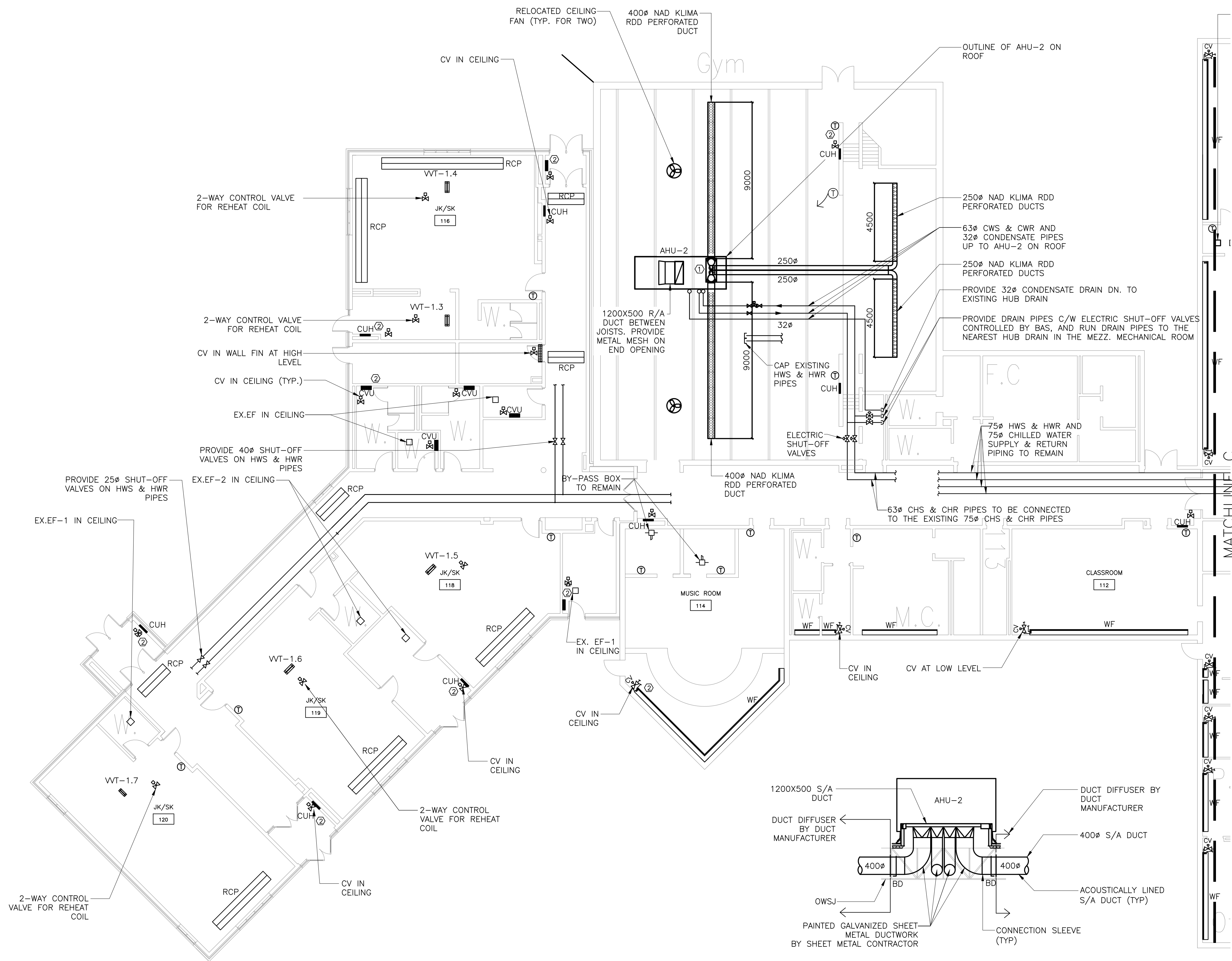
SCALE: AS NOTED	PROJECT: 6239 M-9
DATE: JAN 2021	
DRAWN V.L.	DRAWING M-9
CHECKED P.Y.	
PRINT DATE	JAN, 2021

GENERAL NOTES:

1. ALL EXISTING HVAC SYSTEMS, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
2. FOR ALL WORK SUCH AS REMOVAL & REPLACEMENT OF CEILING, WALL OPENINGS, ROOF OPENINGS, ENCLOSURES FOR PIPING & CONTROLS, REFER TO ARCHITECTURAL DRAWINGS.
3. LOCATIONS OF THE EXISTING EQUIPMENT, CONTROL VALVES, HEATING COILS, THERMOSTATS ARE APPROXIMATE LOCATIONS, THE CONTRACTORS SHALL VERIFY THE EXACT LOCATIONS ON SITE.
4. PROVIDE THERMOSTATS AS SHOWN ON THE DRAWINGS.
5. PROVIDE 2-WAY CONTROL VALVES FOR ALL RADIATORS AND HYDRAULIC COILS. INSTALL 2-WAY CONTROL VALVES FOR RADIATOR IN CEILING. MODIFY EXISTING PIPING TO SUIT NEW CONTROL VALVES. ALLOW FOR ADDITIONAL 20 FEET OF PIPING MODIFICATIONS.
6. PROVIDE SHUT-OFF VALVES ON ALL HEATING/COOLING COILS AND RE-HEAT COILS.

DRAWING NOTES:

- ① 1200X500 S/A & 1200X500 R/A DUCTS UP THROUGH ROOF TO AHU-2 ON ROOF. REFER TO ARCHITECTURAL AND STRUCTURAL DRAWINGS FOR ROOF AND OPENINGS DETAILS
- ② PROVIDE TEMPERATURE SENSOR ON HWS & HWR PIPES



HVAC & BAS PROPOSED - GROUND FLOOR
SCALE: 1:125

1
M-10

NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
3	ISSUED FOR PERMIT	16.04.2021
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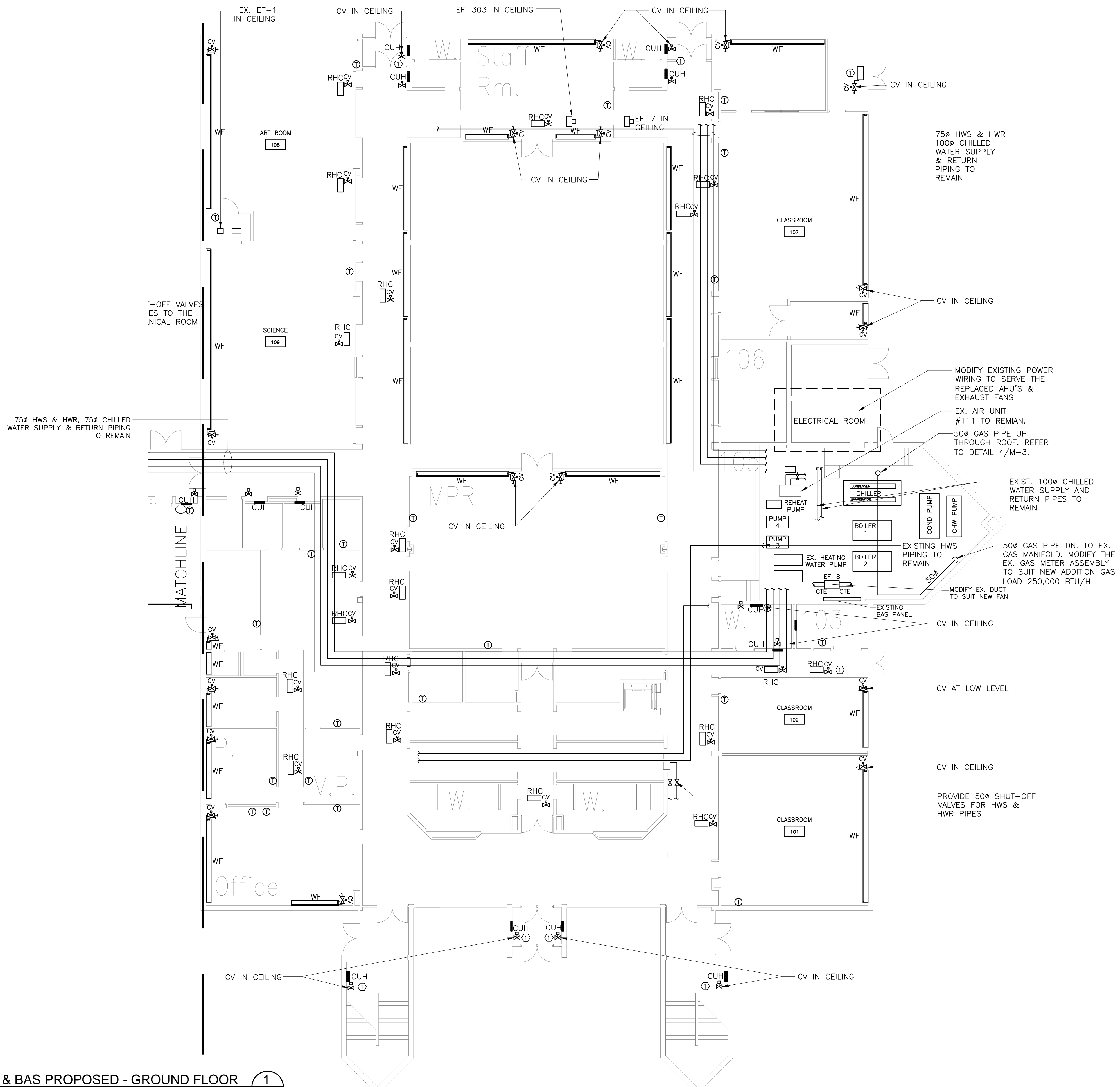


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MONCLAIR PS RENOVATION
1285 MONTCLAIR DR, OAKVILLE, ON

HVAC & BAS PROPOSED -
GROUND FLOOR (YEAR 2009 AND
1970 BUILDING)

SCALE: AS NOTED	PROJECT: 6239 M-10
DATE: JAN 2021	
DRAWN V.L.	DRAWING M-10
CHECKED P.Y.	
PRINT DATE	JAN, 2021



- GENERAL NOTES:
- ALL EXISTING HVAC SYSTEMS, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
 - FOR ALL WORK SUCH AS REMOVAL & REPLACEMENT OF CEILING, WALL OPENINGS, ROOF OPENINGS, ENCLOSURES FOR PIPING & CONTROLS, REFER TO ARCHITECTURAL DRAWINGS.
 - LOCATIONS OF THE EXISTING EQUIPMENT, CONTROL VALVES, HEATING COILS, THERMOSTATS ARE APPROXIMATE LOCATIONS, THE CONTRACTORS SHALL VERIFY THE EXACT LOCATIONS ON SITE.
 - PROVIDE THERMOSTATS AS SHOWN ON THE DRAWINGS.
 - COMPLETELY DRAIN ALL WATER FROM THE EXISTING SYSTEMS (CHILLED WATER AND HEATING WATER). PROVIDE MULTIPLE FLUSHES OF THE EXISTING STRAINERS AND REFILL AND RE-BALANCE THE SYSTEMS AFTER INSTALLATION OF CONTROL VALVES.
 - PROVIDE 2-WAY CONTROL VALVES FOR ALL RADIATORS AND HYDRAULIC COILS. INSTALL 2-WAY CONTROL VALVES FOR RADIATOR IN CEILING. MODIFY EXISTING PIPING TO SUIT NEW CONTROL VALVES. ALLOW FOR ADDITIONAL 20 FEET OF PIPING MODIFICATIONS.
- DRAWING NOTES:
- ① PROVIDE TEMPERATURE SENSOR ON HWS & HWR PIPES

HVAC & BAS PROPOSED - GROUND FLOOR
SCALE: 1:125

1
M-11

5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
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NO	REVISIONS	DATE

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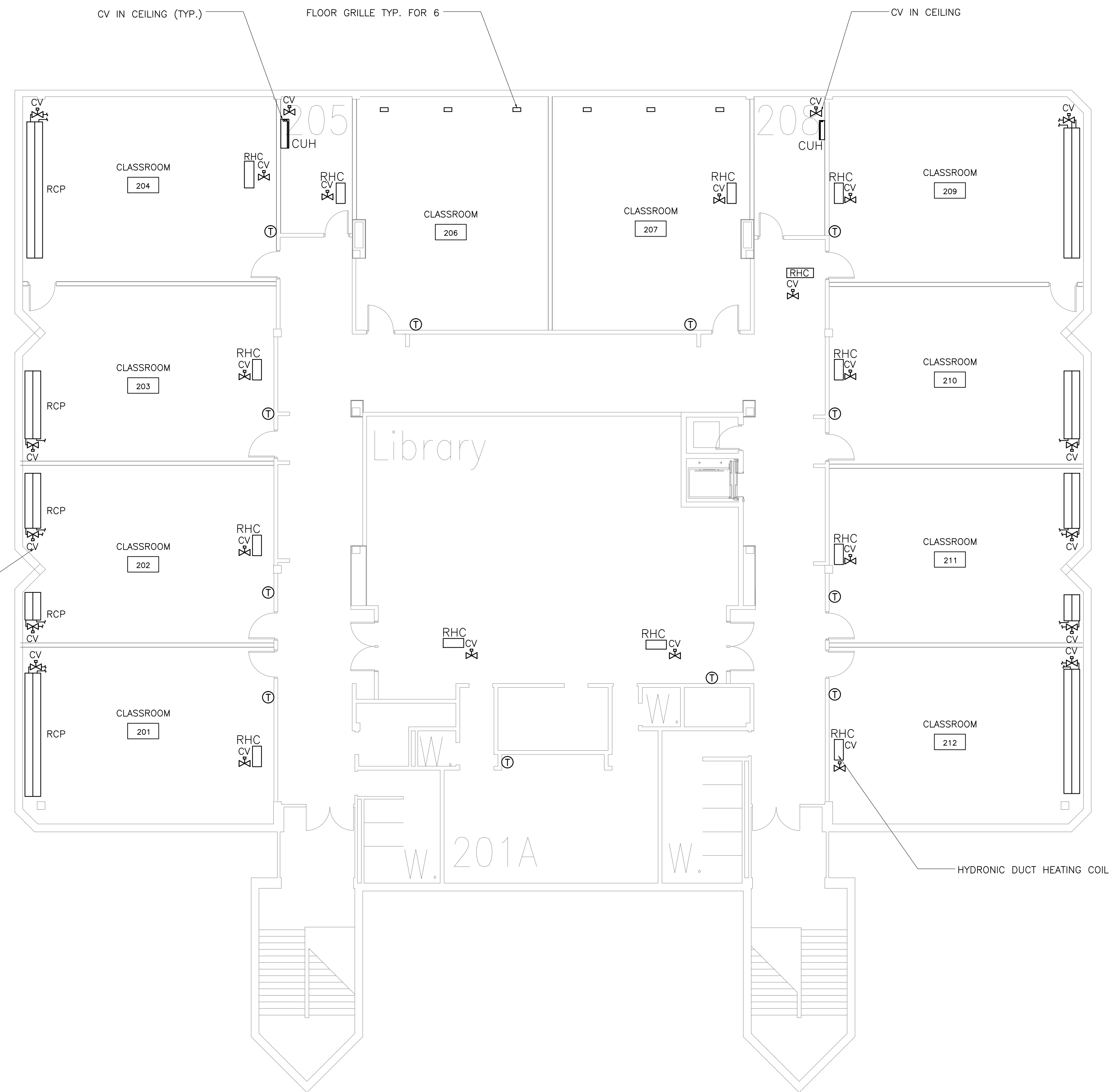


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MONCLAIR PS RENOVATION
1285 MONTCLAIR DR, OAKVILLE, ON

HVAC & BAS PROPOSED - GROUND FLOOR (YEAR 1968 BUILDING)

SCALE: AS NOTED	PROJECT: 6239 M-11
DATE: JAN 2021	
DRAWN V.L.	DRAWING M-11
CHECKED P.Y.	
PRINT DATE	JAN, 2021



GENERAL NOTES:

1. ALL EXISTING HVAC SYSTEMS, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
2. FOR ALL WORK SUCH AS REMOVAL & REPLACEMENT OF CEILING, WALL OPENINGS, ROOF OPENINGS, ENCLOSURES FOR PIPING & CONTROLS, REFER TO ARCHITECTURAL DRAWINGS.
3. LOCATIONS OF THE EXISTING EQUIPMENT, CONTROL VALVES, HEATING COILS, THERMOSTATS ARE APPROXIMATE LOCATIONS, THE CONTRACTORS SHALL VERIFY THE EXACT LOCATIONS ON SITE.
4. PROVIDE THERMOSTATS AS SHOWN ON THE DRAWINGS.
5. PROVIDE 2-WAY CONTROL VALVES FOR ALL RADIATORS AND HYDRAULIC COILS. INSTALL 2-WAY CONTROL VALVES FOR RADIATOR IN CEILING. MODIFY EXISTING PIPING TO SUIT NEW CONTROL VALVES. ALLOW FOR ADDITIONAL 20 FEET OF PIPING MODIFICATIONS.
6. PROVIDE SHUT-OFF VALVES FOR ALL HEATING/COOLING COILS AND RE-HEAT COILS.

NO	REVISIONS	DATE
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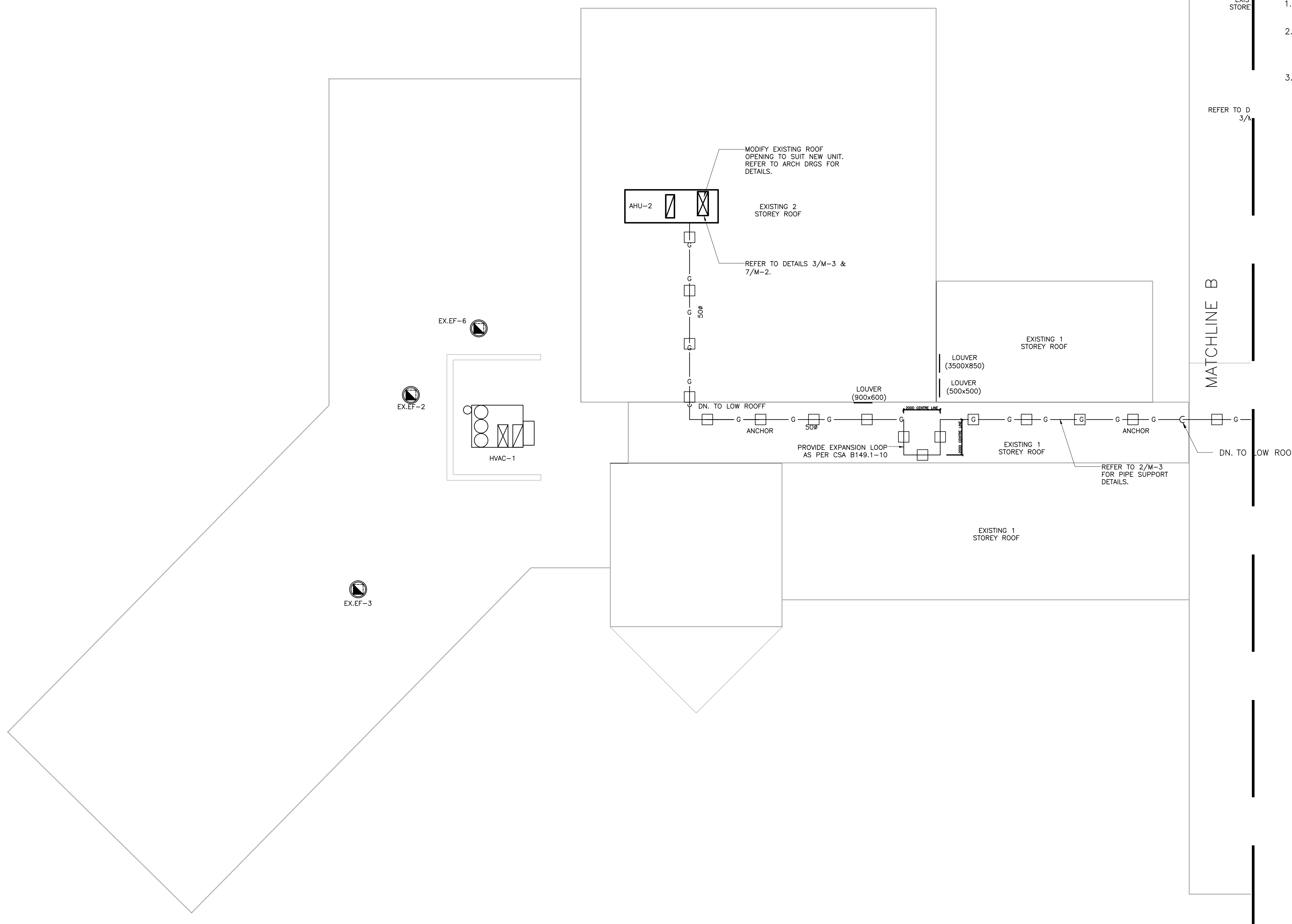
MONCLAIR PS RENOVATION
 1285 MONTCLAIR DR, OAKVILLE, ON

HVAC & BAS PROPOSED -
 SECOND FLOOR (YEAR 1968 BUILDING)

SCALE: AS NOTED	PROJECT: 6239 M-12
DATE: JAN 2021	
DRAWN V.L.	DRAWING M-12
CHECKED P.Y.	
PRINT DATE	JAN, 2021

GENERAL NOTES:

1. ALL EXISTING HVAC SYSTEM, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
2. FOR ALL ARCH WORK SUCH AS REMOVAL & REPLACEMENT OF CEILING, WALL OPENINGS, ROOF OPENINGS, ENCLOSURES FOR PIPING & CONTROLS, REFER TO ARCHITECTURAL DRAWINGS.
3. LOCATIONS OF THE EXISTING EQUIPMENT, CONTROL VALVES, HEATING COILS, THERMOSTATS ARE APPROXIMATE LOCATIONS, THE CONTRACTORS SHALL VERIFY THE EXACT LOCATIONS ON THE SITE.



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NO	REVISIONS	DATE
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**MONCLAIR PS
RENOVATION**

1285 MONTCLAIR DR, OAKVILLE, ON

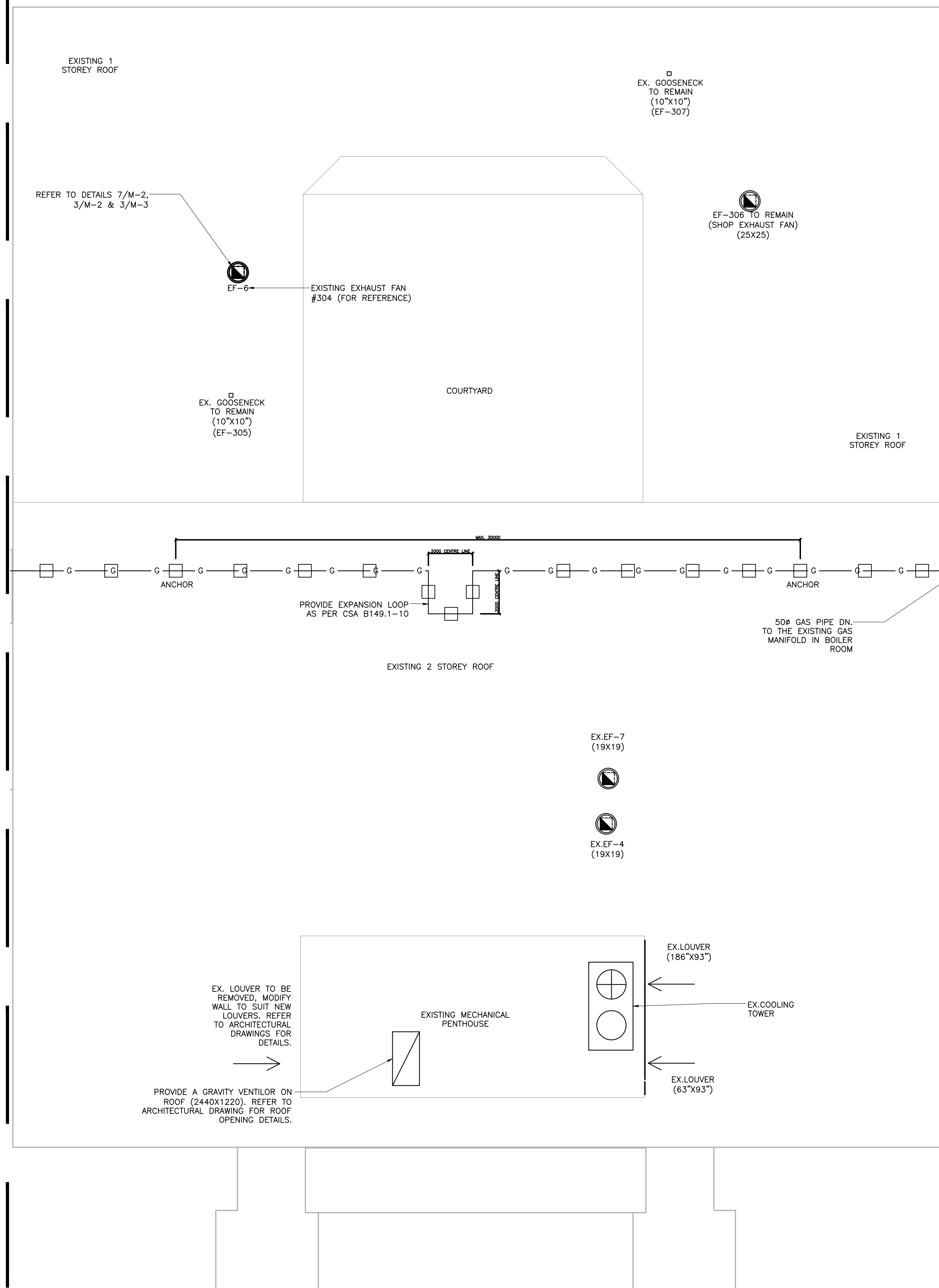
HVAC & BAS PROPOSED - ROOF
(YEAR 2009 AND 1970 BUILDING)

SCALE: AS NOTED	PROJECT: 6239 M-13
DATE: JAN 2021	
DRAWN V.L.	DRAWING
CHECKED P.Y.	M-13
PRINT DATE	JAN, 2021

GENERAL NOTES:

1. ALL EXISTING HVAC SYSTEM, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
2. FOR ALL ARCH WORK SUCH AS REMOVAL & REPLACEMENT OF CEILING, WALL OPENINGS, ROOF OPENINGS, ENCLOSURES FOR PIPING & CONTROLS, REFER TO ARCHITECTURAL DRAWINGS.
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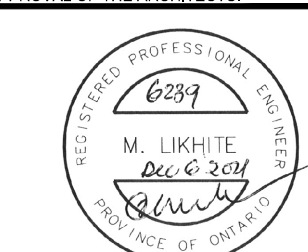
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5	RE-ISSUED FOR TENDER	06.12.2021
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NO	REVISIONS	DATE

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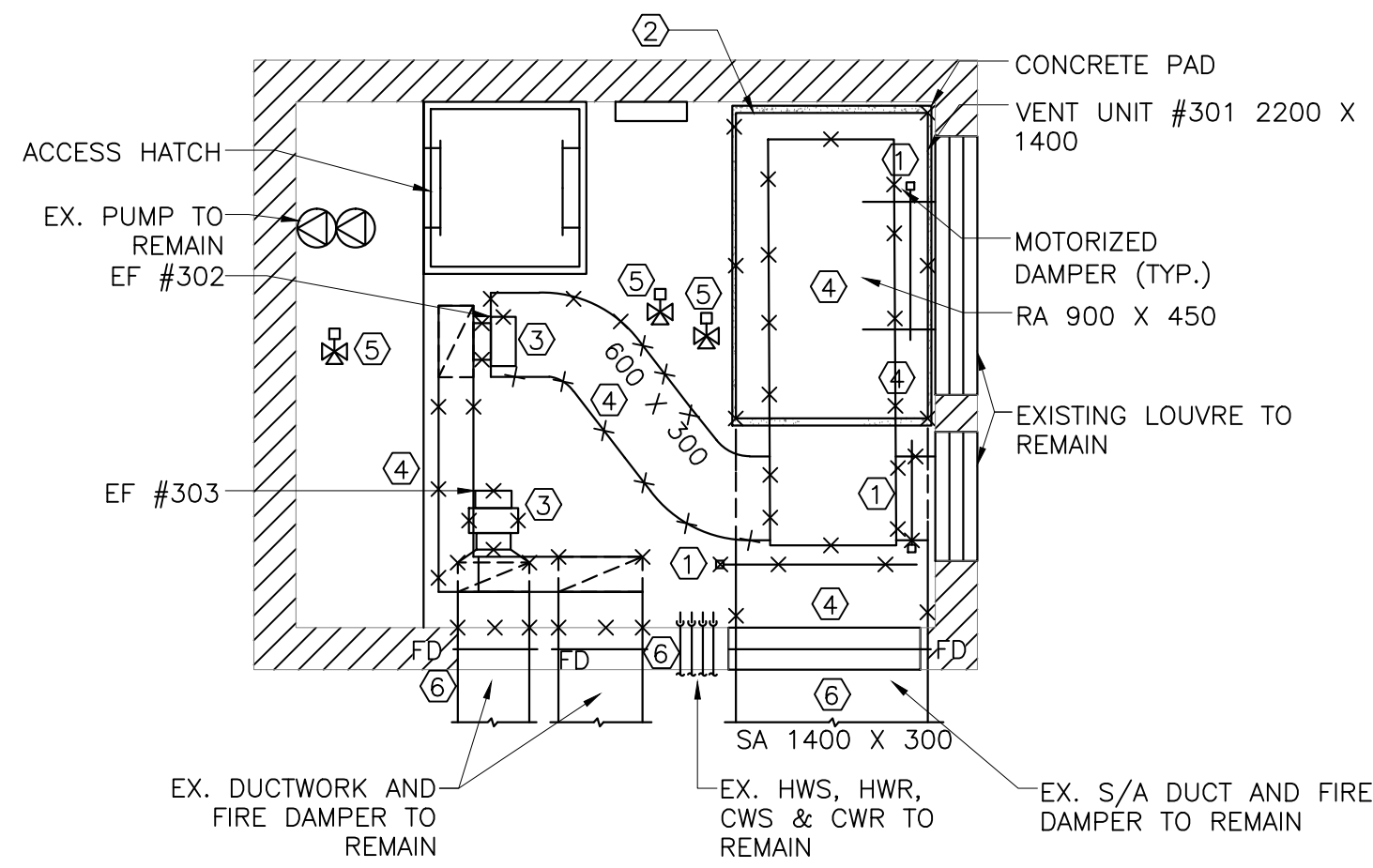
MONCLAIR PS RENOVATION
1285 MONTCLAIR DR, OAKVILLE, ON

HVAC & BAS PROPOSED - ROOF
(YEAR 1968 BUILDING)

SCALE: AS NOTED	PROJECT: 6239 M-14
DATE: JAN 2021	
DRAWN V.L.	DRAWING
CHECKED P.Y.	M-14
PRINT DATE	JAN, 2021

NOTES:

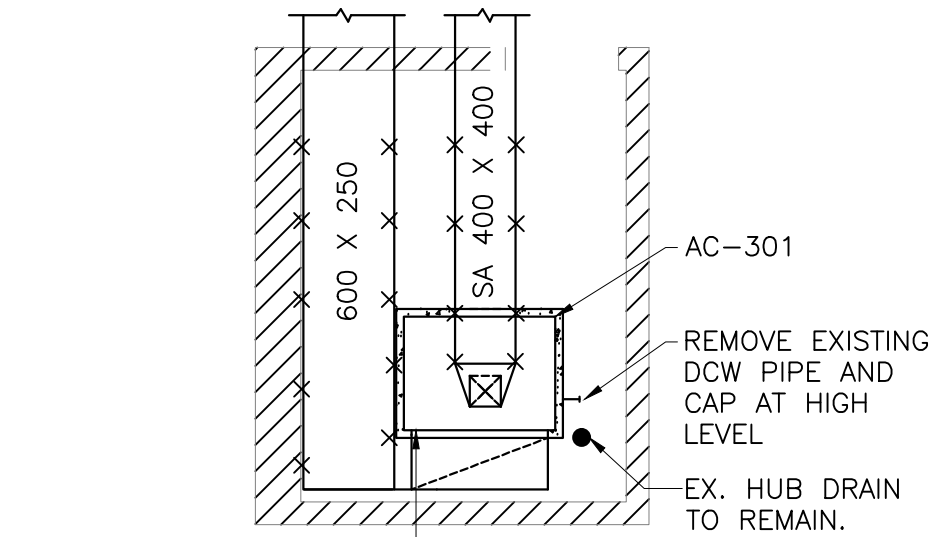
- ① REMOVE EXISTING DAMPERS & ACTUATORS
- ② REMOVE EXISTING HVAC UNIT C/W ASSOCIATED VALVES & PIPING
- ③ REMOVE EXISTING RETURN/EXHAUST FAN
- ④ DEMOLISH EXISTING DUCTWORK
- ⑤ 3-WAY CONTROL VALVE TO BE REPLACED WITH NEW
- ⑥ VERIFY CONDITION & OPERATION OF EXISTING FIRE DAMPERS & CONFIRM THAT THE DAMPERS ARE FUNCTIONAL



MEZZANINE MECHANICAL ROOM DEMOLITION (1)

SCALE: 1:50

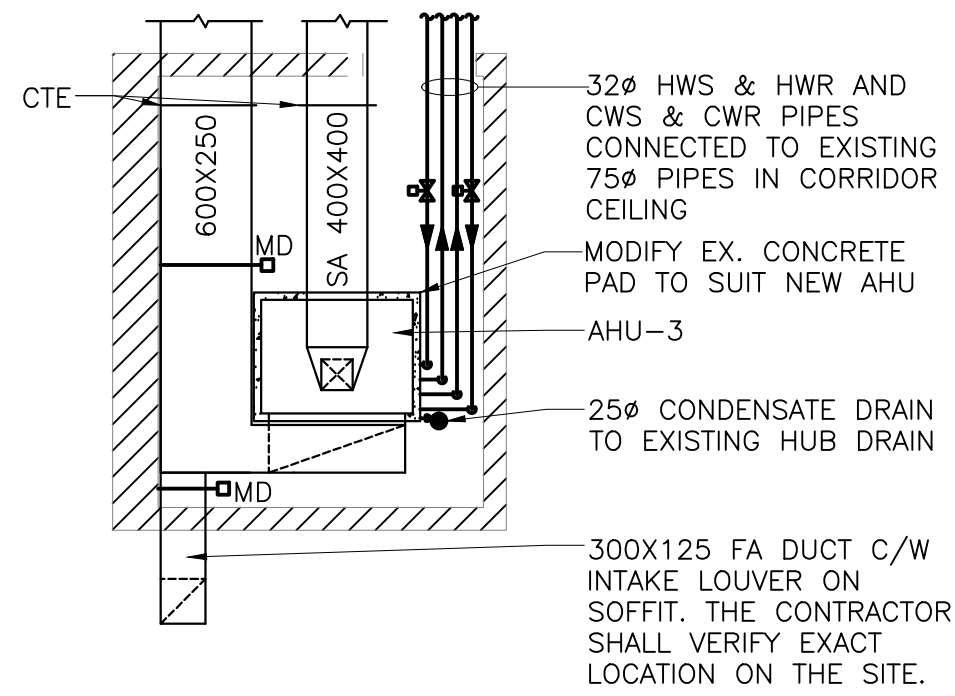
M-15



JANITOR'S ROOM DEMOLITION (3)

SCALE: 1:50

M-15



JANITOR'S ROOM PROPOSED (4)

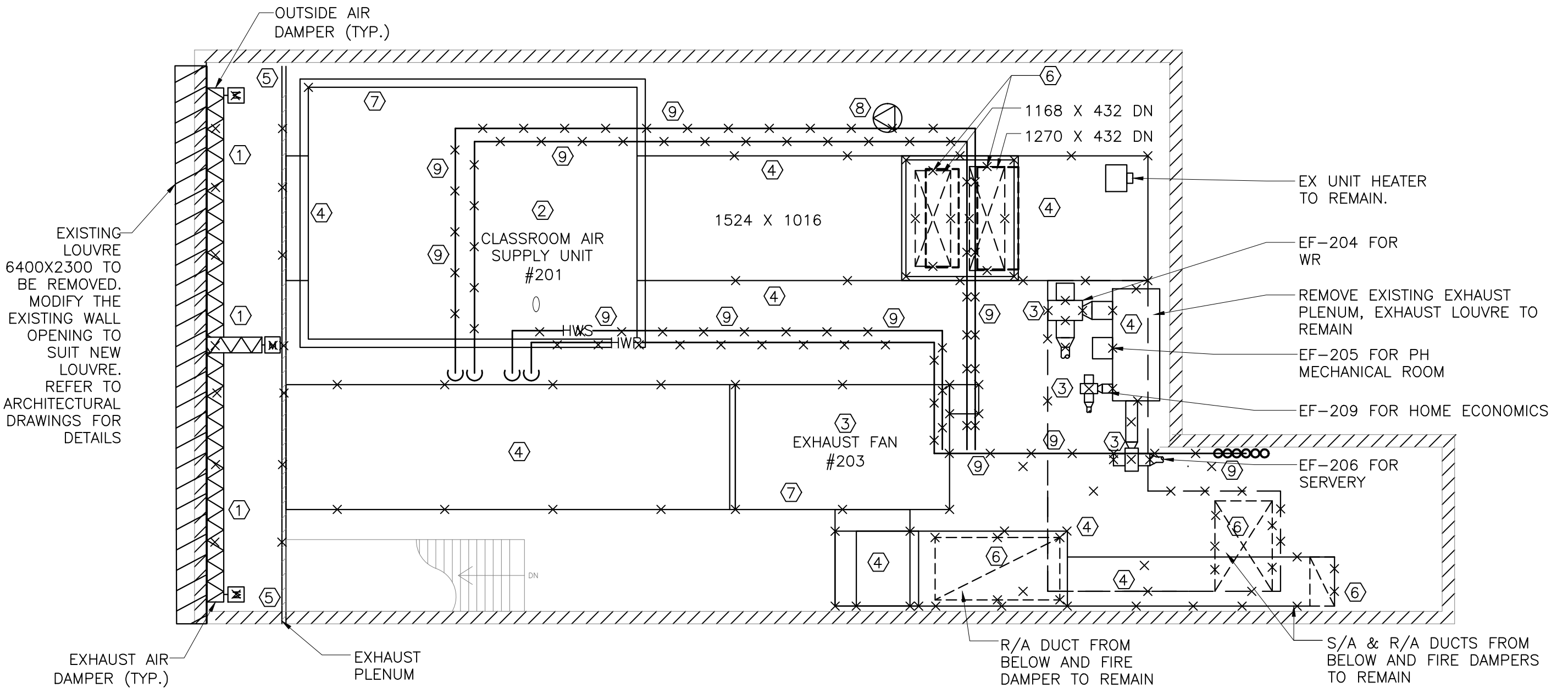
SCALE: 1:50

M-15

NOTES:

- ① REMOVE EXISTING DAMPERS & ACTUATORS
- ② REMOVE EXISTING HVAC UNIT AND ASSOCIATED PIPING.
- ③ REMOVE EXISTING RETURN/EXHAUST FAN
- ④ DEMOLISH EXISTING DUCTWORK
- ⑤ EXISTING PLENUM TO BE REMOVED - REFER TO ARCH DRAWINGS FOR DETAILS

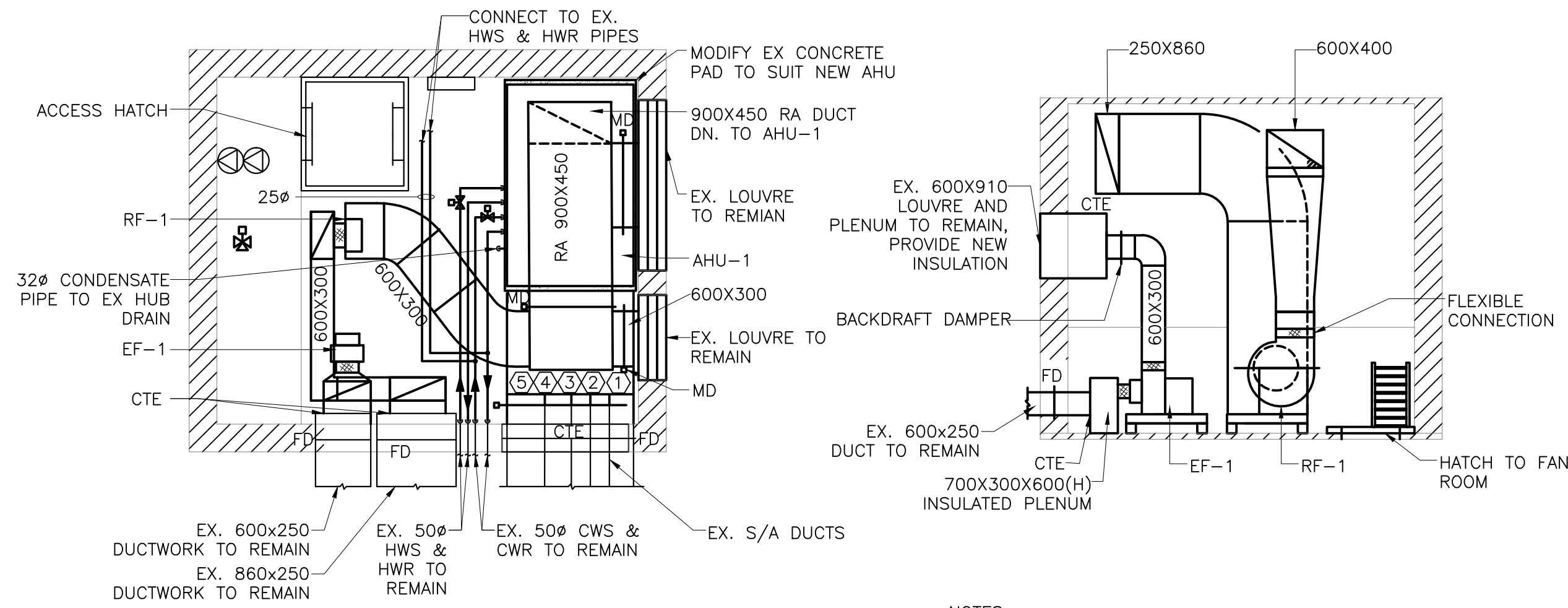
- ⑥ EX. FIRE DAMPERS TO REMAIN; VERIFY CONDITION & OPERATION OF EXISTING FIRE DAMPERS & CONFIRM THAT THE DAMPERS ARE FUNCTIONING.
- ⑦ EXISTING CONCRETE PAD TO BE MODIFIED TO SUIT NEW AHU AND FAN.
- ⑧ EXISTING CIRC. PUMP #208 TO BE REMOVED AND PROVIDE A NEW PUMP.
- ⑨ REMOVE EXISTING HWS & HWR AND CWS & CWR PIPES FOR AHU FROM FLOOR TO AHU.



PENTHOUSE MECHANICAL ROOM DEMOLITION (5)

SCALE: 1:50

M-15



DRAWING NOTES:

- ① PROVIDE MOTORIZED DAMPERS TO ZONE 1 GIRLS CHANGE ROOM 200X400
- ② PROVIDE MOTORIZED DAMPERS TO ZONE 2 CLASSROOM 300X400
- ③ PROVIDE MOTORIZED DAMPERS TO ZONE 3 BOYS CHANGE ROOM 200X400
- ④ PROVIDE MOTORIZED DAMPERS TO ZONE 4 CORRIDOR 150X400
- ⑤ PROVIDE MOTORIZED DAMPERS TO ZONE 5 MUSIC ROOM 250X400

NOTES:

1. REFER TO AHU CONTROL DIAGRAM FOR ZONE DAMPERS.
2. THE CONTRACTOR SHALL VERIFY ZONE DUCT LAYOUT ON THE SITE.
3. PROVIDE INTERNAL THERMAL ACOUSTIC INSULATION FOR S/A AND R/A DUCTS IN MECHANICAL ROOM; DUCT SIZE SHOWN IS NET INTERNAL SIZE.

MEZZANINE MECHANICAL ROOM PROPOSED (2)

SCALE: 1:50

M-15

NOTES:

1. PROVIDE FLEXIBLE CONNECTION BETWEEN AHU, FANS, AND DUCT PIPING

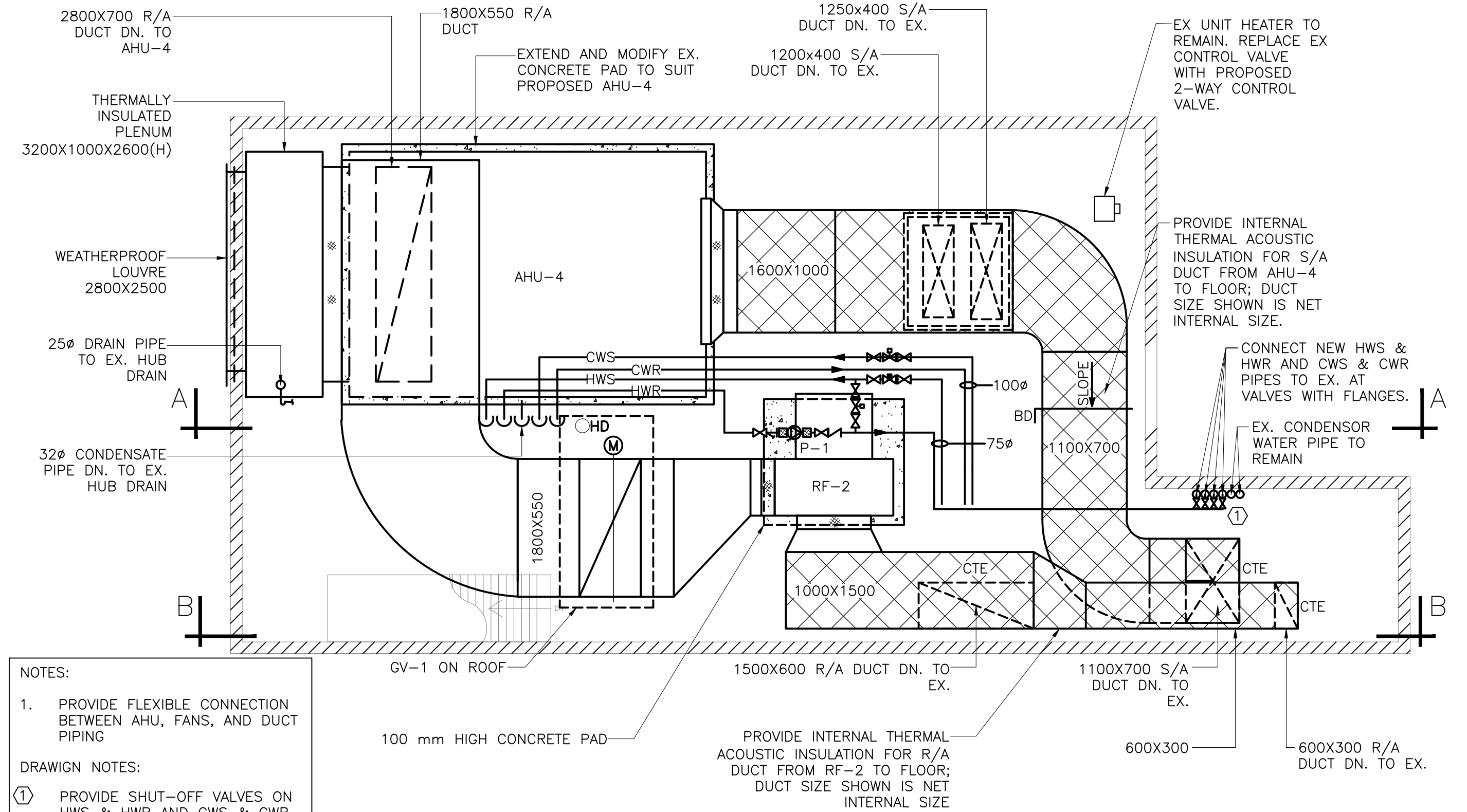
DRAWING NOTES:

- ① PROVIDE SHUT-OFF VALVES ON HWS & HWR AND CWS & CWR PIPES PRIOR TO STARTING DEMOLITION OF THE PROJECT.

PENTHOUSE MECHANICAL ROOM PROPOSED-AHU PLAN (6)

SCALE: 1:50

M-15



5	RE-ISSUED FOR TENDER	06.12.2021
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NO	REVISIONS	DATE

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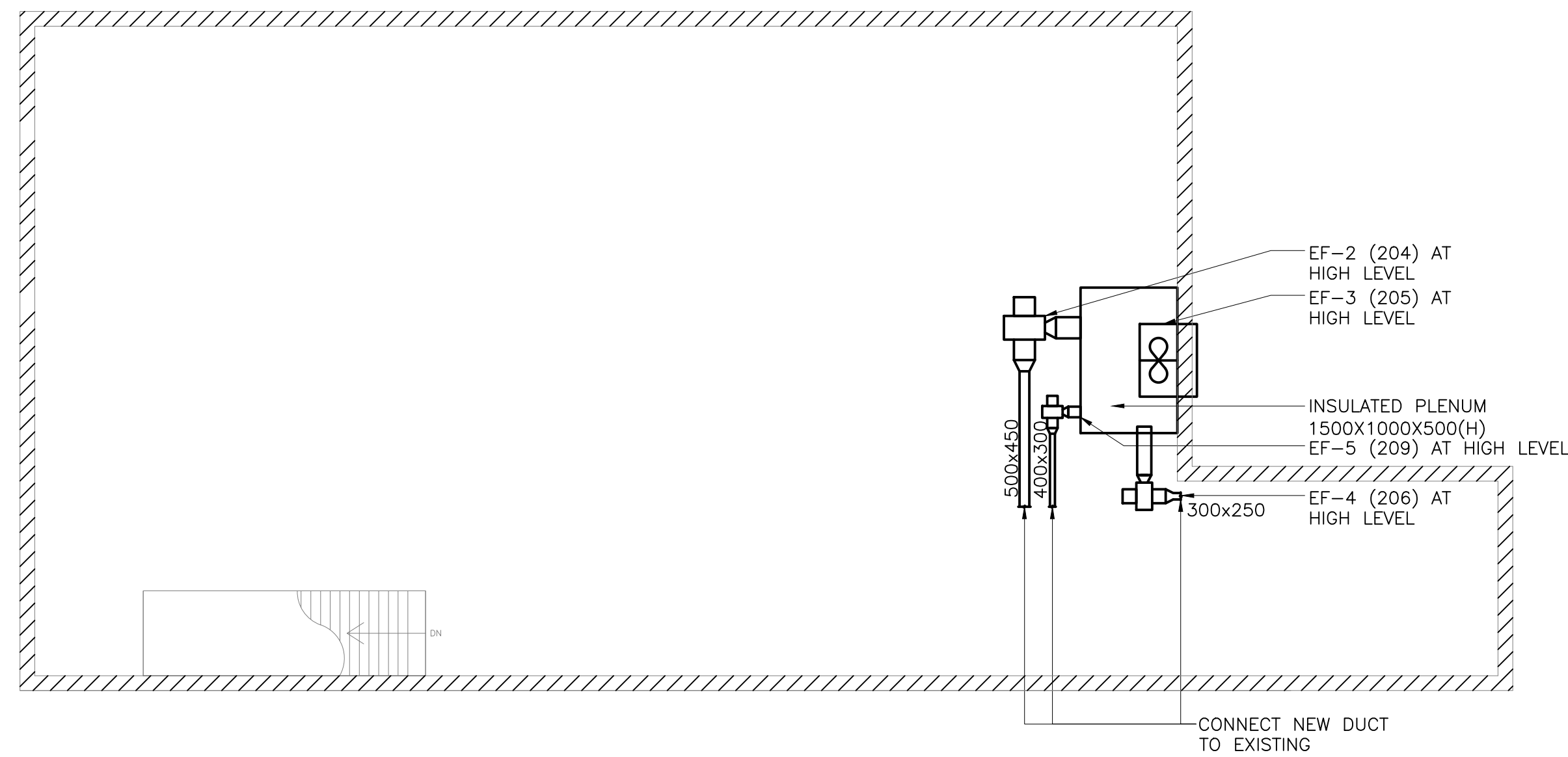
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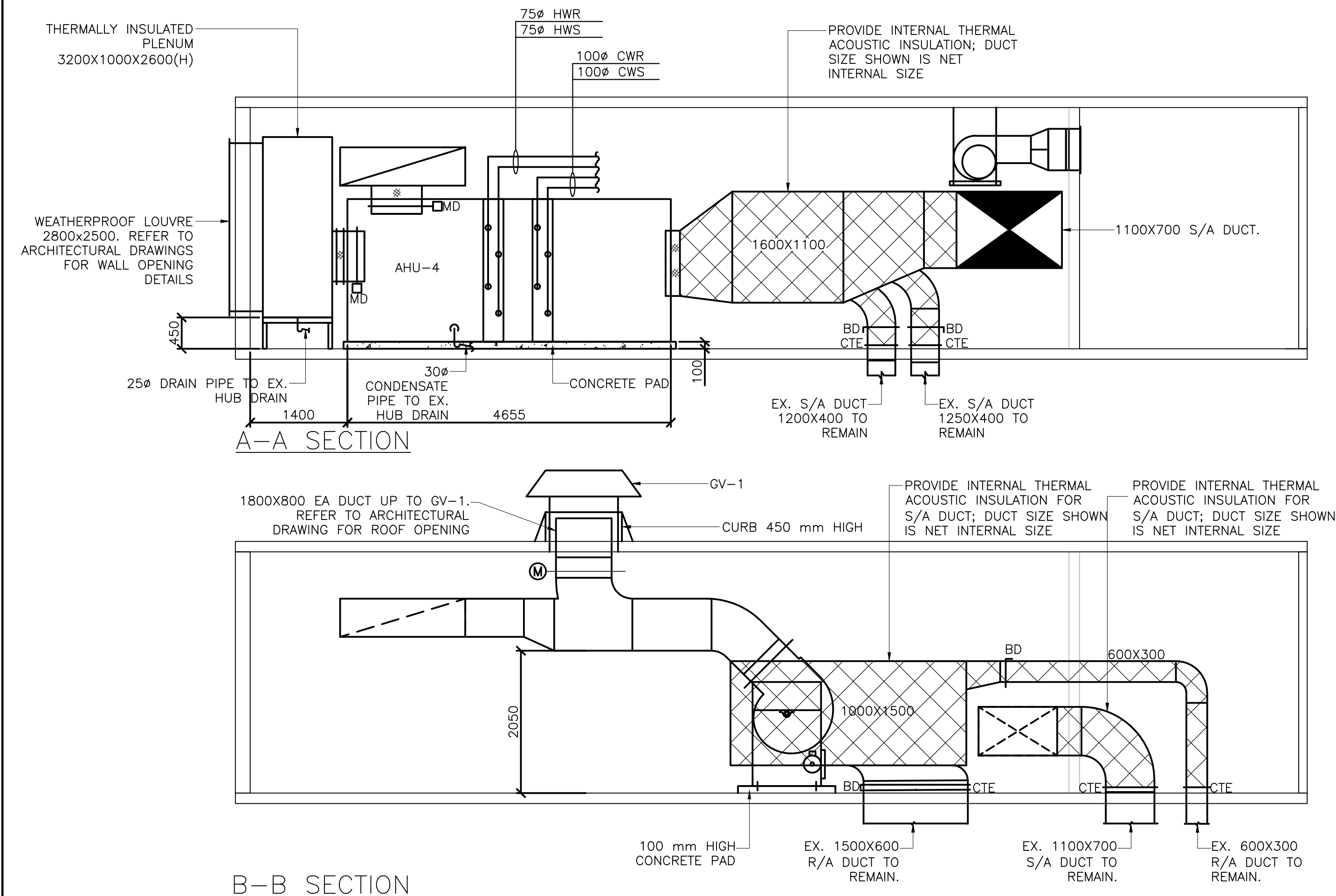
AHU PLAN - GYM ROOF, MECHANICAL ROOMS AND JANITOR'S ROOM

SCALE:	PROJECT: 6239 M-15
AS NOTED	
DATE:	
JAN 2021	
DRAWN:	DRAWING
V.L.	
CHECKED:	
P.Y.	
PRINT DATE:	JAN, 2021

M-15



PENTHOUSE MECHANICAL ROOM PROPOSED EXHAUST FAN PLAN 1
SCALE: 1:50



AHU-4 SECTIONS 2
SCALE: 1:50

	BINARY		ANALOG		ALARM	PROGRAM
	INPUT	OUTPUT	INPUT	OUTPUT		
AHU'S	START/STOP	X				
	MODULATION			X		
	UNIT STATUS			X	EITHER SUPPLY OR RETURN AIR FAN FAIL	
	UNIT SCHEDULE					X
	DAMPERS (OUTDOOR, RETURN, AND EXHAUST AIR)			X	X	
	FREEZE PROTECTION	X				BAS TO SHUT DOWN SYSTEM AND CLOSE OUTDOOR AIR DAMPER IF FREEZING CONDITION EXISTS INSIDE THE AHU
	HEATING COIL CONTROL			X	X	
	COOLING COIL CONTROL			X	X	
	SA TEMPERATURE			X		
	RA TEMPERATURE			X		
MIXED AIR TEMPERATURE			X			
FAN'S	FAN START/STOP	X				
	FAN MODULATION				X	
	FAN STATUS			X	EXHAUST AIR FAN FAIL	
	FAN SCHEDULE					X
PUMPS	PUMP START/STOP	X			EXHAUST AIR FAN FAIL	
	PUMP MODIFICATION				X	
	PUMP STATUS			X		
	FEEDBACK			X		
BOILERS	BOILER START/STOP	X			BOILER FAIL	
	BOILER FIRE MODULATION				X	
	WATER SUPPLY TEMPERATURE			X		
	BOILER STATUS			X		
DOMESTIC WATER HEATERS	HEATER START/STOP	X			DWH FAIL	
	HEATER MODULATION				X	
	WATER SUPPLY TEMPERATURE			X		
	HEATER STATUS			X		
CHILLER	START/STOP	X			CHILLER FAIL	
	CHILLER MODULATION				X	
	WATER SUPPLY TEMPERATURE			X		
CONDENSER	START/STOP	X			CONDENSER FAIL	
	CONDENSER MODULATION				X	
	WATER SUPPLY/RETURN TEMPERATURE			X		
GAS-FIRED AIR HANDLING UNIT	CONDENSER STATUS			X		
	START/STOP	X				
	MODULATION				X	
	UNIT STATUS			X	EITHER SUPPLY OR RETURN AIR FAN FAIL	
	UNITS SCHEDULE					X
	DAMPERS (OUTDOOR, RETURN, AND EXHAUST AIR)			X	X	
	GAS CONTROL				X	
	BURNER STATUS			X		
	COMPRESSORS			X	X	
	COMPRESSOR'S STATUS			X		
SUPPLY AIR TEMPERATURE			X			
RETURN AIR TEMPERATURE			X			
MIXED AIR TEMPERATURE			X			
SUPPLY/RETURN HEATING WATER TEMPERATURE AT RADIATORS			X		WHEN SPACE TEMPERATURE IS LOWER THAN 4°C	

POINTS LIST 3
SCALE: N/A

NO	REVISIONS	DATE
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PENTHOUSE MECHANICAL ROOM
PROPOSED POINT LIST

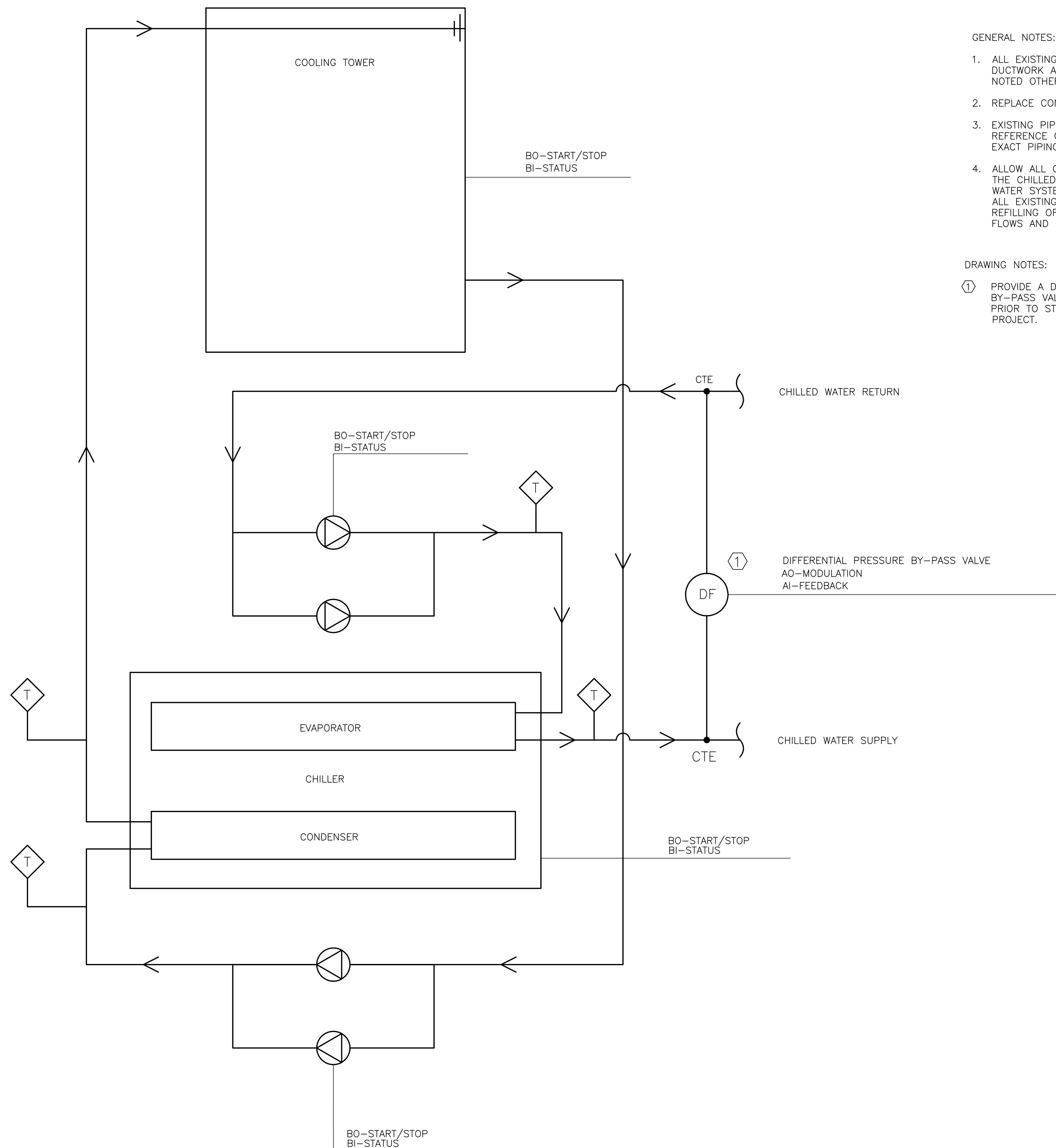
SCALE: AS NOTED	PROJECT: 6239 M-16
DATE: JAN 2021	
DRAWN: V.L.	DRAWING: M-16
CHECKED: P.Y.	
PRINT DATE: JAN, 2021	

GENERAL NOTES:

1. ALL EXISTING HVAC SYSTEMS, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
2. REPLACE CONTROL VALVES.
3. EXISTING PIPING SCHEMATIC DIAGRAM IS FOR REFERENCE ONLY, CONTRACTOR SHALL VERIFY EXACT PIPING LAYOUT ON SITE.
4. ALLOW ALL COSTS FOR COMPLETE DRAINING OF THE CHILLED WATER AS WELL AS THE HEATING WATER SYSTEM, INCLUDE FOR FLUSHING OF ALL EXISTING PIPING AND ACCESSORIES, REFILLING OF THE SYSTEMS, BALANCING OF FLOWS AND MULTIPLE FLUSHING OF STRAINERS.

DRAWING NOTES:

- ① PROVIDE A DIFFERENTIAL PRESSURE BY-PASS VALVE TO THE EXISTING PIPING. PRIOR TO STARTING DEMOLITION OF THE PROJECT.



NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
3	ISSUED FOR PERMIT	16.04.2021
2	ISSUED FOR 95% REVIEW	08.04.2021
1	ISSUED FOR 75% REVIEW	18.03.2021

DRAWINGS ARE NOT TO BE SCALED. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND CONDITIONS ON THE PROJECT, AND MUST REPORT ANY DISCREPANCIES TO THE ARCHITECTS BEFORE PROCEEDING WITH THE WORK. THE USE OF THIS DRAWING OR PART THEREOF IS FORBIDDEN WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECTS.



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MONCLAIR PS RENOVATION

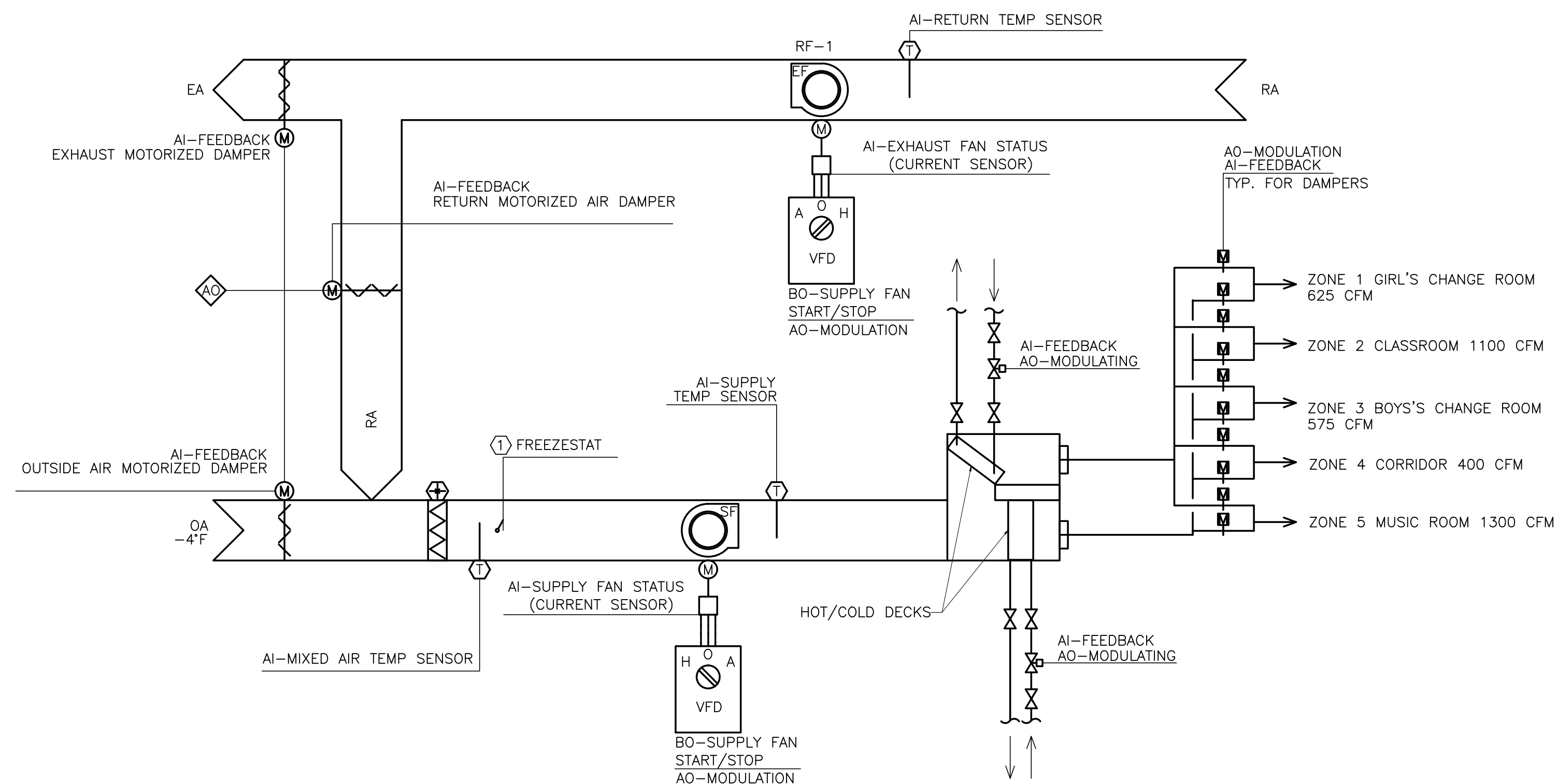
1285 MONTCLAIR DR, OAKVILLE, ON

COOLING SYSTEM CONTROL DIAGRAM

SCALE: AS NOTED	PROJECT: 6239 M-17
DATE: JAN 2021	
DRAWN V.L.	DRAWING M-17
CHECKED P.Y.	
PRINT DATE	JAN, 2021

DRAWING NOTES:

① THE FREEZESTAT SHALL BE HARDWIRED TO SHUT-OFF THE AHU AND CLOSE THE OUTSIDE AIR DAMPER. MONITOR MIXED AIR TEMPERATURE ON BAS AND PROVIDE AN ALARM IF THE TEMPERATURE DROPS BELOW 40 DEGREES F.



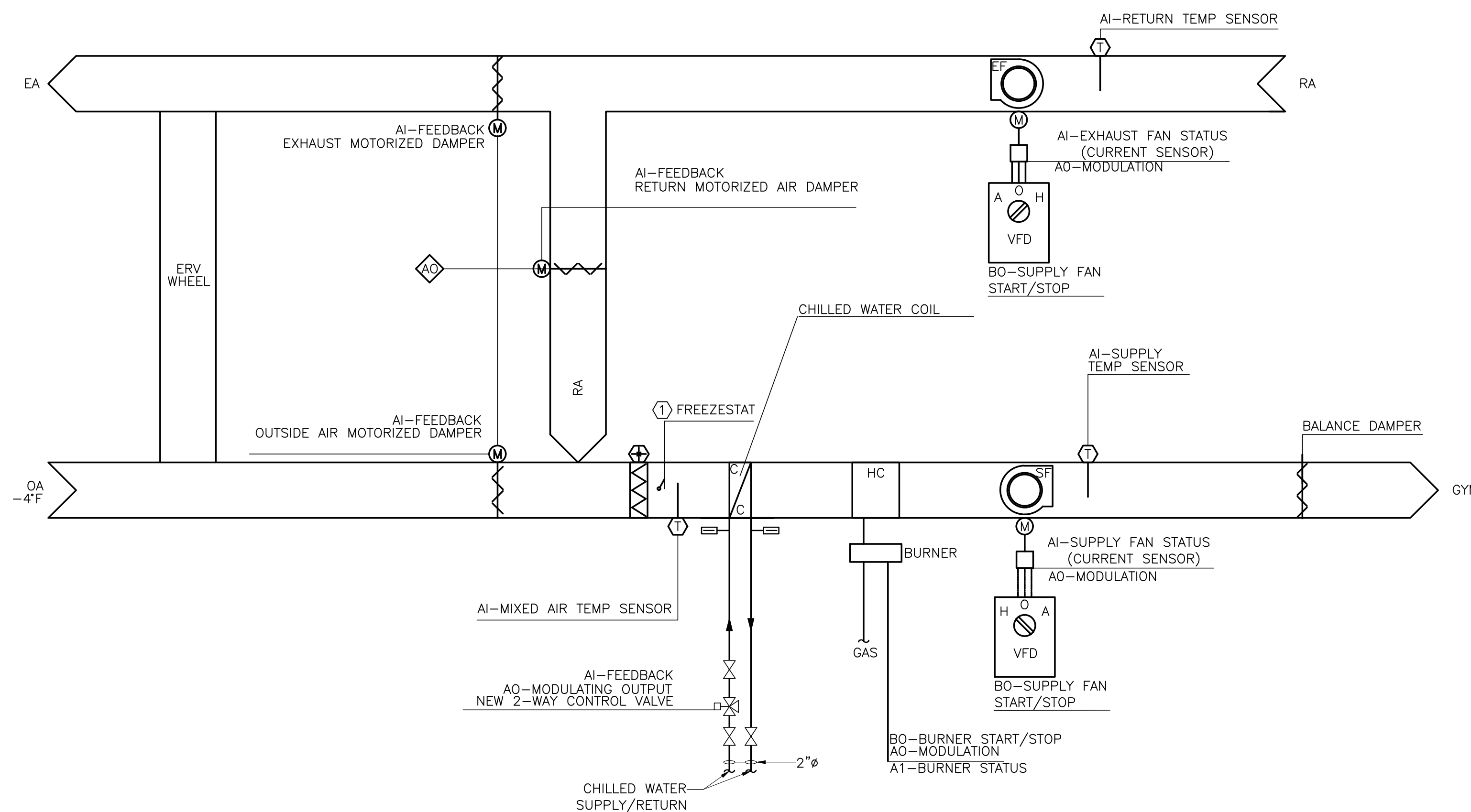
GYM MEZZANINE AHU-1 CONTROL DIAGRAM

①
M-18

SCALE: N.T.S.

NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
3	ISSUED FOR PERMIT	16.04.2021
2	ISSUED FOR 95% REVIEW	08.04.2021
1	ISSUED FOR 75% REVIEW	18.03.2021

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GYM ROOF AHU-2 CONTROL DIAGRAM

②
M-18

SCALE: N.T.S.



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MONCLAIR PS RENOVATION

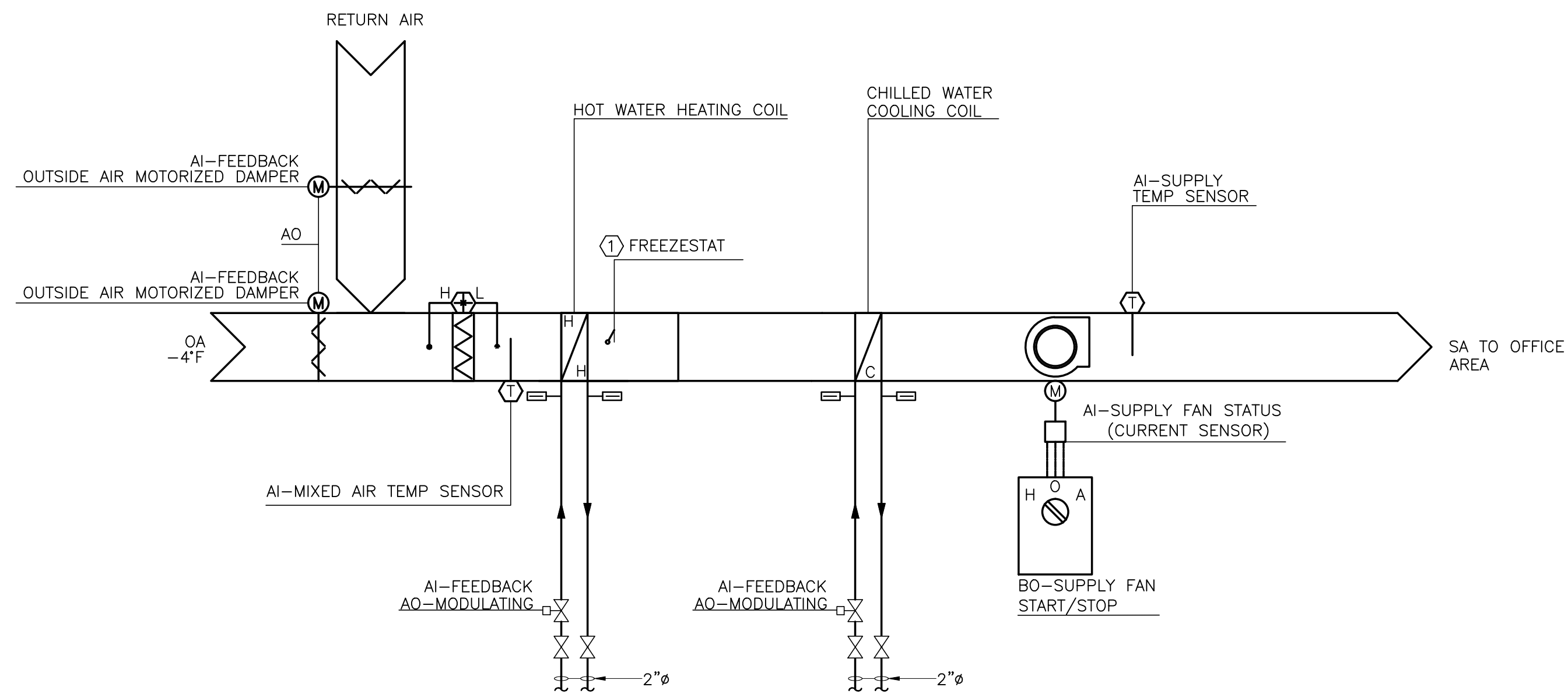
1285 MONTCLAIR DR, OAKVILLE, ON

CONTROL DIAGRAMS

SCALE:	PROJECT: 6239 M-18
AS NOTED	
DATE:	
JAN 2021	
DRAWN:	DRAWING
V.L.	
CHECKED:	M-18
P.Y.	
PRINT DATE:	JAN, 2021

DRAWING NOTES:

- ① THE FREEZESTAT SHALL BE HARDWIRED TO SHUT-OFF THE AHU AND CLOSE THE OUTSIDE AIR DAMPER. MONITOR MIXED AIR TEMPERATURE ON BAS AND PROVIDE AN ALARM IF THE TEMPERATURE DROPS BELOW 40 DEGREES F.



JANITOR ROOM AHU-3 CONTROL DIAGRAM ①
SCALE: N.T.S. M-19

NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
3	ISSUED FOR PERMIT	16.04.2021
2	ISSUED FOR 95% REVIEW	08.04.2021
1	ISSUED FOR 75% REVIEW	18.03.2021

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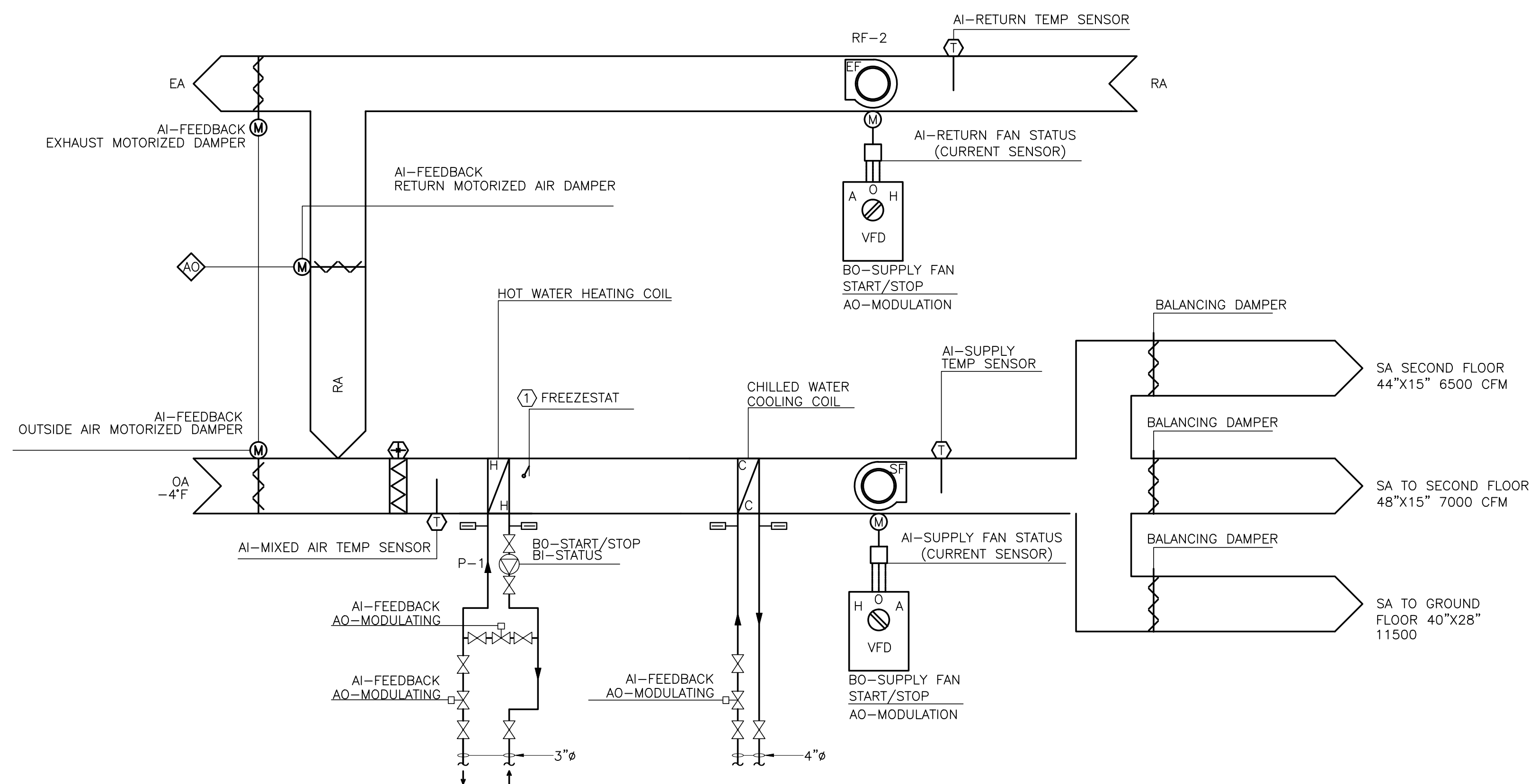
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MONCLAIR PS RENOVATION
1285 MONTCLAIR DR, OAKVILLE, ON

CONTROL DIAGRAMS

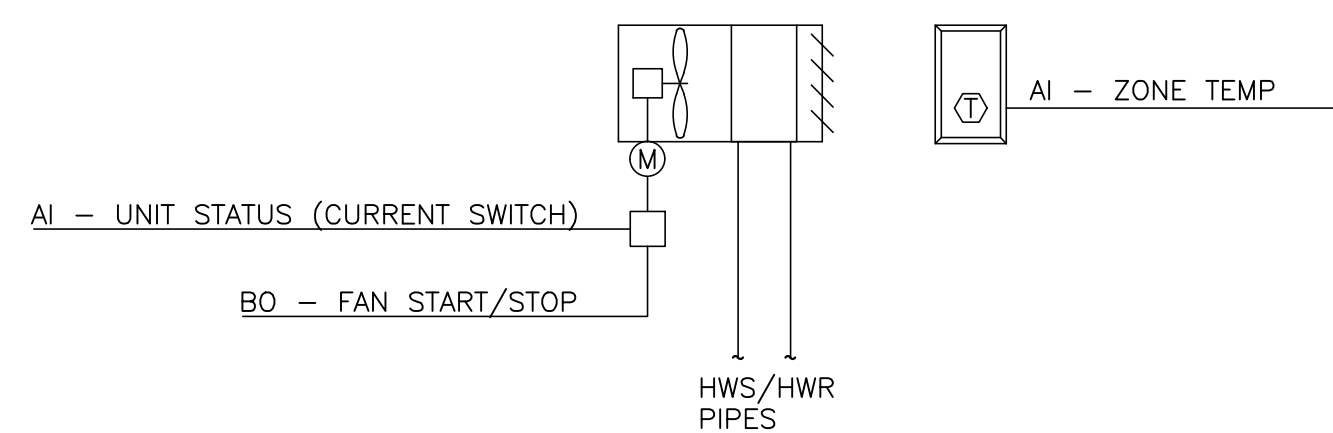
DRAWING NOTES:

- ① THE FREEZESTAT SHALL BE HARDWIRED TO SHUT-OFF THE AHU AND CLOSE THE OUTSIDE AIR DAMPER. MONITOR MIXED AIR TEMPERATURE ON BAS AND PROVIDE AN ALARM IF THE TEMPERATURE DROPS BELOW 40 DEGREES F.

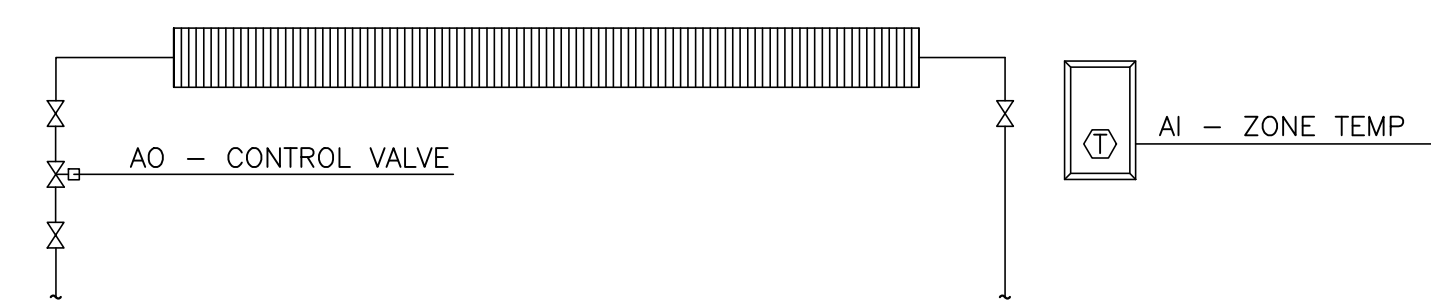


PENTHOUSE AHU-4 CONTROL DIAGRAM ②
SCALE: 1:100 M-19

SCALE: AS NOTED	PROJECT: 6239 M-19
DATE: JAN 2021	
DRAWN: V.L.	DRAWING: M-19
CHECKED: P.Y.	
PRINT DATE: JAN, 2021	



TYPICAL UNIT HEATER & CABINET HEATER CONTROL DIAGRAM 1
SCALE: N.T.S. M-20



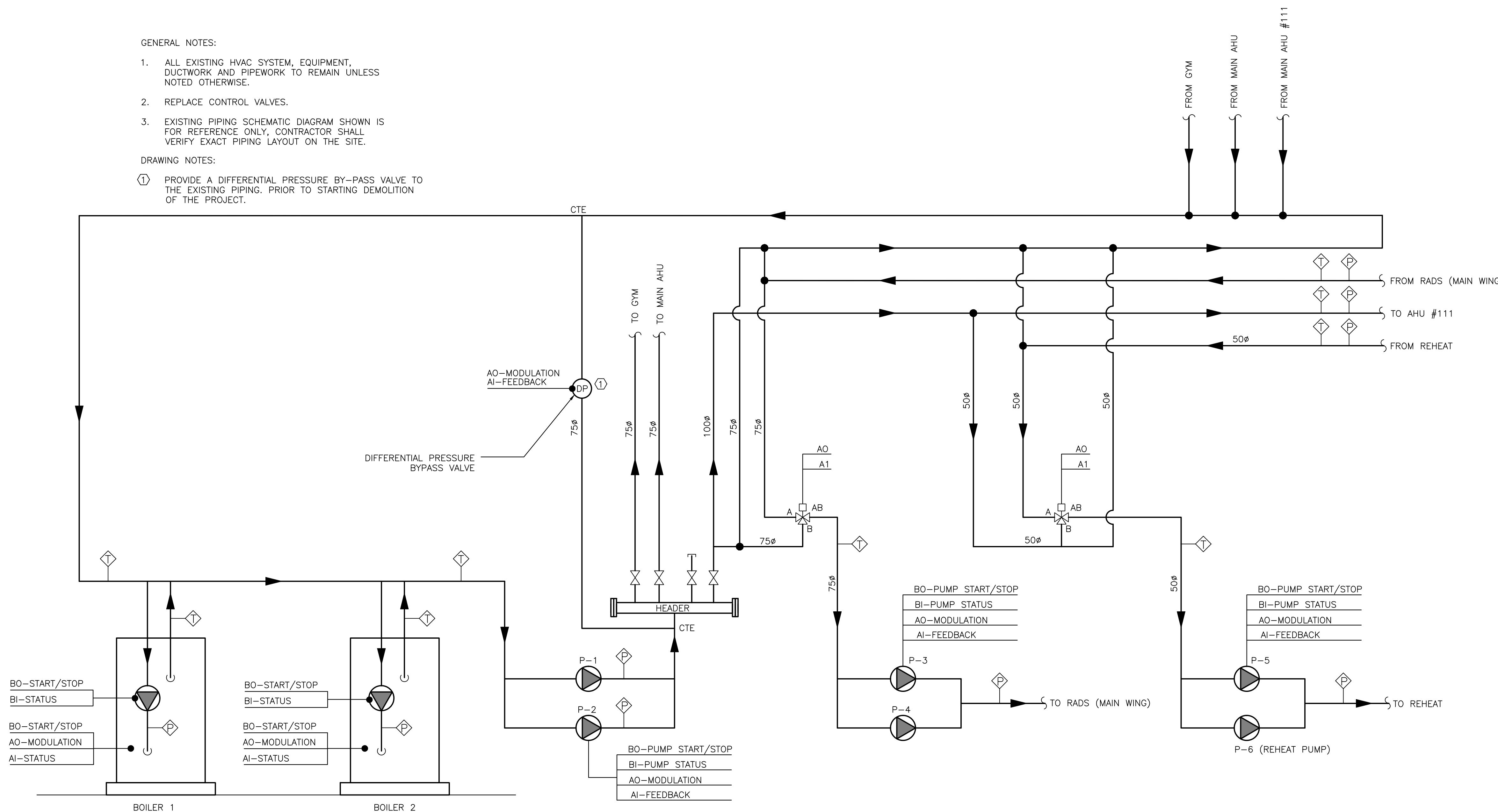
TYPICAL WALL FIN AND CONVECTOR CONTROL DIAGRAM 2
SCALE: N.T.S. M-20

GENERAL NOTES:

1. ALL EXISTING HVAC SYSTEM, EQUIPMENT, DUCTWORK AND PIPEWORK TO REMAIN UNLESS NOTED OTHERWISE.
2. REPLACE CONTROL VALVES.
3. EXISTING PIPING SCHEMATIC DIAGRAM SHOWN IS FOR REFERENCE ONLY, CONTRACTOR SHALL VERIFY EXACT PIPING LAYOUT ON THE SITE.

DRAWING NOTES:

- ① PROVIDE A DIFFERENTIAL PRESSURE BY-PASS VALVE TO THE EXISTING PIPING. PRIOR TO STARTING DEMOLITION OF THE PROJECT.



BOILER ROOM HEATING SYSTEM AND CONTROL DIAGRAM 3
SCALE: N.T.S. M-20

NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	06.12.2021
4	ISSUED FOR TENDER	23.04.2021
3	ISSUED FOR PERMIT	16.04.2021
2	ISSUED FOR 95% REVIEW	08.04.2021
1	ISSUED FOR 75% REVIEW	18.03.2021

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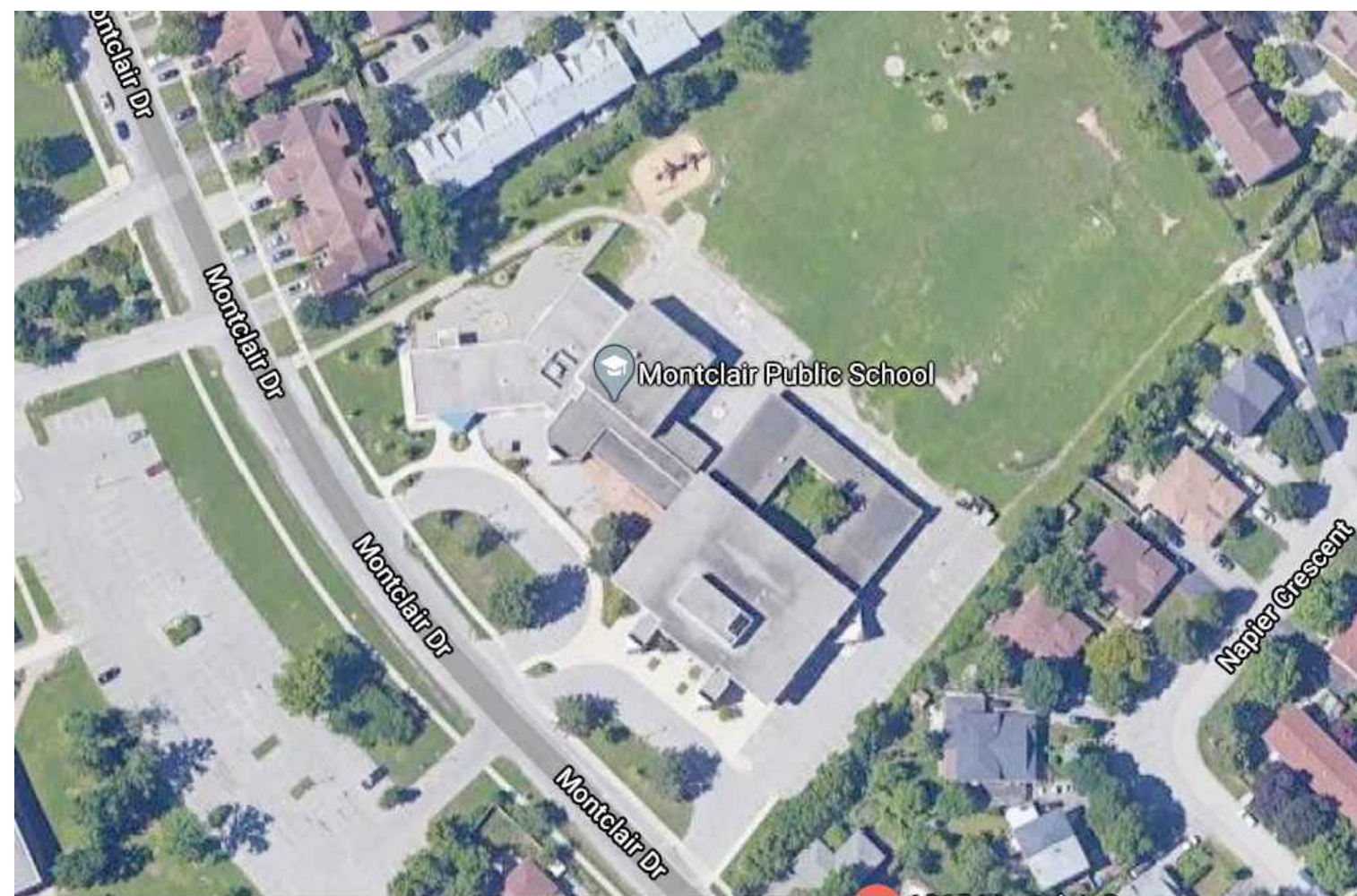


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CONTROL DIAGRAMS

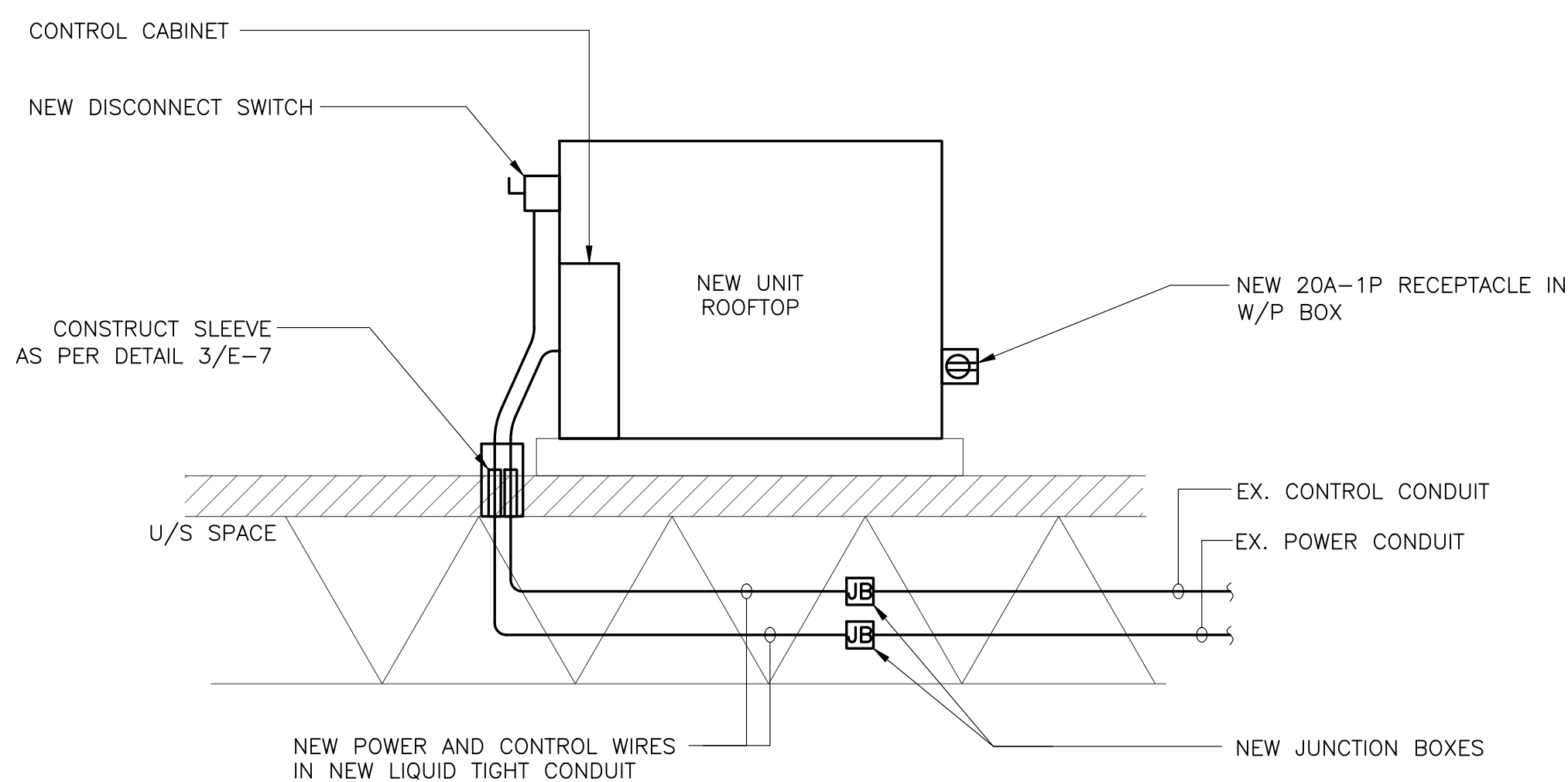
SCALE: AS NOTED	PROJECT: 6239 M-20
DATE: JAN 2021	
DRAWN: V.L.	DRAWING: M-20
CHECKED: P.Y.	
PRINT DATE: JAN, 2021	



SATELLITE MAP 1
SCALE: N.T.S. E-1

LEGEND:

	THREE PHASE DISCONNECT SWITCH	R	EXISTING TO BE REMOVED AND DISPOSED OF
	ROOFTOP 20A-1P RECEPTACLE IN W/P ENCLOSURE	W/P	WEATHERPROOF
	JUNCTION BOX	DN	DOWN
	SINGLE PHASE COMBINATION STARTER	U/S	UNDERSIDE
	THREE PHASE COMBINATION STARTER	CCT#	CIRCUIT NUMBER
	ELECTRICAL DISTRIBUTION PANEL	EX	EXISTING TO REMAIN
	THREE PHASE MOTOR	EM	EXISTING WIRES, CONDUIT TO BE MODIFIED
	SINGLE PHASE MOTOR	C/W	COMPLETE WITH
		FACP	FIRE ALARM CONTROL PANEL
		MD	MOTORIZED DAMPER



NOTE:

- PULL BACK EXISTING POWER AND CONTROL CABLES TO UNDER SIDE ROOF CEILING SPACE. PROVIDE NEW JUNCTION BOXES TO SPLICE AND EXTEND WITH NEW WIRING AND CONDUIT IN LIQUID TIGHT CONDUIT TO W/P DISCONNECT SWITCH AND UNIT CONTROLS PANEL.

TYPICAL ROOF TOP UNIT POWER AND CONTROL WIRING REPLACEMENT 2
E-1

ELECTRICAL CONSTRUCTION NOTES:

- ALL EXISTING INFORMATION TO BE CONFIRMED. CONDUITS AND WIRING ARE SHOWN BASED ON AVAILABLE AS-BUILT INFORMATION ONLY AND CONTRACTOR TO CONFIRM ON SITE AS REQUIRED. INFORMATION IS PROVIDED AS A REFERENCE FOR DEMOLITION AND RE-FEEDING/RE-ROUTING REQUIREMENTS AS DESCRIBED WITHIN THE CONTRACT.
- ALL DIMENSIONS AND INFORMATION SHALL BE CHECKED AND VERIFIED ON THE JOB SITE AND ANY DISCREPANCIES MUST BE REPORTED BEFORE COMMENCING THE WORK.
- IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO BECOME INFORMED OF THE EXACT LOCATION OF, AND ASSUME ALL LIABILITY FOR DAMAGE TO ALL SERVICES, AND STRUCTURES WHETHER ABOVE GROUND OR BELOW GRADE BEFORE COMMENCING THE WORK. SUCH INFORMATION IS NOT NECESSARILY SHOWN ON THE DRAWINGS AND WHERE SHOWN, THE ACCURACY CANNOT BE GUARANTEED.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING ALL EXISTING SERVICES IN WORKING AREA PRIOR TO CONSTRUCTION AND SHALL PROTECT THESE SERVICES TO THE SATISFACTION OF THE CITY. DAMAGES BY THE CONTRACTOR SHALL BE RESTORED TO THE SATISFACTION OF THE CITY AT NO EXPENSE TO THE CITY.
- REMOVE ALL UNNECESSARY ELECTRICAL CONDUIT, WIRING AND EQUIPMENT FROM THE EXISTING PROJECT AREA BEING RENOVATED AS INDICATED IN THE SPECIFICATIONS AND DRAWINGS AND AS DIRECTED ON SITE. THE DRAWINGS DO NOT INDICATE ALL ITEMS TO BE REMOVED OR REWORKED.
- DURING MANDATORY SITE VISIT, EXAMINE THE CONDITIONS AND MAKE NECESSARY ALLOWANCES IN THE TENDER PRICE FOR REMOVAL, REROUTING, RELOCATION AND RECONNECTION OF ELECTRICAL EQUIPMENT AND WIRING AS MAY BE NECESSARY FOR THE EXECUTION AND COMPLETION OF THE PROJECT, EXTRA CHARGES FOR PREMIUM TIME SHALL BE INCLUDED IN THE TENDER AMOUNT.
- WIRING LOCATED IN AREAS BEING ALTERED OR DEMOLISHED, BUT FEEDING LIGHTING, OUTLETS OR EQUIPMENT REQUIRED TO REMAIN IN SERVICE SHALL BE REROUTED AS REQUIRED TO MAINTAIN THE CONTINUITY OF THESE SERVICES. ALL COSTS SHALL BE INCLUDED IN THE CONTRACT.
- FISH ALL CONDUIT AND PROVIDE NYLON PULL STRINGS AND #12AWG RWU90 WIRES IN ALL NEW & EXISTING CONDUITS WHERE WIRING IS INSTALLED AND WHERE CONDUITS ARE BEING LEFT AS SPARES.
- ALL PENETRATIONS IN ROOF, WALLS AND CEILING FOR CONDUIT CROSSING TO BE SEALANT AND FIRE STOPPED.
- REMOVE & DISPOSE OF ALL EXISTING REDUNDANT CONDUIT AND WIRING.
- ALL CONDUITS AND BOXES TO BE LABELED AS PER CONSULTANTS/CITY'S INSTRUCTIONS.
- ALL EXISTING LIFE SAFETY SYSTEMS AND ESSENTIAL SYSTEMS SHALL REMAIN OPERATIONAL DURING CONSTRUCTION PERIOD.
- THE INSTALLATION SHALL BE INSPECTED BY ESA. INCLUDE INSPECTION CERTIFICATION IN CLOSEOUT MANUAL.
- COORDINATE THE ELECTRICAL WORK WITH OTHER TRADES. ASSIST MECHANICAL TRADE TO DE-ENERGIZE ELECTRICAL FEEDERS TO MECHANICAL EQUIPMENT.
- ALL WIRES SHALL BE COPPER ONLY AND SHALL BE INSTALLED INSIDE CONDUITS, NO EXCEPTIONS.
- PULL BACK EXISTING POWER AND CONTROL CABLES TO UNDER SIDE ROOF CEILING SPACE. PROVIDE NEW JUNCTION BOXES TO SPLICE AND EXTEND WITH NEW WIRING AND CONDUIT IN LIQUID TIGHT CONDUIT TO W/P DISCONNECT SWITCH AND UNIT CONTROLS PANEL.

AIR HANDLING UNIT ELECTRICAL SCHEDULE

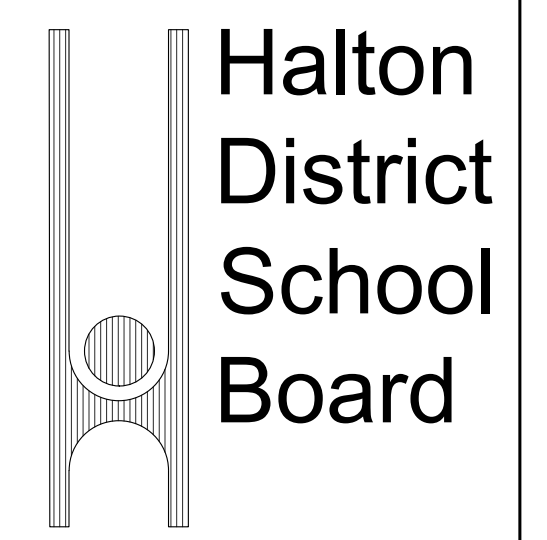
EQUIP. NO.	ELEC. DATA			REMARKS
	V/PH/HZ	MOCP	MCA	
AHU-1	600V/3/60	15	2.68	SIZE-0 COMBINATION STARTER
AHU-2	600V/3/60	20	12.3	SIZE-1 COMBINATION STARTER
AHU-3	208V/3/60	15	5.75	SIZE-1 COMBINATION STARTER
AHU-4	600V/3/60	70	42.50	SIZE-4 COMBINATION STARTER

NOTES:
REFER TO DIVISION IS FOR DETAILED INFORMATION ON NEW UNITS

EXHAUST FANS AND PUMPS ELECTRICAL SCHEDULE

EQUIP. NO.	FAN MOTOR KW	POWER SUPPLY V/PH/HZ	OTHER REQ. DISC. SWITCH BY ELECT	REMARKS
EF-1	0.560	600V/3/60	X	PROVIDE COMBINATION STARTER
EF-2	0.745	600V/3/60	X	PROVIDE COMBINATION STARTER
EF-3	0.376	120V/1/60	X	PROVIDE COMBINATION STARTER
EF-4	0.25	120V/1/60	X	PROVIDE COMBINATION STARTER
EF-5	0.56	120V/1/60	X	PROVIDE COMBINATION STARTER
EF-6	0.56	600V/3/60	X	PROVIDE COMBINATION STARTER
EF-7	0.187	115V/1/60	X	PROVIDE COMBINATION STARTER
EF-8	0.187	115V/1/60	X	PROVIDE COMBINATION STARTER
RF-1	1.5	600V/3/60		VFD
RF-2	15	600V/3/60		VFD
P-1	0.56	120V/1/60		SIZE-0 COMBINATION STARTER

NOTES:
REFER TO DIVISION IS FOR DETAILED INFORMATION ON NEW UNITS.



5	RE-ISSUED FOR TENDER	DEC.12.2021
4	ISSUED FOR TENDER	OCT.15.2021
3	ISSUED FOR BUILDING PERMIT	APR.16.2021
2	ISSUED FOR 95% SUBMISSION	APR.14.2021
1	ISSUED FOR 75% SUBMISSION	MAR.17.2021

NO REVISIONS

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MONTCLAIR PS RENOVATION

1285 MONTCLAIR DR, OAKVILLE, ON

ELECTRICAL
LEGEND, NOTES,
SCHEDULES & DETAILS

SCALE: AS NOTED	PROJECT: 6239 E-1
DATE: JAN 2021	
DRAWN R.V.G.	DRAWING E-1
CHECKED T.B.	
PRINT DATE	JAN. 2021



NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	DEC.12.2021
4	ISSUED FOR TENDER	OCT.15.2021
3	ISSUED FOR BUILDING PERMIT	APR.16.2021
2	ISSUED FOR 95% SUBMISSION	APR.14.2021
1	ISSUED FOR 75% SUBMISSION	MAR.17.2021

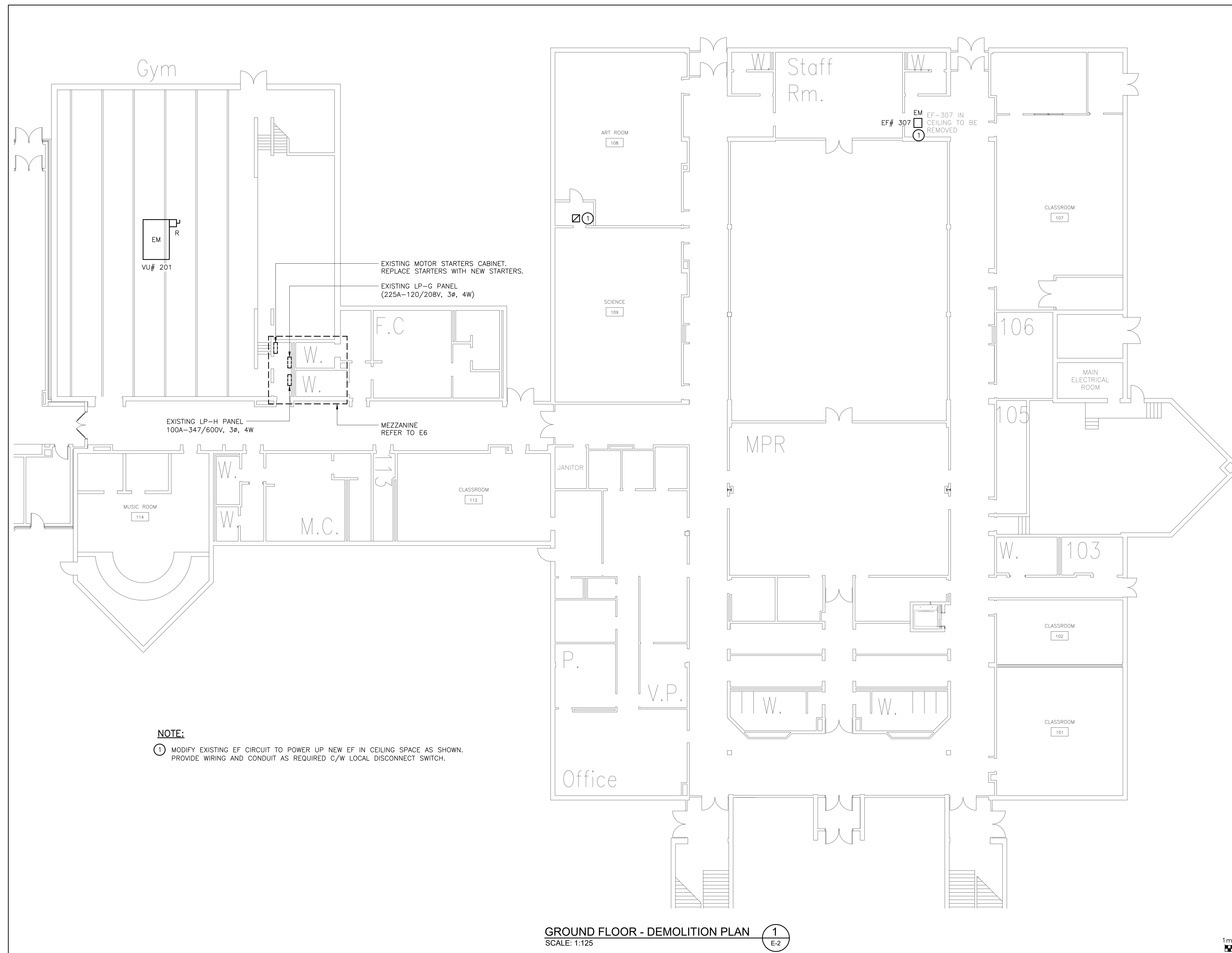
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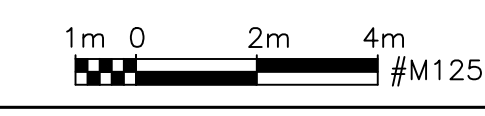
MONTCLAIR PS RENOVATION
1285 MONTCLAIR DR, OAKVILLE, ON

ELECTRICAL GROUND FLOOR DEMOLITION PLAN

SCALE: AS NOTED	PROJECT: 6239 E-2
DATE: JAN 2021	
DRAWN R.V.G.	DRAWING E-2
CHECKED T.B.	
PRINT DATE	JAN. 2021



GROUND FLOOR - DEMOLITION PLAN ①
SCALE: 1:125 E-2





NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	DEC.12.2021
4	ISSUED FOR TENDER	OCT.15.2021
3	ISSUED FOR BUILDING PERMIT	APR.16.2021
2	ISSUED FOR 95% SUBMISSION	APR.14.2021
1	ISSUED FOR 75% SUBMISSION	MAR.17.2021

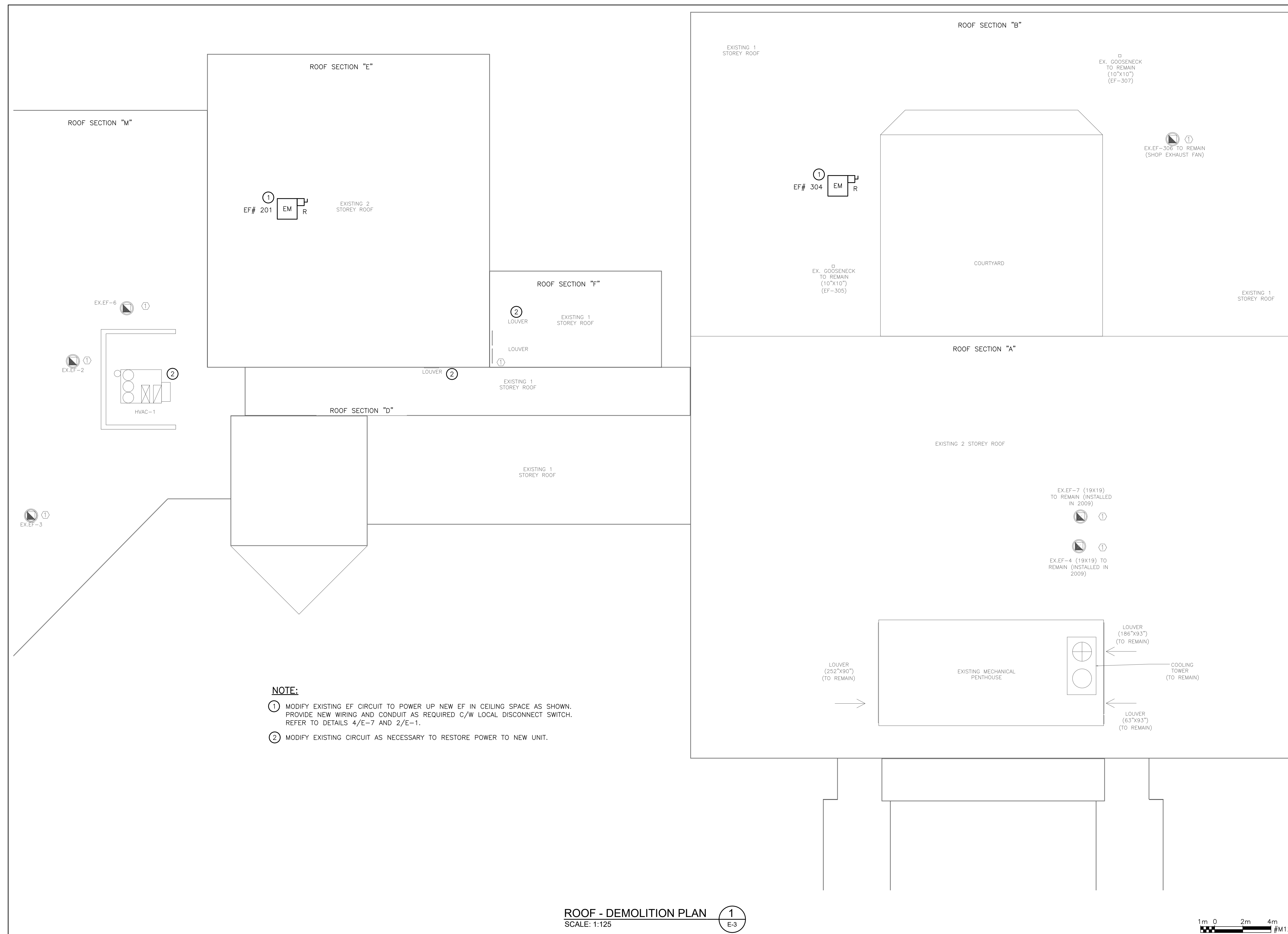
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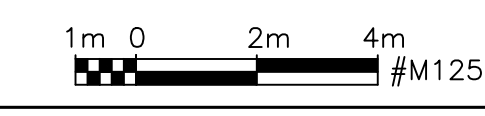
MONTCLAIR PS RENOVATION
 1285 MONTCLAIR DR, OAKVILLE, ON

ELECTRICAL ROOF DEMOLITION PLAN

SCALE: AS NOTED	PROJECT: 6239 E-3
DATE: JAN 2021	
DRAWN R.V.G.	DRAWING E-3
CHECKED T.B.	
PRINT DATE	JAN. 2021



ROOF - DEMOLITION PLAN 1 E-3
 SCALE: 1:125





NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	DEC.12.2021
4	ISSUED FOR TENDER	OCT.15.2021
3	ISSUED FOR BUILDING PERMIT	APR.16.2021
2	ISSUED FOR 95% SUBMISSION	APR.14.2021
1	ISSUED FOR 75% SUBMISSION	MAR.17.2021

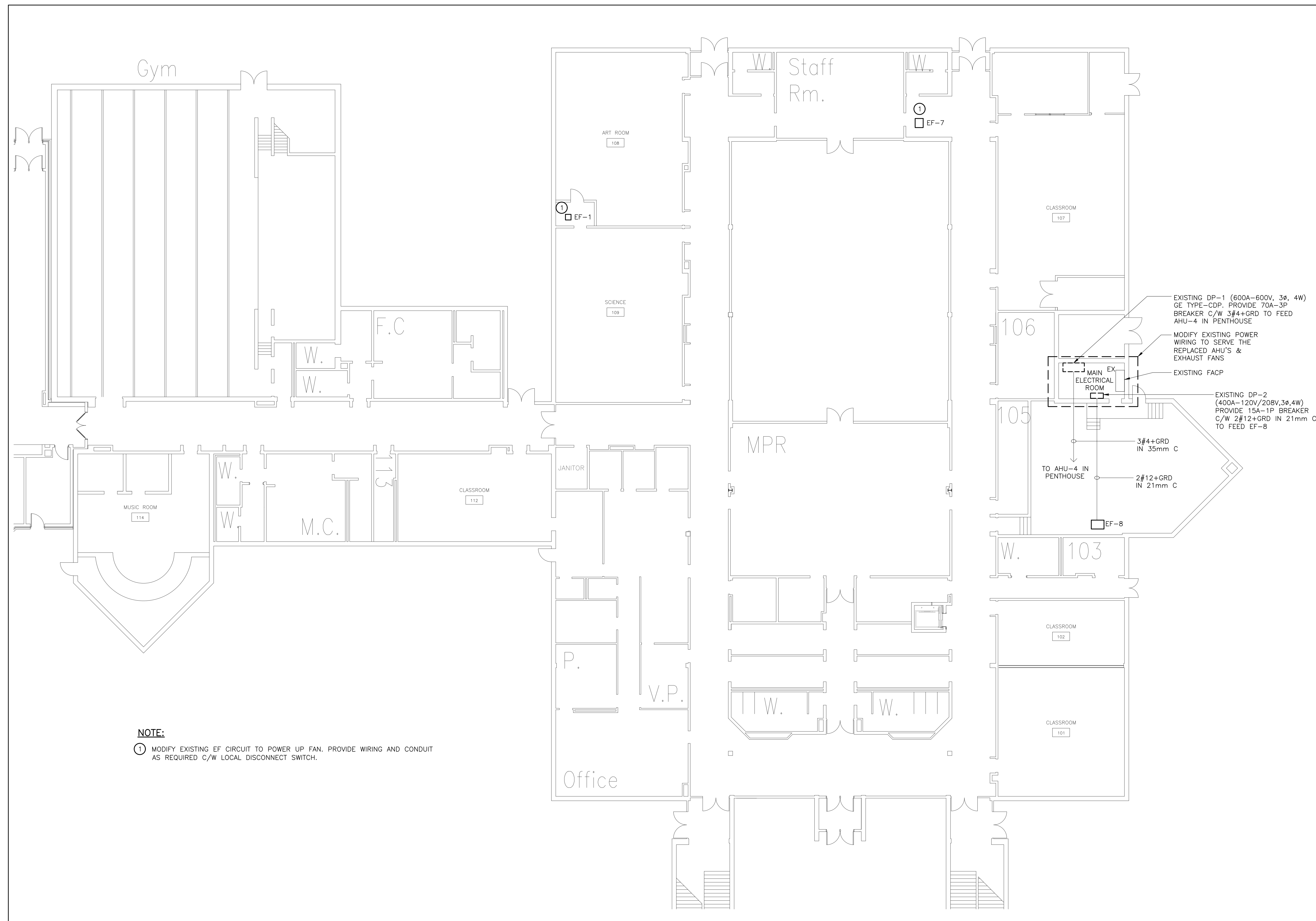
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1285 MONTCLAIR DR, OAKVILLE, ON

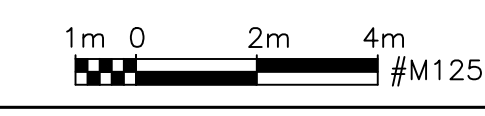
ELECTRICAL GROUND FLOOR PROPOSED PLAN

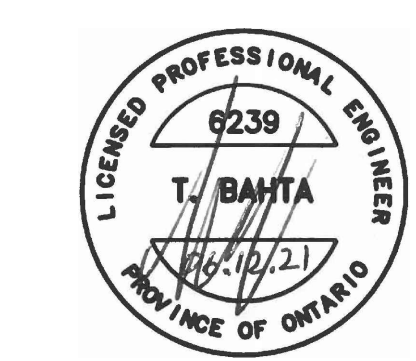
SCALE: AS NOTED	PROJECT: 6239 E-4
DATE: JAN 2021	
DRAWN R.V.G.	DRAWING E-4
CHECKED T.B.	
PRINT DATE	JAN. 2021



NOTE:
① MODIFY EXISTING EF CIRCUIT TO POWER UP FAN. PROVIDE WIRING AND CONDUIT AS REQUIRED C/W LOCAL DISCONNECT SWITCH.

GROUND FLOOR - PROPOSED PLAN ①
SCALE: 1:125 E-4





NO	REVISIONS	DATE
5	RE-ISSUED FOR TENDER	DEC.12.2021
4	ISSUED FOR TENDER	OCT.15.2021
3	ISSUED FOR BUILDING PERMIT	APR.16.2021
2	ISSUED FOR 95% SUBMISSION	APR.14.2021
1	ISSUED FOR 75% SUBMISSION	MAR.17.2021

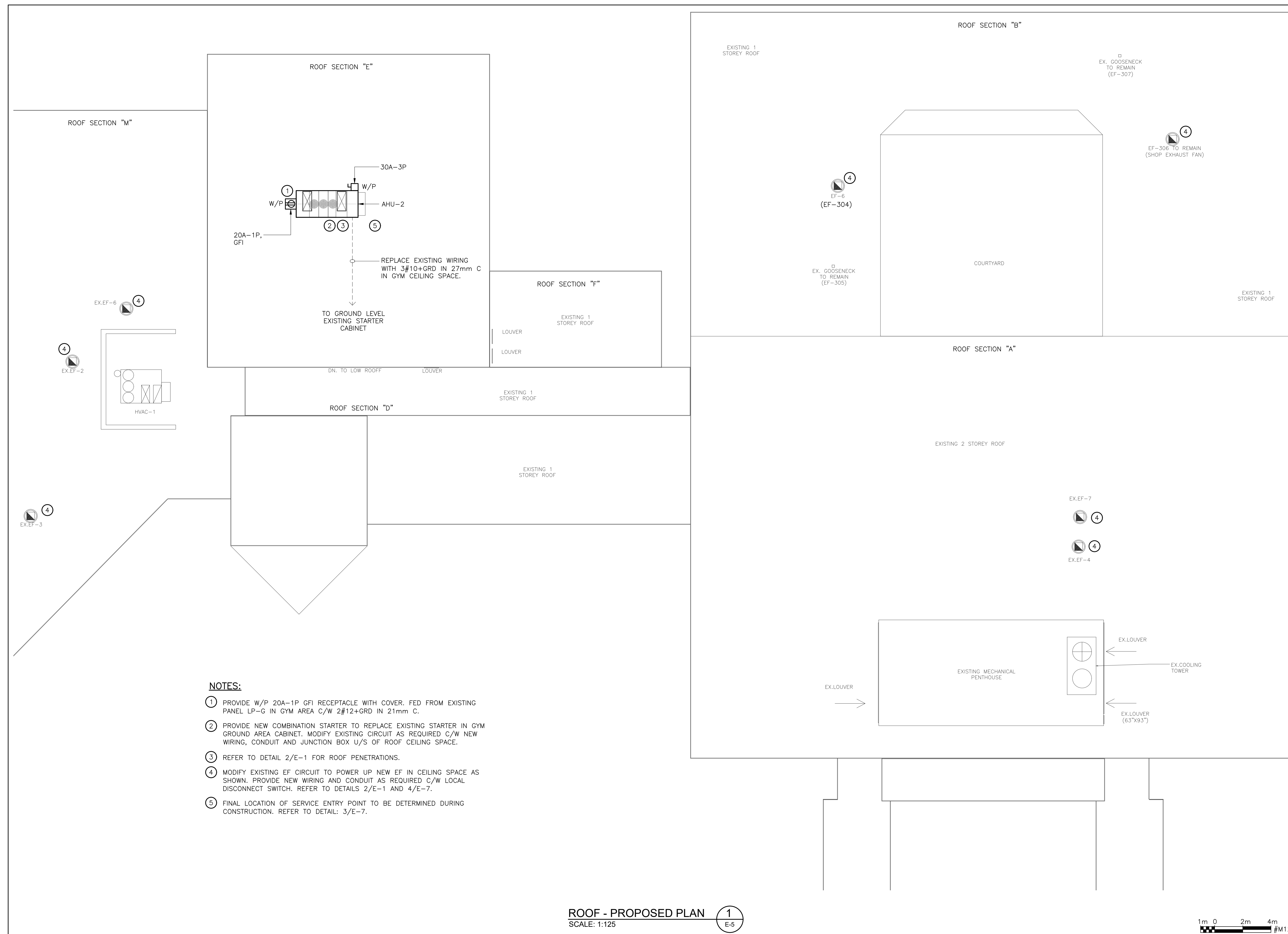
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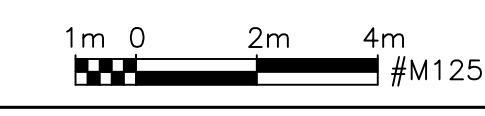
MONTCLAIR PS RENOVATION
 1285 MONTCLAIR DR, OAKVILLE, ON

ELECTRICAL ROOF DEMOLITION PLAN

SCALE: AS NOTED	PROJECT: 6239 E-5
DATE: JAN 2021	
DRAWN R.V.G.	DRAWING E-5
CHECKED T.B.	
PRINT DATE	JAN. 2021



ROOF - PROPOSED PLAN 1
 SCALE: 1:125 E-5





5	RE-ISSUED FOR TENDER	DEC.12.2021
4	ISSUED FOR TENDER	OCT.15.2021
3	ISSUED FOR BUILDING PERMIT	APR.16.2021
2	ISSUED FOR 95% SUBMISSION	APR.14.2021
1	ISSUED FOR 75% SUBMISSION	MAR.17.2021

NO REVISIONS DATE

DRAWINGS ARE NOT TO BE SCALED. CONTRACTOR MUST CHECK AND VERIFY ALL DIMENSIONS AND CONDITIONS ON THE PROJECT, AND MUST REPORT ANY DISCREPANCIES TO THE ARCHITECTS BEFORE PROCEEDING WITH THE WORK. THE USE OF THIS DRAWING OR PART THEREOF IS FORBIDDEN WITHOUT THE WRITTEN APPROVAL OF THE ARCHITECTS.

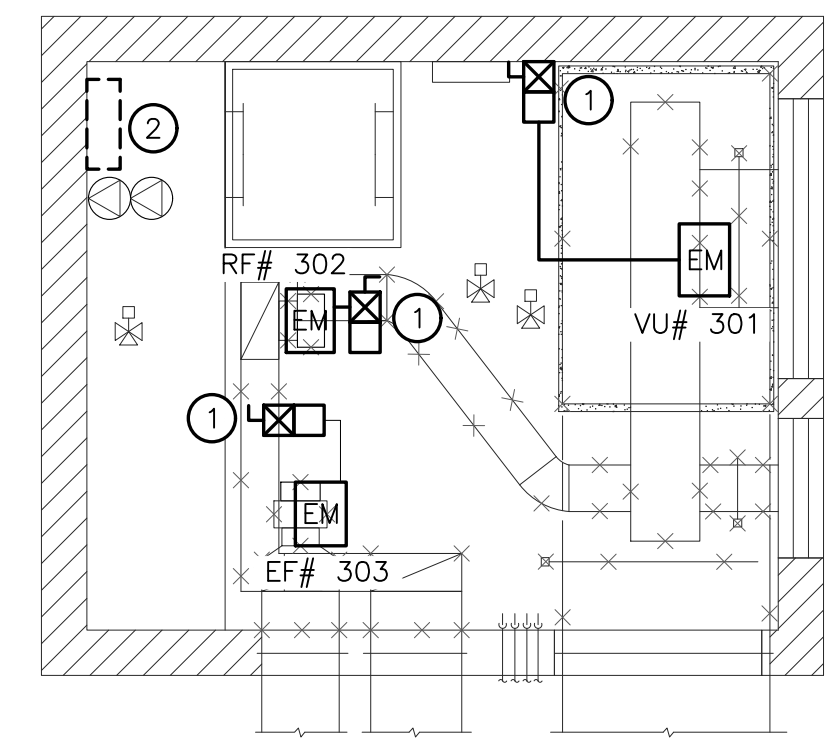
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ELECTRICAL MECHANICAL ROOM & JANITOR ROOM DEMOLITION & PROPOSED PLAN

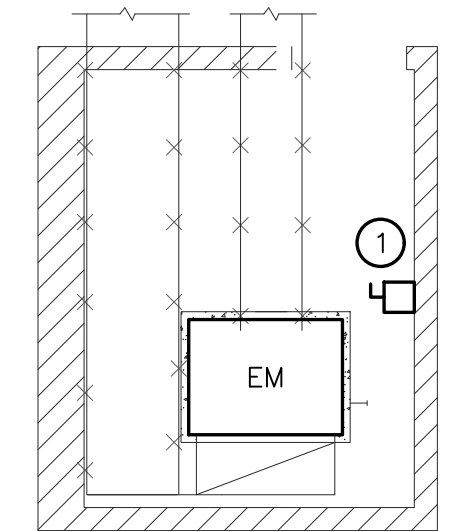
SCALE: AS NOTED	PROJECT: 6239 E-6
DATE: JAN 2021	
DRAWN R.V.G.	DRAWING
CHECKED T.B.	E-6
PRINT DATE	JAN. 2021

- NOTES:**
- 1 REPLACE EXISTING LOCAL STARTER WITH NEW STARTER. REPLACE EXISTING CIRCUIT WIRES AND CONDUIT WITH NEW. PROVIDE JUNCTION BOX AS NECESSARY.
 - 2 GROUND LEVEL MOTOR STARTER EXISTING CABINET. MODIFY EXISTING STARTERS AS NECESSARY.



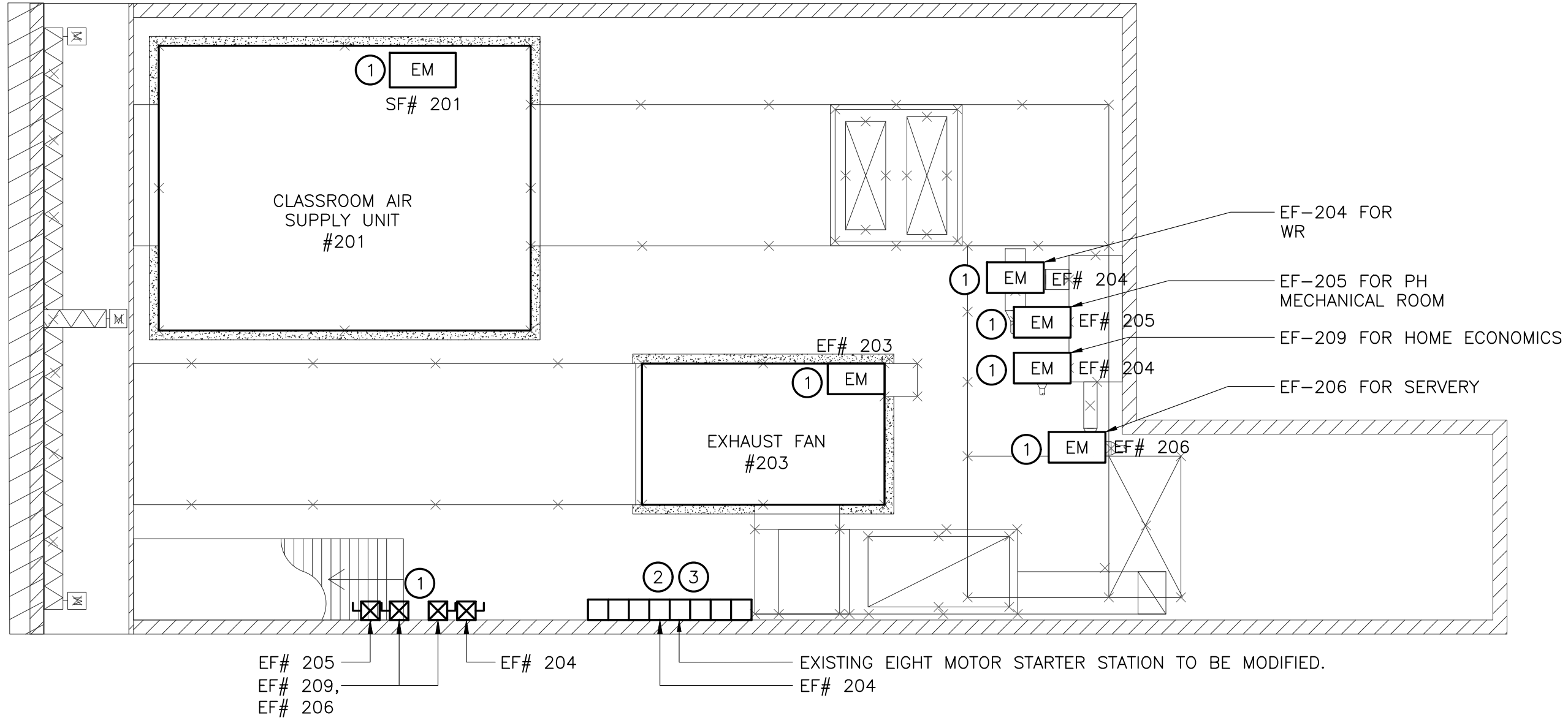
MEZZANINE MECHANICAL ROOM DEMOLITION 1 E-6
SCALE: 1:50

- NOTES:**
- 1 REPLACE EXISTING LOCAL STARTER WITH NEW STARTER. MODIFY EXISTING CIRCUIT WIRES AND CONDUIT AS REQUIRED. PROVIDE JUNCTION BOX TO SPLICE AND EXTEND WIRING AND CONDUIT.



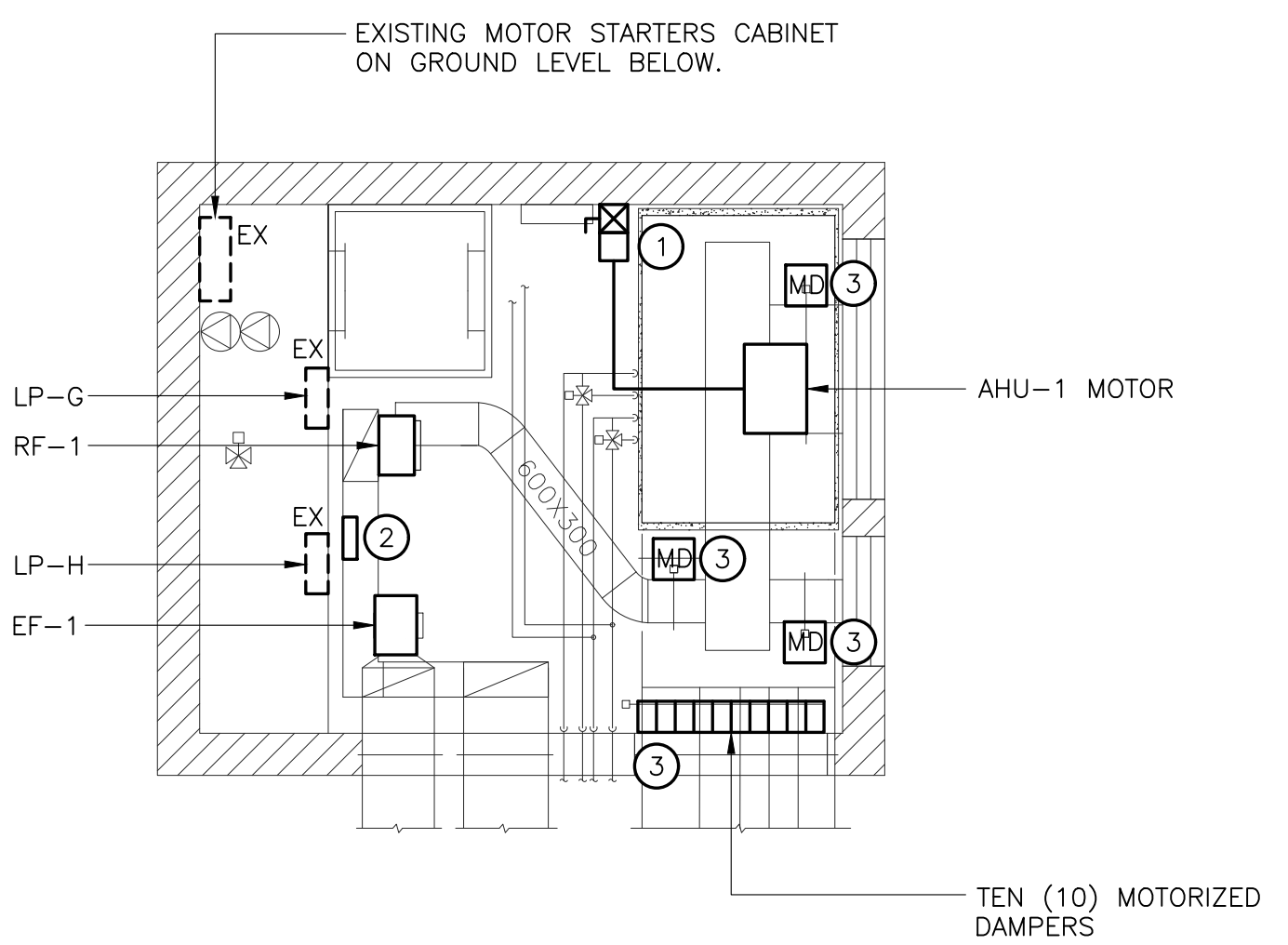
JANITOR'S ROOM DEMOLITION 3 E-6
SCALE: 1:50

- NOTES:**
- 1 REPLACE EXISTING LOCAL STARTER WITH NEW STARTER. MODIFY EXISTING CIRCUIT WIRES AND CONDUIT WITH NEW. PROVIDE JUNCTION BOX AS NECESSARY.
 - 2 REPLACE EXISTING STARTER WITH NEW COMBINATION STARTERS. MODIFY EXISTING WIRING AND CONDUIT AS REQUIRED. REMOVE STARTER (EF# 203) AND REPLACE IT WITH VFD (SUPPLIED BY DIV-15).
 - 3 REPLACE EXISTING SIX (6) STARTERS WITH NEW SIX (6) COMBINATION STARTERS TO INTEGRATE NEW INSTALLATION. MODIFY EXISTING WIRE TROUGH, WIRING AND CONDUIT. TRANSFER EACH EXISTING CIRCUIT TO NEW STARTERS.



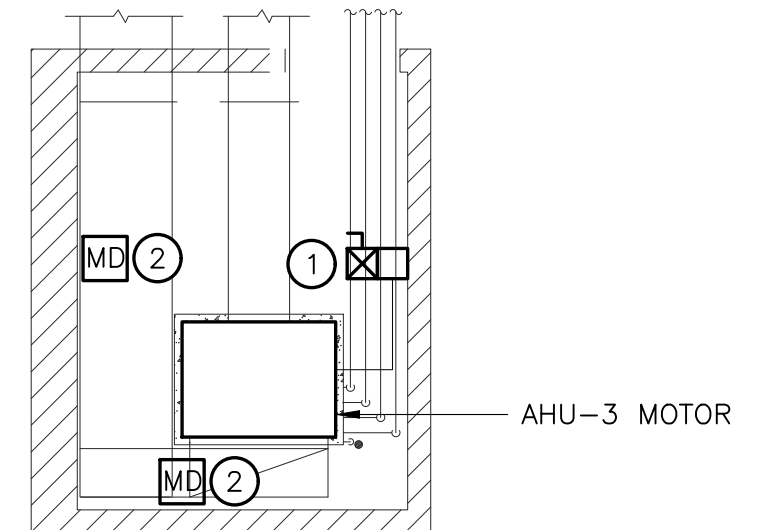
PENTHOUSE MECHANICAL ROOM DEMOLITION 5 E-6
SCALE: 1:50

- NOTES:**
- 1 NEW COMBINATION STARTER (SIZE-1). MODIFY EXISTING WIRING AND CONDUIT AS REQUIRED.
 - 2 MOUNT VFD (RF-1) AND COMBINATION STARTER (EF-1) ON STEEL SUPPORT STRUCTURE WHERE SHOWN. MODIFY EXISTING CIRCUIT WIRES AND CONDUIT AS REQUIRED.
 - 3 PROVIDE 120V, 1Ø, 60HZ CIRCUIT TO FEED MOTORIZED DAMPER C/W LOCAL DISCONNECT SWITCH. PROVIDE TWO (2) 15A-1P TANDEM BREAKERS TO FEED ALL MD FROM EXISTING PANEL LP-H BELOW.



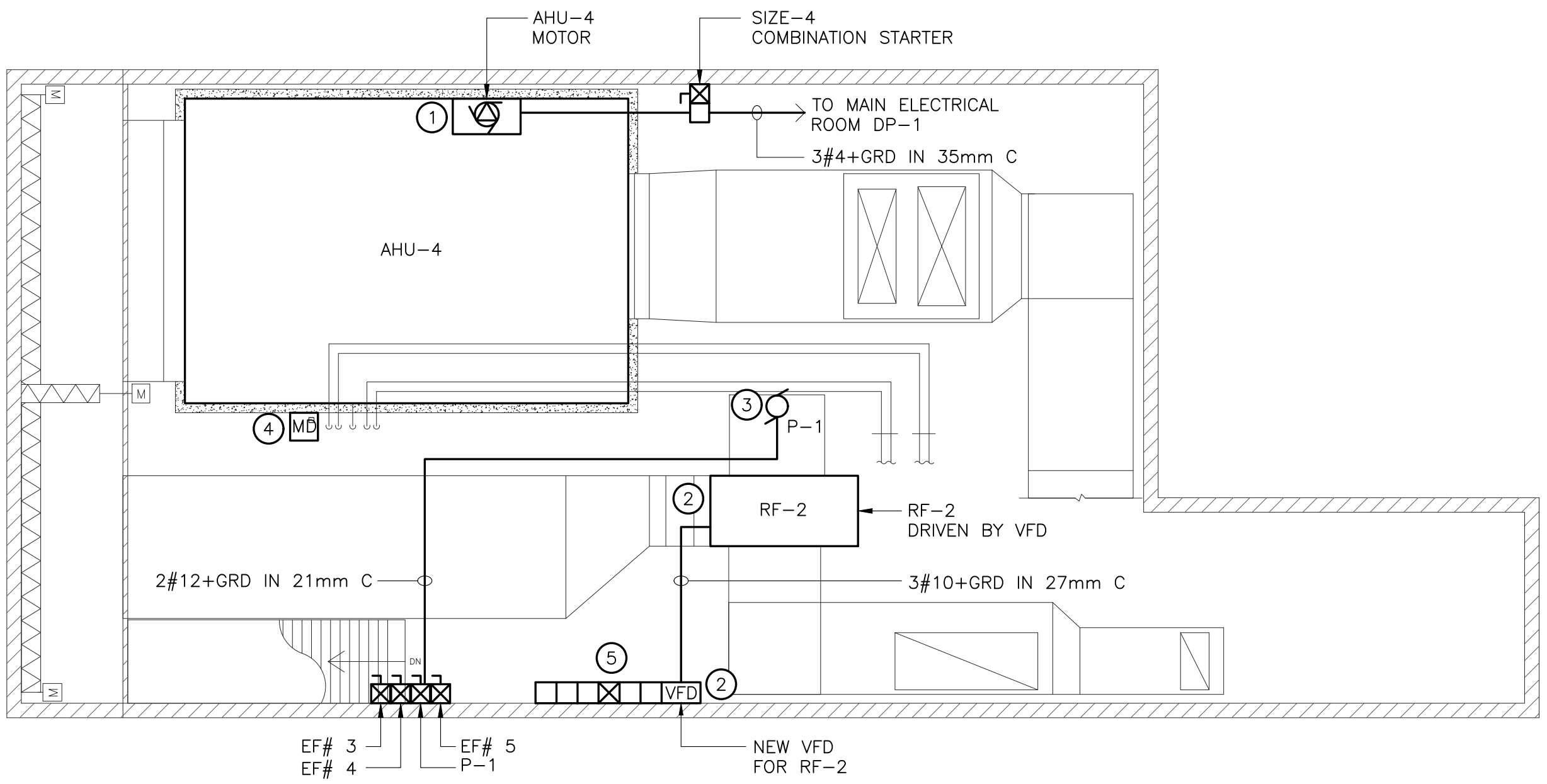
MEZZANINE MECHANICAL ROOM PROPOSED 2 E-6
SCALE: 1:50

- NOTES:**
- 1 NEW COMBINATION STARTER (SIZE 1). MODIFY EXISTING WIRING AND CONDUIT AS REQUIRED.
 - 2 PROVIDE 120V, 1Ø CIRCUIT TO FEED MOTORIZED DAMPER FROM CLOSEST DISTRIBUTION PANEL IN CORRIDOR C/W 2#12+GRD IN 21mm C. APPROXIMATE RUN 100 FT.

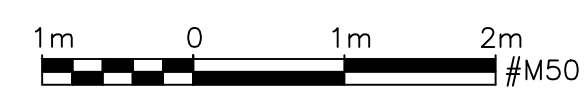


JANITOR'S ROOM PROPOSED 4 E-6
SCALE: 1:50

- NOTES:**
- 1 AHU-4 MOTOR TO BE FED FROM EXISTING DP-1 IN MAIN ELECTRICAL ROOM ON GROUND FLOOR.
 - 2 REPLACE EXISTING STARTER WITH VFD (BY DIV-15) C/W 3#10+GRD IN 27mm C.
 - 3 PROVIDE NEW SIZE-0 COMBINATION STARTER C/W 2#12+GRD IN 21mm C.
 - 4 PROVIDE 120V, 1Ø CIRCUIT TO FEED FOUR (4) MOTORIZED DAMPERS IN PENTHOUSE FROM EXISTING PANEL C/W TWO (2) 15A-1P BREAKER AND 2#12+GRD IN 21mm C. APPROXIMATE FEEDER CIRCUIT RUN 100FT.
 - 5 REPLACE EXISTING SIX (6) STARTERS WITH NEW SIX (6) COMBINATION STARTERS TO INTEGRATE NEW INSTALLATION. MODIFY EXISTING WIRE TROUGH, WIRING AND CONDUIT. TRANSFER EACH EXISTING CIRCUIT TO NEW STARTERS.



PENTHOUSE MECHANICAL ROOM PROPOSED 6 E-6
SCALE: 1:50



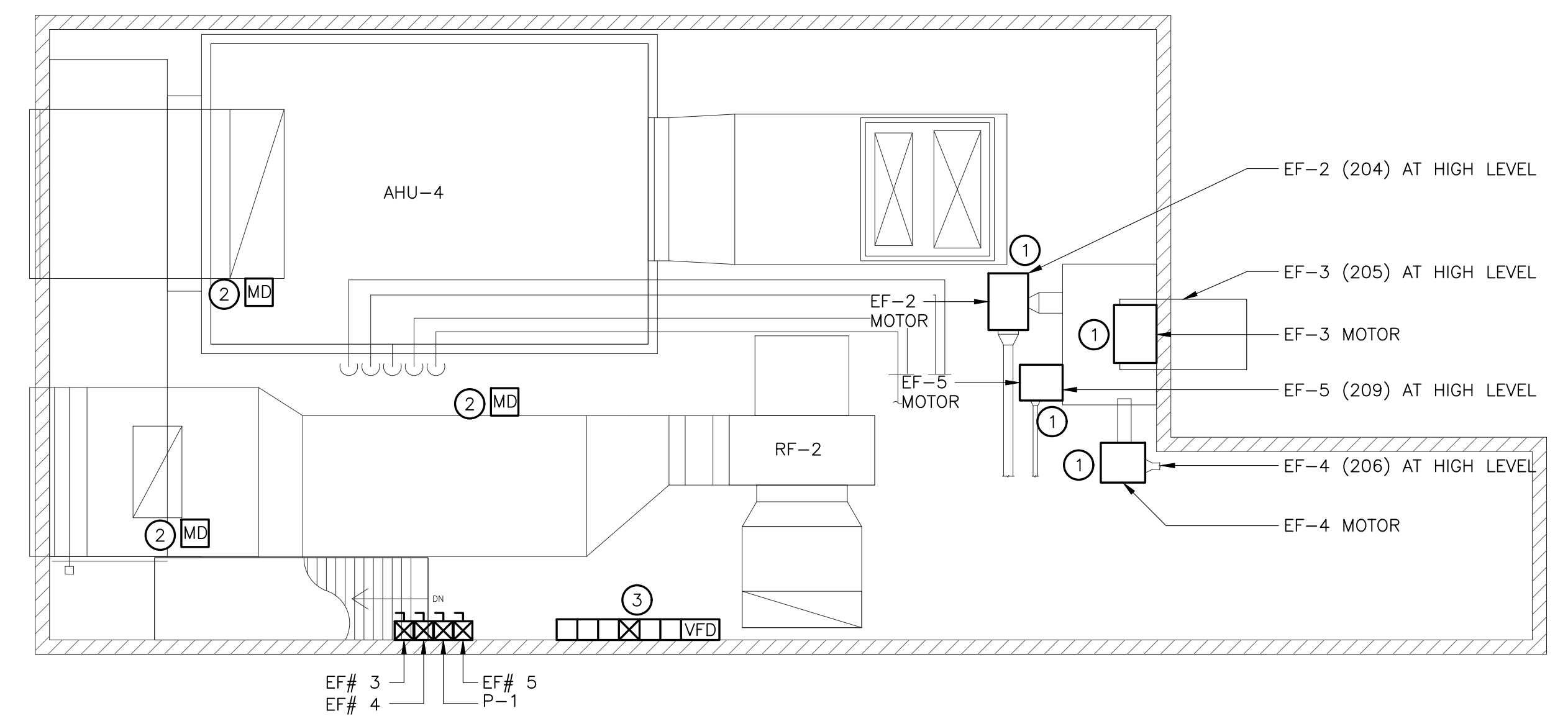


5	RE-ISSUED FOR TENDER	DEC.12.2021
4	ISSUED FOR TENDER	OCT.15.2021
3	ISSUED FOR BUILDING PERMIT	APR.16.2021
2	ISSUED FOR 95% SUBMISSION	APR.14.2021
1	ISSUED FOR 75% SUBMISSION	MAR.17.2021

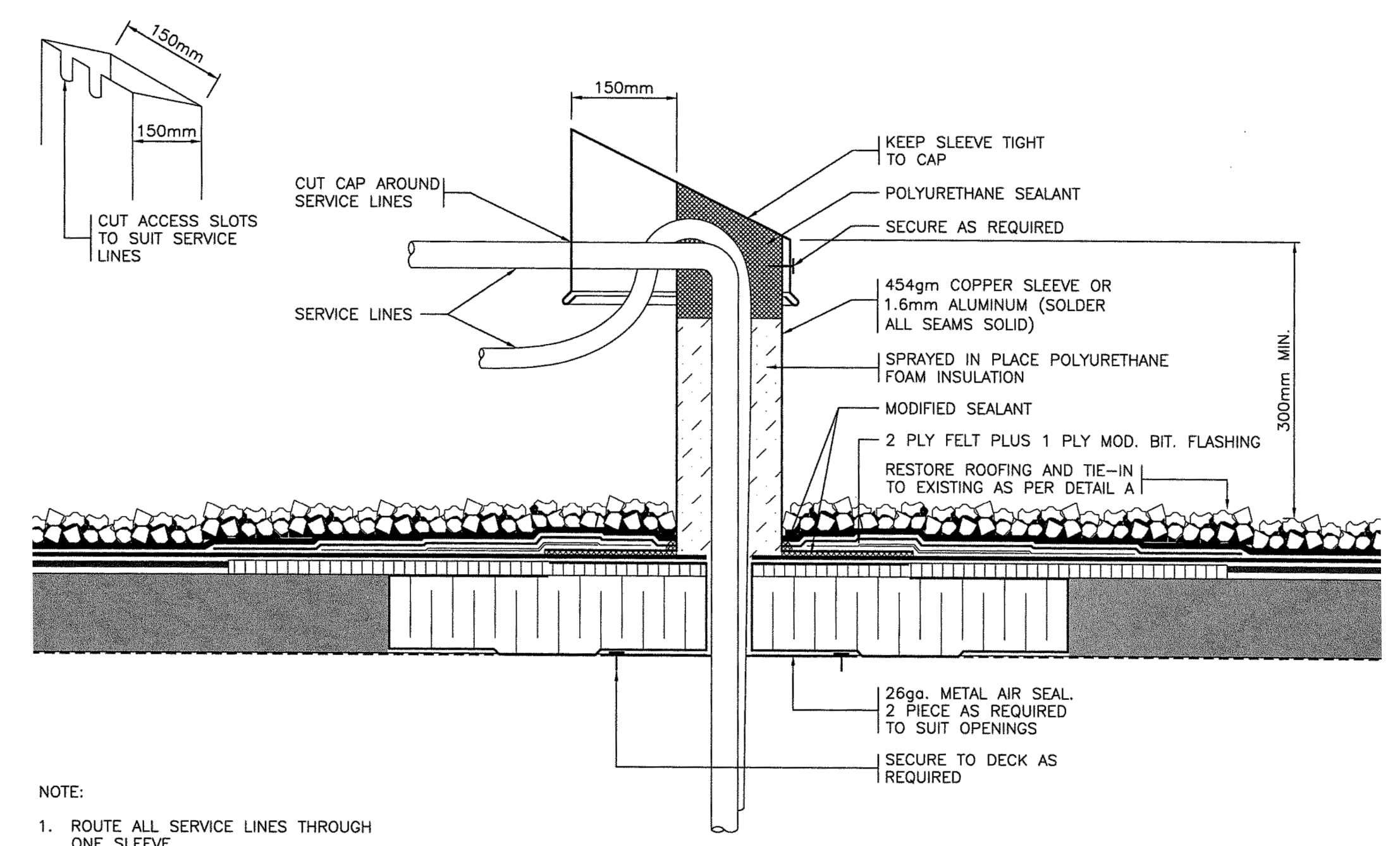
NO REVISIONS DATE

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- NOTE:**
- 1 MODIFY EXISTING CIRCUIT. PROVIDE NEW STARTER TO REPLACE EXISTING STARTERS C/W WIRING, CONDUIT AND JUNCTION BOX.
 - 2 PROVIDE 120V, 1Ø CIRCUIT TO FEED FOUR (4) MOTORIZED DAMPERS IN PENTHOUSE FROM EXISTING PANEL C/W TWO (2) 15A-1P BREAKER AND 2#12+GRD IN 21mm C. APPROXIMATE FEEDER CIRCUIT RUN 100FT.
 - 3 REPLACE EXISTING SIX (6) STARTERS WITH NEW SIX (6) COMBINATION STARTERS TO INTEGRATE NEW INSTALLATION. MODIFY EXISTING WIRE TROUGH, WIRING AND CONDUIT. TRANSFER EACH EXISTING CIRCUIT TO NEW STARTERS.

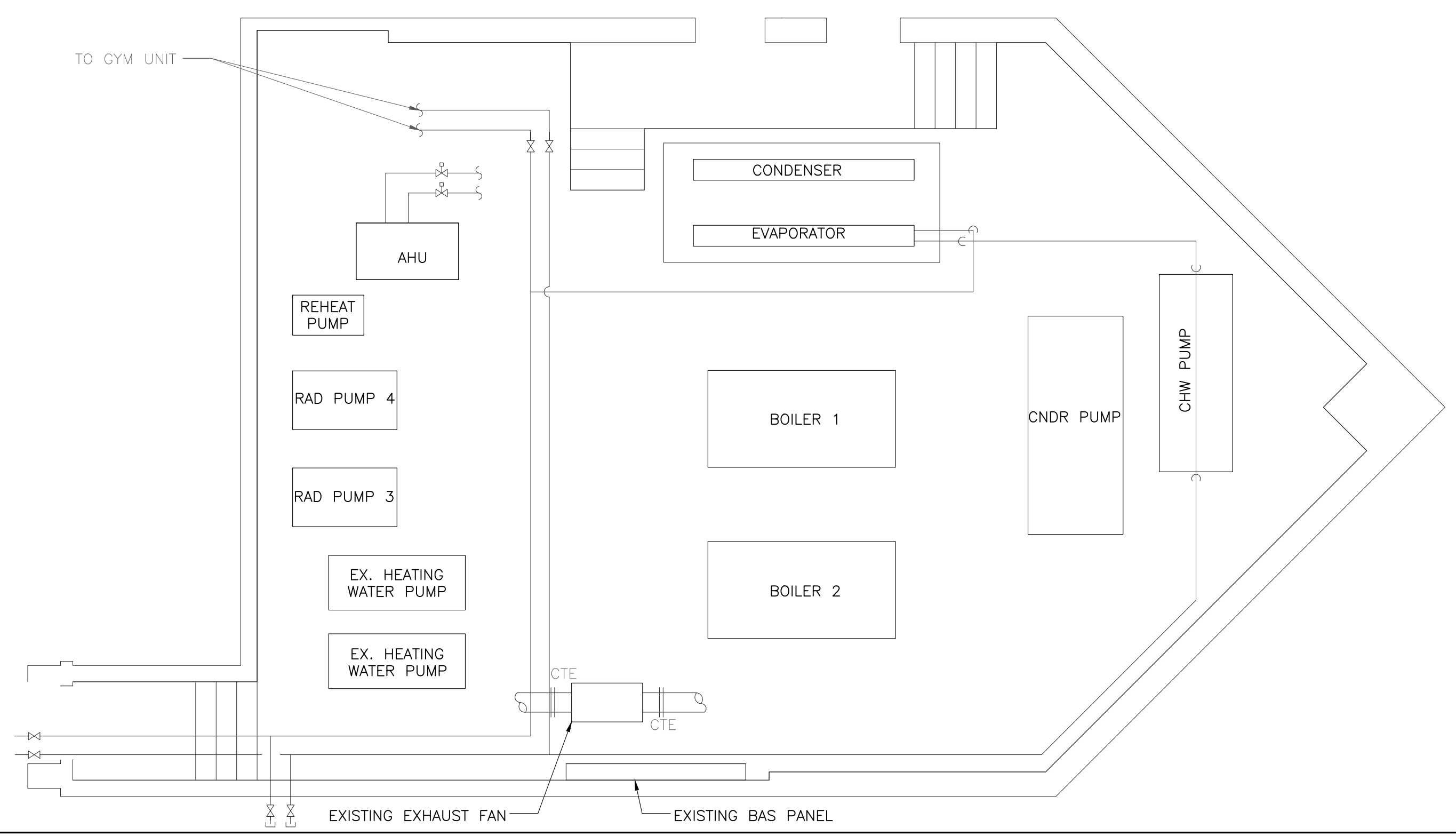
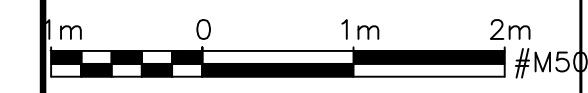


PENTHOUSE MECHANICAL ROOM PROPOSED HIGH LEVEL PLAN 1
SCALE: 1:50 E-7

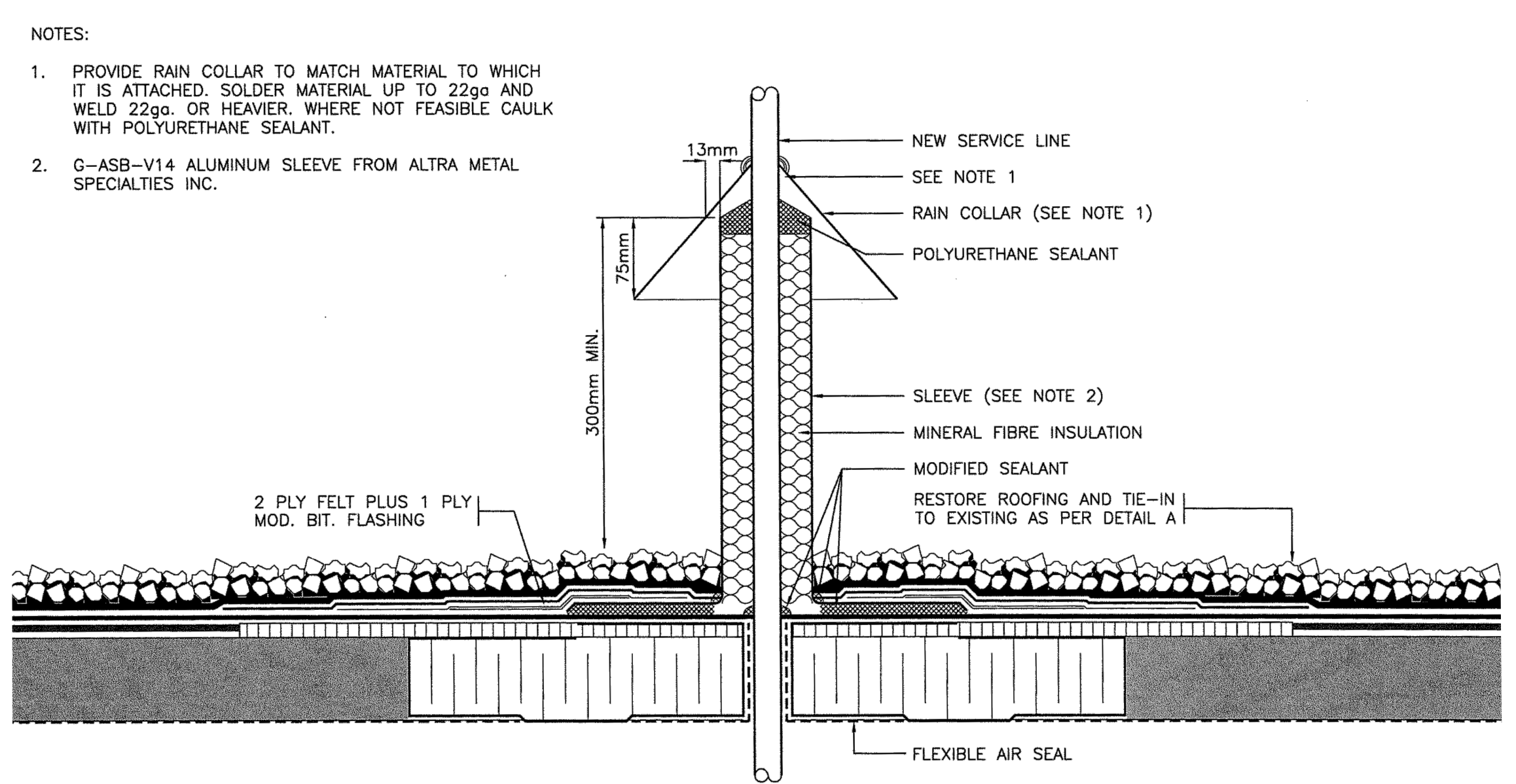


- NOTE:**
1. ROUTE ALL SERVICE LINES THROUGH ONE SLEEVE.

SERVICE LINES DETAIL 3
SCALE: NTS E-7



BOILER ROOM PLAN PROPOSED 2
SCALE: 1:50 E-7



- NOTES:**
1. PROVIDE RAIN COLLAR TO MATCH MATERIAL TO WHICH IT IS ATTACHED. SOLDER MATERIAL UP TO 22ga AND WELD 22ga. OR HEAVIER, WHERE NOT FEASIBLE CAULK WITH POLYURETHANE SEALANT.
 2. C-ASB-V14 ALUMINUM SLEEVE FROM ALTRA METAL SPECIALTIES INC.

SINGLE CONDUIT SLEEVE AND COLLAR DETAIL 4
SCALE: NTS E-7

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ELECTRICAL MECHANICAL ROOM & BOILER ROOM PROPOSED PLAN

SCALE: AS NOTED	PROJECT: 6239 E-7
DATE: JAN 2021	
DRAWN R.V.G.	DRAWING
CHECKED T.B.	E-7
PRINT DATE: JAN. 2021	