TENDER **#3869**

HEAT PUMP REPLACEMENT - PHASE 2

HALIFAX WEST HIGH SCHOOL

Closing Date: **TUESDAY NOVEMBER 1ST, 2016**
Closing/Opening Time: ***2:00:00 P.M.***

Closing Location:
Halifax Regional School Board
33 Spectacle Lake Drive
Dartmouth, N.S. B3B 1X7

Substantial Completion Date:
FEBRUARY 28TH, 2017

HRSB Contacts:
Jennifer King, Buyer
Tel: (902) 464-2000 #2223
Fax: (902) 464-0161
Email: jlking@hrsb.ca

School Location:
HALIFAX WEST HIGH SCHOOL
283 THOMAS RADDALL DR
HALIFAX NS, B3S 1R1

Operations Contact:
Earl McMullin, Manager Special Projects
Tel: (902) 464-2000 #5116
Email: emcmullin@hrsb.ca

A mandatory bidders' site meeting is scheduled for *FRIDAY OCTOBER 21, 2016 AT 9:30 AM, AT THE MAIN ENTRANCE OF THE SCHOOL – 283 THOMAS RADDALL DR.*

To obtain documents:
Download tender documents in .pdf format from the School Board's Website:
http://www.hrsb.ca/about-hrsb/financial-services/purchasing/tenders/tender-listing

The Halifax Regional School Board encourages equity and affirmative action programs.

SECTION 00 00 01 - TABLE OF CONTENTS

MECHANICAL AND ELECTRICAL SPECIFICATION FILES

SECTION 00 00 15 - DESCRIPTION OF WORK & LIST OF DRAWINGS

1. General

1.1. The work of this contract includes the provision of all materials, labour and equipment necessary to complete the **HEAT PUMP REPLACEMENT - PHASE 2** at ***HALIFAX WEST HIGH SCHOOL***, as per the documentation drawings and specifications prepared by ***Dumac Energy Ltd.***

1.2. It is the School Board's intent to have all work completed, to point of Substantial Performance, prior to ***FEBRUARY 28TH, 2017***. The Building will be occupied during this time period. It is expected that an early award of this contract will enable the Contractor to facilitate shop drawing review and ordering of materials to allow commencement of work immediately following award of tender.

1.3. The whole of the work shall agree in all particulars with the levels, measurements and details contained in the drawings accompanying this specification and with such other drawings or information as may from time to time be supplied by the School Board, or may be supplied by the Contractor and reviewed by the School Board.

2. List Of Drawings

Drawing NO.	Drawing Title
M-101	Reflected Ceiling Plan Level 2 & 3
M-102	Heat Pump Layout & Controls Level 2
M-103	Heat Pump Layout & Controls Level 3
M-104	Heat Pump Details
E-101	Mechanical Equipment Connections Level 2
E-102	Mechanical Equipment Connections Level 3
E-103	Existing Panel Schedules, Electrical Legend, Distr. Panel Elevation and Partial Electrical Floor Plan
E-104	Existing Motor Starter and Control List

END OF SECTION 00 00 15

SECTION 00 05 00 - LIST OF CONSULTANTS

Owner: **HALIFAX REGIONAL SCHOOL BOARD**
33 SPECTACLE LAKE DRIVE, DARTMOUTH NS

Electrical/Mechanical Engineer: Gerard Doyle
Dumac Energy Ltd.
Phone: 902-457-1300 x 261
Email: gdoyle@dumac.ns.ca

END OF SECTION 00 05 00

SECTION 00 21 13 – INFORMATION FOR BIDDERS

Invitation:

1. Bid Call

1.1. The HALIFAX REGIONAL SCHOOL BOARD (The Board/HRSB) will receive offers in the form of a bid from Contractors which is signed and received on or before the date and time specified on the cover sheet of this document. HRSB deems the correct time to be the time indicated on the phone clock on the Receptionist's desk at at 33 Spectacle Lake Drive.

1.2. Offers submitted after the closing time/date shall be returned to the bidder unopened.

1.3. Submit completed tender documents for above project in sealed envelope marked as follows: ***TENDER #3869, HEAT PUMP REPLACEMENT - PHASE 2.***

1.4. Bids will be opened at the time indicated on the cover sheet of this document. As of April 1, 2014 Public tender openings are no longer held for any tenders relating to goods, services or construction for HRSB. A list of bidders and bid amounts will be posted on the Procurement Services website (http://novascotia.ca/tenders/tenders/ns-tenders.aspx) shortly following the closing of the tender. All bid submissions are subject to evaluation after opening and before award of contract. The winning bidder and award amount will be posted on the Procurement Services website (http://novascotia.ca/tenders/tenders/ns-tenders.aspx) after award.

1.5. In the event that the HALIFAX REGIONAL SCHOOL BOARD office is closed due to inclement weather or any other reason on the date and at the time of closing, the Closing Date and Time will be extended one (1) business day. Proponents should note that closure of Schools does not necessarily mean closure of the Board's Regional Office.

1.6. Amendments to the submitted offer will be permitted if received in writing prior to bid closing and if endorsed by the same party or parties who signed and executed the offer.

1.7. Emailed/Faxed Bid Submissions **will not** be accepted.

2. Intent

2.1. The intent of this bid call is to obtain an offer to perform all work associated with Tender #3869, ***HEAT PUMP REPLACEMENT - PHASE 2***, at ***HALIFAX WEST HIGH SCHOOL*** for a Stipulated Price Contract in accordance with the Contract Documents.

3. Scope of work

3.1. Refer to Section 00 00 15 – Description of Work and List of Drawings.

4. Availability

4.1. Bid Documents can be obtained as per the directions on the cover sheet of this document.

4.2. Bid Documents are made available only for the purpose of obtaining offers for this project. Their use does not confer a license or grant for other purposes.

4.3. The HALIFAX REGIONAL SCHOOL BOARD is not responsible for accuracy of documents and project postings obtained from any other source.

5. Examination

5.1. Bid Documents are on display at the offices of the Nova Scotia Construction Association (CANS), Halifax, NS.

5.2. Upon receipt of Bid Documents verify that documents are complete; notify the Board's Buyer by email to jlking@hrsb.ca, should the documents be incomplete, or upon finding discrepancies or omissions in the Bid Documents.

5.3. Bidders shall become fully aware of the content of all tender documents for the preparation of the Bidder's offer.

5.4. Bidders will be deemed to have familiarized themselves with the existing site and working conditions and all other conditions which may affect the performance of the work. No plea of ignorance of such conditions as a result of failure to make all necessary examinations will be accepted as a basis for any claims for extra compensation or an extension of time.

6. Clarification and Addenda

6.1. Notify Jennifer King, Buyer, by email to jlking@hrsb.ca no less than **five (5)** working days before Tender Closing of any questions, omissions, errors or ambiguities found in Contract Documents. If HRSB considers that correction, explanation or interpretation is necessary, a reply will be in the form of an addendum, a copy of which will be posted on the novascotia.ca/tenders and/or HRSB website as applicable, and it is the responsibility of the Bidder to ensure all addenda are received and acknowledged.

6.2. Addenda will be issued no less than three (3) business days before tender closing date and time, and will form part of the Contract Documents.

6.3. Verbal answers to queries are not binding. Information must be confirmed by written addenda. The Board and its representatives shall not be bound by or be liable for any representation or information provided verbally. Information obtained by any other source is not official and will not bind the HALIFAX REGIONAL SCHOOL BOARD.

6.4. Complete tender form (section 00 41 13) acknowledging that addenda have been received.

7. Product/System Options

7.1. Alternatives to specified products and systems will only be considered during the bidding period in the manner prescribed below.

7.1.1. Where the Bid Documents stipulate a particular product, alternatives may be considered by the Consultant up to five (5) working days before tender closing date and time. Bidders must forward their written requests by email to: jlking@hrsb.ca. The Buyer will relay the requests to the appropriate person(s) for review.

7.2. The submission must provide sufficient information to enable the Consultant to determine acceptability of such products. Request for an alternate must be accompanied with:

7.2.1. information about how the request affects other work in order to accommodate each alternate;

7.2.2. the dollar amount of additions to or reductions from the Bid Price, including revisions to other Work.

A later claim by the bidder for an addition to the contract price because of changes in work necessitated by use of alternates shall not be considered.

7.3. When a request to substitute a product is made and pursuant to consultation with the Consultant, HRSB may approve or disapprove the substitution. The bidder making the request will be notified of the Board's decision and if the alternate is approved, HRSB will issue an Addendum.

7.4. Alternates must be submitted in above manner; otherwise, they will not be accepted.

8. Mandatory Bidders' Site Meeting (Site Assessment)

8.1. Bidders will be deemed to have familiarized themselves with existing project site and working conditions and all other conditions, which may affect performance of the Contract. No plea of ignorance of such conditions as a result of failure to make all necessary examinations will be accepted as a basis for any claims for extra compensation or an extension of time.

8.1.1. A Mandatory Bidders' Site Meeting has been scheduled as per the information on the cover sheet of this document. All Bidders are required to attend. Representatives of HRSB and the Consultant will be in attendance;

9. Bidders Registration

9.1. The successful Contractor and Sub-contractors must comply with the Nova Scotia Corporations Registration Act or Partnerships and Business Name Registration Act, or equivalent, before a contract is awarded.

10. Qualifications

10.1. Sub-Contractors

10.1.1. HRSB reserves the right to reject a proposed sub-contractor for a reasonable cause.

10.1.2. Refer to Article GC 3.7.3 of CCDC-2 2008.

11. Bid Submission

11.1. Submissions

11.1.1. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.

11.1.2. Bids must be submitted on the **Bid Form** provided by HRSB (Section 00 41 13 – Bid Form). These forms are to be completely filled out in ink, with the signature in longhand, and corporate sealed as applicable, and the completed form shall be without interlineations, alterations or erasures. Electronic bid submissions sent by facsimile transmission or email will not be accepted.

11.1.3. Fully complete the Tender Bid Form and enter the contract price in both written words and numerals. Where this bid is requested in both words and numbers, and if the two (2) do not represent the identical amount, words shall prevail.

11.1.4. Submit the executed offer on the Bid Forms together with the required bid security in a closed opaque envelope, clearly identified with bidder's name, project name and tender number on the outside.

11.1.5. Improperly completed information, irregularities in the bid security, may be cause to declare the bid informal.

12. Accuracy of Referencing

12.1. Indexing and cross-referencing are for convenience only.

13. Conditions of Tendering

13.1. Take full cognizance of content of all Contract Documents in preparation of Tender. Refer to Section 00 41 13 – Tender Form, Subsection 5.0 for a complete list of Contract Documents.

14. Preparation of Tender

14.1. Complete Tender Bid Form (section 00 41 13) provided with Contract Documents in ink. Tender all items and fill in all blanks. Have corrections initialed by person signing Tender. Bidders' are required to provide all information as detailed.

15. Amendment or Withdrawal of Tender

15.1. Bids may be amended or withdrawn by post, hand or facsimile prior to date and time of closing.

15.2. A Tender Price Amendment Form is provided immediately following the Bid Form (section 00 41 73).

15.2.1.1. The Tender Price Amendment Form provided is the standard Master form for submission of all tender price amendments for this project.

15.2.1.2. Copy and complete form, as directed, for all tender price amendments submitted.

15.3. Amendments shall not disclose either original or revised total price.

15.4. Sign, execute and submit to HRSB Board Office or by facsimile to (902) 464-0161 prior to time of Tender Closing.

16. Bid Ineligibility (reason for rejection)

16.1. HRSB may reject a bid which has been received prior to the closing time where:

16.1.1. The bid is not submitted on the required bid form (Section 00 41 13) included herein.

16.1.2. The bid is submitted by electronic transmission.

16.1.3. There are omissions of information that HRSB in its sole discretion deems to be significant.

16.1.4. The bid is not signed as required.

16.1.5. The bid has conditions attached which are not authorized by the invitation to bid**.**

16.1.6. The bid fails to meet one or more standards specified in the invitation to bid.

16.1.7. All addenda have not been acknowledged.

16.1.8. Any other defect which, in the opinion of the HRSB brings the meaning of the bid into question.

16.1.9. A major irregularity is a deviation from the bid request which affects the price, quality, quantity, or delivery of the project and is material to the award, and is a reason for rejection.

16.1.10. A minor irregularity is a deviation from the bid request which affects form, rather than substance. The effect on price, quality, quantity or delivery is not material to the award, and may be waived by the HRSB.

16.1.11. The required bid security in the required form is not provided.

16.1.12. Bidder failed to attend Bidders' Mandatory Site Meeting.

17. Communications Affecting Bids

17.1. Electronic Transmissions, including, but not limited to facsimile transmission:

17.1.1. Bid forms submitted by facsimile and/or e-mail etc. transmission are not acceptable and will be rejected.

17.1.2. Electronic transmissions (facsimile only) modifying bidder supplied information are acceptable when signed by an authorized signatory of the original bid. Submission and receipt of such electronic transmissions is at the risk of the bidder. HRSB assumes no liability for the receipt of the electronic transmission or for their proper inclusion with original bid. There is no requirement for HRSB to follow up upon receipt of an electronic transmission. Electronic submissions will be considered binding on both parties. Electronic submissions must be submitted and received prior to closing time and date specified in the bid documents. HRSB Procurement Department Date and Time stamps will prevail. **HRSB Procurement facsimile number is 902-464-0161.**

18. Right to Accept or Reject any Tender

18.1. The Board reserves the right to reject any bid in its sole and absolute discretion for any reason whatsoever.

18.2. The Board specifically reserves the right to reject all bids if none is considered to be satisfactory in the Board's sole and absolute discretion and, in that event, at its option, to call for additional bids.

18.3. Without limiting the generality of any other provision herein, the Board reserves the right to accept or reject any bid in accordance with bullet #16 above. (Bid Ineligibility)

18.4. Notwithstanding the above, the Board shall be entitled, in its sole and absolute discretion, to waive any irregularity, informality or non-conformance with these instructions in any proposal received by the Board. HRSB reserves the right to reject any or all tenders, or to accept any tender, or portion thereof, deemed in its best interest.

18.5. In the event that a number of Bidders submit bids in substantially the same amount, the Board may, at its discretion, call upon those Bidders to submit further bids or take into consideration any value added services being provide in determination of award.

18.6. No term or condition shall be implied, based upon any industry or trade practice or custom or in a practice or policy of the Board or otherwise, which is inconsistent or conflicts with the provisions contained in these Instructions.

19. Construction Contract Guidelines

19.1. The printed policies of the Nova Scotia Construction Guidelines, dated May 18, 2006 (or latest revisions) are applicable to these bid documents.

20. Bid and Security Forms – Signatures

20.1. All bid forms, bid security forms and performance assurance forms **must** bear the Bidder's original signature and name HRSB as insured.

21. Bid Security

21.1. Submit with Bid one of the following: Bid security in the form of a Certified Cheque, Irrevocable Letter of Credit, or Bid Bond on CCDC Form 220, in the amount of ten percent (10%) of the Bid Price made payable to, or naming HRSB (as obligee), must accompany the tender.

21.2. Where bid bond is provided as bid security:

21.2.1. Provide bond on the standard CCDC Bid Bond Form, latest version, in the amount of not less than ten percent (10%) of the Bid Price.

21.2.2. Bid Bonds, submitted by the general contractor bidder, signed and sealed by the principal (Contractor) and Surety and shall be with an established Surety Company satisfactory to and approved by HRSB.

21.2.3. Where Bid Bond is used as Bid Security, include the cost of providing the Bid Bond in the Bid Price.

21.3. Where certified cheque or bank draft is provided as bid security:

21.3.1. Provide a certified cheque or bank draft, endorsed in the name of HRSB, for a sum not less than ten percent (10%) of the amount of the Bid Price.

21.3.2. Where certified cheque or bank draft is used as Bid Security, include the cost in the Bid Price.

21.4. Where the Irrevocable Standby Letter of Credit is used as bid security:

21.4.1. Provide an Irrevocable Standby Letter, endorsed in the name of HRSB, for a sum not less than ten percent (10%) of the Bid Price

21.4.2. The Irrevocable Standby Letter of Credit shall be issued by a certified financial institution subject to the Uniform Custom and Practices for Documentary Credit (1993 revision or latest revision) International Chamber of Commerce (Publication No. 500).

21.4.3. Where Irrevocable Standby Letter of Credit is used as bid security, include the cost in the Bid Price.

21.5. Return of Bid Security:

21.5.1. The bid security of the unsuccessful bidders will be returned to them after the contract has been signed, or previous to such time, at the discretion of HRSB.

21.5.2. The above shall apply provided a contract is awarded within ninety (90) days from the closing date of the bid.

21.5.3. If no contract is awarded, all bid security will be returned.

22. Contract Security (Performance Assurance)

22.1. All bid forms, bid security forms and performance assurance forms must bear the bidder's original signature and name HRSB as insured.

22.2. Bidder shall maintain performance assurance in force for a period of not less than twelve (12) months after the issue of the substantial performance certificate certified by HRSB and until completion of the contract.

22.3. Endorse Performance Assurance as specified for bid security.

22.4. Should it become apparent that the final cost of the project will exceed the total amount payable by more than 20%, the bidder shall arrange to have their bonds reissued based on the projected final cost.

22.5. Refer to Section 00 72 13 – General Conditions GC11.2 and Section 00 73 00 – Supplementary General Conditions for form of Contract Security. Refer to project documents for amount of Contract Security and alternate type of Contract Security if applicable.

22.6. Submit as Performance Assurance one of the following:

22.6.1. Where a Bid Bond was used as bid security:

22.6.1.1. Within ten (10) days after notification of award of the Contract, provide a Performance Bond and a Labour & Material Payment Bond, each in an amount equal to fifty percent (50%) of the amount of the Contract, naming HRSB.

22.6.1.2. Performance Bond and Labour and Material Payment Bonds, submitted by the bidders, shall be provided at the expense of the bidder and shall be with an established Surety Company satisfactory to and approved by HRSB.

22.6.1.3. Include the cost of providing the Performance Bond and Labour and Material bond in the Contract price.

22.6.2. Where a Certified Cheque or Bank Draft is used as Contract Security:

22.6.2.1. The Certified Cheque or Bank Draft submitted during the bid period will be cashed and the amount retained by HRSB shall serve as Performance Assurance**,** including the payment of all obligations arising under the Contract.

22.6.2.2. The Certified Cheque or Bank Draft will be held in lieu of the Performance Bond and Labour and Material Bonds, providing that, at Contract award, the successful Bidder shall supplement their Certified

Cheque or Bank Draft to maintain an amount of ten (10%) of the total amount payable (Contract Price plus HST) under the contract.

22.6.2.3. The amount remaining will be returned without interest after a period of not less than twelve (12) months after the issue of the substantial performance certificate certified by HRSB and shall serve as performance assurance and not until completion of the contract.

22.6.2.4. Where certified cheque or bank draft is used as Performance Assurance, include the cost of providing the certified cheque in the Contract price.

22.6.3. Where an Irrevocable Standby Letter or Credit is used as Contract Security:

22.6.3.1. The Irrevocable Standby Letter of Credit submitted during the bid period will be retained by HRSB and shall serve as performance assurance, including the payment of all obligations arising under the contract. The irrevocable standby letter of credit shall be issued by a certified financial intuition subject to the Uniform Customs and Practices for Documentary Credit (1993 revision) International Chamber of Commerce (Publication No. 500).

22.6.3.2. Where irrevocable standby letter of credit is used as Performance Assurance, include the cost of providing and Irrevocable Standby Letter of Credit in the Contract Price. The contractor shall provide to HRSB documentation throughout the duration of the contract that the irrevocable standby letter of credit remains in full effect at all times as specified,

22.6.3.3. Upon expiry of the Irrevocable Standby Letter of Credit, a separate Irrevocable Standby Letter of Credit shall be provided for work requiring extended warranties for such amounts as are required by the contract.

22.6.3.4. The Irrevocable Standby Letter of Credit is to be in effect for a period of not less than twelve (12) months after the issue of the substantial performance certificate certified by HRSB and shall serve as performance assurance and not until completion of the contract.

23. Insurance

23.1. Refer to Section 00 72 13 -General Conditions of Contract, GC 11.1 – Insurance and Section 00 73 00 – Supplementary General Conditions for form of Insurance. Refer to project documents for amount of insurance, duration of coverage and alternate type of Insurance if applicable.

23.2. General Contractor shall secure and maintain at its expense during the term of the Insurance:

23.2.1. Workers' Compensation to meet Statuary requirements and/or Employers Liability.

23.2.2. Wrap Up liability Insurance must insure the general contractor(s) and all sub-contractors on this project:

23.2.2.1. including but not limited to, products liability and completed operations, contractual liability, owners and contractors liability, attached machinery extension endorsement, independent contractor, for a combined single limit of no less than $5,000,000.00 per occurrence.

23.2.3. Commercial Auto Liability insurance covering all owned, non-owned and hired vehicles for a minimum combined single coverage of $2,000,000.00 per occurrence.

23.2.4. Builders Risk – all risks – in the amount of the project contract stipulated bid price.

23.2.5. Deliver a certificate of insurance evidencing the above prior to work being performed. It is also agreed that the above insurance coverage is primary and must be kept in force during the term of this agreement. Furthermore, HRSB must receive, in writing, at least thirty (30) days' notice of cancellation or modification of the above insurances. All insurance policies or certification documents shall specify coverage being applicable to this contract. The Contractor shall not do or omit to do or suffer anything to be done or omitted to be done which will in any way impair or invalidate such policy or policies of insurance.

23.3. Primary Insurance- Supplier agrees that the insurance as required above shall be primary and non-contributory.

23.4. No limitation- Supplier is responsible for determining whether the above minimum insurance coverage's are adequate to protect its interests. The above minimum coverage's do not constitute limitations upon Supplier's Liability.

23.5. Endorsements – For the policies in para 23 above, there shall contain an endorsement naming HRSB and its Affiliates as an Additional Insureds, and eliminating and removing any exclusion of liability for:

23.5.1. injury, including bodily injury and death to an employee of the insured or of HRSB, or

23.5.2. any obligation of the insured to indemnify, hold harmless, defend, or otherwise make contribution to School Board because of damage arising out of injury, including bodily injury and death, to an employee of HRSB.

24. Proof of Competency of Bidder

24.1. Any bidder may be required to furnish evidence satisfactory to the owner that he and his proposed sub-contractors have sufficient means and experience in the types of work called for to assure completion of the contract in a satisfactory manner.

24.1.1. The successful bidder **must** be a member in good standing with CRCA, RCANS; and

24.1.2. Nova Scotia Construction Safety Association or approved recognized association or program.

25. Bid Form Requirements

25.1. Bid Submission

25.1.1.1. Bidders shall be solely responsible for the delivery of their bids in the manner and time prescribed.

25.1.1.2. Bids must be submitted on forms provided by the Board. These forms are to be completely filled out in ink or by typewriter, with the signature in longhand, and the completed form shall be without interlineations, alterations or erasures.

25.1.1.3. Submit the executed bid on the bid forms provided, signed and corporate sealed as applicable together with the required security in a closed opaque envelope, clearly identified with Bidders name, project name on the outside.

25.1.1.4. Improperly completed information, irregularities, in required enclosures may be cause to declare the bid informal.

25.2. Bid Signing

25.2.1. The bid form **Must** be signed and under seal (as applicable) by a duly authorized signing officer(s) in their normal signatures.

25.3. Contract Time

25.3.1. The bidder, in submitting an offer, agrees to achieve Substantial performance of the work by the date indicated in the contract documents. The Substantial Performance date in the agreement shall be as indicated on the cover sheet.

26. Offer Acceptance / Rejection

26.1. Duration of offer

26.1.1. Bids shall remain open to acceptance and shall be irrevocable for a period of ninety (90) days after the bid closing date.

26.2. Award/Selection/Acceptance of Offer

26.2.1. In the evaluation of a bid, HRSB will consider, but not be limited to, the following criteria:

26.2.1.1. Compliance with Bid requirements.

26.2.1.2. Bid price submitted.

26.2.1.3. The qualifications and experience of the bidder with similar projects in size and scope.

26.2.1.4. References.

26.2.1.5. Gantt chart (schedule of proposed scope of work for various disciplines).

26.2.1.6. Completion date.

26.2.2. The Owner's evaluation of any and all bid submission(s) will be final.

26.3. HRSB reserves the right to accept or reject any or all offers or to accept any offer deemed most satisfactory, HRSB reserves the right to waive any informality in any or all bids.

26.4. After acceptance HRSB will issue to the successful bidder, a written bid acceptance.

26.5. After acceptance by HRSB, the successful bidder shall be notified in writing of acceptance of the bid and will be issued an official purchase order.

27. Agreement

27.1. After acceptance by HRSB and the successful bidder will enter into a CCDC-2 –2008, standard form of contract for the execution of the work.

28. Post Bid Submissions

28.1. Provide after closing of bid period, but before award of Contract, when requested by HRSB, a copy of the following documents:

28.1.1. Current Certificate of Recognition or Letter of Good Standing:

28.1.1.1. Certificate of Recognition issued jointly by the Nova Scotia Department of Labour and an occupational health and safety organization approved by Nova Scotia Department of Labour, or a valid letter of Good Standing from an occupational health and safety organization approved by HRSB

indicating the Contractor is in the process of qualifying for the Certificate of Recognition. Contractor shall remain in good standing for the duration of the contract. In the event that any such certification during the term of the contract expires, the obligation remains with the contractor to provide the updated required certificates.

28.1.1.2. Worker's Compensation Coverage

28.1.1.2.1. Evidence of an account with the Workers' Compensation board, coverage under the Workers Compensation Ace, R.S.N.S. and a clearance certificate indicating the bidder is in good standing and shall remain so for the duration of the contract. In the event that any such certification during the term of the contract expires, the obligation remains with the contractor to provide the updated required certificates.

28.1.1.3. Certificates of good standing with CRCA (Canadian Roofing Contractors Association) and RCANS (Roofing Contractors Association of Nova Scotia),

28.1.2. Submit Post-Bid Submissions requested by HRSB within forty-eight (48) hours of request in order to be eligible to receive award of contract.

28.1.3. Submit the following post award documents within ten (10) working days of notice of award:

28.1.3.1. Provide all required contract security and insurance documentation,

28.1.3.2. Schedule of Values,

28.1.3.3. Copy of safety plan,

28.1.3.4. Copy of Hot Work Permit system and procedures,

28.1.3.5. Shop drawings, as applicable, and

28.1.3.6. Applicable documentation as required by the Tender Documents.

28.1.4. All post bid submissions must be received by HRSB in the manner prescribed above, or prior to commencement of work and delivery of materials on-site, whichever occurs first.

29. Taxes

29.1. The General Conditions of the Contract state that the Contractor as of April 1, 1997 and thereafter, the Contractor is to pay all Harmonized Sales Tax.

29.2. HRSB is not exempt for Harmonized Sales Tax (HST) purposes. As a result, the aggregate amount of the bid for contracts is subject to HST, however, **prices submitted shall not include HST.**

29.3. The HST payable by the Board will be added as a separate item during the processing of progress payments and therefore **HST will not appear as a cost in the aggregate amount of the tender.**

29.4. Bidders are advised that they may be eligible to claim an Input Tax Credit (ITC) for a portion of the HST paid in relation to the Contract requirement of the Government of Canada.

29.5. Bidders are to note that prices indicated on the Bid Form and the appendices to the Bid Form shall not include Provincial Sales Taxes, the Federal Goods and Services Tax or the Harmonized Sales Tax.

29.6. Exclude Harmonized Sales Tax in Tender Contract Price, unless requested to do otherwise.

29.7. Refer to CCDC-2 - 2008 (Section 00 72 13) and Supplementary General Conditions (Section 00 73 00).

END OF SECTION 00 21 13

SECTION 00 41 13 - TENDER FORM

1. Salutation:

To: **HALIFAX REGIONAL SCHOOL BOARD**
33 SPECTACLE LAKE DRIVE, DARTMOUTH NS
Attn: JENNIFER KING, BUYER

For: #3869 HEAT PUMP REPLACEMENT - PHASE 2 – HALIFAX WEST HIGH
From: _____
Address: _____
_____
E-Mail: _____
Phone: _____ **Fax**: _____
Person Signing for Firm: _____
Position: _____

2. Bidder Declares:

2.1. That this tender was made without collusion or fraud.
2.2. That the proposed work was carefully examined.
2.3. That the Bidder was familiar with local conditions.
2.4. That Contract Documents and Addenda were carefully examined.
2.5. That all the above were taken into consideration in preparation of this Tender.

3. Bidder Agrees:

3.1. To provide all necessary equipment, tools, labour, incidentals and other means of construction to do all the Work and furnish all the materials of the specified requirements which are necessary to complete the Work in accordance with the Contract and agrees to accept, therefore, as payment in full the Lump Sum Price stated in Subsection 6 hereunder.
3.2. Carefully examined the site of the work described herein; become familiar with local conditions and the character and the extent of the work; carefully examined every part of the proposed Contract and thoroughly understands its stipulations, requirements and provisions.
3.3. Determined the quality and quantity of materials required; investigated the location and determined the source of supply of the materials required; investigated labour conditions; and has arranged for the continuous prosecution of the work herein described

3.4. To be bound by the award of the contract and if awarded the contract on this bid to execute the required contract within ten (10) days after notice of award.

3.5. Noted that the Harmonized Sales Tax is excluded from his "Contract Price".

3.6. School/Work site access control: Contractor's employees shall always report to the main office of a school, indicate who they are and state their purpose on site prior to starting any work in the school. Contractor is not permitted to work on the school site without School Board's assigned representative on site unless authorized by School Board Operations representative. Working in occupied schools will be determined by the Operations representative. No work shall be conducted on weekends or holidays without specific approval of the Operations Representative – **see below in 3.7**.

3.7. Hours of work – All work shall be carried out during regular business hours unless otherwise indicated below or in writing by the Manager of Operations or designate. Hours of work shall comply with local ordinances and bylaws for each site.

For this project: Work within occupied areas and work causing a disruption to school operations will be performed outside regular business hours, (evenings, weekends, Christmas Break) as determined by a representative of the HRSB in conjunction with the Architect.

School Bell Times:
Start – 9:10am
Finish – 3:20

October 10th – Thanksgiving Day – No Classes
October 28th - Provincial Conference Day (no classes)
November 11th - Remembrance Day (no classes)
November 24th – PD Day
December 21st – Last day of classes
January 3rd – Classes Resume
January 30th - Assessment & Evaluation Day High Schools (no classes)
February 20th – Mi'kmaq Heritage Day (no classes)
March 13-17th - March Break (no classes)

4. Owner Agrees

4.1. To examine this bid and in consideration, therefore, the bidder hereby agrees not to revoke this bid:

4.1.1. until some other bidder has entered into the contract with The School Board for the performance of the work and the supply of the materials specified in the notice inviting bids; or in the Information to Bidders, or

4.1.2. until ninety (90) days after the time fixed in the Information to Bidders for receiving bids has expired,

4.1.3. Whichever first occurs; provided, however, that the bidder may revoke this bid at any time before the time fixed in the Information to Bidders for receiving bids has expired upon receipt by the Board from the bidder of written notice of such revocation before said time has expired.

4.1.4. The Bidder declares that he has obtained from the Subcontractors all Bid Security required to be provided by Subcontractors pursuant to the "Instructions to Bidders".

5. Contract Documents include:

5.1.1. Cover Page

5.1.2. Table of Contents – Section 00 00 01

5.1.3. Description of Work & List of Drawings – Section 00 00 15

5.1.4. List of Consultants – Section 00 05 00

5.1.5. Information for Bidders – Section 00 21 13

5.1.6. Tender Form – Section 00 41 13

5.1.7. Tender Price Amendment Form (if applicable) – Section 00 41 73

5.1.8. Agreement Between Owner and Contractor (CCDC 2 – 2008) – Section 00 52 00

5.1.9. Definitions (CCDC 2 – 2008) – Section 00 52 13

5.1.10. General Conditions of the Stipulated Contract Price (CCDC 2 -2008) – Section 00 72 13

5.1.11. Supplementary General Conditions – Section 00 73 00

5.1.12. HRSB General Terms & Conditions – Section 00 73 10

5.1.13. Specifications of Work (all applicable sections)

5.1.14. Drawing(s) – as applicable

5.1.15. Addendum/Addenda issued by HRSB.

5.1.16. Contract Sets (2)

6. Fee Submission - Contract Price:

6.1. The undersigned Bidder, having carefully read and examined the aforementioned Contract Documents prepared by the Consultant, for Halifax Regional School Board hereby accepts the same as part and parcel of the Contract herein referred to, and having carefully examined the locality and Site of Works and having full knowledge of the work required and of the materials to be furnished and used, does hereby Tender and offer to enter into a contract to perform and complete, the whole of the said works and provide all necessary labour, plant, tools, materials and equipment and pay all applicable taxes, as set forth and in strict accordance with the Specifications, Drawings and other Contract Documents and to do all therein called for on the terms and conditions and under the provisions therein set forth for the following:

6.2. LUMP SUM BID PRICE

_____ /100 Dollars ($_____) (HST Excluded)

Contract Price to be completed in written form on the lines provided above, with cents expressed as numerical fraction of a dollar. Contract price to be completed in numerical form on the line bounded by parenthesis above, with cents expressed as a decimal of a dollar. WHERE THERE IS A CONFLICT, WRITTEN WORD WILL GOVERN.

6.3. Breakout Prices: Breakout prices requested in the Tender Document, as detailed below, **SHALL BE INCLUDED IN THE LUMP SUM TENDER PRICE** above (6.1 - Contract Price) and deleted only on the instruction at the sole discretion of the Owner, for which a credit will be offered by the Contractor, equal to the breakout pricing detailed below (price excludes HST):

Item No.	Description	Unit of Measurement	Credit Amount
1.	_____	_____	$_____
2.	_____	_____	$_____
3.	_____	_____	$_____
4.	_____	_____	$_____
5.	_____	_____	$_____

Total Credit Amount for ALL Breakout Items:

_____ /100 Dollars ($_____) (HST Excluded)

Separate Prices: Separate prices requested in the Tender Document, as detailed below **SHALL NOT BE INCLUDED IN THE LUMP SUM TENDER PRICE** above (6.1 - Contract Price) and added only on the instruction and at the sole discretion of the Owner, for which the contract will be adjusted, equal to the separate pricing detailed below (price excludes HST):

Listing of Separate Price Details Requested by Board:

Item No.	Description	Unit of Measurement	Unit Price
6.	Supply of additional Heat Pumps	EACH	$
7.			$
8.			$
9.			$
10.			$

7. Completion Time:

7.1. Bidder agrees to be substantially complete as follows:

7.1.1.1. ***FEBRUARY 28TH, 2017***

7.1.1.2. The undersigned Bidder agrees if awarded the Contract on this Bid to achieve the Substantial Completion Date providing the contract is awarded within ten (10) business days of tender closing time.

7.2. Detailed breakdown of overall project specific phases (schedule of proposed scope of work for various disciplines) written and/or Gant Chart to be provided with bid documents or within five (5) business days of tender award.

8. Addenda Acknowledgement

I/We have received and noted the following addenda for Tender #3869 HEAT PUMP REPLACEMENT - PHASE 2:

Addendum #	Dated	# Of Pages
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

9. Supporting Information

9.1. References: (Minimum of three)

Bidder to furnish particulars of at least three (3) similar contracts successfully completed or currently being carried to completion. The projects quoted should preferably be approximate in nature to the work now tendered for and be of comparable or greater size. References are to be submitted with the bid prior to closing date and time.

Contact Name & Phone #	Date	Contract Value
_____	**From** _____ **to** _____	**$** _____
_____	**From** _____ **to** _____	**$** _____
_____	**From** _____ **to** _____	**$** _____
_____	**From** _____ **to** _____	**$** _____

9.2. Bid submission to include a minimum of two letters of endorsement from clients commenting upon the contractor's ability to deliver quality projects, similar in scope and size, which met schedule and budget.

10. Proof Of Competency Of Bidder

10.1. Any bidder may be required to furnish evidence satisfactory to the Owner that he and his proposed sub-contractors have sufficient means and experience in the types of work called for to assure completion of the Contract in a satisfactory manner.

10.1.1. The Bidder acknowledges, as part of their bid submission, their responsibility and contract obligations to ensure that the proposed sub-contractors will fully perform the project requirements and meet the timings as detailed in this tender call.

10.2. Sub-Contractors: The Bidder to provide the name and address of each major sub-contractor used in making up this tender. This list of sub-contractors is to be submitted with the bid prior to closing date and time. Only one sub-contractor shall be named for each part of the work to be sublet.

Subcontractor/Suppliers/Manufacturers	Service/Material
Site Works	
Electrical	
Mechanical	
Roof	

10.2.1. Project Personnel: The Bidder to include below, the names, qualifications and previous experience of those people who will be directly involved with the project. The names shall, for example, include foremen, superintendent, project engineer and/or project manager, labourers and trade staff. This list of personnel is to be submitted with the bid prior to closing date and time.

Name	Position	Qualifications/Experience

Signature * The undersigned Bidder declares that this bid is made without connection with any other person(s) submitting bids for the same work and is in all respects fair and without collusion or fraud.

SIGNATURE:

SIGNED AND DELIVERED
in the presence of:

_____
Witness

CONTRACTOR

_____
Company name

_____
Signature of Signing Officer

_____
Name and Title (printed)

HRSB is directly responsible for the safety of its students and staff. Should contractors be required to work in or on school property while children are present, it is a MANDATORY SCHOOL BOARD REQUIREMENT that contractors assign the work to employees and/or sub-contractors who DO NOT have a CRIMINAL RECORD and who ARE NOT LISTED ON THE CHILD ABUSE REGISTRY. Failure to comply with this requirement may result in immediate contract termination.

By checking the "Agreed" box you are confirming that you understand and will abide by this mandatory School Board requirement.

Agreed □

Note: *Bids submitted **Must** be signed by a duly authorized officer or agent.*

END OF SECTION 00 41 13

SECTION 00 41 73 - TENDER AMENDMENT FORM

#3869 HEAT PUMP REPLACEMENT - PHASE 2

Note: to be completed and forwarded for each Bid Price adjustment prior to bid closing time and date as detailed on the Cover Sheet of the tender document and related Addendum.

Lump Sum Price Adjustment – Section 00 41 13 Tender form, Article 6.1.1 Contract Price

Increase Bid by		**Decrease Bid By**	
Amount (excluding HST)	**$**	**Amount** (excluding HST)	**$**
HST	**$**	**HST**	**$**
Total Amount (including HST)	**$**	**Total Amount** (including HST)	**$**

It is the Bidder's responsibility to ensure the table above is legible

Attachments included: **no** ☐ **yes** ☐ (✓ one)

If yes above, check ✓ and complete information regarding attachments

☐ **Revised Bid Form**: Dated _____ # of pages _____

☐ **Other, Specify** _____

Dated _____ # of pages _____

Total number of pages (including this form) _____

Submitted by:

_____

Company Name (please print as it appears on original tender envelope)

_____

Authorized Bidder's Name (please print as it appears on Bid Form)

_____

Authorized Bidder's Signature

END OF SECTION 00 41 73

SECTION 00 52 00 - AGREEMENT BETWEEN OWNER AND CONTRACTOR

CCDC 2 – 2008

(a copy of Section 00 52 00, Standard Construction Contract CCDC 2 – 2008 (5 pages) is available upon request, otherwise, will form part of the contract sets to the successful bidder)

END OF SECTION 00 52 00

SECTION 00 52 13 - DEFINITIONS

CCDC 2 - 2008

(A copy of section 00 52 13, Standard Construction Contract CCDC 2 – 2008 (2 pages) is available upon request, otherwise, will form part of the contract sets to the successful bidder)

END OF SECTION 00 52 13

SECTION 00 72 13 - GENERAL CONDITIONS
OF THE STIPULATED PRICE CONTRACT
CCDC 2 - 2008

(A copy of section 00 72 13, Standard Construction Contract CCDC 2 – 2008 (23 pages) is available upon request, otherwise, will form part of the contract sets to the successful bidder)

END OF SECTION 00 72 13

SECTION 00 73 00 - SUPPLEMENTARY GENERAL CONDITIONS CCDC2 – 2008

The Canadian Standard Construction Document for Stipulated Price Contract (CCDC 2, 2008 version), Definitions and General Conditions governing same, shall be used by the project. The following Supplementary General Conditions are intended to supplement or amend the General Conditions, and where conflicts occur, the Supplementary Conditions shall take precedence.

Where a General Condition or paragraph of the General Conditions of the Stipulated Price Contract is deleted by these Supplementary Conditions, the numbering of the remaining General Conditions or paragraphs shall remain unchanged, and the numbering of the deleted item will be retained, unused.

ARTICLE A-5 PAYMENT

Delete paragraph 5.1 in its entirety and insert:

5.1 "Subject to applicable legislation and the provisions of the Contract Documents, and in accordance with legislation and statutory regulations respecting holdback percentages and, where such legislation or regulations do not exist or apply, subject to a holdback of ten percent (10%) including the HST (Harmonized Sales Tax), the Owner shall:"

.1 Make progress payments to the Contractor on account of the Contract Price (work performed) when due in the amount certified by the Consultant together with Value Added Taxes as may be applicable to such payments, and
.2 Upon Substantial Performance of the Work as certified by the Consultant, pay to the Contractor the unpaid balance of monies then due, excepting that amounts as certified by the Consultant to rectify deficiency items, or incomplete portions of individual work items may be retained by the Owner pending Total Performance of the work or other authorization for the release by the Consultant, and
.3 Upon Total performance of the Work as certified by the Consultant pay to the contractor the unpaid balance of monies due together with such Value Added Taxes as may be applicable to such payment.

Change 5.3.1 (1) to read: "1% per annum above the prime rate."

Delete 5.3.2 (2) in its entirety.

DEFINITIONS

Add subparagraph 19a to definitions:

19a. Submittals

Submittals are documents or items required by the Contract Documents to be provided by the Contractor, such as:

1 Shop Drawings, samples, models, mock-ups to include details or characteristics, before the portion of the Work that they represent can be incorporated into the Work; and
2 As-built drawings and manuals to provide instructions to the operation and maintenance of the Work.

GC 1.1 CONTRACT DOCUMENTS

Add to the end of subparagraph 1.1.2.2:

1.1.2.2 Except where the Consultant shall be indemnified as a third party beneficiary as provided in subparagraphs 9.2.7.4, 9.5.3.4 and in 12.1.3.

Add subparagraph 1.1.7.5:

1.1.7.5 Should conflicts occur between Contract Documents and any work is done without consulting the Consultant for his decision, the Contractor shall assume full responsibility.

Add subparagraph to 1.1.7.6:

1.1.7.6 In case of discrepancies, noted materials and annotations shall take precedence over graphic indications in the Contract Documents.

Delete paragraph 1.18 in its entirety and insert:

1.18 "The Contractor will be provided with up to a maximum of ten (10) copies, without charge, of the Contract Documents or parts thereof for the performance of the work. Extra copies may be obtained for cost of printing and mailing."

GC 2.4 DEFECTIVE WORK

Add new subparagraphs 2.4.1.1 and 2.4.1.2:

2.4.1.1 The Contractor shall rectify, in a manner acceptable to the Owner and the Consultant, all defective work and deficiencies 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 operation of the Owner.

GC 3.1 CONTROL OF THE WORK

Add new paragraph 3.1.3:

3.1.3 Prior to commencing individual procurement, fabrication, and construction activities, the Contractor shall verify, at the Place of work, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the Work and shall further carefully compare such field measurements and conditions with the requirements of the Contract Documents. Where dimensions are not included or contradictions exist, or exact locations are not apparent, the Contractor shall immediately notify the Consultant before proceeding with any part of the affected work.

GC 3.4 DOCUMENT REVIEW

Delete paragraph 3.4.1 in its entirety and substitute new paragraph:

3.4.1 The Contractor shall review the Contract Documents and shall report promptly to the Consultant and error, inconsistency or omission the Contractor may discover. Except for its obligation to make such review and report the result, the Contractor does not assume any responsibility to the Owner or to the Consultant for the accuracy of the Contract Documents. The Contractor shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the Contract Documents, which the Contractor could not have reasonably have discovered. If the Contractor does discover any error, inconsistency, or omission in the Contract Documents the Contractor shall not proceed with the work affected until the Contractor has received corrected or missing information from the Consultant.

GC 3.7 SUBCONTRACTORS AND SUPPLIERS

Add the following paragraph 3.7.7:

3.7.7 A copy of the agreement between Contractor and any subcontractor(s) shall be provided to the Consultant if so requested.

GC 3.8 LABOUR AND PRODUCTS

Add the following paragraph 3.8.4:

3.8.4 The Contractor is responsible for the safe on-site storage of Products and their protection (including Products supplied by the Owner and other contractors to be installed under the Contract) in such ways as to avoid dangerous conditions or contamination to the Products or other persons or property and in locations at the Place of the Work to the satisfaction of the Owner and the Consultant. The Owner shall provide all relevant information on the Products to be supplied by the Owner.

GC 3.10 SHOP DRAWINGS

Add the words "AND OTHER SUBMITTALS" to the Title after SHOP DRAWINGS in GC 3.10.

Add "and submittals" after the words "Shop Drawings" in paragraphs 3.10.1, 3.10.2, 3.10.4, 3.10.7, 3.10.8, 3.10.8.2, 3.10.9, 3.10.10, 3.10.11 and 3.10.12.

Delete 3.10.3 in its entirety and substitute new paragraph:

3.10.3 Prior to the first application for payment, the Contractor and the Consultant shall jointly prepare a schedule of the dates for submission and return of Shop Drawings and any Submittals.

Add the following subparagraph 3.10.6.1:

3.10.6.1 The following paragraph shall apply to each shop drawing and submittals reviewed in connection with the project. This review shall not mean that the Consultant approved the detailed design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same. The Contractor is responsible for information that pertains solely to fabricated processes or to techniques of construction and installation, and for coordination of the work of all sub trades.

Delete and insert the words in paragraph 3.10.12

3.10.12 "with reasonable promptness so as to cause no delay in the performance of the Work" and replace with "within ten (10) working days or such longer period as may be reasonably required"

PART 3 EXECUTION OF THE WORK

Add new GC 3.14 as follows:

GC 3.14 CONTRACTOR RESPONSIBILITY FOR WATER TIGHTNESS

GC 3.14.1 The drawings and specifications are not intended to depict each and every condition or detail of construction. As the knowledgeable party in the field, the contractor is in the best position to verify that all construction is completed in a manner which will provide a watertight structure. The contractor has the sole responsibility for ensuring the watertight integrity of the structure.

Add new GC 3.15 as follows:

GC 3.15 PERFORMANCE BY CONTRACTOR

GC 3.15.1 In performing its services and obligations under the Contract, the Contractor shall exercise a standard of care, skill and diligence that would normally be provided by an experienced and prudent contractor supplying similar services for similar projects. The Contractor acknowledges and agrees that throughout the Contract, the Contractor's obligations, duties and responsibilities shall be interpreted in accordance with this standard. The Contractor shall exercise the same standard of due care and diligence in respect of any products, personnel, or procedures which it may recommend to the Owner.

The Contractor further represents, covenants and warrants to the Owner that:

1. The personnel it assigns to the Project are appropriately experienced;
2. It has sufficient staff of qualified and competent personnel to replace its designated supervisor and project manager, subject to the Owner's approval, in the event of death, incapacity, removal or resignation.

GC 4.1 CASH ALLOWANCES

Delete paragraph 4.1.4 in its entirety and substitute:

4.1.4 Where cost under a cash allowance exceed the amount of the allowances, unexpended amounts from other cash allowances shall be reallocated at the *Consultant's* direction to cover the shortfall.

Delete paragraph 4.1.5 in its entirety and substitute:

4.1.5 The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the Contract Price by Change Order.

Delete paragraph 4.1.7 in its entirety and substitute:

4.1.7 At the commencement of the work, the Contractor shall prepare for the review and acceptance of the Owner and the Consultant, a schedule indicating the times, within the construction schedule referred to in GC 3.5, that items call for under cash allowances and items that are specified to be Owner purchased and Contractor installed or hooked up are required at the site to avoid delaying the progress of the Work.

Add new paragraph 4.1.8:

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

GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

Delete section GC 5.1 in its entirety.

GC 5.2 APPLICATION FOR PROGRESS PAYMENT

Add the following at the end of paragraph 5.2.2:

5.2.2 Such applications shall be accompanied by one or more of the following documents: a Statutory Declaration Waiver of Lien or receipt stating that the holdback monies claimed have been paid to the particular party or parties so named or referred to in the Declaration. Form of Statutory Declaration shall meet the approval of the Consultant.

Add the following paragraph 5.2.8:

5.2.8 The reference to payment for products delivered to the place of work in Article 5.2.7 shall not be construed as covering day-to-day financing of the project. Products delivered to the place of work shall be construed to mean major items of equipment or quantities of items that are essential for the expedient conduct of the work.

GC 5.3 PROGRESS PAYMENT

Supplement paragraph 5.3.1 by adding the following:

5.3.1 A holdback percentage of ten (10) percent (%) shall apply to progress payments. The sworn statement by the Contractor for release of holdback monies shall be in the form of a Statutory Declaration meeting the approval of the Consultant. Amounts as certified by the Consultant to rectify deficiency items, or incomplete portions of individual work items, may be retained by the Owner after Substantial Performance has been obtained, pending Total Performance of the work or other authorization for release by the Consultant.

Amend subparagraph 5.3.1.3 as follows:

5.3.1.3 Delete "20" and replace with "30."

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK

Add the following paragraph 5.4.4:

5.4.4 Before the Contractor submits his application for Substantial Performance of the Work, all Operations and Maintenance Manual materials shall be submitted in accordance with the Contract Documents. The Certificate of Substantial Performance will not be issued until this requirement is met.

GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF WORK

Add the following subparagraphs 5.5.1.3 and 5.5.1.4:

5.5.1.3 Submit a certificate from barrister stating that there are no Builders' Liens filed relating to the Contract Works.

5.5.1.4 Submit a clearance letter from the Workers' Compensation Board.

GC 5.7 FINAL PAYMENT

Add the following subparagraphs 5.7.1.1, 5.7.1.2, 5.7.1.3, 5.7.1.4 and 5.7.1.5:

5.7.1.1 Contractor's application for final payment is considered to be valid when the following have been performed:

1. Work has been completed and inspected for compliance with Contract Documents, and the Consultant is satisfied that all the requirements of the Contract have been fulfilled by the Contractor.
2. Defects have been corrected and deficiencies have been completed.
3. Equipment and systems have been tested, adjusted and balanced and are fully operational, and written reports as outlined in the Contract Documents have been provided to the Consultant.
4. Certificates required by Utility companies, manufacturer's representative and inspectors have been submitted.
5. Spare parts, maintenance materials, warranties and bonds have been provided.

5.7.1.2 If Work is deemed incomplete by Consultant, complete outstanding items and request re-inspection.

5.7.1.3 If in opinion of the Consultant, it is not expedient to correct defective work or Work is not performed in accordance with the requirements of the Contract, the Owner may deduct from Contract Price difference in value between work performed and that called for by Contract Documents, amount of which shall be determined by the Consultant.

5.7.1.4 If, within sixty (60) days after the issue by the Consultant of the Certificate of the Substantial Performance, the Contractor has not corrected all the deficiencies, the Owner will retain sufficient money to cover the cost of completing said deficiencies, as determined by the Consultant, in addition to holding monies retained in accordance with the Contract and subject to the provisions of the Builders' lien legislation of Nova Scotia.

5.7.1.5 Neither the final certificate nor the payment thereunder, nor any provision in the Contract Documents shall relieve the Contractor from responsibility for faulty material or workmanship which shall appear within a period of one (1) year from the date of Substantial Performance of the Work and he shall remedy any defects due thereto and pay for any damage to other Work resulting therefrom which shall appear within such period of one year. The Owner shall give notice of observed defects promptly. This article shall not be deemed to restrict any liability of the Contractor arising out of any law in force in the Province of Nova Scotia.

GC 6.2 CHANGE ORDER

Add the following paragraphs 6.2.3, 6.2.4, 6.2.5, 6.2.5, 6.2.6 and 6.2.7:

6.2.3 All contemplated changes in the work shall be issued by the Consultant on a "Contemplated Change Order" form.

6.2.4 For lump sum pricing, the Contractor shall, upon receipt of the Contemplated Change Order, submit to the Consultant for approval within seven (7) days, a quotation for changes in the work.

6.2.5 Quotation for changes shall be priced in sufficient detail (GC6.6 applies).

6.2.6 Consultant shall, within five (5) working days, notify the Contractor whether estimates are accepted by Owner or further information required. Acceptance of Owner shall be indicated by writing, and a signed copy of form (Change Order) returned to Contractor.

6.2.7 Contractor shall take reasonable measures to stop work or minimize the work in areas affected by or related to the contemplated changes.

GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

Add new paragraph 6.4.5:

6.4.5 The *Contractor* confirms that, prior to bidding the *Project,* it carefully investigated the Place of the Work and applied to that investigation the degree of care and skill described in paragraph 3.15.1, given the amount of time provided between the issue of the bid documents and the actual closing of bids, the degree of access provided to the Contractor prior to submission of bid, and the sufficiency and completeness of the information provided by the Owner. The Contractor s not entitled to compensation or to an extension of the Contract Time for which could reasonably have been ascertained by the Contractor by such careful investigation undertaken prior to the submission of the bid.

GC 6.5 DELAYS

Delete the period at the end of paragraph 6.5.1 and substitute the following words:

6.5.1 ", but excluding any consequential, indirect or special damages."

Add new paragraph 6.5.6:

6.5.6 If the Contractor is delayed in the performance of the Work by any act or omission of the Contractor or anyone employed or engaged by the Contractor directly or indirectly, or by any cause within the Contractor's control, then the Contract Time shall be extended for such reasonable time as the Consultant may decide in consultation with 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 all services required by the Owner from the Consultant as a result of such delay by the Contractor and, in particular, the cost 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 provisions of these General Conditions and any later, actual date of Substantial Performance of the Work achieved by the Contractor.

Add new paragraph 6.5.7:

6.5.7 If the Contractor is delayed in the completion of the Work by any act or neglect of: The School Board, any employee or either any other Contractor employed by The School Board, changes ordered in the Work, strikes, lockouts, fire, unusual delay by common carriers, unavoidable casualties, any other cause of any kind whatsoever beyond the Contractor's control or by any cause within the Contractor's control which the Consultant shall decide as justifying the delay, then the time of completion shall be extended for such reasonable time as the Consultant may decide.

Add new paragraph 6.5.8:

6.5.8 No such extension shall be made for delay occurring more than seven (7) days before claim therefore is made in writing to the Consultant, provided however that in the case of a continuing cause of delay, only one (1) claim shall be necessary.

Add new paragraph 6.5.9:

6.5.9 If no schedule is made, no claim for delay shall be allowed on account of failure to furnish such schedule until two (2) weeks after demand for such schedule and not then unless such claim be reasonable.

Add new paragraph 6.5.10:

6.5.10 The Consultant shall not, except by written notice to the Contractor, stop or delay any part of the main Contract Work pending decisions or proposed changes.

GC6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

Amend paragraph 6.6.5 as follows:

6.6.5 Add the words “as noted in paragraph 6.6.3” after the words “of the claim” and add the words “and the consultant”, at the end.

GC 6.7 VALUATION OF CHANGES

Add the following Header and paragraphs 6.7.1, 6.7.2, 6.7.3 and 6.7.4 in their entirety:

GC 6.7 VALUATION OF CHANGES

6.7.1 The value of any change shall be determined in one or more of the following way as determined by the Consultant:

(a) By estimate and acceptance in a lump sum, submitted with sub-contractors' and suppliers' signed quotations and breakdown estimates including itemized material and labour lists.
For changes where the individual trade cost is anticipated to be less than $1000, the requirement for the detailed cost breakdown may be waived, but individual trade quotation must be supplied.

(b) By unit prices agreed upon or as listed in the contract.

(c) Cost of work and percentage or by cost and fixed fee.

6.7.2 In cases of additional work to be paid for under method "c", the Contractor shall keep and present in such form as the Consultant may direct, a correct account of the net cost of labour and materials, together with vouchers. In any case, the Consultant shall certify to the amount due to the Contractor including the profit and overhead. Pending final determination of value, payments on account of changes shall be made on the Consultant's certificate.

6.7.3 In determination of method ".1(a) or ".1(c) above, the labour costs to be calculated by the actual estimated hours at an hourly rate determined as follows:

The hourly labour rate to be total payroll costs including hourly wage, statutory contributions to UIC, WCB, CPP, Training Funds, Health Benefits and other applicable labour burdens paid directly by the employer such as vacation pay, holiday pay, pension plan etc.

The School Board reserves the right to verify the payroll cost by independent audit.

To the total payroll cost the following percentage factors will be recognized.

- small tools/expenditures 5% (on payroll costs)
- site supervision 5% (on payroll costs)

(d) In determination of methods ".1(a)" and ".1(c)" above, the material costs to be calculated as follows:

Contractors net costs, including contractor discounts from suppliers, FOB the project site plus applicable taxes.

(e) In determination of methods ".1(a)" and ".1(c)" above, equipment rental costs for major pieces of equipment required will be at local industry rates.

(f) In determination of methods ".1(a)" and ".1(c)" above, overhead and fees shall be calculated as follows:

The cost of any authorized change shall be determined by the net total of labour and material or equipment as outlined in ".3(a)", ".3(b)" and ".3(c)" above on which the percentage markup shall be determined as follows:

For Extras Up to $5,000:

Sub- Contractors Own Work	- Overhead & Fee – 15% total
General Contractors Own Work	- Overhead & Fee – 15% total
General Contractors on Sub Contractors work	- 10% total
(no percentage markup shall be applied to deductions)	

For Extras Above $5,000:

Sub Contractors Own Work	- Overhead & Fee – 10% total
General Contractors Own Work	- Overhead & Fee – 10% total
General Contractors on sub contractor's work	– 8% total
(no percentage markup shall be applied to deductions)	

6.7.4 Submit to the Consultant and The School Boards representative detailed breakdown of the hourly labour rate as defined in paragraph ".3(a)".

GC 8.2 NEGOTIATION, MEDIATION, AND ARBITRATION

Add the following paragraphs 8.2.9, 8.2.10, 8.2.11, 8.2.12, 8.2.13, 8.2.14, and 8.3:

8.2.9 Within five days of receipt of the notice of arbitration by the responding party under paragraph 8.2.6, the Owner and the Contractor shall give the Consultant a written notice containing:

a) a copy of the notice of arbitration;
b) a copy of supplementary conditions 8.2.9 to 8.2.14 of this contract, and;
c) any claims or issues which the Contractor or the Owner, as the case may be, wishes to raise in relation to the Consultant arising out of the issues in dispute in the arbitration.

8.2.10 The Owner and the Contractor agree that the Consultant may elect, within ten days of receipt of the notice under paragraph 8.2.9, to become a full party to the arbitration under paragraph 8.2.6 if the Consultant:

a) has a vested or contingent financial interest in the outcome of the arbitration;

b) gives the notice of election to the Owner and the Contractor before the arbitrator is appointed;

c) agrees to be a party to the arbitration within the meaning of the rules referred to in paragraph 8.2.6, and;

d) agrees to be bound by the arbitral award made in the arbitration.

8.2.11 If an election is made under paragraph 8.2.10, the Consultant may participate in the appointment of the arbitrator and, notwithstanding the rules referred to in paragraph 8.2.6, the time period for reaching agreement on the appointment of the arbitrator shall begin to run from the date the respondent receives a copy of the notice of arbitration.

8.2.12 The arbitrator in the arbitration in which the Consultant has elected under paragraph 8.2.10 to become a full party may:

a) on application of the Owner or the Contractor, determine whether the Consultant has satisfies the requirements of paragraph 8.2.10, and;

b) make any procedural order considered necessary to facilitate the addition of the Consultant as a party to the arbitration.

8.2.13 The provisions of paragraph 8.2.9 shall apply mutatis mutandis to written notice to be given by the Consultant to any sub-consultant.

8.2.14 In the event of notice of arbitration given by the Consultant to a sub-consultant, the sub-consultant is not entitled to any election with respect to the proceeding as outlined in 8.2.10, and is deemed to be bound by the arbitration proceeding.

8.3 An application for arbitration shall be accompanied by security in the amount of $1000 to apply to the cost of arbitration. Any claims of excess costs must be submitted in writing to the Consultant within two weeks of completion or alleged completion of the work. No claims shall be accepted after this date and, also, no claims shall be accepted for disputed work unless the Consultant has been notified as specified.

GC 9.1 PROTECTION OF WORK AND PROPERTY

Delete subparagraph 9.1.1.1 in its entirety and substitute the following new paragraph 9.1.1.1:

9.1.1.1 errors in the Contract Documents which the Contractor could not have discovered applying the standard of care described in paragraph 3.15.1.

Delete paragraph 9.1.2 in its entirety and substitute the following new paragraph 9.1.2:

9.12 Before commencing any Work, the Contractor shall determine the locations of all underground utilities and structures indicated in the Contract Documents, or that are discoverable by applying to an Inspection of the Place of Work exercising the degree of care and skill described in paragraph 3.15.1.

GC 9.2 TOXIC AND HAXARDOUS SUBSTANCES

Add in paragraph 9.2.6 after the word “responsible”, the following new words:

9.2.6 Or whether any toxic or hazardous substances or materials already at the Place of Work (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the Contractor or anyone for whom the Contractor is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the Owner and others,

Add in subparagraph 9.2.7.4:

9.2.7.4 “and the Consultant” after “Contractor”:

Add in paragraph 9.2.8 after the word “responsible”, the following new words:

9.2.8 or that any toxic or hazardous substances or materials already at the Place of the Work (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the Contractor or anyone for whom the Contractor is responsible in a manner which does not comply with legal and regulatory requirement, or which threatens, humane health and safety or the environment, or material damage to the property of the Owner or others.

GC 9.5 MOULD

Add in subparagraph 9.5.3.4:

9.5.3.4 "and the Consultant" after "Contractor"

GC 10.1 TAXES AND DUTIES

Add the following paragraph 10.1.3:

10.1.3 The Contractor shall indicate on each application for payment as a separate amount, the appropriate Harmonized Sales Tax the Owner is legally obliged to pay. This amount will be paid to the Contractor in addition to the amount certified for payment under the Contract.

GC 10.2 LAWS, NOTICES, PERMITS AND FEES

Delete from the first line of paragraph 10.2.5 the word, "The" and substitute the words:

10.2.5 "Subject to paragraph 3.15.1, the"

GC 10.4 WORKERS' COMPENSATION

Add the following paragraphs 10.4.3, 10.4.4,and 10.4.5:

10.4.3 The contractor is referred to regulations, as applicable, under the Worker's Compensation Act of Nova Scotia.

10.4.4 Registration with Worker's Compensation Board shall be continuous during the contract. Should registrations be scheduled to expire during the contract period, the Contractor shall submit a copy of registration renewal one month prior to the expiration of the current certificate.

10.4.5 The Contractor shall furnish evidence of coverage under the Worker's Compensation Act, R.S.N.S. and a clearance Certificate providing proof of registration with Worker's Compensation Board prior to commencement of work. (A photocopy of the Contractors registration certificate is acceptable proof). On-going proof of good standing with the Worker's Compensation Board during the term of the contract is required.

GC 11.1 INSURANCE

Delete sentences and replace with the following in subparagraph 11.1.1.1:

11.1.1.1 "General liability insurance shall be maintained from the commencement of the work until one year from the date of Substantial Performance of the Work. Liability coverage shall be provided for completed operations hazards from the date of Substantial Performance of the Work, as set out in the certificate of Substantial Performance of the Work, on an ongoing basis for a period of 6 years following the Substantial Performance of the Work**" and replace with:** " General Liability Insurance or Wrap- Up Liability Insurance, (as detailed in the Information to Tenders section under "Insurance Requirements"), shall be maintained from the commencement of the work until final completion and acceptance of the work including the making good of faulty work or materials, except that coverage of completed operations liability shall in any event be maintained for twelve (12) months from date of Substantial Performance of the work as certified from the Consultant, and approved by the Owner".

Add the following subparagraphs 11.1.1.1.1, 11.1.1.1.2, and 11.1.1.2.1:

11.1.1.1.1 The general liability insurance to be maintained by the Contractor shall include Commercial General Liability Insurance covering Premises and Operations Liability, elevators, board form property damage, board from automobile, owners and contractors protective, blanket contractual, personal injury, completed operations liability contingent employers liability, cross liability clause, non-owned automobile liability, and a 30 day notice of cancellation clause.

11.1.1.1.2 All liability insurance policies shall be written in such terms as will fully protect the Contractor and

The School Board as an additional named insured.

11.1.1.2.1 Liability coverage of not less than two million dollars ($2,000,000) is required with regard to operations of owned automobiles.

Delete subparagraph 11.1.1.4 in its entirety and insert the following subparagraphs:

11.1.1.4 Broad Form (All Risks) Builders Risk Coverage - Prior to the commencement of any Work the Contractor shall maintain and pay for Broad Form (All Risks) Builders Risk Coverage in the joint names of The School Board and the Contractor totalling not less than one hundred percent (100%) of the total value of the Work done and materials delivered on the site (contract value), so that any loss under such policies of insurance will be payable to The School Board and the Contractor as their respective interests appear. The Builders

Risk Insurance shall include all materials related to the work while in transit or at other locations.

11.1.1.4.1 Should a loss be sustained under the Builders Risk Coverage, the Contractor shall act on behalf of The School Board and Contractor for the purpose of adjusting the amount of such loss with the insurance companies. As soon as such adjustment has been satisfactorily completed, the Contractor shall proceed to repair the damage and complete the Work and shall be entitled to receive from The School Board in addition to any sum due under the Contract, the amount at which The School Board interest has been appraised in the adjustment made with the insurance companies as referred to above, said amount to be paid to the Contractor as the Work of restoration proceeds. Any loss or damage which may occur shall not affect the rights and obligations of either party under the Contract except as aforesaid and except that the Contractor shall be entitled to a reasonable extension of time for the performance of the Work, as The School Board may decide.

11.1.1.4.2 Upon approval by The School Board of the Substantial Performance certificate issued by the Consultant, the Contractor's obligation to maintain Builder Risk Insurance shall cease and The School Board shall assume full responsibility for insuring the whole of the Work against loss or damage.

11.1.1.4.3 "Broad form" property insurance in the joint names of the *Contractor,* the *Owner* and the *Consultant*. The policy shall include as insureds all *Subcontractors* The Broad form" property insurance shall be provided from the date of commencement of the *Work* until the earliest of:

11.1.4.3.1 Ten (10) Calendar days after the date of *Substantial Performance of the Work;*

11.1.4.3.2 on the commencement of use or occupancy of any part or section of the *Work* unless such use or occupancy is for construction purposes, habitational, office, banking, convenience store under 465 square meter in area, or parking purposes, or for the installation, testing and commissioning or equipment forming part of the *Work*; and

11.1.4.3.3 when left unattended for more than thirty (30) consecutive calendar days or when construction activity has ceased for more than thirty (30) consecutive calendar days.

Paragraph 11.1.2 is clarified as follows:

11.1.2 Submit Certified true copies of each insurance policy to the Owner's Contract Authority within seven (7) working days after notification of award or in any event prior to payment of the first progress claim. Such copies shall be exclusive of information pertaining to premium or premium bases used by the insurer to determine the cost of the insurance. Prior to the commencement of any work, the Contractor shall file with the Owner a certified copy of each insurance policy and certificate required.

Delete 11.1.5 in its entirety and replace with the following:

11.1.5 Insurance contracts shall be procured from and the premiums paid to a resident agent of an insurance Company licensed to underwrite insurance in the Province of Nova Scotia.

Add the following paragraph 11.1.9:

11.1.9 All of the insurance policies shall contain a clause stating that no change in terms and conditions or cancellation may at any time be made without the full knowledge and consent of the owner.

GC 11.2 CONTRACT SECURITY

Add the following subparagraph 11.2.2.1:

11.2.2.1 "Bonds shall be procured from a Nova Scotia resident agent of an insurance company licensed to do business in Nova Scotia and shall be maintained in good standing and held by the Owner until one (1) year after Substantial Performance of the Work.

Add the following paragraph 11.2.3:

11.2.3 If a Certified Cheque is held as contract security it shall be in an amount equal to ten (10) percent (%) of the Contract Price. Supplement the Certified Cheque as necessary to maintain the amount equal to ten (10) percent (%) of the total amount payable (Contract Price plus HST).

.1 The Certified Cheque will be deposited at the chartered bank holding The School Board deposits.
.2 The School Board will return the cheque amount to the Contractor upon satisfactory completion of the contract and duration as specified in the Tender documents.
.3 Should Contractor default, total amount payable under the Certified Cheque will be the face value of the cheque plus all accrued interest.

.4 Payment for completion of work, due to failure of performance of the Contractor, shall include all reasonable obligations under the Contract, including architectural and engineering costs arising because of the default of the Contractor.

.5 Payment for labour and materials shall be limited to those who have a direct contract with the Contractor for the provision of labour and/or material (which includes equipment rental).

GC 12.3 INDEMNIFICATION

Add the following paragraph 12.1.1.3:

12.1.1.3 The Contractor shall indemnify and hold harmless the Consultant, its agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceeding by third parties that arise out of, or are attributable to, the Contractor's performance of the Contract, provided such claims are attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property, and caused by negligent acts or omissions of the Contractor or anyone for whose acts the Contractor may be liable, and made in writing within a period of six (6) years from the date of Substantial Performance of the Work, or within such shorter such period as may be prescribed by any limitation statute or the province or territory of the Place of Work.

GC 12.3 WARRANTY

Delete from the first line the word, "The" and substitute the words in paragraph 12.3.2:

12.3.2 "Subject to paragraph 3.15.1, the…"

Add the following paragraph 12.3.7:

12.3.7 Warranty repairs or replacements which arise during warranty period which affect the operation of the system shall be attended to immediately upon notification from the Consultant.

END OF SECTION 00 73 00

SECTION 00 73 10 - HRSB GENERAL TERMS & CONDITIONS

1. General

1.1. These Terms and Conditions, shall apply only to those documents (Quotations, Request for Proposals and Tenders, herein referred to as Public RFX or RFX) that reference them specifically. In the event of any conflict or disagreement between these Terms and Conditions and the RFX documents, the RFX documents have precedence and will be assumed to be correct.

1.2. These Terms and Conditions are intended to cover a wide range of procurements, including goods and services. As such, not all clauses will be applicable in all situations. If Suppliers have questions regarding any of these Terms and Conditions, they should contact the Halifax Regional School Board (HRSB) Procurement Division. To satisfy special requirements, supplementary Terms and Conditions may also apply to some acquisitions. If this is the case, the RFX documents will reference any such documents, in addition to these Terms and Conditions.

1.3. For the purpose of these Terms and Conditions HRSB intends to only contract with responsible Suppliers who are in the business of providing the goods and/or services submitted upon, and can provide proof that they can furnish satisfactory performance based on past work experience with HRSB, other companies, or government agencies and have the financial managerial, and resource capabilities for the size of project bid upon. Satisfactory performance includes meeting all of the requirements of the various federal and provincial regulations and agencies for the completion of work and making payment to sub-contractors in a timely basis.

1.4. All of the terms, conditions and/or specifications stated or referenced in the Solicitation are assumed to be accepted by the Bidder and incorporated in the Bid.

2. RFX Documents

2.1. RFX Documents should be obtained as indicated on the Cover Sheet of the tender document.

2.2. While HRSB has tried to ensure accuracy in the RFX documents, it is not guaranteed or warranted by HRSB to be accurate, nor is it necessarily comprehensive or exhaustive.

2.3. HRSB cannot ensure the accuracy of RFX documents obtained from any other source. (i.e. Construction Association of Nova Scotia (CANS), Nova Scotia Electronic Tendering Bulletin Board, Project Consultants, etc.).

2.4. All inquiries to this RFX are to be directed, in writing, to HRSB Procurement Division representative indicated in the RFX documents. Information obtained from any other source is not official and will not bind HRSB.

2.5. HRSB will assume that all Suppliers have resolved any questions they might have about the RFX and have informed themselves as to existing conditions and limitations, site restrictions, etc. before providing a RFX submission.

2.6. Nothing in the RFX is intended to relieve Suppliers from forming their own opinions and conclusions with respect to the matters addressed in the RFX or its associated documents.

2.7. In the event that HRSB Regional Office (33 Spectacle Lake Drive, Dartmouth) is closed (this includes partial day closures) due to inclement weather on the date and time of the RFX closing, the closing date and time will be extended one (1) business day. Bidders should note that closure of Schools does not necessarily mean the closure of the Board's Regional Office. Closures are detailed on HRSB website.

3. Verbal instructions: Any changes to RFX call, specifications, terms and conditions shall be stated in writing. Verbal statements made by employees or representatives of HRSB, whether or not they appear to have the proper authority, shall not be binding on HRSB.

4. Addenda: HRSB reserves the right to modify the terms of the RFX documents prior to closing, at its sole discretion by addenda.

4.1. HRSB Procurement Division will make every effort to ensure the information provided on HRSB.ca is complete and accurate, please report any omissions or discrepancies to the Procurement Division immediately. **Any**

questions or requests for clarification arising from omissions, discrepancies, or ambiguities, must be made in writing no later than five(5) working days prior to the closing date, not including the closing date. Replies to requests for clarification, if required, will be made in the form of written addenda, copies of which will be posted on www.HRSB.ca/tender no later than three (3) working days prior to the date of closing, not including the closing date.

4.2. By downloading files from the www.hrsb.ca, you will automatically become registered for the applicable RFX. HRSB Procurement Division will make reasonable efforts, strictly as a courtesy, to directly inform registered Suppliers of any addenda, **however it is the sole responsibility of each registered Supplier to ensure that they have all the documents associated with any RFX and, to this end, every registered Supplier should review HRSB Tender Web Site daily**. These documents must be downloaded from the www.hrsb.ca/tender or obtained from HRSB Procurement Division, as applicable. Suppliers must acknowledge receipt of all addenda(s) with their RFX Submission.

5. Suppliers Responsibility: Suppliers are solely responsible for their own expenses in preparing, delivering or presenting a RFX and for subsequent negotiations, if any, with HRSB. It will be the responsibility of the Supplier to acquire at the Suppliers cost, any RFX documents as indicated on the Cover Sheet of the tender document.

6. Existing Conditions: Suppliers will be deemed to have familiarized themselves with the existing conditions which may affect the performance of required goods, services and construction. No plea of ignorance of such conditions as a result of failure to make all necessary examinations will be accepted as a basis for any claims for extra compensation or an extension of time. Suppliers are to ensure that they understand the expected use for the requested goods, service and construction and submit their RFX submission accordingly.

7. RFX Submissions

7.1. RFX will close at the time, date and location specified in the RFX documents (Atlantic Time Zone).

7.2. All RFX submissions must be received in their entirety on or before the closing time specified. Suppliers are responsible for ensuring that their RFX submission, however submitted, is received on time and at the location specified.

7.3. RFX Submissions must be submitted on the forms provided or in such format as directed in the RFX documents. These forms must be legible, complete, filled out in ink, or by typewriter, with the signature in longhand and the completed form shall be without interlineations, alterations or erasures.

7.4. If an electronic transmission (i.e. Facsimile, e-mail or HRSB.ca upload) can be accepted, as detailed in the applicable RFX documents, it is the responsibility of the Supplier:

7.4.1. to ensure that the submissions are delivered on or before the closing time and date shown on the RFX documents;

7.4.2. that the correspondence is legible and properly transmitted; and

7.4.3. that the name and number of the RFX is clearly displayed.

7.5. Electronic transmission of a RFX submission cannot be used where original documents are required, e.g. bid bonds, certified cheques, samples, etc., or as may be otherwise stated in the RFX documents.

7.6. **Sealed RFX submissions** must be delivered to HRSB Receptionist, 1st floor, 33 Spectacle Lake Drive, Dartmouth, Nova Scotia, on or before the closing time and date shown on the RFX documents. The RFX Submission is to be submitted on the provided forms, signed (together with the required RFX security as applicable) in a sealed opaque envelope, clearly identified with Suppliers name, RFX identification number and name, and closing date on the outside of the envelope. RFX Submissions are date and time stamped upon receipt at the Procurement Division (not at any other location) by the Procurement date time stamp. Any submission received after the closing date and time shown on the RFX documents will not be accepted and will be returned to the Supplier unopened and deemed non-compliant.

7.7. **Facsimile submissions** received are date and time stamped by the Procurement Division Facsimile, no other time stamp will be considered. A facsimile submission received after the closing date and time shown on the RFX documents will not be accepted and shall be deemed non-compliant. **The facsimile number for the Procurement Department of HRSB is (902) 464-0161. Do not send RFX correspondence to any other fax number.**

7.7.1. Where specified, facsimile submissions are accepted for the convenience of the Supplier; HRSB cannot ensure the confidentiality or error-free receipt of facsimile submissions.

7.8. **Amendments/Withdrawn Submissions**

7.8.1. Submissions may be withdrawn or amended by written request (on company letterhead or equivalent), prior to RFX closing date and time, but cannot be altered or changed in any way after the RFX closing.

7.8.2. Facsimile transmissions modifying supplier provided information are acceptable when signed by a duly authorized officer or agent. Submission of such electronic transmissions is at the risk of the Supplier. HRSB assumes no liability for the receipt of the electronic transmissions or their proper inclusion with original RFX submission. An electronic submission must be submitted prior to closing time and date specified in the RFX documents.

7.8.3. An amendment to a RFX submission replaces any other RFX submission amendment previously submitted by the supplier; only the last of any RFX submission amendment received will be accepted.

7.9. All RFX submissions must be signed by an authorized representative of the entity.

7.10. HRSB's time clocks will be assumed to be correct in the event of dispute.

7.11. HRSB reserves the right in its sole discretion to clarify any RFX submission after closing by seeking further information from that Supplier, without becoming obligated to clarify or seek further information from any or all other Supplier. However, Suppliers are cautioned that any clarifications sought will not be an opportunity either to correct errors or change their Bids in any substantive manner.

8. **Brand Name:** Some terminology may be used that would imply or denote a particular supplier. Brand names may be utilized to designate the type and quality of the product requested. Such usage shall not to be construed as restrictive in any way. Suppliers must be prepared to provide samples if required.

9. **Substitute**

9.1. If the Supplier is offering an equivalent (similar) substitute product to those specified, unless a specific product is requested, the supplier must clearly identify this substitution and supply the manufacturer's name, product number and provide any technical information required so that HRSB can determine the acceptability of the substitute.

9.2. HRSB reserves the right to inspect or test any product bid to determine equivalency, and may require demonstrator or sample items in order to be able to evaluate the items proposed.

9.3. HRSB shall be the sole judge of the acceptability of any substitute or proposed equivalent.

9.4. Specifications may, for technical or logistical reasons, require that the items specified be supplied without substitution.

10. Warranty

10.1. The supplier must describe the duration, type (e.g. on-site, depot, ship-in or carry-in) and terms of the manufacturer's warranty on all goods. If the supplier provides any additional/supplementary warranty coverage, describe this as well.

10.2. If warranties can be upgraded or extended, identify the upgrade costs separately. Do not include warranty upgrade or extension costs in the price unless the RFX documents specifically states that the upgrade is a mandatory requirement.

11. Pricing

11.1. All prices must be extended and totaled, where practical to do so. RFX Submission may be rejected as incomplete if total figures are not provided. In the case of an error in the extension of prices, the unit prices shall prevail.

11.2. Prices must be in Canadian funds, and shall include all shipping, handling, freight, offloading, duty, insurance and any other charges, which are applicable at time RFX is awarded (FOB – Destination). HRSB will not assume responsibility for any goods or services until they have been delivered to the destination(s) specified in the Solicitation. It is the responsibility of the Supplier to find out from the appropriate authorities what rates and charges are applicable to this RFX. No extra charges will be paid by HRSB.

11.3. In the event that a number of Suppliers provide submission in substantially the same amount, HRSB may, at its discretion, call upon those Suppliers to submit further bids.

12. Permits and Taxes: It is the responsibility of the Supplier to ensure that quotations include all taxes, permits, and other charges required to supply the goods, services and construction. The successful Supplier is to comply with all codes, regulations, and by-laws and all government and applicable standards pertaining to the work and job-site including, and not limited to, the Nova Scotia Occupational Health and Safety Act and Regulations. HRSB is required to pay a Harmonized Sales Tax (HST) at a rate specified by the Province of Nova Scotia. This tax is to be shown as a separate line item.

13. Standards

13.1. All goods, services and construction supplied to HRSB shall, when standards are available, be certified in accordance with the applicable code(s), but not limited to:

13.1.1. Canadian Standards Association;

13.1.2. Canadian Government Standards HRSB;

13.1.3. Underwriters Laboratories of Canada; and

13.1.4. And all applicable Federal, Provincial and Municipal regulations and acts.

13.2. HRSB reserves the right to discontinue the purchase of any product/service that does not continue to meet the applicable standard(s).

14. Inspection: HRSB reserves the right to inspect any goods, services or construction supplied either during or after manufacture and delivery, and shall be the sole judge as to the acceptability of goods, services and construction to meet the needs of HRSB and fulfills the requirements as specified.

15. Rejection of RFX Submissions/Compliance:

15.1. Failure to comply with any of the mandatory terms or conditions contained or referenced in the RFX documents shall result in the rejection of the RFX submission.

15.2. HRSB specifically reserves the right to accept or reject any or all RFX submission and implies no obligation on HRSB to accept any RFX submission, a portion of any RFX submission or any RFX submission. HRSB reserves the right to cancel any RFX in its entirety and shall not be responsible, in any manner, for expenses incurred by the

Supplier for preparing a RFX submission. HRSB may award all or a portion of the work to one or more Suppliers. Without limiting the generality or any other provision hereof, HRSB reserves the right to reject or accept any RFX submission:

15.2.1. that contains any irregularity or informality;
15.2.2. that is not accompanied by the security documents required;
15.2.3. that contains an alteration in the quoted price that is not initialed by the or on behalf of the Supplier;
15.2.4. that is incomplete or ambiguous;
15.2.5. contains clauses additional to the RFX that are "qualified" or "conditional"; and/or
15.2.6. that does not strictly comply with the requirements contained in these instructions.

15.3. HRSB reserves the right to waive minor non-compliance where such non- compliance is not of a material nature in its sole and absolute discretion, or to accept or reject in whole or in part any or all RFX submissions, with or without giving notice. Such minor non-compliance will be deemed substantial compliance and capable of acceptance. HRSB will be the sole judge of whether a RFX submission is accepted or rejected.

15.4. HRSB reserves the right to accept or reject any or all RFX submission, not necessarily accept the lowest priced RFX submission, or to accept any RFX submission which it may consider to be in its best interest.

16. Evaluation criteria: If applicable, award of the RFX will be based on “Best Value” (which includes, but not limited to; price, discounts, product specifications, warranty, delivery, reference checks, etc.

17. Cancellation/no award

17.1. Issuing a RFX implies no obligation on HRSB to accept any submission, or a portion of any submission. The lowest or any RFX submission will not necessarily be accepted.

17.2. RFX’s may be cancelled in whole or in part by HRSB in its sole discretion when:

17.2.1. the RFX submission price exceeds the funds allocated for the purchase;
17.2.2. there has been a substantial change in the requirements after the RFX has been issued;
17.2.3. information has been received by the RFX after the RFX has been issued that the RFX believes has substantially altered the procurement;
17.2.4. there was insufficient competition in order to provide the level of service, quality of goods or pricing required.

17.3. If no compliant RFX submission is received in response to a RFX, the RFX reserves the right to enter into negotiations with one or more suppliers in order to complete the procurement.

17.4. HRSB will be the sole judge of whether there is sufficient justification to cancel any RFX.

17.5. No action or liability will lie or reside against HRSB in its exercise of its rights under this section.

18. Eligibility and Conflict of Interest

18.1. A RFX Submission may not be eligible for acceptance if current or past corporate or other interests of the Bidder may, in HRSB's opinion, give rise to a conflict of interest in connection with a project.

18.2. Suppliers are cautioned that acceptance of their RFX submission may preclude them from submitting a response on subsequent phases where a conflict of interest may arise. Suppliers should study the project implementation strategy to determine whether or not they plan to submit response on subsequent phases.

18.3. If the RFX submission covers the first phase of what may prove to be a multi-phased project, the successful Supplier on the initial phase may be permitted to respond on subsequent phases as long as, in HRSB's opinion, no conflict of interest would be created in performance of the work by that Supplier.

18.4. Sub-contracting to any firm or individual whose current or past corporate or other interests may, in HRSB's opinion, give rise to a conflict of interest in connection with this bid will not be permitted. This includes, but is not limited to, any firm or individual involved in the preparation of the RFX documents.

19. **Disputes:** In case of dispute as to whether or not an item or service quoted or delivered meets RFX requirements, the decision of HRSB, or its authorized representative, shall be final and binding on all parties.

20. **Exceptions:** A RFX submission shall be considered an agreement to all terms and conditions provided herein and in various RFX documents, unless specifically noted otherwise in the RFX documents.

21. **Irrevocable Offer:** A RFX submission represents an irrevocable offer, unless otherwise stated in the RFX documents and shall be valid for a period of ninety (90) days following the closing date for RFX submissions.

22. **Patent right and royalties:** The successful Supplier shall pay all royalties and patent license fees required for the performance of the work. The successful Supplier shall hold HRSB harmless from and against claims, demands, losses, costs, damages, action suits or proceedings arising out of the successful Supplier's performance of the Contract which are attributable to an infringement or an alleged infringement of a patent of invention by the successful Supplier or anyone for whose acts the successful Supplier may be liable.

23. **Assignment:** The successful Supplier shall not assign the Contract (or portion thereof) nor sub-contract without the prior written consent of HRSB, consent shall not be unreasonably withheld.

24. **Purchase Order:** Work by the Supplier will begin only with the issuance of HRSB's official purchase order and/or any Contract Documents as applicable. The purchase order number must appear on any/all invoices covering same. No work is authorized until the successful Supplier has received an official HRSB purchase order and/or required Contract Documents. HRSB accepts no responsibility for any work performed prior to the issuance of a purchase order and/or required Contract Documents.

25. **Delivery**
    - **25.1.** Where the RFX Document includes a mandatory delivery schedule, HRSB will assume that the Supplier can meet the requested schedule and is satisfied that the goods or services required will be available for delivery on the requested date(s).
    - **25.2.** If Suppliers wish to specify a delivery schedule different from that requested in the RFX document, they must provide specific delivery dates or a schedule in calendar days from the date a Purchase Order is issued. RFX Submission that do not meet the delivery schedule as requested in the RFX documents may be rejected.
    - **25.3.** Time is of the essence, and supplier's delivery schedule is legally binding. HRSB reserves the right to assess penalties or cancel awards to Suppliers who fail to meet their stated delivery or completion dates.

26. **Invoices**
    - **26.1.** All invoices are to be submitted quoting the Purchase Order number (as applicable). The H.S.T. number must be shown on each invoice. Invoices must include a description of the goods, services and construction provided with HRSB Work Order Numbers (where applicable). Invoices must also clearly indicate list price, discounts offered and net price, if applicable. All invoices are to be forwarded to:

      Halifax Regional School Board
      33 Spectacle Lake Drive
      Dartmouth, NS, B3B 1X7
      Attn: Accounts Payable
    - **26.2.** All Suppliers are required to maintain their tax status in good standing. In this regard, Suppliers are advised that verification of good standing with the Nova Scotia Minister of Finance and Revenue Canada (GST/HST) may be carried out prior to the award of a contract to a successful Supplier.

26.3. In order to maximize efficiencies, as well as to be more environmentally friendly, vendor payments are now being paid via EFT (Electronic Funds Transfer) direct deposit to vendor bank accounts. A vendor direct deposit form must be filled out with banking information for EFT payments.

27. Payment:

27.1. HRSB's normal payment terms are thirty (30) days from acceptance that the goods, services and construction meet the specifications. Alternative payment schedules may be proposed and are to be shown as an option and list any additional discounts to HRSB. Early payment discount terms (minimum period ten (10) days) may be considered in the evaluation of the RFX response. Payment of term discount invoices will be calculated from the date of the invoice or goods have been received, whichever is later. Discount terms must appear on the invoice.

27.2. The Supplier shall make application for payment at least monthly with the application based on progress or services provided during that month. HRSB will hold back ten percent (10%) of any payment until the lien periods have expired and the Supplier has provided HRSB with a complete release of any lien registered as a result of any work carried out by the Supplier, or any sub-contractor or supplier to the Supplier.

28. Right to offset: The successful Supplier agrees that HRSB may apply payments for goods, services and construction to any amount owing to HRSB by the Supplier or supplier including any related administration fees.

29. Confidentiality: The Supplier shall keep private, treat as being confidential, and not make public or divulge during, as well as after, the term on this Agreement, any information or material to which the Supplier or staff becomes privy as a result of acting under this Agreement without having first obtained HRSB's consent in writing.

30. Freedom of Information and Protection of Privacy (FOIPOP) Act and Personal Information International Disclosure Protection Act (PIIDPA)

30.1. As a public body, HRSB is subject to provincial legislation, Freedom of Information and Protection of Privacy (FOIPOP) Act. RFX submissions and associated documents are subject to disclosure and protection under this legislation. In the event an application for disclosure of information is made under FOIPOP, HRSB is subject to the disclosure and protection of information in accordance with that legislation. Suppliers are recommended to visit the following websites for more information on the Act: http://www.gov.ns.ca/just/IAP/default.asp and http://www.foipop.ns.ca/

30.2. The Province of Nova Scotia is required to comply with the Personal Information International Disclosure Protection Act (PIIDPA)(S.N.S 2006, c.3). The act creates obligations for the Province of Nova Scotia and its service providers when personal information is collected, used or disclosed. Requirements include limiting storage, access and disclosure of personal information to Canada, except as necessary or otherwise required by law. Suppliers are recommended to visit the following PIIDPA websites for more information on the Act: http://nslegislature.ca/legc/bills/60th_1st/3rd_read/b019.htm and http://www.gov.ns.ca/just/IAP/PIIDPAquest.asp#p01

30.3. The Supplier acknowledges and confirms that it is a "service provider" as defined in the Personal Information International Disclosure Protection Act, SNS 2006 c. 3 ("PIIDPA"), that the Supplier has read and understands its obligations as a service provider thereunder and that as a service provider It is legally bound by the obligations imposed on it by PIIDPA. It is a condition precedent to HRSB entering into the Agreement with the Supplier that the Supplier irrevocably undertakes covenants and agrees to be bound by and comply with the obligations imposed on it as a service provider under PIIDPA.

30.4. The Supplier further covenants, warranty and represents to HRSB that it will not at any time provide or allow the release of personal information to which it has access in its capacity as a service provider to HRSB in response to any "foreign demand for disclosure" or permit or allow the "unauthorized disclosure of personal information" as each of those terms are defined in PIIDPA.

30.5. The Supplier shall implement and strictly enforce security arrangements that will ensure that all personal information that it collects or uses on behalf of HRSB is protected at all times from unauthorized access or disclosure and shall confirm in writhing to HRSB, upon request, the details of such security arrangement. The Supplier also agrees to implement and enforce any additional security procedures as may be required by HRSB from time to time to protect the personal information that the Supplier collects on behalf of HRSB. HRSB shall be authorized, upon giving prior written notice to the Supplier, to enter the premises of the Supplier during normal business hours for the purpose of conducting an audit of the security arrangement referenced herein.

30.6. All personal information that the Supplier obtains or becomes aware of while providing services to HRSB is not and shall not be or be deemed to be the property of the Supplier. The Supplier acknowledges and agrees that it will not, either directly or indirectly, acquire any rights to use or own any such information other than the right to use it for the sole purpose of fulfilling its obligations to HRSB under the Agreement.

30.7. All RFX submissions become the property of HRSB. By providing a RFX submission, the supplier hereby grants HRSB a license to distribute, copy, print or translate the RFX submission for the purposes of the RFX. Any attempt to limit HRSB's right in this area may result in rejection of the RFX submission.

30.8. Suppliers RFX submission may be subject to disclosure under the Province's "freedom of information" legislation. By submitting a RFX submission, the Supplier agrees to the appropriate disclosure of the information supplied, subject to the provisions of the governing law. HRSB cannot guarantee the confidentiality of the complete content of any RFX submissions after the procurement has been awarded to the successful supplier.

30.9. During the delivery and installation of goods and/or services, the supplier or supplier's staff may have access to confidential information belonging to HRSB. Should this occur, the supplier must ensure that such information is not released to any third parties or unauthorized individuals; failure to comply may result in legal action being taken and/or the supplier's disqualification from any further RFX's issued by HRSB.

31. Indemnification: The Supplier shall indemnify and hold harmless HRSB, their agents, representatives and employees from and against all claims, demands, losses, costs, damages, actions, suits or proceedings arising out of, or resulting from the performance of this work, provided that any such claim is caused in whole or in part by the negligent act or omission of the Supplier, and sub-contractor, supplier, licensee, anyone directly or indirectly employed by any one of them or anyone for whose act any of them is liable, regardless of whether or not it is cause in part by a party indemnified hereunder.

32. Insurance: Unless otherwise stated, Commercial General Liability Insurance with policy limits of not less than two (2) million dollars ($2,000,000.00) must be filed with the Procurement Department of HRSB; such insurance shall be in the name of the Supplier and HRSB. The insurance must include non-owned automobile liability with policy limits of not less than two (2) million dollars ($2,000,000.00). All insurances are to be maintained in good standing for the duration of the Contract.

33. Termination for convenience: HRSB may terminate a contract, in whole or part, whenever HRSB determined that such termination is in the best interest of HRSB, without just cause giving sixty (60) days written notice to the proponent. However, in no event shall the proponent be paid an amount that exceeds the submitted price for the work performed.

34. Termination for default: When the proponent has not performed or has unsatisfactorily performed the contract, HRSB may terminate the contract for default. Upon termination for default, outstanding payment will be withheld at the discretion of HRSB. Failure on the part of the proponent to fulfill the contract obligations shall be considered just cause for termination of the contract. The proponent will be paid for work satisfactorily performed prior to termination, less any excess costs incurred by HRSB in re-procuring and completing the work.

35. Workers Compensation: Prior to commencing the work, the Supplier shall provide a current clearance letter from the Workmen's Compensation HRSB (WCB) and must maintain this coverage during the whole term of the Contract.

36. WHMIS: All controlled products supplies to HRSB must have approved Workplace Hazardous Materials Information System (WHMIS) supplier labels; Material Safety Data Sheets must also be supplied. Failure to comply with this requirement may result in rejection of any shipment, and may result in cancellation of the order and the return of goods to the supplier at the supplier's expense.

37. Health and Safety Act: The Supplier shall take every precaution to ensure that every employee, self-employed person and employer performing work in respect of the project complies with the latest revisions of the Nova Scotia Occupational Health and Safety Act and the Regulations. Halifax Regional School HRSB Occupational Health and Safety Policy BP 303.1, and all other safety measures as required by authorities having jurisdiction.

38. Site Safety Plan: Before being permitted access to the site to commence construction the Supplier may be requested provide HRSB with a written Project Specific Site Safety Plan. The Site Safety Plan provided shall be a written course of action that, through a pre-job evaluation, identifies and sets out specific actions to be taken to eliminate or control hazards associated with the work to be performed and to also deal with concerns or hazards that may develop during the course of the project. This Plan shall include, but not be limited to, identification of safety hazards anticipated during the project, solutions to those hazards, safety procedures, identification of designated safety officers and provision for safe access to the site for HRSB staff and or Consultants. Receipt and acceptance of the safety plan shall be mandatory prior to commencement of work.

39. Extension to the Broader Public Sector

39.1. HRSB may choose to allow the Broader Public Sector to purchase goods or services from some RFX's. The Broader Public Sector are generally permitted to purchase from "Standing Offers", which are contracts resulting from a RFX. Other RFXs may also be available to the Broader Public Sector; if so, the Solicitation documents will state this.

39.2. By submitting a response to a RFX, the Supplier agrees to extend the same pricing to other eligible Broader Public Sector institutions as per the terms and specifications in the Solicitation

40. Governing Laws and Trade Agreements

40.1. Unless the RFX documents specifically state otherwise, the RFX, all submissions, and any subsequent contracts will be construed and interpreted in accordance with the laws of the Province in which the Solicitation was issued.

40.2. RFX's subject to the Atlantic Procurement Agreement, the Agreement on Internal Trade, any other inter-provincial trade agreements, or any international trade agreements, will be specifically identified as such in the public notice and/or the Solicitation documents.

40.3. Information of any applicable trade or procurement agreements and/or legislation can be obtained by contacting HRSB Procurement Department.

40.4. Suppliers agree to comply with all applicable laws, regulations and standards, including all labour, occupational health & safety, and worker compensation requirements of the Province.

40.5. HRSB may consider and evaluate any RFX submission from other jurisdictions on the same basis that the purchasing authorities in those jurisdictions would treat a similar RFX submission from a supplier located in this Province. HRSB will be the sole judge of whether these conditions will be used and the extent to which they will be applied.

40.6. Suppliers registered to do business in any Atlantic Province can bid on RFX issued by any other Atlantic Province without having to satisfy any local registration or residency requirements.

40.7. Under Canadian law (and international agreements), your RFX submission must be arrived at separately and independently, without conspiracy, collusion or fraud; see: http://www.competitionbureau.gc.ca/internet/index.cfm?itemid=1243&lg=e for further information.

41. Other General Conditions

41.1. No RFX submissions shall be accepted from any person or corporation who, or which, has a claim or has instituted a legal proceeding against HRSB or against whom HRSB has a claim or has instituted a legal proceeding with respect to a previous contract, without prior approval of HRSB.

41.2. The Supplier shall perform the obligations of this Contract in a good and workmanlike manner in compliance with all applicable legislation in effect in Nova Scotia, and in accordance with industry standards and practice.

41.3. The Supplier shall be solely responsible for all means, methods, techniques and procedures necessary for performing the work required under this Contract.

41.4. All Suppliers must comply with the Nova Scotia Corporations Registration Act (CRA) or the Partnerships and Business Names Registration Act (PBNRA) as one of the conditions of doing business with the Province of Nova Scotia. In this regard, Suppliers are advised that verification of registration and good standing may be carried out prior to the final award of a contract to a successful Supplier. Suppliers residing outside Nova Scotia (which are not otherwise carrying on business in Nova Scotia) are expected to be registered in an equivalent manner in their respective jurisdictions.

41.5. Unless otherwise specified, all materials installed by the Supplier as part of this Contract shall be new and shall comply with the specifications and any applicable building codes. The Supplier is, at all times, responsible for correcting any defective work or materials at the Supplier's cost, and payment by HRSB to the Supplier does not relieve the Supplier of that responsibility.

41.6. Where applicable, the end user must be provided with complete operation manuals, warranty registration forms, user licenses/ authentications and/or other associated documentation normally provided by the manufacturer, reseller, installer and/or consultant.

41.7. The Supplier shall, at all times, keep HRSB premises free from accumulations of waste and rubbish. Disposal of all waste and rubbish shall be at approved waste disposal sites.

41.8. If the Supplier files for bankruptcy, becomes insolvent or fails to perform the Supplier's obligations under this Contract in a timely and workmanlike manner, HRSB may, by written notice, immediately terminate the employment of the Supplier and the Supplier shall be entitled only to the value of work performed and materials supplied up to the date of the termination.

41.9. The Supplier shall not permit smoking by any of its employees or sub-contractors on HRSB property and will act in accordance to the Halifax Regional School HRSB policy BP101.3 Tobacco-Free Schools and Workplaces.

41.10. The Supplier warrants its work and materials for a minimum of twelve (12) months after the date of substantial completion.

41.11. The Supplier, if performing work on HRSB property may be required to provide a safety program certified with the Nova Scotia Construction Safety Association or with an approved alternate safety association and/or program.

41.12. HRSB reserves the right to split an award amongst Suppliers as deemed in the best interests of HRSB.

END OF SECTION 00 73 10

SECTION 01 11 00 - HRSB SUMMARY OF WORK

1. Project Location & General Scope

1.1. ***HALIFAX WEST HIGH SCHOOL, 283 THOMAS RADDALL DR***

1.2. Scope: Refer to Section 00 00 15 for scope and schedule information.

2. Contract Documents

2.1. Work will be performed under CCDC-2, 2008 contract.

3. General Conditions

3.1. Halifax Regional School Board and CCDC-2, 2008, form an integral part of this Project Manual, a copy of which is bound herein.

4. Project Manual

4.1. Sections of the Project Manual are numbered in conformance with the Master List of Section Titles and Numbers, CSC Document 004E, published jointly by Construction Specifications Canada and The Construction Specifications Institute (USA). Sections are arranged in their standard format.

4.2. Sections are written as units of the Work which have been assigned numbers in conformance with the CSC/CSI system. They are arranged in sequence for this Manual. Gaps in the order of numerical sequence do not indicate that a section has been inadvertently omitted from this Manual, but, rather that a Section is not required for completion of the Work.

4.3. Wherever the project location building name occurs in the Contract Documents it shall be taken to mean all work included in the Contract.

4.4. Wherever in the Contract Documents the words "approval", "approved", "direction", "directed", "selection", "selected", "request", "requested", "report", and similar words are used, such approvals, directions, selections, requests and reports shall be given by the HRSB unless specifically stated otherwise.

4.5. Wherever in the Contract Documents the word "provide" is used in any form, it shall mean that the Work concerned shall include both supply and installation of the products required for completion of that part of the Work.

4.6. Wherever in this Project Manual it is specified that Work is to proceed or to meet approval, direction, selection or request of jurisdictional authorities or others, such approval, direction, selection or request shall be in writing.

5. Errors & Omissions

5.1. If errors or omissions are observed in the Contract Documents, immediately notify the HRSB Procurement in writing of all such errors or omissions. In the event no such notice is given, the Contractor will be held responsible for the results of any such error or omission and the cost of rectifying the same.

6. Division 1

6.1. The provisions of all Sections of **Division 1** shall apply to each Section of this Specification**.**

7. Wage Rates

7.1. Pay all employees engaged on the Work a wage not less than the minimum wage per hour as set out by the Province of Nova Scotia. For overtime work beyond 48 hours in any one week, pay no employee at a rate of less than one and one-half times the minimum wage per hour noted above. Provide for these wage rates in tendered contract amount.

8. Work Performed Under Separate Contracts

8.1. Work not to be included in the Contract, as noted "NIC" on the Drawings, shall be governed by Article 37, Separate Contracts, of General Conditions of Contract.

8.2. Furniture installation will be carried out by others.

8.3. Computer installation will be carried out by others.

9. Project Schedule

9.1. Refer to Section 00 00 15 Description of Work.

9.2. Existing services (mechanical & electrical) will need to be maintained through the renovations.

9.3. During construction, all life safety systems as well as mechanical and electrical systems must be in active, usable condition to permit the school to operate or alternate methods used to ensure the safe operation of the school as directed by HRSB project representative.

9.4. As construction progresses revise the schedule to compensate for any delays or unforeseen activities so as to maintain the contract completion date. Each schedule submission is to be complete with a statement indicating the changes made, the reason they were changed and confirmation that the project completion date will not change. The above schedule information is to be submitted monthly or more often if necessary.

10. Site Progress Records

10.1. Maintain at site a permanent written record of progress of Work. Make the record available at all times with copies provided when requested. Include in record each day:

10.1.1. Commencement and completion dates of the Work of each trade in each area of Project.

10.1.2. Attendance of Contractor's and Subcontractor's Work forces at Project and a record of the work they perform.

10.1.3. Visits to site by representatives of the Owner, Engineer, jurisdictional authorities, Contractor, Subcontractors, and suppliers.

10.2. Maintain a progress chart in approved format. Show on chart proposed Work schedule and progress of Work by Contractor and Subcontractor.

11. Examination

11.1. Site:

11.1.1. Examine site, and ensure that site conditions have been examined, that all are fully informed on all particulars which affect Work thereon and at the place of construction, and in order that construction proceeds competently and expeditiously.

11.1.2. Ensure by examination that all physical features, and working restrictions and limitations which exist are known.

11.2. Previously Completed Work:

11.2.1. Verify dimensions of existing Work in place before construction of Work to be incorporated with it.

11.2.2. Verify that previously executed Work and surfaces are satisfactory for construction, and that performance of subsequent Work will not be adversely affected.

11.2.3. Commencement of Work will constitute acceptance of site conditions and previously executed Work as satisfactory.

11.2.4. Report to Engineer defects in prior Work which will affect quality of subsequent Work, or construction schedule.

11.3. Construction Measurements:

11.3.1. Before commencing installation of Work, verify that its layout is accurate in accordance with intent of Drawings, and that locations, elevations, and clearances to adjacent infrastructure are maintained.

11.3.2. If Work is installed in wrong location, rectify it before other Work concerned proceeds.

12. PROTECTION OF WORK, PROPERTY & PERSONS

12.1. Include in Work necessary methods, materials, and construction to ensure that no damage or harm to Work, materials, property and persons results from the Work of this Contract. Temporary facilities relating to protection are specified in Section 01 52 00.

12.2. Protect, and if damaged make good, adjacent private and public property.

12.3. Keep surfaces, on which finish materials will be applied, free from grease, oil, and other contamination which would be detrimental in any way to the application of finish materials.

12.4. Protect finished surfaces of completed Work from damage by restriction of access or by use of physical means suitable to the material and surface location. Establish with each Subcontractor the suitability of such protection in each case.

12.5. Protect existing underground infrastructure, mechanical, electrical, telephone and similar services from damage. If necessary, relocate active services to ensure that they function continuously in safety and without risk of damage.

12.6. Cap off and remove unused utility services encountered during Work after approval is given by the utilities concerned or jurisdictional authorities, whichever may apply. Relocation, removal, protection and capping of existing utility services shall be performed only by the applicable utility and of other services by licensed mechanics.

12.7. To prevent soiling or damage to finish flooring where pedestrian traffic occurs after the flooring has been installed, install and maintain 6 mil. polyethylene membrane or reinforced kraft paper temporary protection, secured in place and with joints sealed by reinforced pressure sensitive tape.

12.8. Install plywood panels of minimum ¼" thickness over completed finish flooring materials, on which further construction Work is performed by other trades or delivery of products is made, or both. Seal joints between panels with reinforced pressure sensitive tape.

12.9. Prevent spread of dust beyond the construction zone by wetting, or by other approved means, as it accumulates.

12.10. Outside work areas shall be appropriately demarked and/or surrounded by rigid chain link panels or fencing to prevent unauthorized entry to the work area. Any area of roof having work completed is to be covered below with this fencing approximately 10' from the edge of the building. It is to be maintained at all times throughout the project. All waste disposal bins are to be fenced in using the same type of fencing as indicated above during working hours. After working hours, all waste disposal bins shall be located a minimum of 25 feet from any structure. Any windows where the debris chute is located are to be covered. All entrances below the roof area are to have covered scaffolding erected to ensure a safe travel path to a distance of ten

feet from edge of building. All workers shall contain their activity to the work site area. Access to the school shall only be allowed as planned in coordination with HRSB Operations and the school administration.

12.11. The contractor is responsible for security of all project materials and access to the project site and/or the school through the project site at all times until completion of work and acceptance of the finished project by HRSB. Such additional security costs for security personnel or other means of security as deemed necessary by the contractor will be the sole responsibility of the contractor. The HRSB will provide security personnel up to and including the Substantial Completion date as noted on the bid submission documents.

12.12. The contractor shall keep the work site free from accumulated debris caused by the employees or work and shall remove all debris at the end of each work shift. Debris shall not be deposited in HRSB controlled garbage and/or recycling containers.

12.13. All waste materials and debris created during demolition and/or construction shall be disposed of in a dumpster provided by the contractor, to be removed at the end of the construction project, using a methodology that is in compliance with the applicable HRM solid waste by laws. Otherwise, the material must be removed and disposed of off-site at the end of each working day. The waste materials may not be stored on site unless they are held in an approved project dumpster no closer than twenty five (25) feet from any structure.

12.14. All temporary structures such as portable washroom facilities, materials storage trailer, work trailer, debris dumpster, vehicles, etc., shall be located a minimum of (25) twenty-five feet from the school building.

12.15. Where applicable, a hot work permit will be required to be completed prior to commencement of work and all conditions of the permit must be maintained until completion of hot work. A copy of the hot work permit signed by the contractor representative shall be provided to HRSB upon completion of each hot work session. Contractor must assign a designated fire watch as noted on the permit document who shall remain on site for three hours after completion of each hot work session.

12.16. A school washroom will be designated for use where appropriate. However, protection of the surfaces as indicated above must be maintained. It should also be noted that access to the building during summer months will be limited for security reasons. Contractor is responsible to provide temporary portable washroom facilities for general use of contractor staff.

12.17. Access to Interior of School - All interior access is to be scheduled with the PM. This will allow for notice to the school admin., custodial and possible scheduling of a security guard for after hour access.

12.18. Adhesives / Torch Work - All adhesive use and torch work must be completed after school

hours.

13. Cleaning

13.1. Ensure that during and after construction the public streets and existing asphalt parking lot are cleaned as required.

14. Salvage

14.1. Unless otherwise specified, salvaged material resulting from construction, and surplus materials and construction debris shall become property of Contractor, who must dispose of it away from Site.

15. Site Limitations

15.1. Since the existing building will be occupied during the Work (in accordance with the Phasing Schedule) the Architect will designate the precise areas on the site which may be utilized for work and storage, and where personnel will be permitted to be present. Refer also to Drawings. Allow for hoarding to secure construction areas from occupied portions of the Building and Site.

15.2. All access to the construction site is to be coordinated with the Project Manager for HRSB and communicated at the pre-construction meeting.

15.3. Any Work carried out in the building is to be carried out during hours approved by the School Administration.

15.4. Any disruption to services within the building must occur during hours approved by School Administration.

15.5. Any Work which may have an adverse affect on the occupancy functions, must have prior approval of the School Administration and **may** require scheduling during off-hours.

16. Security Regulations

16.1. Perform Work in conformance to the security regulations of the building as directed by the Project Manager for HRSB.

17. Project Identification

17.1. No project sign is required on this Project.

18. Owner's Occupancy

18.1. The Owner reserves the right to occupy and use portions of the Project, whether partially or

entirely completed, or whether completed on schedule or not, provided such occupancy does not interfere with the Contractor's continuing Work.

18.2. Partial occupancy or installation by the Owner of his equipment shall not imply acceptance of the Project in whole, or in part, nor shall it imply acknowledgement that terms of the Agreement are fulfilled.

END OF SECTION 01 11 00

SECTION 01 11 25 - PRICES

1. General

1.1. Prices included in the Contract shall be complete for the applicable Work, and shall include for each price:

1.1.1. Expenditures for wages and for salaries of workmen, engineers, superintendents, draftsmen, foremen, timekeepers, accountants, expeditors, clerks, watchmen and such other personnel as may be approved, employed directly under the Contractor and while engaged on the applicable Work at the site and expenditures for travelling and board allowances of such employees when required by location of the applicable Work or when covered by trade agreements and when approved; provided, however, that nothing shall be included for wages or salary of the Contractor if an individual, or of any member of the Contractor's firm if the Contractor is a firm or the salary of any officer of the Corporation if the Contractor is a corporation, unless otherwise agreed to in writing.

1.1.2. Expenditures for material used in or required in connection with the construction of the applicable Work including material tests and required by the laws or ordinances of any authority having jurisdiction and not included under Subparagraph .9.

1.1.3. Expenditures for preparation, inspection, delivery, installation and removal of materials, equipment, tools and supplies.

1.1.4. Temporary facilities as required for the applicable Work.

1.1.5. Travelling expenses properly incurred by the Contractor in connection with the inspection and supervision of the applicable Work or in connection with the inspection of materials prepared or in course of preparation for the applicable Work and in expediting their delivery.

1.1.6. Rentals of all equipment whether rented from the Contractor or others, in accordance with approved rental agreements including any approved applicable insurance premiums thereon and expenditures for transportation to and from the site of such equipment, costs of loading and unloading, cost of installation, dismantling and removal thereof and repairs or replacements during its use on the applicable Work, exclusive of any repairs which may be necessary because of defects in the equipment when brought to the Work or appearing within thirty (30) days thereafter.

1.1.7. The cost of all expendable materials, supplies, light, power, heat, water and tools (other than tools customarily provided by tradesmen) less the salvage value thereof at the completion of the applicable Work.

1.1.8. Assessments under the Workmen's Compensation Act, the Unemployment Insurance Act, Canada Pension Act, statutes providing for government hospitalization, vacations with pay or any similar statutes; or payments on account of usual vacations made by the Contractor to his employees engaged on the applicable Work at the site, to the extent to which such assessments or payments for vacations with pay relate to the Work covered by the specified price; and all sales taxes or other taxes where applicable.

1.1.9. The amounts of all Subcontracts related to the specified price.

1.1.10. Premiums on all insurance policies and bonds called for under this Contract as related to the specified price.

1.1.11. Royalties for the use of any patented invention on the applicable Work.

1.1.12. Fees for licences and permits in connection with the applicable Work. No Building Permit is required for the project.

1.1.13. Duties and taxes imposed on the applicable Work.

1.1.14. Such other expenditures in connection with the applicable Work as may be approved.

1.1.15. Provided always that except with the consent of the Owner, the above items of cost shall be at rates comparable with those prevailing in the locality of the Work.

END OF SECTION 01 11 25

SECTION 01 11 41 - PROJECT COORDINATION

1. Requirements Included

1.1. Each Trade Contractor's responsibilities include the coordination of Work within his own Contract and with the Work of other Contracts.

2. Related Requirements

2.1. Project Meetings: Section 01 31 19

2.2. Submittals: Section 01 33 00

3. Description

3.1. Coordinate Work on which subsequent Work depends to facilitate mutual progress, and to prevent conflict between parts of the work.

3.2. Ensure that each Section makes known for the information of the Construction Manager and other Sections, the environmental and surface conditions required for the execution of its Work, and the sequence of others Work required installation of its Work.

3.3. Ensure that each Section, commencing Work, and that each Section is assisted in the execution of its preparatory Work by Sections depending upon its preparation.

3.4. Deliver materials supplied by one Section to be installed by another well before the installation begins.

3.5. Sections giving installation information in error, or too late to incorporate in the Work, shall be responsible for having Work done which was thereby additionally made necessary.

3.6. Coordinate warranty conditions of interconnected Work to ensure that full coverage is obtained.

3.7. Remove work installed in error which is unsatisfactory for subsequent Work.

4. Cutting And Patching

4.1. Include under Work of this Section all cutting and patching of asphalt required by the Work.

4.2. Finish new surfaces flush with existing surfaces.

4.3. Cut and patch as required making work fit.

4.4. Make cuts with clean, true, smooth edges.

4.5. Patching of existing or new asphalt shall be performed only by workmen with expertise in that particular trade and who normally perform that Trade.

4.6. Replace, and otherwise make good, damaged or defective Work. If required by the Construction Manager.

4.7. Do not endanger Work or property by cutting, digging, or similar activities. No Section shall cut or alter the Work of another Section unless approved by the Section which has installed it.

4.8. Cut and drill with true smooth edges and to minimum suitable tolerances.

4.9. If required, before cutting, drilling, or sleeving structural load bearing elements, obtain approval of location and methods.

4.10. Cutting, drilling and sleeving of Work shall be done only by the Section which has installed it. The Section requiring drilling and sleeving shall inform the Section performing the Work of the location and other requirements for drilling and sleeving. The Contractor shall directly supervise performance of cutting and patching.

4.11. Cutting and Patching for Holes Required by Mechanical & Electrical Work:

4.11.1. Include under Work of Mechanical Divisions cutting or provision of holes up to 8" in diameter and related patching.

4.11.2. Include under Work of this Section holes and other openings required by the work of Mechanical Divisions which are larger than 8" in diameter or least dimension, and chases, bulkheads, furring and required patching. This Section shall be responsible for determination of Work required for holes in excess of 8" diameter or least dimension.

4.11.3. Include under the Work of Electrical Divisions all cutting or provision of holes and related patching for the Work of that Division.

4.12. Include under Work of this Section all other cutting and patching required by the Work except as described in Clause .11 above.

4.13. Patching or replacement of damaged Work shall be done by the Subcontractor under whose Work it was originally executed, and at the expense of the Subcontractor who caused the damage.

4.14. Make patches invisible in final assembly.

5. Quality Assurance

5.1. Requirements of Regulatory Agencies:

5.1.1. Make known and coordinate the requirements of jurisdictional authorities, as made explicit by the Contract Documents, and by representatives of such authorities

5.2. Source Quality Control:

5.2.1. Ensure that Work meets specified requirements

5.2.2. Schedule, supervise and administer inspection and testing as specified in Section 01 45 00.

5.3. Job Records:

5.3.1. Maintain job records and ensure that such records are maintained by subcontractors.

6. Submittals

6.1. Prepare a Project schedule in accordance with Section 01 33 00, and ensure that all subcontractors and suppliers are aware of the details of this schedule, and progressively of their general compliance with the schedule.

6.2. Become aware of the required submittals specified in each Section, and expedite submission of such submittals so as not to hinder the Project Schedule.

6.3. Review submittals and make comments as specified in Section 01 33 00.

7. Job Conditions

7.1. Ensure that Work proceeds under conditions meeting specified environment and job safety requirements

7.2. Ensure that protection of adjacent property and the Work is adequately provided and maintained to meet specified requirements.

8. Product Delivery, Storage And Handling

8.1. Site has limited spaces for storage, only delivery of materials agreed upon by the Construction Manager will be allowed. Comply with Construction Manager's allocations. Any requirement for modifications to the building in order to allow delivery and storage of the materials to complete this work is the responsibility of the contractor.

8.2. Schedule delivery of products & removal of material with Construction Manager.

8.3. Make available areas for storage of products and construction equipment to meet specified requirements, and to ensure a minimum of interference with progress of the Work and relocations.

8.4. Trade Contractor to provide flag persons, traffic signals, barricades and Flares/lights/lanterns as required to perform the Work and to protect the public.

8.5. Material and Waste - Deliveries and Removals - Must be coordinated to be completed 30 minutes after school dismissal where applicable.

END OF SECTION 01 11 41

SECTION 01 31 19 – PROJECT MEETINGS

1. Pre-Award Meeting

1.1. A Pre-award meeting will be held at which time the following will be addressed:

1.1.1. Owner and HRSB's functions.
1.1.2. The Consultant and the Consultant's functions.
1.1.3. The General Contractor and the General Contractor's functions.
1.1.4. Documentation requirements from the General Contractor.
1.1.5. Obligee for Performance and Payment Bonds from Sub-contractors.
1.1.6. Progress Claims.
1.1.7. CO's & CCO's.
1.1.8. Construction Schedule.
1.1.9. Project Start-up.
1.1.10. Job Meetings.
1.1.11. Superintendent – General Contractor's Representative.
1.1.12. Design / Administration authority.
1.1.13. Owner's Representative.
1.1.14. Special Consultants.
1.1.15. Quality of Workmanship.
1.1.16. Accountability.
1.1.17. Harmonized Sales Tax.
1.1.18. Contract Close-out Documentation.

2. Preconstruction Meeting

2.1. Within fifteen (15) days after award of Contract, arrange a meeting between the, Consultant, Subcontractors, Project Superintendents, Inspection and Testing Company Representatives, and representatives of others whose coordination is required during construction.

2.2. Discuss at the meeting the means by which full cooperation and coordination of the participants during construction can be achieved.

2.3. Document the responsibilities and necessary activities of the participants during construction as discussed, and distribute to each participant.

2.4. Establish procedures for maintenance and completion of Project record drawings specified in Section 01 77 00.

2.5. Review and establish methods of maintaining life safety and egress for the school occupants. Communicate these methods thoroughly with the School Principal.

3. Progress Meeting

3.1. Invite representatives of HRSB, to attend twice monthly site meetings called by the Contractor during the progress of the Work.

3.2. Inform HRSB of each meeting and of proposed agenda a minimum of five (5) days before meeting.
3.3. Submit proposed schedule of site meetings to Engineer and Owner.
3.4. Record, prepare and distribute minutes of each meeting to HRSB and to each other participant within 72 hours of meeting.
3.5. Ensure that all representatives who attend meetings have the authority to conduct business on behalf of firms they represent.
3.6. Details of Progress Meetings to be discussed at the project start-up meeting.

4. Suggested Agendum (Preconstruction Meeting)

4.1. Distribution and discussion of:
4.1.1. List of major subcontractors and suppliers.
4.1.2. Projected Construction Schedules.
4.2. Critical work sequencing.
4.3. Major equipment deliveries and priorities.
4.4. Project Coordination:
4.4.1. Designation of responsible personnel.
4.5. Procedures and Processing of:
4.5.1. Field decisions
4.5.2. Proposal requests
4.5.3. Submittals
4.5.4. Change orders
4.5.5. Applications for Payment.
4.6. Adequacy of distribution of Contract Documents.
4.7. Procedures for maintaining Record Documents.
4.8. Use of premises:
4.8.1. Office, work and storage areas.
4.8.2. Owners requirements.
4.9. Construction facilities, controls and construction aids.
4.10. Safety/Tool Box Meetings.
4.11. Security procedures.
4.12. Housekeeping procedures.
4.13. Egress/life safety procedures

5. Suggested Agendum (Progress Meetings)

5.1. Review and approval of minutes of previous meeting.
5.2. Safety meeting minutes.
5.3. Review of work progress since previous meeting.
5.4. Field observations, problems, conflicts.

5.5. Problems which impede Construction Schedule.
5.6. Review of off-site fabrication, delivery Schedules.
5.7. Corrective measures and procedures to regain projected schedules.
5.8. Revisions to Construction Schedules.
5.9. Maintenance of quality standards.
5.10. Pending changes and substitutions and effect on Construction Schedule.
5.11. Other Business.

6. Attend, with representatives of HRSB twice monthly meetings with the School Administration to review construction activities and concerns of Building Occupants.
7. Quarterly meetings with Contractor and School Board / User during Warranty Period including major sub-trade contractors.
8. Dates for meetings will be set at time of completion.

END OF SECTION 01 31 19

SECTION 01 33 00 – SUBMITTAL PROCDURES

1. General Requirements

1.1. Make submittals specified in this Section to Consultant unless otherwise specified, with additional submissions made, in manner he directs, to other parties involved with construction of the Project as their interests are concerned. These parties are, but shall not be restricted to, consultants, jurisdictional authorities, and Subcontractors whose Work must be coordinated with Work related to Submittals.

1.2. Ensure that submissions are made to allow sufficient time for review without the construction schedule being delayed.

2. Document Submissions Required

2.1. At Commencement of Contract:

2.1.1. Performance and Payment Bonds.

2.1.2. Public Liability and Property Damage Insurance Certificates.

2.1.3. List of Subcontractors by firm name.

2.1.4. Construction Schedule and other required schedules and estimates.

2.1.5. Site Specific Safety Plan/Safety Policy.

2.1.6. Workers' Compensation Board status.

2.2. During Construction:

2.2.1. Bi-weekly progress reports.

2.2.2. Job meeting reports and minutes.

2.2.3. Updated construction schedules.

2.2.4. Shop drawings as required.

2.2.5. Inspection and test reports.

2.2.6. Daily communication of Hot Work Permits as needed.

2.3. Submissions at completion of Work are specified in Section 01 77 00, Contract Closeout.

3. Administrative

3.1. Submit to Consultant submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time no claim for extension by reason of such default will be allowed.

3.2. Do not proceed with Work affected by submittal until review is complete.

3.3. Present shop drawings, product data, samples and in Imperial units.

3.4. Review submittals prior to submission to 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 requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

3.5. Notify Consultant in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

3.6. Verify field measurements and affirm that affected adjacent work is co-ordinated.

3.7. Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.

3.8. Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant's review.

3.9. Keep one review copy of each submission on site.

4. Construction Schedules

4.1. Submit proposed construction schedule at beginning of Project, as specified in Project Documents.

4.2. As construction progresses, submit up-dated construction schedules as specified in Project documents.

5. Shop Drawings And Product Data

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

5.2. Submit drawings stamped and signed by professional consultant registered or licensed in Province of Nova Scotia of Canada.

5.3. 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 co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

5.4. Allow seven (7) days for Consultant's review of each submission. Do not proceed with work involving relevant products until completion of shop drawing review.

5.5. Adjustments made on shop drawings by Consultant are not intended to change Contract Price. If adjustments affect value of work, state such in writing to Consultant prior to proceeding with work.

5.6. Make changes in shop drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of revisions other than those requested.

Accompany submission with transmittal letter, in duplicate, containing:

5.6.1. Date

5.6.2. Project title and number

5.6.3. Contractor's name and address

5.6.4. Identification and quantity of each shop drawing, product data and sample.

5.6.5. Other pertinent data.

5.7. Submission to include:

5.7.1. Date and revision dates.

5.7.2. Project title and number.

5.7.3. Name and address of:

5.7.3.1. Subcontractor.

5.7.3.2. Supplier.

5.7.3.3. Manufacturer.

5.7.4. Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

5.7.5. Details of appropriate portions of Work as applicable:

5.7.5.1. Fabrication.

5.7.5.2. Layout, showing dimensions, including identified field dimensions, and clearances.

5.7.5.3. Setting or erection details.

5.7.5.4. Capacities.

5.7.5.5. Performance characteristics.

5.7.5.6. Standards.

5.7.5.7. Relationship to adjacent work.

5.8. After Consultant's review, distribute copies.

5.9. Submit for review one electronic copy in PDF file format of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

5.10. Submit electronic copies of product data sheets for brochures for requirements requested in specification Sections and as requested by Consultant where shop drawings will not be prepared due to standardized manufacture of product.

5.11. Submit electronic copies of test reports for requirements requested in specification Sections and as requested by Consultant.

5.11.1. Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

5.11.2. Testing must have been within three (3) years of date of contract award for project.

5.12. Documentation of testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

5.13. Delete information not applicable to project.

5.14. Supplement standard information to provide details applicable to project.

5.14.1. If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies 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 same procedure indicated above, must be performed before fabrication and installation of work may proceed.

5.14.2. Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of work of sub-trades.

5.15. Shop Drawings are specified for submission under the following:

Section 03 20 00 Concrete Reinforcement
Section 05 12 23 Structural Steel
Section 05 31 00 Steel Deck
Section 05 50 00 Metal Fabrications
Section 06 10 11 Rough Carpentry
Section 06 40 00 Architectural Woodwork
Section 07 41 43 Aluminum Composite Panels
Section 07 46 13 Preformed Metal Siding
Section 07 55 00 Modified Bitumen Roofing System & Flashing
Section 07 84 00 Fire Stopping and Smoke Seals
Section 08 11 14 Steel Doors & Frames
Section 08 11 16 Aluminum Doors & Frames
Section 08 14 10 Wood Doors
Section 08 50 50 Aluminum Windows
Section 08 62 11 Vinyl Windows
Section 08 71 10 Door Hardware
Section 09 22 16 Non-Load Bearing Wall Framing
Section 09 30 13 Ceramic Tile
Section 10 11 13 Communication Boards

Section 10 11 23 Tackboards
Section 10 14 53 Traffic Signs
Section 10 28 10 Toilet & Bath Accessories
Section 10 50 00 Miscellaneous Specialties
Section 11 40 11 Food Services Catalogued & Custom Equipment
Section 12 21 13 Horizontal Blinds
Section 12 21 16 Roller Shades
Section 14 42 13 Wheelchair Platform Lift

All pre-manufactured Mechanical & Electrical items as noted in Mechanical & Electrical Divisions.

6. SAMPLES

6.1. Submit for review samples in duplicate as requested in respective specification Sections, as requested by the Consultant. Label samples with origin and intended use.

6.2. Deliver samples prepaid to Consultant's business address.

6.3. Notify Consultant in writing, at time of submission of deviations in samples from requirements of Contract Documents.

6.4. Adjustments made on samples by Consultant are not intended to change.

6.5. Make changes in samples which Consultant may require, consistent with Contract Documents.

6.6. Reviewed and accepted samples will become standard of workmanship and material against which installed work will be verified.

6.7. Samples are specified for submission under the following Sections:

Section 07 41 43 Aluminum Composite Panels
Section 07 46 13 Preformed Metal Siding
Section 08 14 10 Wood Doors
Section 08 50 50 Aluminum Windows
Section 09 30 13 Ceramic Tile
Section 09 51 13 Acoustical Ceiling Units
Section 09 65 19 Resilient Tile Flooring
Section 12 21 13 Horizontal Blinds
Section 12 21 16 Roller Shades

Refer to Mechanical & Electrical Divisions for sample requirements in those Trades.

7. Record Drawings

7.1. Record, as the Work progresses, changes and deviations in the location of Work concealed by the finished Work, and such other approved changes that occur during progress of Work, to ensure that an accurate record is provided for future maintenance and alterations.

7.2. White prints will be provided by the School Board for use in preparing record drawings. Record changes in the Work on these prints in red ink.

7.3. Dimension location of concealed Work in reference to building walls, and elevation in reference to floor elevation. Indicate at which point dimension is taken to concealed Work. Dimension all terminations and offsets of runs of concealed work.

7.4. Record work constructed differently than shown on Contract Documents, changes in the work caused by site conditions, by Owner, Consultant, Contractor and Subcontractor originated changes, and by site instructions, supplementary instructions, field orders, change orders, addenda, correspondence and directions of jurisdictional authorities.

7.5. Record location of mechanical and electrical services, piping, valves, conduits, pull boxes, junction boxes and similar work not clearly in view, and position of which is required for maintenance, alteration work and future additions. Do not conceal critical work until its location has been recorded.

7.6. Identify record drawings as a "Project Record Copy". Maintain in good condition, do not use for construction purposes and make available to Consultant at all times.

7.7. Submit record drawings at completion of Work. Final acceptance of the Work will be predicated on receipt and approval of record drawings.

8. Extra Stock

8.1. Supply extra stock at completion of Project as specified in other Sections of the Project Manual.

8.2. Deliver extra stock as directed by the Architect to location he designates.

8.3. Extra stock is specified to be supplied in the following Sections:

Section 09 30 13 Ceramic Tile
Section 09 51 13 Acoustical Ceiling Units
Section 09 65 19 Resilient Tile Flooring
Section 09 91 23 Painting
Refer to Mechanical & Electrical Divisions for Extra Stock requirements in those Trades.

9. Maintenance Manual & Operating Instructions

9.1. Submit three (3) copies of Maintenance Manual with application for completion certificate.

9.2. Include in Maintenance Manual one (1) copy of each final approved shop drawing issued for Project on which have been recorded changes made during fabrication and installation caused by unforeseen conditions.

9.3. Submit extended guarantees together in one (1) report binder.

9.4. The Manuals shall:

9.4.1. Consist of a hard-cover, black, vinyl-covered, loose-leaf, letter-size binder.

9.4.2. Have a title sheet, or sheets preceding data on which shall be recorded Project name, Project number, date, list of contents, and Contractor's and Subcontractors' names.

9.4.3. Be organized into applicable Sections of Work with each Section separated by hard paper dividers with plastic covered tabs marked by Section.

9.4.4. Contain only typed or printed information and notes, and neatly drafted drawings.

9.4.5. Contain maintenance and operating instructions on all building, and mechanical and electrical equipment.

9.4.6. Contain maintenance instructions as specified in various Sections.

9.4.7. Contain brochures and parts lists on all equipment.

9.4.8. Contain sources of supply for all proprietary products used in the Work.

9.4.9. Contain lists of supply sources for maintenance of all equipment in Project of which more detailed information is not included above.

9.4.10. Contain finished hardware schedule.

9.4.11. Contain charts, diagrams and reports specified in Mechanical & Electrical Divisions.

10. Extended Warranties

10.1. Submit the extended warranties listed in this Article and as specified in each applicable Section of this Project Manual.

10.2. Extended warranties shall commence on termination of the standard one-year warranty granted in this Contract.

10.3. Submit each extended warranty on a standard Form of Warranty, a sample of which is included in this Section.

10.4. Secure each extended Warranty by a Maintenance Bond in an amount indicated.

10.5. Submit extended warranties for:

Section 06 40 00 Architectural Woodwork – extended 4 years
Section 07 41 43 Aluminum Composite Panels – extended 10 years (panel finish)
Section 07 55 00 Modified Bitumen Roofing System & Flashing:

- 2 year CRCA materials and workmanship against leaks and blow off
- 10 year material warranty the membrane will perform as a roofing material
- 1 year CRCA warranty against defects of materials and workmanship for the sheet metal work.

Section 07 92 10 Joint Sealants – extended 5 years
Section 08 11 16 Aluminum Doors & Frames – extended 4 years
Section 08 14 10 Wood Doors – extended 4 years
Section 08 50 50 Aluminum Windows – extended 4 years
Section 08 62 11 Vinyl Windows – extended 5 years

Section 08 71 10 Door Hardware – various, refer to that Section
Section 09 30 13 Ceramic Tile – extended 4 years
Section 09 51 13 Acoustical Ceiling Units – extended 4 years
Section 09 65 19 Resilient Tile Flooring – extended 4 years
Section 10 11 13 Communication Boards – extended 24 years
Section 10 11 23 Tackboards – extended 9 years
Section 12 21 13 Horizontal Blinds – extended 5 years
Section 12 21 16 Rollers Shades – extended 5 years
Section 14 42 13 Platform Lift – extended 5 years

Refer to Mechanical & Electrical Divisions for extended Warranty requirements in those trades.

11. Inspection Laboratory Reports

11.1. Submit copies of inspection and test reports obtained by the Contractor and Subcontractors for their Work or for Jurisdictional Authorities, if requested by Consultant.

11.2. Submit reports in accordance with requirements specified in Section 01 41 00.

12. Documentation On Suppliers & Manufacturers

12.1. Provide information under headings identifying the following: Associated Technical Section, Manufacturer, Supplier, Contact Name, Phone Numbers.

SAMPLE FORM OF WARRANTY FOLLOWS THIS PAGE

Sample Form for Warranty

Date .....

Client .....

Project .....

.....

Warranty .....
(title of work)

We hereby undertake to warrant all materials supplied and installed under our Contracts and include the providing of necessary materials and labour to cover the result of faulty materials or workmanship. Upon written notification from Client or the Architect that the above work is defective any repair or replacement work required shall be to the Architect's satisfaction at no cost to the Client. This Warranty shall not apply to defects caused by the work of others, maltreatment of materials, negligence or Acts of God. This Warranty shall remain in effect for the total period from the acceptance of the Work to (....date....), irrespective of the date of completion or the beneficial use by the Owner.

Signature .....

Authorized Signing Officer .....

Name of Firm .....

Address .....

END OF SECTION 01 33 00

SECTION 01 35 13 – APPENDIX A - SPECIAL PROJECT PROCEDURES

1. Introduction

1.1. School construction, renovation and maintenance projects are scheduled every year as a normal and necessary course of business by operations departments in each Nova Scotia School Board. Building modifications, repairs and additions/demolitions to buildings may impact the school environment without appropriate controls. With increased controls based primarily on the CSA standards implementation, proper scheduling and clear communication on adequate controls can be put into place to eliminate/minimize the impact to all occupants.

1.2. Projects of this nature may generate varying levels of dusts, noises and odors. It is possible, unknown/unforeseeable environmental contaminants, such as spills, mould, fumes, lead or asbestos exposure maybe identified.

1.3. To successfully complete work within the school environment, it is necessary to plan and implement appropriate containment and control strategies. This document is developed to provide a minimum standard for contaminant controls for various types of projects in schools. These standards are in addition to and should complement all legislated protocols for working with regulated materials such as asbestos, lead paints, PCB's etc.

1.4. Executing a successful project will depend primarily on clear, concise communication. This may involve a number of parties (Project Manager, Operations staff, School Administration and Health & Safety staff and Joint Occupational Health & Safety Committee).

2. Communication Plan

2.1. The most critical element of any project management plan is effective communication between all stakeholders. Communication between the Operations project manager/supervisor, the contractor and school administrators before the start of a project is very important. This meeting is meant to explain the scope, schedule and risk assessment for the project. The meeting will also help establish clear expectations when managing planned and unplanned exposure risks associated with contaminant controls.

2.2. The communication plan shall include:

2.2.1. A description of potential contaminants, which may include but is not limited to:

2.2.1.1. Particulates (dirt, concrete/silica, steel, fiberglass, wood dust, ash, cellulose, etc.)

2.2.1.2. Moisture: external water infiltration, internal system leaks (domestic water, sanitary, storm, sprinkler)

2.2.1.3. Noise from equipment/tool operation,

2.2.1.4. Fumes/odors from equipment exhaust, boiler exhaust, septic waste, chemical/adhesives, etc.

2.2.1.5. Hazardous materials including, asbestos, PCB, mercury, lead, fuel oil, fungi/mould, etc.

2.2.1.6. Excessive heat/cold

2.2.2. A description of the control measure which may include but not be limited to:
- **2.2.2.1.** Isolation within an enclosure (water, noise, hazardous materials)
- **2.2.2.2.** Ventilation and filtration
- **2.2.2.3.** Dehumidifiers/blowers (moisture)
- **2.2.2.4.** Personal protective equipment
- **2.2.2.5.** Schedule outside or inside school hours
- **2.2.2.6.** Sound dampeners
- **2.2.2.7.** Monitoring
- **2.2.2.8.** Security

2.2.3. Other Hazards created by the work, including but not limited to fire safety and the need to alter fire safety plans.

2.3. For small routine work orders the communication plan may only involve one tradesperson and the school principal or designate. This communication is equally as important for management of contaminant controls.

3. Contaminant Control Management

3.1. Regardless of the contaminant or control measure used, the following procedures shall apply for every project:

3.1.1. Every project, including all routine work requests, shall be assessed, as per this document, by appropriate personnel for potential contaminant risk.

3.1.2. Clear lines of communication must be established between project personnel, site supervisor or project manager and the school administration.

3.1.3. Control strategies as per this document, shall be, communicated to workers as well as the site JOHSC and implemented prior to starting the work.

3.1.4. Where isolation is used as a control, all entry points must be clearly posted to describe the purpose of the enclosure and limitations of access.

3.1.5. During the execution of the project, the control measures must be regularly inspected and maintained before the start of each work shift, and throughout the shift as required.

3.1.6. A process for stop work and remediation orders must be established to ensure the project manager; site supervisor and school administrator have a means to cease project operations when a contaminant control breach may impact the school environment. Breached control measures must be reported immediately to the board project manager upon discovery. He/she will be responsible to communicate to the school principal or designate. Work shall be stopped immediately until the control measures are re-established.

3.1.7. Access to the controlled work site is only permitted by authorized personnel. The project supervisor or designate shall determine appropriate personal protective equipment (PPE) and necessary worker orientation.

4. Particulate Control

4.1. Exposure to minimal levels of dust is a normal condition in most outdoor and indoor environments and is typically controlled inside a building through building ventilation, filtration and routine housekeeping measures. However, as noted, construction projects generally create elevated dust levels in work areas, whether inside or outside of a building.

4.2. Operational Services Managers must ensure maintenance staff and contracted service providers implement dust control measures appropriate for the type and scope of work being performed. This will include assessing the type and amount of dust being created as well as the location of the work being conducted.

4.2.1. Interior Construction Projects:

4.2.2. Construction projects may be described as projects that may include window replacement, wall creation/demolition, etc.

4.3. As a minimum for these types of construction projects, all interior entry points into a construction zone must be effectively sealed. The barrier must prevent contaminants from the work area to be distributed to other areas of the school. Appropriate signage must be posted to indicate only authorized persons are permitted access.

4.4. Entrance design could range from a two flap plastic tarp door to a fully constructed sealed entry door with negative hepa-filtered ventilation on the construction side of the barrier.

4.5. Exterior Construction Projects:

4.5.1. Exterior work shall be performed so as not to affect the safety of building occupants. It will also provide controls to avoid impact to adjacent properties. Depending up on the results identified in the risk assessment, at a minimum consideration must be given to prevent dust from entering into the school environment. This may be controlled through isolation, dampening application, closing building AHU and window/door openings.

5. Noise Control

5.1. Hearing plays an essential role in communication, speech and language development and learning within a school environment. During construction the contractor is responsible for ensuring acceptable noise levels will be adhered to for school board staff and students within the building. Noise related to a project may prove to be very distracting for staff and students. To minimize distractions and interruptions in student learning the following are important to consider:

5.1.1. Contractors are responsible to ensure appropriate noise control measures are taken

5.1.2. "No work" periods may need to be incorporated into construction schedules

5.1.3. Work causing a noise disruption may need to take place during unoccupied times and/or during pre-determined acceptable times of the day (i.e. before and after class times)

5.1.4. It may be necessary for the School Administrator to make a request to the Board Project Manager or the Contractor to exclude undertaking certain noisy activities during particular periods and/or activities.

6. Moisture Control

6.1. Moisture levels are to be controlled during construction and maintenance activities. Moisture levels above normal may impact the air in the room and/or building and may also penetrate building materials giving the potential to lead to mould growth.

6.2. Certain activities (i.e. tape and mud of drywall, painting, pressure washing, concrete cutting with water or other water based dust-suppression) introduce high amounts of moisture into the room environment and ventilation and or drying is required to control local moisture.

6.3. An enclosure properly set-up to contain other contaminants will similarly contain/control high levels of airborne moisture. A wet-vac should be available on-site for activities which have a risk of water spillage of more than 5 gallons at any instance.

6.4. Standing and or stagnate water must be avoided on construction sites, for a number of reasons, including, but not limited to; insects breed in these bodies of water, the water may give off odours, it is a nuisance to walk through, and it may be an ice hazard in cold weather.

6.5. It is important that all water leaks and flooding are reported immediately to the board's project manager and building supervisor. Where works to existing "plumbing" is to occur the water lines (potable, heating, fire suppression) must be isolated and drained (de-energized/de-pressurized) following Lock Out - Tag Out procedure. Adequate supplies such as buckets and absorbents should be present when drains are not available to drain a line.

6.6. When an interruption to the water supply, potable or service, is to occur then the "owner's representative" and building supervisor should be notified 24 hours in advance. Bottled water provision may be required.

6.7. Materials used in the construction and or maintenance activities are to be stored in dry areas. The introduction of materials to the activities with moisture levels above the acceptable (XXX%)CNBC states for wood, on dry weight basis, a max of 19%, I can't find info on drywall but assume it is much lower range is prohibited as these materials are highly susceptible to colonization by mould spores.

7. Fumes

7.1. Fumes may be produced on a project site for a variety of reasons such as use of motorized equipment, off gassing of sealants, adhesives and finish products, cutting/torching processes, exposure of sanitary systems, process ignition gases such as propane and acetylene, proximity of project temporary washrooms, radon, etc.

7.2. The impact of fumes on occupants may range from discomfort to health risk, to life safety risk.

7.3. The project manager or supervisor must ensure that all potential fume sources are identified and remedial or control measures included in the scope of work by the contractor.

7.4. Monitoring equipment may be required to determine for example radon exposure or safety of confined space access.

8. Activity Assessment

8.1. Activities that may produce contaminants which require control may be considered as low, medium and high impact.

8.2. Low impact activities include routine maintenance and repairs that may create localized dust or odors or brief periods of noise which are not considered harmful to occupants but may be a nuisance which requires minimal control. These may include activities such as opening ceiling tiles or gyproc walls, replacing a plumbing fixture, paint touch ups, drilling through a wall, etc.

8.3. Medium impact activities include larger repair jobs or longer duration projects that will create more wide spread levels of contaminant which must be controlled to prevent exposure to building occupants. Boiler cleaning, ceiling replacement, long periods of hammer drilling, etc.

8.4. High impact activities include large demolition and construction projects, or jobs with exposure to contaminants that are a risk to health or life safety such as asbestos remediation, mould abatement, lead paint clean up, etc.

9. Hazard Assessment

9.1. A hazardous assessment is required to be completed for each job to ensure hazards are identified and corresponding controls are implemented. Depending upon the circumstances at the site it may be necessary to upgrade and/or add other precautions.

9.2. Determine the most appropriate hazard classification and apply the corresponding protocols. The attached hazard assessment identifies the minimum controls that must be in place during the corresponding activities. Depending on the specific circumstances at a site further controls may be required. When the hazards are deemed to be in the C or F category the form including specific controls must be submitted to the board for review, prior to commencing work. The contractor may still be required to complete their own hazard assessment of the job/work.

10. Contaminant Controls Procedure for initiating work for all Contaminant Controls:

10.1. Contaminant Control I

10.1.1. The tradesperson or project manager for the board will discuss the details, including the scope and any impacts of the job/project with the principal.

10.1.2. Ensure fire exiting requirements and life safety systems are addressed or adequate mitigating plans are implemented for the building, construction staff and building occupants.

10.1.3. Presence of lead paint or ACM's (Asbestos Containing Materials) must be determined prior to the start of any job. Specific protocols or Codes of Practice may apply.

10.1.4. Consideration will be given for work that is anticipated to generate significant noise, odours or VOC's (Volatile Organic Compounds) and this will be scheduled outside of school hours or during times when the noise will not disrupt occupant activities. This will require coordination with the Principal.

10.1.5. The work area shall be isolated where possible. This may be achieved at varying levels, by closing doors and opening outside windows for ventilation or by installing appropriate hoarding and negative pressure units to ensure contaminants are not circulated throughout the school causing further health and safety concerns.

10.1.6. Dust shall be minimized during the activity. When drilling, sanding or cutting is taking place, wetting the area may be necessary to reduce dust.

10.1.7. Good housekeeping practices shall be maintained at all times on the work site. Bag and remove dust and debris from the building as soon as possible.

10.1.8. Possible environmental impacts shall be managed and minimized. If work uncovers environmental contaminants or suspected contaminants such as oil spills (current or historic) or potentially friable asbestos materials (check the school asbestos audit) that may be disturbed, this information shall be brought to the attention of the Board's employee responsible for the project so that appropriate actions can be taken.

10.1.9. When the activity is completed the work area shall be inspected and cleaned. Dust and debris shall be removed from the area and all efforts will be made to return items to their pre-maintenance activity location.

10.1.10. The Principal shall be notified that the work is completed.

10.2. Contaminant Control II - All Contaminant Control I measures shall apply, as well as;

10.2.1. Cover furniture, bookshelves and teaching materials with plastic sheets.

10.2.2. Water misting while performing dust generating activities may be required.

10.2.3. Seal un-used doors. Seal wall penetrations, electrical outlets, or any other source of air leaks in the construction area.

10.2.4. Seal exhaust air vents in construction area and open the windows. If possible shut down air handling system in the area for duration of project.

10.2.5. A walk out mat at exterior of exit door to trap dust may be required.

10.3. Contaminant Control III - All Contaminant Control I and II measures shall apply, as well as;

10.3.1. Install an impermeable dust barrier from the true ceiling to the floor consisting of two layers of 6 mil fire retardant polyethylene or solid wall and sealed door. The wall shall remain in place until the job is finished and the clean-up is completed.

10.3.2. Seal all wall penetrations
10.3.3. Seal off all return and supply air handling ducts and close all windows.
10.3.4. Turn off the air handling system in the area of construction.
10.3.5. Maintain negative air pressure in the construction area using HEPA filter equipped exhaust ventilation. The pressure differential between the project area of contamination and the building's occupied areas shall be demonstrable by a means approved by the Board employee responsible for the project.
10.3.6. Ensure that the air is exhausted directly outside and away from intake vents.
10.3.7. Vacuum all horizontal surfaces including drop cloths with a hepa vacuum.
10.3.8. Remove drop clothes
10.3.9. Vacuum again all horizontal surfaces with HEPA Vacuum.
10.3.10. Restore ventilation.
10.3.11. Remove enclosure and equipment.

10.4. Control IV: (External Work)

10.4.1. External work may impact building interior or occupants.
10.4.2. To reduce the impact to building interior or occupants, it may be necessary to contain the work area from impacting building interior. This may include closing or opening windows, tarping ceilings to capture debris or water, temporary relocation of occupants or ventilation controls.
10.4.3. The job supervisor shall consider weather conditions and forecast to reduce the effect of any weather impacts to the building materials or building occupants.
10.4.4. It may be necessary to use protective tarps and ground cover sheets below equipment and work areas to contain building debris such as paint chips, materials, dust or oil from equipment.
10.4.5. When the job is completed and the tarps have been lifted, inspect the ground around the job for debris and clean as necessary.

Fire Protection

10.5. Type V: General Fire Protection

10.5.1. Ensure fire exiting requirements and life safety systems are addressed or adequate mitigating plans are implemented for the building, construction staff and building occupants. Staff must be aware of temporary modifications to fire safety plans.

10.5.2. MSDSs for all materials to be used must be reviewed and available on site.

10.5.3. Construction materials stored outside must be a minimum distance of ten feet from the building and be in a secured area.

10.5.4. Flammable or Combustible liquids must be stored as per Fire Code requirements. All flammable and combustible liquids or materials must be kept in a secure area at all times.

10.6. Control VI: Fire Protection (minor hot work) - All Contaminant Control V shall apply as well as;

10.6.1. Notify the Principal that a risk of fire has increased and the area in which the hot work will occur.

10.6.2. Refer and implement the board's hot work permit process. At a minimum the following should be considered;

10.6.2.1. Sweep the work area and remove all unnecessary materials in the vicinity; particularly all combustible and flammable materials and liquids shall be removed from the area (35 feet).

10.6.2.2. Have an appropriate size fire extinguisher available.

10.6.2.3. Inspect the work location for areas (such as a hole in the wall) where hot material or sparks could fall and smolder and close them off so that any hot debris can only fall within your field of view.

10.6.2.4. If it is possible that the flame will go past the object being welded or soldered and excessively heat a flammable or combustible material then either protect that material with a non-flammable material or wet the material and keep it wetted during the use of heat or grinding.

10.6.2.5. Remain in the area while the joint and/or heated materials cool to room temperature (ambient) while checking for the smell or appearance of smoke in the area.

10.6.2.6. Stay in the area for at least Y2 hour and then re-inspect for any smell or appearance of smoke.

10.6.2.7. Ask another staff person to inspect the area for the smell or appearance of smoke. Record who you asked to do the final inspection.

10.6.3. Type VII: Fire Protection (hot work w fire watch) - All Contaminant Control V and VI shall apply as well as;

10.6.4. Notify the Principal that a risk of fire has increased and the area in which the hot work will occur. If any life safety system components (sprinkler, detectors, fire alarms) are not functioning, hot work should not proceed until these systems are

functioning unless fire watch procedures for life systems are followed. See Activation of Fire Watch for Life Safety Systems checklist. Appendix…XX

10.6.5. Refer and implement the board's hot work permit process. At a minimum the following should be considered;

10.6.5.1. Cover all floor openings with fire stop material. Seal duct work openings with metal covers or blankets and close all doors.

10.6.5.2. Ensure that there are no potentially explosive atmospheres in the area.

10.6.5.3. Hot work on vessels, pressure tanks or boilers, use only contractors who are qualified by nationally or internationally recognized boiler and pressure vessel code.

10.6.5.4. Notify the local fire department of the type of work and the work schedule.

10.6.5.5. Before hot work is started, designate one employee responsible to complete the fire watch: while work is in progress, during lunch breaks and other breaks and for one hour after all fames are extinguished for the day and monitor the area for an additional two hours. After three hours after the last flame has been extinguished, have a second employee do a final survey of the area for smells or evidence of smoldering or fire and record the inspection.

APPENDIX
Fire Watch Activation Checklist

1. Documentation (identify locations to be checked on an hourly basis, provide contact information for relevant board staff and outside agencies} Board provided template to be used for documentation.
2. Procedure reviewed with Custodian or individual responsible for fire watch. Any high risk areas shall be identified to be highlighted on the documentation page and checked during the rounds.
3. Staff working in the building have been notified of the Fire Watch and that they are responsible to monitor areas for signs of fire or smoke and have been reminded of required actions to take according to the school fire safety plan.
4. Staff responsible for fire watch have been trained in how to use a fire extinguisher. (PASS)
5. Staff responsible for the fire watch have a means of communication (cell phone or walkie-talkies)
6. Staff responsible for the fire watch are aware of the procedure for initiating fire alarm and what systems are functioning. i.e. systems (sprinklers, alarm panel or if school has monitoring company or if calling 911 is required)
7. The School Insurance Program (SIP) Emergency Information Line has been notified 1-902-448-2840
8. All relevant information has been documented in the school's fire books. Including date, time and reason for fire watch.

Fire Watch De-Activation Checklist

1. Document the date, time and actions taken to remedy the deficiency requiring the fire watch.
2. School Insurance Program (SIP) has been notified
3. Copy of the Fire Watch documentation is kept in the fire book and the original is sent to the HRSB Project Representative.

END OF SECTION 01 35 13

SECTION 01 35 29 - OCCUPATIONAL HEALTH & SAFETY REQUIREMENTS

1. References

1.1. CSA S269.1-1975 Falsework for Construction Purposes.

2. CONSTRUCTION SAFETY MEASURES

2.1. Observe construction safety measures of:

2.1.1. National Building Code 2010, Part 8

2.1.2. National Fire Code of Canada

2.1.3. Provincial Government, including but not limited to the:

2.1.3.1. Occupational Health & Safety Act revised Statutes of Nova Scotia 1996, Chapter 7 and regulations.

2.1.3.2. Workers' Compensation Act

2.1.3.3. Fire Protection Act

2.1.3.4. Dangerous Goods Transportation Act

2.2. In case of conflict or discrepancy the more stringent requirement shall apply.

2.3. Ensure that employees working on this specific project have met training requirements as legislated by the Nova Scotia Occupational Health & Safety Act and its regulations.

2.4. Where reference is made to jurisdictional authorities, it shall mean all authorities who have within their constituted powers the right to enforce the laws of the place of the building.

3. Equipment & Tools

3.1. Each user of equipment or tools shall be responsible to examine for sufficiency before use. Make equipment and tools safe if necessary.

4. WHMIS

4.1. Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets.

4.2. Have a copy of WHMIS data sheets available at the workplace on delivery of materials.

5. Hazardous Material

5.1. Should material resembling hazardous materials other than those identified with the Contract Documents, including but not limited to spray or trowel applied asbestos, be encountered in course of work; stop work immediately. Do not proceed until written instructions have been received from Consultant.

5.2. Where work entails use, storage, or disposal of toxic or hazardous materials, chemicals and or explosives, or otherwise creates a hazard to life, safety, health, or the environment; work shall be in accordance with the Jurisdictional Authority.

6. Site Cleaning

6.1. Except where special permission is obtained, maintain clear access on public sidewalks and roads.

6.2. Maintain walks and roads clear of construction materials and debris, including excavated material. Clean walks and roads as frequently as required to ensure that they are cleared of materials, debris and excavated material.

7. Fire Safety Requirements

7.1. Enforce fire protection methods, good housekeeping and adherence to local and Underwriter's fire regulations including, but not limited to, Fire Protection Act and the Provincial Building Code Act. Provide UL approved fire extinguishers, and other fire- fighting services and equipment, except where more explicit requirements are specified as the responsibility of individual Sections.

7.2. Smoking is not permitted on school property.

7.3. Advise Fire Chief in the area of Work of any work that would impede fire apparatus response, including but not limited to violation of minimum overhead clearance prescribed by the fire chief, erecting of barricades and digging of trenches and in areas where work is being done.

7.4. Ensure nothing subverts the integrity of fire protection provided for the building structure.

8. Reporting Fires

8.1. Know the location of the nearest fire alarm box and telephone, including the emergency phone number.

8.2. Report immediately all fire incidents to the fire department as follows:

8.2.1. Activate nearest fire alarm box, or

8.2.2. Telephone local fire department

8.2.3. Where fire alarm box is exterior to building, the person activating the fire alarm box shall remain at the box to direct Fire Department to scene of the fire.

8.2.4. When reporting a fire by telephone, give location of fire, name or number of building and be prepared to verify the location.

9. Safety Document Submission

9.1. Ensure Safety Document Submission applies to Work of this specific project and site.

9.2. Submit two (2) copies of Project Safety Document at the Pre-Construction Meeting. Do not commence Work nor deliver material on-site prior to submission.

9.3. Include in Safety Document submission specific information detailing the methods and procedures to be implemented ensuring adherence to the acts, regulations, codes and policies specified in this section and to:

9.3.1. Ensure the Health & Safety of persons at or near the Work; including, but not limited to, the Public.

9.3.2. Ensure the measures and procedures of the regulatory agencies specified are carried out.

9.3.3. Ensure every employee, self-employed person and employer performing Work under this contract complies with the regulatory agencies specified.

9.3.4. Where changes to the methods and procedures in the execution of work change submitted safety methods and procedures, modify submitted Safety Documentation and submit modifications, in writing to the Consultant and Owner prior to implementation.

10. Safety Document Organization

10.1. Organize information in the form of an instructional manual as follows:

10.1.1. Place in binders of commercial quality, accommodating 8½" x 11" paper size.

10.1.2. Cover: Identify binder with typed or printed title ‘Project Safety Document’ and list the title of project.

10.1.3. Provide tabbed fly leaf for each separate heading, with typed heading on tab.

10.1.4. Where drawings are within the safety document, provide with reinforced punched binder tab. Bind in with text; fold in larger drawings to size of text pages.

10.1.5. Arrange content under Safety Document headings specified herein.

11. Safety Document Headings

11.1. Employee Safety Training

11.1.1. Place, under this heading, a statement indicating employees working on this specific project have met specified training requirements, if required.

11.2. Company Safety Policy

11.2.1. Place, under this heading, information pertaining to the company's policy and commitment to Occupational Health & Safety, including the responsibilities of management, supervisors and workers.

11.3. Company Safety Rules in General Terms

11.3.1. Place, under this heading, information of a general, global nature, applying to every work environment where the company has staff and pertaining to rules directing compliance to policy. For example state company safety rules with respect to use of hard hats, safety glasses, safety foot ware, CSA approval on such items, use of alcohol or non-prescription drugs.

11.4. Hazard Assessment

11.4.1. Place, under this heading, information identifying possible hazards specific to this project and identify safe methods and procedures for the execution of work to ensure safety in the work place.

11.4.2. Arrange contents of this heading by technical section number of the project manual.

11.5. Emergency Action Plan

11.5.1. Place, under this heading, information detailing action to be taken in the event of various emergencies.

11.5.2. Arrange content under the following sub-headings:

11.5.2.1. First Aid

11.5.2.1.1. Include information concerning establishment of a First Aid Station, related supplies, staff awareness of location and staff training in First Aid Care of Casualties.

11.5.2.2. Contact of Emergency Support Groups:

11.5.2.2.1. Include relative information including phone location for emergency use, the emergency telephone numbers and their location for the various organizations which must be contacted in case of an emergency, and staff training in procedures.

11.5.2.3. Cessation of Work:

11.5.2.3.1. Include relative information how work cessation during emergencies is handled and communicated to persons present on site.

11.6. Joint Occupational Health & Safety Committee/Representative:

11.6.1. Place under this heading information detailing membership and terms of reference.

OCCUPATIONAL HEALTH & SAFETY SUMMARY FOLLOWS THIS PAGE

Occupational Health & Safety Summary (to be submitted with each monthly Progress estimate)

The following information summarizes Occupational Health & Safety activities on the project conducted by the Contractor during the month and includes activities of Subcontractors. Activities include all matters prescribed by the Occupational Health & Safety Act and Regulations and the submitted Occupational Health & Safety Document for the Project.

Indicate the applicable # number below:

#_____new contractors on site,
#_____orientations
#_____toolbox talks
#_____safety meetings
#_____Joint Occupational Health and Safety Committee meetings
#_____hazard assessments
#_____formal written inspections
#_____warnings issued to employees or subcontractors
#_____other, explain_____

List new Contractors on Site below:

_____
_____
_____
_____
_____

The Contractor certifies that the above noted activity list is accurate and that during the month:

Check

☐ All activities on the Project were found to be in compliance with the Occupational Health & Safety Act and Regulations

☐ Some activities on the Project were not found to be in compliance with the Occupational Health & Safety Act and Regulations but were adequately corrected in an appropriate time frame. Explain _____
_____

Prepared by

_____
(Contractor Project Manager)

Certified by

_____
(Contractor Senior Management)

END OF SECTION 01 35 29

SECTION 01 37 00 - SCHEDULE OF VALUES

1. Related Documents

1.1. General Conditions of Contract.

2. General

2.1. Submit to the Architect, and Owner, Schedule of Values, within twenty (20) days after signing Agreement.

2.2. Use Schedule of Values as basis for Contractor's Progress Claim.

3. Form Of Submittal

3.1. Form included at end of this Section.

3.2. **The form included below is a suggested guide but might not be appropriate for all projects. Contractors may submit their own template to the Owner for review/approval.**

4. Preparing Schedule Of Values

4.1. Itemize separate line item cost for work required.

4.2. Round off figures to nearest ten (10) dollars.

4.3. The sum of all values listed in the schedule shall equal the total contract sum.

5. Review And Submittal

5.1. After review by Architect and Owner, revise and resubmit Schedule as directed.

5.2. The form shall be completed and supported by such evidence as to its correctness as the Architect may reasonably direct.

Schedule Of Values

Project Name **HEAT PUMP REPLACEMENT - PHASE 2 #3869**

Contract Number .....

Architect .....

Contractor .....

Date .....

Item	Description	Item Amount

1. **General Requirements**
   - **1.1.** Mobilization & Initial Expenses
   - **1.2.** Site Overhead & Fee
   - **1.3.** Bonds
   - **1.4.** Certificates
   - **1.5.** Testing
   - **1.6.** Construction Facilities & Temporary Controls
   - **1.7.** Other (Specify)

Total (Items 1.1 to 1.7) _____

2. **Excavation, Backfill, Sitework**

Total (Item 2.) _____

3. **Concrete**

Total (Item 3.) _____

Item	Description	Item Amount

4. **Masonry**

Total (Item 4.) _____

5. **Metals**

Total (Item 5.) _____

6. **Wood & Plastics**
   - **6.1.** Rough Carpentry
   - **6.2.** Finish Carpentry
   - **6.3.** Architectural Woodwork

Total (Items 6.1 to 6.3) _____

7. **Thermal & Moisture Protection**
   - **7.1.** Insulation
   - **7.2.** Air Vapour Barrier
   - **7.3.** Aluminum Composite Panels
   - **7.4.** Preformed Metal Siding
   - **7.5.** Fire Stopping
   - **7.6.** Roofing

Total (Item 7.1 to 7.6) _____

8. Doors And Windows

8.1. Metal Doors & Frames
8.2. Wood Doors
8.3. Hardware
8.4. Windows

Total (Items 8.1 to 8.4) _____

Item	Description	Item Amount

9. Finishes

9.1. Acoustic Ceiling Systems
9.2. Gypsum Board and Support Systems
9.3. Hard Tile
9.4. Resilient Tile
9.5. Painting

Total (Items 9.1 to 9.5) _____

10. Specialties

10.1. Tackboards, Communication Boards
10.2. Toilet & Bath Accessories
10.3. Manufactured Specialties
10.4. Food Service Equipment

Total (Items 10.1 to 10.4) _____

11. Mechanical

11.1. As per Sections — Total (Item 11.) _____

12. Electrical

12.1. As per Sections — Total (Item 12.) _____

TOTAL (Items 1 - 12) _____

END OF SECTION 01 37 00

SECTION 01 41 00 - REGULATORY AGENCIES

1. Jurisdictional Authorities

1.1. Where reference is made to jurisdictional authorities, it shall mean all authorities who have within their constituted powers the right to enforce the laws of the place of building.

2. Definitions

2.1. The "Constructor" named in the Construction Safety Act, Chapter 52, Revised Statutes of Nova Scotia, as amended by 1972, Chapter 25; and Construction Safety Regulations, pursuant to Chapter 52 R.S.N.S., including any amendments, shall mean the "Contractor" for the Work performed under this Specification.

3. Fire Prevention, Safety & Protection

3.1. General Construction Safety Measures:

3.1.1. Observe safety measures of the

3.1.1.1. National Building Code 2010, Part 8.

3.1.1.2. National Fire Code of Canada.

3.1.1.3. Provincial Government, including but not limited to the Occupational Health & Safety Act Revised Statutes of Nova Scotia 1996, Chapter 320, and the Construction Safety & Industrial Safety Regulations made pursuant to the Occupational Health and Safety Act, 1996.

3.1.1.4. Workers'/Workmen's Compensation Board.

3.1.2. In case of conflict or discrepancy the more stringent requirement shall apply.

3.1.3. Maintain clear emergency exit paths for personnel.

3.2. Except where special permission is obtained, maintain clear access on public sidewalks and roads.

3.3. Maintain walks and roads clear of construction materials and debris, including excavated materials. Clean walks and roads as frequently as required to ensure that they are cleared of materials, debris and excavated materials.

3.4. WHMIS:

3.4.1. Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Labour Canada and Health & Welfare Canada.

3.4.2. Have a copy of WHMIS data sheets available at the workplace on delivery of materials.

Blockage Of Roadways

3.5. Advise Fire Chief of any work that would impede fire apparatus response. This includes violation of minimum overhead clearance, as prescribed by fire chief, erecting of barricades and the digging of trenches.

4. Smoking Precautions

4.1. Observe, at all times, smoking regulations.

5. Rubbish And Waste Materials

5.1. Rubbish and waste materials are to be kept to a minimum.

5.2. The burning of rubbish is prohibited.

6. Flammable And Combustible Liquids

6.1. The handling, storage and use of flammable and combustible liquids are to be governed by the current National Fire Code of Canada.

6.2. Flammable and combustible liquids such as gasoline, kerosene and naphtha will be kept for ready use in quantities not exceeding 45 litres provided they are stored in approved safety cans bearing the Underwriter's Laboratory of Canada or Factory Mutual seal of approval. Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes, requires the permission of the Fire Chief.

6.3. Transfer of flammable and combustible liquids is prohibited within buildings or jetties.

6.4. Transfer of flammable and combustible liquids will not be carried out in the vicinity of open flames or any type of heat-producing devices.

6.5. Flammable liquids having a flash point below 38°C such as naphtha or gasoline will not be used as solvents or cleaning agents.

6.6. Flammable and combustible waste liquids, for disposal, will be stored in approved containers located in a safe ventilated area. Quantities are to be kept to a minimum and the Fire Department is to be notified when disposal is required.

7. Hazardous Substances

7.1. Work entailing the use of toxic or hazardous materials, chemicals and/or explosives, otherwise creates a hazard to life, safety or health, will be in accordance with the National Fire Code of Canada.

7.2. Where flammable liquids, such as lacquers or urethanes are to be used, proper ventilation will be assured and all sources of ignition are to be eliminated. The Fire Chief is to be informed prior to and at the cessation of such work.

8. Questions and/or Clarification

8.1. Direct any questions or clarification on Fire Safety in addition to above requirements to Fire Chief.

9. Fire Inspection

9.1. Site inspections by Fire Chief will be coordinated through AVRSB Project Manager.

9.2. Allow Fire Chief unrestricted access to the work site.

9.3. Co-operate with the Fire Chief during routine fire safety inspection of the Work site.

9.4. Immediately remedy all unsafe fire situations observed by the Fire Chief.

10. Reference Standards

10.1. Where edition date is not specified, consider that references to manufacturer's and, published codes, standards and specifications are made to the latest edition, (revision) approved by the issuing organization, current at the date of this Specification.

10.2. Reference standards and specifications are quoted in this Specification to establish minimum standards. Work which in quality exceeds these minimum standards shall be considered to conform.

10.3. Should the Contract Documents conflict with specified reference standards or specifications the General Conditions of the Contract shall govern.

10.4. Where reference is made to manufacturer's directions, instructions or specifications they shall include full information on storing, handling, preparing, mixing, installing, erecting, applying, or other matters concerning the materials pertinent to their use and their relationship to materials with which they are incorporated.

10.5. Have a copy of each code, standard and specification, and manufacturer's directions, instructions and specifications, to which reference is made in this Specification, always available at construction site.

10.6. Standards, specifications, associations, and regulatory bodies are generally referred to throughout the specifications by their abbreviated designations:

AA	The Aluminum Association
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute
ARI	Air Conditioning & Refrigeration Institute
ASTM	American Society for Testing & Materials
CCA	Canadian Construction Association
CGSB	Canadian General Standards Board
CSA	Canadian Standards Association
NSDTIR	Department of Transportation & Infrastructure Renewal, Province of Nova Scotia
IAO	Insurers Advisory Organization
NBC	National Building Code
NFPA	National Fire Protection Association
CANS	Construction Association of Nova Scotia
ULC	Underwriters Laboratories of Canada
WHMIS	Workplace Hazardous Materials Information System

END OF SECTION 01 41 00

SECTION 01 45 00 - QUALITY CONTROL

1. Section Includes

1.1. Inspection and testing, administrative and enforcement requirements

1.2. Tests and mix designs.

1.3. Mock-ups.

1.4. Mill tests.

1.5. Equipment and system adjust and balance.

1.6. Verification by affidavits and certificates that specified products meet requirements of reference standards: In applicable Sections of the Specification.

1.7. Testing, balancing and adjusting of equipment: In applicable Mechanical and Electrical Sections of the Specification.

1.8. Cutting & Patching: Section 01 11 41.

2. Related Sections

2.1. Section 01 33 00 Submittal Procedures: Submission of samples to confirm product quality.

2.2. Section 01 61 00 Material & Equipment: Material and workmanship quality – reference standards.

2.3. Section 01 77 00 Contract Closeout.

3. REVIEW OF WORK

3.1. The Owner 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.

3.2. Give timely notice to the Owner's Representative, requesting review of the Work as indicated in the Contract Documents.

3.3. If the Contractor covers or permits to be covered Work that has been designated for review by the Owner before such is made, uncover such Work, have the review satisfactorily completed and make good such Work at no extra cost to Owner.

4. Inspection, Special Tests, Approvals

4.1. Engage the services of appropriate inspection testing agencies ensuring the Work meets codes, acts and regulations, and lows in force at the place of Work. Include such costs in the Contract Price.

4.2. Give timely notice requesting inspection to those required to provide inspections, special tests, or approvals, where Work is designated, by the Owner's instructions or the law of the place of Work, for special tests.

4.3. 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 at no extra cost to the Owner.

4.4. The Owner 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 Contractor Documents, the Owner shall pay the cost of examination and replacement.

5. Independent Inspection Agencies

5.1. Independent Inspection/Testing Agencies may be engaged by the Owner for the purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the Owner.

5.2. Provide access to the Work, and equipment required for executing inspection and testing by the appointed agencies.

5.3. Employment of inspection/testing agencies does not relax the Contractor's responsibility to perform Work, or carry out his own inspections and testing in accordance with the Contract Documents.

5.4. 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 Owner at no cost to the Owner. Pay costs for retesting and reinspection.

6. Access To Work

6.1. Allow inspection/testing agencies access to the Work, off site manufacturing and fabrication plants.

6.2. Co-operate to provide reasonable facilities for such access.

7. Procedures

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

7.2. Submit samples and/or materials required for testing, at specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work.

7.3. Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

8. Rejected Work

8.1. 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, including (but not limited to) defective Work rejected by the Owner as failing to conform to the Contract Documents. Replace or re-execute in accordance with the Contract Documents.

8.2. Make good other Contractor's work damaged by such removals or replacements promptly.

8.3. If in the opinion of the Owner, 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 Owner.

9. Reports

9.1. Submit four (4) copies of inspection and test reports to the Owner.

9.2. Provide copies to Contractor's Consultant and Subcontractor of Work being inspected or tested.

10. Tests and Mix Designs

10.1. Furnish test results and mix designs as may be requested.

10.2. The cost of tests and mix designs beyond those called for in the Contract Documents or beyond those required by law of the Place of Work shall be appraised by the Owner and may be authorized as recoverable.

11. Mock-Up

11.1. Prepare mock-up for Work for each finish in the Work and other work specifically requested in the specifications. Include for Work of all Sections required to provide mock-ups.

11.2. Construct in all locations as specified in specific Section.

11.3. Prepare mock-up for Owner's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in the Work.

11.4. 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.

11.5. If requested the Owner will assist in preparing a schedule fixing the dates for preparation.

11.6. Mock-ups may remain as part of the Work, unless specified otherwise in the Contract Documents.

12. Mill Tests

12.1. Submit mill test certificates as may be requested.

13. Equipment And Systems

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

13.2. Refer to Contract Documents for definitive requirements.

END OF SECTION 01 45 00

SECTION 01 52 00 – CONSTRUCTION & TEMPORARY FACILITIES

1. General

1.1. Include in the Work construction and temporary facilities required as construction aids or by jurisdictional authorities or as otherwise specified. Install to meet needs of construction as Work progresses. Maintain construction and temporary facilities during use, relocate them as required by the Work, remove them at completion of need and make good adjacent Work and property affected by their installation.

1.2. Include in the Work construction and temporary facilities to provide for construction safety such as: fences, barricades, bracing, supports, storage, sanitation and first aid facilities, fire protection, stand pipes, electrical supply, construction equipment with its supports and guards, stairs, ramps, platforms, runways, ladders, scaffolds, guardrails, temporary flooring, rubbish chutes, and walkway, morality and guard lights, and as otherwise required of the Constructor by the Construction Safety Act, of the Province of Nova Scotia, as well as all other applicable regulations or jurisdictional authorities.

1.3. Construct temporary Work of new materials unless use of second-hand materials is approved.

1.4. Ensure that structural, mechanical, and electrical characteristics of temporary facilities are suitable and adequate for use intended. Be responsible that no harm is caused to persons and property by failure of temporary facilities because of placing, location, stability, protection, structural sufficiency, removal, or any other cause.

1.5. Locate temporary facilities as directed and coordinated with School Administration and HRSB.

1.6. Relocate construction and temporary facilities as required by the Progress of the Work, and remove at completion of Work.

1.7. Do not permit construction personnel to use new washroom and toilet facilities.

1.8. Interior work zones to be complete with temporary negative air ventilation units to be functioning at all times to control dust migration to occupied areas.

1.9. Refer also to HRSB Policies & Guidelines contained in Appendix A of Section 01 35 13.

2. Services

2.1. Temporary Electric Power:

2.1.1. The Contractor will provide a source of electric power for all construction purposes.

2.1.2. Coordinate with the Building Operator locations of power sources and arrange to connect under his direction.

2.1.3. Install electric service distribution conductors and necessary components. Determine anticipated demand which will be placed on service during normal peak

periods and obtain approval on this basis before making installation. Supply power of characteristics required by the Work. Install a power centre for miscellaneous tools and equipment for each major building floor area with distribution box, a minimum of four 20 amp grounded outlets, and circuit breaker protection for each outlet. Make connections available to any part of the Work within distance of a 100'-0" extension.

2.2. Temporary Lighting:

2.2.1. Install lighting for

2.2.1.1. emergency evacuation, safety and security throughout the Project at intensity levels required by jurisdictional authorities.

2.2.1.2. performance of Work throughout Work areas as required, evenly distributed, and at intensities to ensure that proper installations and applications are achieved.

2.2.1.3. performance of finishing Work in areas as required, evenly distributed and of an intensity of at least 15 foot candles.

2.2.2. Permanent fluorescent lighting may be used during construction, provided that fixtures, lamps and lenses are completely cleaned. Incandescent sources may be used during construction to the extent of 20% of the total. Electrical Division Contractor to provide 20% spare lamps to the Owner for replacement purposes.

2.3. Temporary Sanitary Facilities:

2.3.1. Provide sanitary facilities for persons on the Work site. Facilities in areas of the building are only to be used under extraordinary circumstances and with prior approval.

2.4. Maintain fire protection as required by jurisdictional authorities. The Contractor is responsible for de-activating and re-activating Fire Alarm zones as required by the Work of the Contract and to maintain protection in the existing building.

3. Construction Aids

3.1. Hoists & Cranes:

3.1.1. Select, operate and maintain hoisting equipment and cranes as may be required. Operate such equipment only by qualified hoist or crane operators. Make hoist available for Work of each Section.

3.2. Building Enclosure:

3.2.1. Include in Work temporary enclosure for building as required to protect it, in its entirety or in its parts, against the elements, to maintain environmental conditions

required for Work. Design enclosures to withstand wind pressures required for the building by jurisdictional authorities. Erect enclosures to allow complete accessibility for installation of materials during the time enclosures remain in place.

3.3. Scaffolding:

3.3.1. Each user of scaffolding shall be responsible for its examination and testing for sufficiency before using it. He shall make it secure if necessary, or shall notify the Contractor in writing that he will not commence work until it is made secure; otherwise he will be held responsible for accidents due to its insufficiency.

4. Barriers

4.1. Install barricades for traffic control, and to prevent damaging traffic over exterior and interior finished areas, as well as safety barricades and otherwise, as may be required.

4.2. Construct hoardings and walkways as required by HRSB or jurisdictional authorities.

5. Protection

5.1. Protect roofs and podiums by substantial temporary construction to ensure that no damage occurs. Provide protection by materials of sufficient thickness to prevent all damage to structure and finish, and to waterproofing qualities of membranes, whenever each of these individual components are exposed. Damage shall include harm resulting from all construction work, such as falling objects, wheel and foot traffic, failure to remove debris, operation of machinery and equipment, and scaffolding and hoisting operations. Positively secure protection to prevent displacement from any cause.

5.2. Box with wood or otherwise protect from damage, by continuing construction, finished sills, jambs, corners, and the like.

END OF SECTION 01 52 00

SECTION 01 61 00 - MATERIAL & EQUIPMENT

1. General

1.1. Products refer to materials, manufactured components and assemblies, fixtures and equipment incorporated in the Work.

1.2. Use only products of Canadian manufacture unless such products are not manufactured in Canada, are specified otherwise, or are not competitive.

1.3. Products for use in the Project and on which the Tender was based shall be in production at that time, with a precise model and shop drawings available for viewing.

1.4. Where equivalent products are specified, or where alternatives are proposed under "substitution of products", these products claimed by the Contractor as equivalent shall be comparable in construction, type, function, quality, performance, and, where applicable, in appearance, as approved. Where specified equivalents are used in the tendered bulk sum price for the Work, they shall be subject to final approval.

1.5. Incorporate products in the Work in strict accordance with manufacturers' directions unless specified otherwise.

1.6. Products delivered to the Project site for incorporation in the Work shall be considered the property of the Owner. Maintain protection and security of products stored on the site after payment has been made for them.

1.7. Do not install permanently incorporated labels, trademarks and nameplates, in visible locations unless required for operating instructions or by jurisdictional authorities.

2. Specified Products

2.1. Products specified by manufacturer's name, brand name or catalogue reference shall be the basis of the bid and shall be supplied for the Work without exception in any detail, subject to allowable substitutions as specified.

2.2. Where several proprietary products are specified, any one of the several will be acceptable.

2.3. For products specified by reference standards, the onus shall be on the supplier to establish that such products meet reference standard requirements. The Architect may require affidavits from the supplier, as specified in Section 01 33 00, or inspection and testing at the expense of the supplier, or both, to prove compliance. Products exceeding minimum requirements established by reference standards will be accepted for the Work if such products are compatible with and harmless to Work with which they are incorporated.

3. Substitution Of Products During Progress Of Work

3.1. Products substituted for those specified or approved, or both, shall be permitted only if the listed product cannot be delivered to maintain construction schedule and if the delay is caused by conditions beyond the Contractor's control.

3.2. Obtain approval for substitutions. Application for approval of substitutions shall be made only by Contractor. Process proposals for substituted Work in accordance with procedures established for changes in the Work.

3.3. Submit, with request for substitution, documentary evidence that substituted products are equal to, or superior to, approved products, and a comparison of price and delivery factors for both specified or approved products, and proposed substitute.

3.4. Ensure that substituted products can be both physically and dimensionally incorporated in the Work with no loss of intended function, performance, space or construction time, and that spare parts and service are readily available. The Contractor shall be responsible for additional installation costs, including architectural and engineering fees, required by incorporation of substituted products, and for adaptations made otherwise necessary to ensure that above requirements are satisfied.

4. Product Handling

4.1. Manufacture, pack, ship, deliver and store products so that no damage occurs to structural qualities and finish appearance, nor in any other way detrimental to their function or appearance, or both.

4.2. Ensure that products, while transported, stored or installed, are not exposed to an environment which would increase their moisture content beyond the maximum specified.

4.3. Schedule early delivery of products to enable Work to be executed without delay. Before delivery, arrange for receiving at site.

4.4. Deliver package products, and store until use, in original unopened wrapping or containers, with manufacturer's seals and labels intact.

4.5. Label packaged products to describe contents, quantity and other information as specified.

4.6. Product handling requirements may be repeated and additional requirements specified, in other Sections.

5. Storage & Protection

5.1. Coordinate material delivery to ensure that areas within or on building are available to receive them.

5.2. Store manufactured products in accordance with manufacturer's instructions, when such instructions are attached to products or submitted by him.

5.3. Store finished products and woodwork under cover at all times.

5.4. Store and handle flammable liquids and other hazardous materials in approved safety containers and as otherwise prescribed by safety authorities. Store no flammable liquids or other hazardous materials in bulk within the Project.

5.5. Storage and special protection requirements may be repeated, and additional requirements specified, in other Sections.

6. Defective Products & Work

6.1. Products and Work found defective; not in accordance with the Specifications; or defaced or injured through negligence of the Contractor, his employees or subcontractors, or by fire, weather or any other cause will be rejected for incorporation in the Work.

6.2. Remove rejected products and Work from the premises immediately.

6.3. Replace rejected products and Work with no delay after rejection. Provide replacement products and execute replacement Work precisely as required by the Specification for the defective Work replaced. Previous inspection and payment shall not relieve the Contractor from the obligation of providing sound and satisfactory Work in compliance with this Project Manual.

7. Workers, Suppliers & Subcontractors

7.1. Assign Work only to workers, suppliers, and Subcontractors who have complete knowledge, not only of the conditions of this Project Manual, but of jurisdictional requirements, and reference standards and specifications.

7.2. Give preference to use of local workers, suppliers, and Subcontractors wherever possible.

8. Workmanship

8.1. Unless otherwise specified in a more detailed manner, workmanship shall be of the highest quality recognized by trade executing the Work in accordance with standard practices, by the best methods recommended by the manufacturer of the Product, and as approved by the Architect.

END OF SECTION 01 61 00

SECTION 01 77 00 – CONTRACT CLOSEOUT

1. Section Includes

1.1. Final cleaning.

1.2. Spare parts and maintenance materials.

1.3. Take over procedures.

2. Related Sections

2.1. Individual Specifications Sections: Specific requirements for operation and maintenance data.

3. Final Cleaning

3.1. Refer to the General Conditions of Contract.

3.2. Before final inspection, replace glass and mirrors broken, damaged and etched during construction, or which are otherwise defective.

3.3. In addition to requirements for cleaning-up specified in General Conditions of the Contract, include in Work final cleaning by skilled cleaning specialists on completion of construction.

3.4. Remove temporary protections and make good defects before commencement of final cleaning.

3.5. Remove waste products and debris other than that caused by the Owner, other contractors or their employees, and leave the Work clean and suitable for occupancy by Owner.

3.6. Remove surplus products, tools, construction machinery and equipment. Remove waste products and debris other than that caused by the Owner or other Contractors.

3.7. 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.

3.8. Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, and floors and ceilings.

3.9. Vacuum clean and dust building interiors, behind grilles, louvres and screens as affected by Work.

3.10. Wax, seal, shampoo, buff or prepare floor finishes, as recommended by the manufacturer. Use products compatible with products used by building maintenance staff.

3.11. Broom clean and wash all horizontal and vertical surfaces as affected by Work.

3.12. Clean up and make good exterior grades, lawns, planting and surfaces after removal of temporary access and facilities.

3.13. Removing of visible labels left on materials, components, and equipment.

3.14. Maintain cleaning until Owner has taken possession of building or portions thereof.

4. Spare Parts And Maintenance Materials

4.1. Spare parts and maintenance materials provided shall be new, not damaged or defective, and of the same quality and manufacture as Products provided in the Work. If requested, furnish evidence as to type, source and quality of Products provided.

4.2. Defective Products will be rejected, regardless of previous inspections. Replace products at own expense.

4.3. Store spare parts and maintenance materials in a manner to prevent damage, or deterioration.

4.4. Provide spare parts, special tools, maintenance and extra materials in quantities specified in individual specification Sections.

4.5. Provide items of same manufacture and quality as items in the Work.

5. Demonstration Of Systems & Equipment

5.1. Give a complete demonstration of all systems and equipment in the presence of the Consultant at the following times:

5.2. When each is 100% completed at the request of the Contractor.

5.3. At time of inspection to validate final completion.

5.4. At final completion for the benefit of the maintenance staff for the Project.

5.5. Responsible personnel representing the Subcontractor responsible for the Work being demonstrated shall be present at each demonstration.

6. Submittals

6.1. Submit with application for substantial performance certificate.

6.1.1. Certificate of substantial completion inspection report from electrical utility or inspection.

6.1.2. Certificate of verification of fire alarm system.

6.1.3. Certificate from the Fire Marshal's Office and I.A.O. of final inspection of sprinkler system.

6.1.4. Air balance reports.

6.1.5. Other reports required or specified.

6.1.6. Maintenance Manuals and Operating Instructions.

6.2. Submit with application for release of final payment:

6.2.1. Final project record drawings.

6.2.2. Extra stock.

6.2.3. Performance bonds which shall remain in effect for one (1) year after take-over date.

6.2.4. Completed Liability Insurance Policy extended for one (1) year from take-over date.

6.2.5. Written guarantee covering all workmanship and materials used in the Work.

6.2.6. Maintenance bonds as specified.

6.2.7. Extended Warranties as specified

6.2.8. Certificate from Workers' Compensation Board.

6.2.9. Certificate from Health Services Tax Division.

7. Final Inspection Procedures

7.1. Schedule, make arrangements for and administer final inspections and close out in the following stages.

7.2. Contractor's Inspection:

7.2.1. Determination that Project meets requirements for substantial performance and inspection is the responsibility of the Contractor.

7.2.2. The Contractor and all Subcontractors shall conduct an inspection of the work, identify deficiencies and defects; repair as required. Notify the Consultant in writing of satisfactory completion of the contractor's Inspection and that corrections have been made. Request a Consultant's Substantial Performance Inspection.

7.3. Consultant's Inspection: Consultants and the Contractor will perform an inspection of the Work to identify obvious defects or deficiencies. The contractor shall correct Work accordingly.

7.4. Substantial Performance Inspection:

7.4.1. When the items noted above are complete, request a substantial performance inspection of the Work by the Consultant, and the Contractor. If Work is deemed incomplete by the Consultant, complete the outstanding items and request a re-inspection.

7.4.2. Substantial performance inspections shall be scheduled to begin within eight working days of the Contractor's request.

7.4.3. Present at the substantial performance inspection will be:

7.4.3.1. The Consultant and his Sub-consultants that he requires and notifies.

7.4.3.2. The Owner's representatives, upon notification by the Consultant.

7.4.3.3. The Contractor and such Subcontractors that he considers are required.

7.4.3.4. The Contractor will compile a substantial performance deficiency list at this inspection and issue it to the Consultant and Owner.

7.4.3.5. The Contractor shall correct substantial performance deficiencies before a date agreed upon by the Contractor and Consultant.

7.4.3.6. Upon the Consultant's approval of substantial performance, the Contractor shall submit an application for a substantial performance certificate.

7.4.3.7. When the Contractor has satisfied himself that these corrections have been completed in a satisfactory manner by his inspection he shall schedule a final Contractor's inspection by the Consultant, and the Owner's representatives if required, within five working days of the Contractor's request.

7.4.3.8. Upon the Consultant's approval of completion, the Contractor shall submit an application for a completion certificate.

8. Substantial Performance

8.1. The Consultant will issue a Certificate of Substantial Performance when satisfied outstanding deficiencies noted during inspections prior to the substantial completion inspection have been corrected, the Work is substantially complete and is so certified by the Owner.

8.2. A list of remaining deficiencies to be rectified before final acceptance will be attached to the Certificate of Substantial Performance.

8.3. Make submissions specified in Subparagraph 1.06 of this Section.

9. Certificate For Release Of Amount Due At Substantial performance

9.1. The Consultant will issue to the Owner a certificate for release of money in an amount equal to the amount due the Contractor under the Agreement providing he is satisfied the Work has been substantially completed.

9.2. The certificate shall indicate the date of substantial performance.

9.3. Payment shall be due upon date of substantial performance.

10. Completion Certificate

10.1. The Consultant will issue a Certificate of Completion (DSS Document DC670-92) when he is satisfied that outstanding deficiencies noted during inspections have been corrected and the Work is completed and is so certified by the Owner.

10.2. The date of the completion certificate will commence the required sixty (60) day period before release of final payment.

11. Certificate For Release Of Final Payment

11.1. The Consultant will issue to the Owner a certificate for release of final payment sixty (60) days after date of completion certificate providing he is satisfied the Work has been completed.

11.2. The certificate will be in an amount equal to the remaining money due the Contractor under the Contract, and shall indicate the date of final completion.

11.3. Payment shall be due upon date of final completion.

12. Warranties

12.1. Establishment of Warranties:

12.1.1. Warranties shall commence on date of substantial performance certificate.

12.2. Warranty Period:

12.2.1. The Owner will advise the Consultant of defects observed during warranty periods.

12.2.2. The Consultant will notify the Contractor of defects observed during warranty period and request him to remedy the defects in accordance with the Contractor documents.

12.2.3. Thirty (30) days before expiration of warranties the Owner's representatives, the Consultant and the Contractor will inspect the Work as arranged by the Contractor noting defects of products and workmanship.

12.2.4. The Contractor shall immediately remedy such noted defects.

END OF SECTION 01 77 00

CONTRACTOR'S CHECKLIST

Enclose the following documents with your bid:

□ ***Bid Security as required in section 21.1(Information for Bidders)*** **-** in the amount of 10% of the Contract Price (before HST).

□ ***Contract Security for bids over $100,000 as required in section 22.6.1.1(Information for Bidders)*** – required upon award)

□ ***Certificate of Insurance*** indicating a minimum of **$5,000,000** ***Commercial General Liability Insurance*** per occurrence and ***Commercial Auto Liability Insurance*** covering all owned, non-owned and hired vehicles for a minimum combined single limit of **$2,000,000** per occurrence and ***Builder's Risk Insurance*** in the amount of the contract price.

□ ***Tentative Work Schedule (Timelines)*** – Subsequently, within five (5) business days of tender award the successful bidder shall provide a schedule clearly indicating timelines for completion of all aspects of the project.

□ ***Workers' Compensation Board Letter*** of Good Standing

□ ***Certificate of Recognition from one of the seven safety audit companies that jointly sign with the WCB***:

- East Coast Mobile Medical Inc.
- HSE Integrated
- Nova Scotia Construction Safety Association
- Nova Scotia Trucking Safety Association
- Occupational Health & Educational Services (2002) Inc.
- Safety Services Nova Scotia
- Stantec Inc.

This list can be found on WCB's website: www.wcb.ns.ca.

□ ***Completed HRSB Safety Plan***

□ ***Applicable Warranty Information***

Halifax Regional School Board

Project Safety Plan Outline

During the planning of each project, environmental and occupational health and safety issues will be assessed like any other key project component.

Prior to beginning a new project, tendering contractors shall examine the work area to identify potentially hazardous site specific situations.

Once identified, these hazards should be prioritized on this Hazard Assessments/Project Safety Plan Outline and corrective *actions* noted to eliminate or control each hazard. The dates of when and names of the persons who are responsible for completing the *action* should also be assigned.

Copies of the completed Safety Plan Outline shall be submitted as part of the tender document submittal, sent to the HRSB Operations Services Regional Manager, made available on the job site and communicated to the workers.

Project Name: _____

Project Location: _____

Project Start date: _____

Project End date: _____

Company Name: _____

Completed by: _____
(Contractor's project manager)

Date: _____

Copy to: _____

PLANNING:

Does the Contractor's Occupational Health and Safety Program deal with the work activities associated with this project? ☐ Yes ☐ No

Describe tasks to be undertaken:_____

_____

_____

_____

HAZARDS ASSESSMENT:

Identify the hazards that could present themselves on this project (e.g. live electrical wires, over water, confined space, etc) and describe what steps will be taken to prevent an incident (e.g. cover up, de-energize, safe work practices, netting, etc). Prioritize from #1 as needing immediate action.

#	Hazard	Required Action	Completed by	Date
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

ENVIRONMENTAL ASSESSMENT:

Identify the environmental issues that could present themselves on this project (e.g. oil spills, asbestos, etc.) and describe the action that will betaken to eliminate or reduce the risk of occurrence (e.g. mop kits, air sampling, etc.)

#	Hazard	Required Action	Completed by	Date
1				
2				
3				
4				
5				

EMERGENCY RESPONSE:

In the event of an incident, pre-plan the response and write up the procedures. Minimally, the following list should be completed and posted on site:

Contact	Phone #	Contact	Phone #
Fire	911	Poison Control	428-8161
Ambulance	911	Dangerous Goods	1-800-565-1633
Doctor	911	Waste Disposal	
Police	911	Insurance	
HRSB Office	493-5110	Min/Dept of Labour	1-800-952-2687
Min./Dept.of Transport.		Min/Dept of Environment	1-800-565-1633

- Identify and arrange source of first aid, ambulance and rescue.
- Accidents will be reported to: _____
- Accidents will be investigated by: _____
- Back-up call to: _____
- HRSB # emergency/after hours: day 493-5110 after 4:00 pm 442-2476

SAFETY MEETINGS:

On this project, given the nature of the work and the anticipated size of the work force, the following frequency will apply:

Site meetings _____

Site Audits _____

Follow up with HRSB Manager: _____

SITE IMPLEMENTATION:

- Health and Safety Rep & Safety Committee:
  Establish liaison between HRSB, contractor, site administration
  First Aid, PPE, other safety items as required.

- Documentation:
  Applicable MSDS
  Safety program
  Applicable work procedures
  Permits
  First Aid Certification

TRAINING:

The following training/testing will be mandatory on site:

1) _____

_____

2) _____

_____

3) _____

_____

TENTATIVE SCHEDULE OF WORK:

1) Date Project Will Commence: _____

2) Number of Weeks to Complete Project: _____ weeks

NOTE:

Within one week of tender award the successful bidder shall provide a schedule clearly indicating timelines for completion of all aspects of the project.

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section.

.2 This section covers items common to all sections of Division 21, 22, 23, 24 and 25.

1.2 RELATED SECTIONS THAT ARE PART OF DIVISION 21 TO 25 WORK

.1 Section 25 01 11 BAS: Start-Up and Verification

.2 Section 25 05 01 BAS: General Requirements

.3 Section 25 05 02 BAS: Submittals

.4 Section 25 30 01 BAS: Building Controllers

.5 Section 25 30 02 BAS: Field Control Devices

.6 Section 25 30 03 BAS Field Wire and Components Installation

1.3 INTENT

.1 It is the intent of these specifications to outline the method, materials, and quality of equipment to be furnished and installed hereinafter specified and/or shown on the drawings.

.2 The Mechanical Contractor shall be responsible for the installation of all equipment, materials, and accessories, and the labour required for the completion of this contract to the full satisfaction and acceptance of the Consultant. Misinterpretation of either the drawings or the specifications will not relieve the Contractor of responsibility.

1.4 DEFINITIONS

.1 "CONCEALED" - mechanical services and equipment in hung ceiling spaces and non-accessible chases and furred spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 "Domestic Water" includes domestic cold water, domestic hot water, tempered hot water and domestic hot water recirculation.

.4 "Hydronic" includes heat pump supply and return piping.

.5 “Provide” will mean “Supply and install”.

1.5 REFERENCE STANDARDS

.1 The most stringent requirements of local municipal by-laws, provincial codes and following codes and standards shall be followed.

.2 In no instance shall the Standard established by the contract documents be reduced by the application of any other codes.

.3 General
- .1 Nova Scotia Building Code Regulations Effective January 31, 2015.
- .2 National Building Code of Canada - 2010.
- .3 National Fire Code of Canada - 2010.
- .4 National Plumbing Code of Canada - 2010.
- .5 National Energy Code of Canada for Buildings 2011.
- .6 The following standards/codes are referenced in the above codes:
  - .1 ASTM A653/A653M Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  - .2 SMACNA HVAC Duct Construction Standards - Metal and Flexible.

1.6 EQUIPMENT INSTALLATION

.1 Unions or flanges: provide for ease of maintenance and disassembly.

.2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer or as indicated.

.3 Equipment drains: pipe to floor drains.

.4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.

1.7 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

1.8 ELECTRICAL

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

.2 Coordinate with Electrical Contractor to ensure that all controlled equipment is correctly connected for operation in accordance with plans and specifications, including supplying all necessary electrical interconnection information and location to Electrical Contractor.

1.9 EXISTING SYSTEMS

.1 Connections into existing systems to be made at time approved by Consultant. Request written approval of time when connections can be made.

.2 Be responsible for damage to existing plant by this work.

.3 Ensure that all plumbing, heating, ventilation and other mechanical systems and services remain operational during the course of the renovation of the existing building and, if necessary, this Contractor shall be responsible for providing such temporary services by cutting off, altering, adapting, relocating and connecting existing services and disconnecting and removing such temporary or existing services upon providing new permanent services as detailed on all drawings. The site shall be examined to determine the extent of the temporary services and all co-ordination shall be made with the Owner's Representative. All costs shall be included in the Tender Price.

.4 Existing equipment, piping, ducting, etc. not being re-used under new schemes, shall be removed whether shown on drawings or not. The General Contractor shall repair all openings resulting from the removal of existing mechanical equipment and services. All costs shall be included in the Tender Price.

1.10 DRAWINGS

.1 The drawings accompanying this specification are to be considered as diagrammatic only and do not show all the structural and construction details. Any information involving measurements of the building shall be taken from the architectural and structural drawings, and at the building site. Make without additional charge any necessary changes or additions to the runs to accommodate structural conditions.

.2 The Mechanical drawings are not to be scaled.

.3 The drawings and the specifications shall be considered an integral part of the contract documents. Neither the drawings nor the specifications shall be used alone. Misinterpretation of any requirements of either plans or specifications shall not change the requirements of the specifications for proper completion of the work to the full approval of the Consultant.

.4 Except where dimensioned, indicate general Mechanical layouts only. Because of the small scale of Mechanical drawings, it is not possible to show all offsets, fittings and accessories which may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves and accessories which are required to meet the conditions.

.5 The drawings indicate the general location and route to be followed by the pipes, ducts, conduits, etc., which are installed under this contract. Where the required conduit work, piping, ductwork, etc., is not shown on the plans or only shown diagrammatically, these shall be installed as tight as possible to structural members, concrete, ceilings, and walls to interfere as little as possible with the free use of the space through which they pass.

.6 The drawings and specifications are intended to supplement each other so that any details shown on the drawings are not mentioned in the specifications, or vice versa, shall be executed in the same manner as if contained in the specifications and shown on the drawings.

.7 Should any discrepancy appear between these specifications and the drawings to cause doubt as to the true meaning and intent of the drawings ad specifications, a ruling shall be obtained from the Consultant before submitting the tender. If this is not done it will be assumed that the more expensive alternative has been included in the contract.

.8 Layouts on the Mechanical drawings are based on the specified equipment, including mechanical and electrical connections and physical dimensions. Alternate equipment and systems proposed by the Contractor for use on this project, which necessitates changes in service connections to perform the specified functions may be considered by the Consultant, however, any required modifications or additions shall be done at no additional cost to the Owner. Furthermore, if it is found that the provisions made regarding space conditions and code required clearances are not met, the right is reserved by the Consultant to require installation of the equipment specified.

1.11 CONTRACT DOCUMENTS

.1 Before submitting tender for his work, each Contractor shall examine the contract documents (electrical drawings, structural drawings, and architectural drawings and specifications) to ascertain that the work can be carried out as shown on these drawings and herein specified. No extra will subsequently be allowed to cover any omission and/or oversight for not having made a thorough inspection of the contract documents.

1.12 EXAMINE THE SITE AND CONDITIONS

.1 Each Contractor shall visit and examine the site and the local conditions affecting this work. No allowance will be made later for any expenses occurred through failure to make these examinations.

1.13 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with the Project Waste Reduction Workplan.
.2 Place materials defined as hazardous or toxic waste in designated containers.

.3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Project Waste Management Plan

1.14 LOW VOC MATERIALS

.1 All site applied coatings, adhesives & sealants must conform to low VOC content requirements.

.2 Provide Material Safety Data Sheets for all products and materials of these types incorporated into the work.

2 Products

2.1 MATERIAL

.1 For the purpose of uniformity similar materials shall be by one manufacturer.

.2 Standard of Acceptance and/or Acceptable Material:
.1 Means that item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

.3 Acceptable Manufacturer:
.1 Means that item manufactured by named and specified manufacturer, meeting the specification and referenced standard regarding performance, quality of material and workmanship shall be deemed acceptable.

.4 Refer to Instructions to Bidders for requirements of additional Acceptable Manufacturers or Acceptable Material.

2.2 ELECTRICAL DEVICES AND PANELS.

.1 All electrical equipment and devices to be CSA certified and manufactured to standard quoted.

.2 The assembly of combinations of electrical components, such as, relays, current transformers, BAS devices, transformers, fuse blocks, transducers or other certified components in an enclosure to form an overall electrical assembly shall be CSA certified.
.3 Where field modifications are made to certified electrical equipment, arrange and pay for field certification by CSA.

2.3 MOTORS

.1 Provide motors for mechanical equipment as specified.
.2 If delivery of specified motor will delay delivery or installation of any equipment, install motor approved by Consultant for temporary use. Final acceptance of equipment will not

occur until specified motor is installed.

.3 All motors to be Definite Purpose Inverter Fed Motors in accordance with NEMA MG1.1993 Rev 3 Part 31 suitable for current and/or future variable frequency drives (VFD's). Exceptions: Sump pumps, wet rotor pumps, multi speed pumps, ECM pumps, oil and gas burners, unit heaters, cabinet heaters, cabinet fans and where noted.

.4 Motors under 370 Watts (1/2 HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, 60 Hertz, unless otherwise specified or indicated.

.5 Motors 370 Watts (1/2 HP) and larger: EEMAC Class B, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, 3 phase, 208 V, 60 Hertz, maximum temperature rise 40° C, unless otherwise specified or indicated.

.6 Service factor 1.15.

.7 Totally enclosed fan cooled (TEFC) where specified.

2.4 BELT DRIVES

.1 Fit reinforced belts in sheaves matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motors under 7.5kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5kW (10 HP) and over: sheaves with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheaves of correct size to suit balancing.

.5 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

2.5 GUARDS

.1 Provide guards for unprotected drives.

.2 Provide means to permit lubrication and use of test instruments with guards in place.

.3 Guards for belt drives:
- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.3 mm (18 Ga.) thick sheet metal tops and bottoms.
- .3 38 mm (1 1/2") diameter holes on both shaft centers for insertion of tachometer.

.4 Removable for servicing.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Guard for flexible coupling:
- .1 "U" shaped, minimum 1.6 mm (16 Ga.) thick galvanized mild steel.
- .2 Securely fasten in place.
- .3 Removable for servicing.

.6 Unprotected fan inlets or outlets:
- .1 Wire or expanded metal screen, galvanized, 20 mm (3/4") mesh.
- .2 Net free area of guard: not less than 80% of fan openings.
- .3 Securely fasten in place.
- .4 Removable for servicing.

2.6 EQUIPMENT SUPPORTS

.1 Equipment supports supplied by equipment manufacturer: specified elsewhere in Mechanical Contractor.

.2 Equipment supports not supplied by equipment manufacturer: fabricate from structural grade steel.

2.7 PAINT

.1 Apply at least one coat of primer paint to ferrous supports, pipe hangers and site fabricated work.

.2 Primer to be The Master Painters Institute MPI #23 with VOC < 351 grains/L

2.8 SMOKE SEAL AND/OR ACOUSTIC SEAL

.1 Firestop all pipe penetration through fire rated walls and fire rated floor.
- .1 Refer to Section 21 05 04 Through-Penetration Firestopping for Mechanical Systems

.2 Where non rated walls extend from floor to floor or floor to roof deck and non-rated floors.
- .1 Smoke seal and/or acoustic seal all pipes, both sides of wall/floor.
- .2 Smoke seal and/or acoustic seal between duct and wall, both sides of wall/floor.

2.9 ESCUTCHEONS

.1 On pipes passing through walls, partitions, floors and ceilings in finished areas.

.2 Chrome or nickel plated brass or Type 302 stainless steel, split piece type.
- .1 Standard of Acceptance:

.1 Grinnell Fig 2 and 13.

.3 Outside diameter to cover opening or sleeve.

.4 Inside diameter to fit around finished pipe.

2.10 ACCESS DOORS

.1 Supply access doors to concealed mechanical equipment for operating, inspecting, adjusting and servicing.

.2 Size:
- .1 Sized to access concealed services
- .2 Minimum 600 x 600 mm (24" x 24") for body entry
- .3 Minimum 300 x 300 mm (12" x 12") for hand entry
- .4 Minimum 150 mm (6”) larger than access door in ductwork.
- .5 Unless otherwise noted.

.3 Door flush with frame.

.4 For unrated construction
- .1 Allen Key lock(es)
- .2 Flat door type
  - .1 Rounded safety corners
  - .2 One piece outer flange welded to mounting frame
  - .3 One piece concealed hinge
- .3 Formed door type

.5 For fire rated construction
- .1 Pull ring or raised knurled knob operated latch bolt
- .2 Interior latch release
- .3 Automatic closer
- .4 Hinged door
- .5 Flanged frame
- .6 For walls:
  - .1 1- 1/2 hour 'B' label
- .7 For ceiling membrane:
  - .1 1 hour label

.6 Material:
- .1 Remaining areas: use prime coated steel.

.7 Installation:
- .1 Locate so that concealed items are accessible.
- .2 Locate so that hand or body entry (as applicable) is achieved.
- .3 Install in accordance with manufacturer's recommendation

.8 Acceptable material:

	Unrated	Fire Rated	Fire Rated

		Wall	Wall	Ceilings
.1	Acudor	EB-2002 or UF-5000	FB-5050	FW-5050
.2	Cendrex	AHD	PFI	-
.3	Mifab	UA	MPFR	MPFR
.4	SMS	WB-GP	WB-FR	WB-FRC

2.11 DRAINS VALVES

.1 In accordance with Section 23 05 23 Valves.

2.12 HANGERS AND SUPPORTS

.1 As per Section 23 05 29 Hangers and Supports.

2.13 IDENTIFICATION

.1 As per Section 23 05 53 Mechanical Identification.

2.14 INSULATION

.1 As per Section 23 07 00 Mechanical Thermal Insulation.

3 Execution

3.1 INSTALLATION

.1 Install all work in accordance with authorities having jurisdiction and manufacturer's requirements. In case of conflicting requirements, the more stringent shall apply.

3.2 PROTECTION OF OPENINGS

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

.2 No fans to be started until the project has been cleaned to the satisfaction of the Consultant.

3.3 TESTS

.1 Give 4 working days written notice of date for tests.

.2 Insulate or conceal work only after testing by contractor and review by Consultant.

.3 Conduct tests in presence of Consultant or representative authorized by the Consultant.

.4 Bear costs including retesting and making good.

.5 Equipment: test as specified in relevant sections.

.6 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures of test medium.

.7 Provide signed copies of all tests within 2 weeks of completion of each test.

3.4 BACnet

.1 When equipment is specified to be supplied with a communication card and is to be connected to the BAS network and "communicate to the BAS" using the BACnet standard, the equipment includes:

- .1 BACnet communication media
  - .1 For unitary equipment, BACnet communication over RS485 2- wire network and a 76,800 baud rate is acceptable.
  - .2 For major mechanical equipment BACnet communication over an Ethernet is acceptable.
- .2 Equipment shop drawings are to include:
  - .1 Job specific wiring diagrams with details on interface wiring including, wire type and detailed wire termination drawings.
  - .2 Details on site specific addressing requirements and confirmation there will be no conflicts with the existing system architecture.
  - .3 Details as to what type of information can be read from the device and also what type of information can be written or defined from the BAS.
  - .4 Specified or intended sequence of the equipment and how the equipment will operate to meet your sequence a building requirements.
- .3 Complete with all configuration and programming software. Including any specific cables and proprietary software required to connect to and program the equipment. The owner will have full access to the equipment sequence at turnover of project. Equipment sequence is to be fully programmable by the Factory Trained Authorized Manufacturer Service Technician on site.
- .4 Field start-up to be performed by Factory Trained Authorized Manufacturer Service Technician.
- .5 Factory Trained Authorized Manufacturer Service Technician to be on site for start-up, commissioning and be available for technical support when required during the installation, setup and customer training.

.2 BAS ready equipment.

- .1 Complete with a terminal strip and receive direct hardwired control commands from the BAS.
- .2 BAS will directly control the equipment using analog and digital signals. This will allow the BACnet BAS to have direct control of the equipment and sequence. The only internal controls are the high/low safety limits that are “hardwired” inside the equipment.

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Shop Drawings to be Project Specific

.2 All Shop Drawings to be Metric.

.3 Prior to submitting shop drawings, the Mechanical Contractor to review the shop drawing to ensure that they meet the requirements of the contract documents in all respects, that they are clear and legible, all options are being provided are clearly indicated and that the dimensions, weights, power requirements, quantities and capacity are consistent with the requirements of the contract documents.

.4 Assembled in groups and bound in sets.

.5 On cover/front page indicate total number of pages in submission.

.6 Consecutively number each page.

.7 Shop Drawings to list components that are shipped loose.

.8 Shop Drawings to include **Project Specific** wiring diagrams.

.9 Shop Drawings for items with BACnet® control to include **Project Specific** list of BACnet® read/write variables. Also refer to Section 21 05 01 Mechanical General Requirements and Section 25 05 02 BAS: Submittals

.10 Attach a Mechanical Contractor's Shop Drawing Review Confirmation to each shop drawing confirming the following:

- .1 The mechanical shop drawings have been reviewed by the Mechanical Contractor and all items are in conformance with the contract documents __ Yes __ No
- .2 Project specific model numbers and/or options are indicated __ Yes __ No
- .3 Mechanical Contractor: _____
- .4 Mechanical Contractor Project Representative: _____
- .5 Mechanical Contractor Signature: _____
- .6 Item: _____
- .7 Specification Section and item number: _____
- .8 Drawing reference: _____

.11 In addition to the electronic shop drawing, submit one hard copy to the office of the mechanical consultant.

.12 Section 23 25 00 HVAC Water Treatment Systems.

.13 Section 23 81 40 Water Source Heat Pumps.
- .1 Fan curves and sound rating data showing point of operation.
- .2 Motor type.
- .3 Capacity at specified conditions.
- .4 Control equipment shipped loose, by packaged equipment supplier, showing final location in field assembly.
- .5 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories, controllers.
- .6 Provide electrical service requirements in accordance with Canadian Electrical Code.
  - .1 Minimum circuit Ampacity.
  - .2 Maximum overcurrent protection.
- .7 Provide comparison sheet showing the following for the specified unit versus unit being supplied: Unit #, fan size, Airflow, ESP, RPM, BHP/HP, coil performance, discharge sound data, radiated sound data and electrical requirements.

.14 Section 25 05 01 BAS: General Requirements.
- .1 Refer to Section 25 05 02 BAS: Submittals
- .2 Copy of Control Wiring Electrical Wiring Permit

.15 Shop drawings and product data shall show:
- .1 Mounting arrangements.
- .2 Operating and maintenance clearances, e.g. access door swing spaces.

.16 Shop drawings and product data shall be accompanied by:
- .1 Detailed drawings of bases, supports, and anchor bolts.
- .2 Acoustical sound power data, where applicable.
- .3 Points of operation on performance curves.
- .4 Manufacturer to certify as to current model production.
- .5 Certification of compliance to applicable codes.
- .6 Wiring diagrams and electrical characteristics specified for unit supplied.

1.3 MATERIAL ON SITE

.1 Refer to General Conditions of Contract.

.2 All claims for material on site must be supported by supplier’s invoices showing supplier’s unit prices including taxes.

.3 Material on site shall not be claimed under the “work complete” portion of the claim.

.4 Material eligible to be claimed as “material on site” must be project specific equipment, such as Heat pumps, etc.

.5 General material which is not considered project specific such as piping, fittings, control conduit, control wire, ductwork, small tools, etc., are not eligible to be claimed as "material on site."

.6 Project specific equipment may be claimed as "material on site" subject to the following:
- .1 Claim to show previous material on site and deduct the amount of previously claimed material that was incorporated into the work during the current month.
- .2 Claim to show material brought on site this month supported by a copy of the supplier's invoices showing supplier's unit prices including taxes.

.7 Invoices submitted for a "material on site" claim will not be considered by the engineer unless they are examined and initialed by both the mechanical contractor and the General Contractor.

1.4 START UP REPORT MANUAL

.1 Custom designed and contain material pertinent to this project only and to provide full and complete coverage of subjects referred to in this section.

.2 Operating and maintenance manual to be approved by and final copies deposited with Consultant before final inspection.

.3 Organize by specification section.

.4 Start Up and Performance data to include:
- .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
- .2 Start up and verification reports
- .3 Testing, adjusting and balancing reports as specified in Section 24 05 93, Testing, Adjusting and Balancing (TAB) of Mechanical Systems.

.5 Submittals:
- .1 Submit a copy of the complete Start Up Report Manual to Consultant for Review.
- .2 Start Up Report Manual Part 1
  - .1 Start up and verification reports as required with application for substantial performance certificate as per Section 21 05 03, Common Work Results for Mechanical Contract Closeout.
- .3 Start Up Report Manual Part 2
  - .1 Start up and verification reports as required with application for release of final payment as per Section 21 05 03, Common Work Results for Mechanical Contract Closeout.
- .4 Submission of individual data will not be accepted unless so directed by Consultant.
- .5 Make changes as required and re-submit as directed by Consultant.
- .6 Hard-back, 25 mm (1") 3 ring, D-ring binders.
- .7 Binders to be 2/3 maximum full.
- .8 Provide index to full volume in each binder.

.9 Identify contents of each manual on cover and spine.

.10 Include names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.11 Provide full Table of Contents in each manual. Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.5 OPERATING AND MAINTENANCE (O&M) MANUAL

.1 Operating and maintenance manual to be reviewed by the Consultant and final copies deposited with Consultant before application for substantial performance certificate

.2 Organize by specification section.

.3 O&M Manuals to be custom designed and contain material pertinent to this project only and to provide full and complete coverage of subjects referred to in this section.

.4 Customize O&M data from manufacturer's to suit this project.

.1 Provide site specific manual or

.2 Neatly cross out non applicable generic information in the manual.

.3 In Manufacturer's literature, highlight model supplied for this project.

.5 Project records and O&M manuals specified in this section

.6 Operation data to include:

.1 Control schematics for each system including environmental controls.

.2 Description of each system and its controls.

.3 Description of operation of each system at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for each system and each component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule.

.7 Color coding chart.

.7 Maintenance data shall include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.8 Submittals:

.1 Include a copy of all reviewed mechanical shop drawings.

.2 Submit a copy of the complete O&M Manual to Consultant for Review.

.3 Submission of individual data will not be accepted unless so directed by Consultant.

.4 Make changes as required and re-submit as directed by Consultant.

.5 Minimum 2 copies of Manuals

.6 Hard-back, 50 mm (2") 3 ring, D-ring binders.

.7 Binders to be 2/3 maximum full.

.8 Provide index to full volume in each binder.

.9 Identify contents of each manual on cover and spine.

.10 Include names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.

.11 Provide full Table of Contents in each manual. Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

.9 Provide maintenance data for the following:

.1 Section 23 81 40 Water Source Heat Pumps

.10 Prepare and insert into operation and maintenance manual, additional data when need for same becomes apparent during demonstrations and instructions specified above.

1.6 RECORD DRAWINGS

.1 Site Records:

.1 Make available for reference purposes and inspection at all times. Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include change orders, site instructions, and changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Obtain AutoCAD drawing files from the consultant. The Contractor to update at his own expense the AutoCAD files to show the as-built conditions.

.3 On a regular basis, transfer information to the AutoCAD files, revising drawings to show all work as actually installed. These AutoCAD files will at their completion, become the as-built drawings for this project.

.4 Ensure that the modifications follow the same standard as the original file, that is, layer control, line weights, line types, etc.

.5 Make available for reference purposes and inspection at all times.

.2 Record Drawings:

.1 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of record drawings.

.2 Identify each drawing in lower right hand corner in letters at least 13 mm (1/2") high as follows: -"RECORD DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).

.3 Include on the Record Drawings the identification number off all terminal units and as installed location.

.4 Include on the Record Drawings as installed location of all temperature sensors and/or thermostats

.5 Submit to Consultant for approval and make corrections as directed.

.6 TAB to be performed using as-built drawings.

.7 Submit completed hard copy of as-built drawings with Operating and Maintenance Manuals.

.8 Submit computer disk with the AutoCAD files to the consultant

.3 Where products are specified by manufacturer and/or model, update AutoCAD file to show installed manufacturer and model.

2 Products N/A

3 Execution N/A

END OF SECTION

1 General

1.1 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Common Work Results for Mechanical.

1.2 SUBMITTALS

.1 Start-up Report.
- .1 Provide start-up reports as listed below.
- .2 Reports to show model number, serial number, voltage and rated amperes.
- .3 If during start up there is an operation concern, repeat start-up after operation concern has been corrected.

.2 Section 21 05 02 Mechanical Submittals.
- .1 Operation and Maintenance Manuals.
- .2 Record drawings.

.3 Section 21 05 03 Common Work Results for Mechanical Contract Closeout.
- .1 Confirmation of Demonstration and Operating and Maintenance Instruction.

.4 Section 23 81 40 Water Source Heat Pumps.
- .1 Installation Check List.
- .2 Start-up Report.

.5 Section 25 05 01 BAS: General Requirements.
- .1 BAS start-up report including all field programmable software settings including demand expand setpoint and schedules.
- .2 Letter confirming maintenance contract during warranty period.
- .3 Printout of alarm limits.
- .4 Printout of program.
- .5 Copy of program on disks.
- .6 Final Inspection certificate from Inspection Authority for Control Wiring Electrical Wiring Permit

1.3 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.3 Instruction duration time requirements at Substantial Performance: 8 hours.

.4 Where deemed necessary, Owner may record these demonstrations on video tape for future reference.

2 Products N/A

3 Execution

3.1 CLEANING

.1 In preparation for final acceptance, clean and refurbish all equipment and leave in operating condition including replacement of all filters in all air and piping systems.

3.2 VERIFICATION

.1 In context of this paragraph "verify" to include "demonstrate" to consultant.

.2 Timing: commission only after start-up deficiencies rectified.

.3 Access doors: verify size and location relative to items to be services.

.4 Controls: Refer to Section 25 05 01 BAS: General Requirements.

.5 Verification reports:
- .1 Record all results on approved report forms.
- .2 Include signature of tester and supervisor.

.6 Verification:
- .1 Notify Consultant 24 hr before commencing tests.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

2 Products

2.1 RELIEF VALVE PIPING AND DRAINS

.1 All sizes: copper tube, hard drawn, type L to ASTM B88
  .1 Applications: relief valve piping, etc.

.2 NPS 1 ¼ and larger: Copper DWV or PVC DWV 25-50 as described above
  .1 Applications: air handling drains, plenums, A/C drains, etc.

2.2 HANGERS SUPPORTS

.1 As per Section 23 05 29 Hangers and Supports.

2.3 INSULATION

.1 As per Section 23 07 00 Mechanical Thermal Insulation

3 Execution

3.1 INSTALLATION

.1 Install piping parallel to building lines and close to walls and ceilings to conserve headroom and space and to grade indicated.

3.2 DRAINS

.1 Turn down at floor drain.

.2 Cut end of discharge pipe at 45°.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

1.3 MANUFACTURED ITEMS

.1 All valves of one type to be by one manufacturer.

1.4 LEAD FREE

.1 In accordance with NSF/ANSI 372 Drinking water system components – Lead Content or California Health and Safety Code (Section 116875; commonly known as AB1953) or Vermont Bill S.152

2 Products

2.1 VALVES NPS 2 AND UNDER

.1 Lead Free Ball Valves NPS 2 and under soldered and screwed:
- .1 Application
  - .1 Section 23 21 13 Hydronic Systems
- .2 Quarter-turn: 4130 kPa (600 psi) W.O.G., bronze, large port.

.2 Lead Free Swing Check Valves NPS 2 and under, soldered and screwed:
- .1 Application
  - .1 Section 23 21 13 Hydronic Systems
- .2 1380 kPa (200 psi) W.O.G., bronze body, bronze swing disc, screw in cap, regrindable seat.

.3 Acceptable material:

NPS 2 and under	Lead Free Ball	Lead Free Check
Milwaukee	UPBA150/ UPBA100	UP1509/UP509
Apollo	77CLF-100/77CLF-200	161S-LF/161T-LF
Nibco	S-685-80-LF /T -685-80-LF	S-413-Y-LF / T-413-Y-LF
Kitz	868/869	822T/823T
Watts	LFB6080/ LFB6081	LFCV/LFCVS

2.2 DRAIN VALVES AND GAUGE COCKS

.1 Lead Free Drain Valves
- .1 Locate at low points of mains, branches and risers.
- .2 At domestic water branch isolation valves, provide drain unless branch can be drained through a fixture.
- .3 At hydronic branch isolation valves, provide drain unless branch can be drained through a hydronic unit.
- .4 At pumps locate drain between pump and suction diffuser. Don't use suction diffuser drain plug.
- .5 Equipment drain valves line size.
- .6 Minimum NPS 1/2 unless otherwise specified.
- .7 Ball valve with hose end male thread and cap with chain.
- .8 On radiation and radiant panels, provide piggy back stops with hose end male thread and cap with chain.

.2 Lead Free Gauge Cocks
- .1 NPS 1/4 screwed.
  - .1 Application
    - .1 Pressure Gauge
    - .2 Air vents
    - .3 Where indicated
- .2 Quarter-turn: 1725 kPa (250 psi) W.O.G., bronze.

.3 Acceptable material:

	Drain valves	**Gauge Cocks**
Apollo	77CLF-100-HC/77CLF-200-HC	77CLF-100/77CLF-200
Kitz	868/869 w/cap and chain.	868/869
Nibco	S-685-80-LF-HC/T -685-80-LF-HC	S-685-80-LF /T -685-80-LF
Watts	LFB6080/ LFB6081 w/cap and chain	LFB6080/ LFB6081
Milwaukee	UPBA150/ UPBA100 w/cap and chain	UP1509/UP509

3 Execution

3.1 GENERAL

.1 Install valves with stems upright or horizontal unless approved otherwise.

.2 Line size.

3.2 CIRCUIT BALANCING VALVES

.1 Maintain Manufacturer's recommended minimum straight pipe diameters.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

2 Products

2.1 GENERAL

.1 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

2.2 UPPER ATTACHMENTS

.1 Caddy clip for 6 mm (¼") rod Min 90 kg Static Load.
- .1 Steel beam, channel, joist or angle.
- .2 Application: Ductwork.

.2 Universal C-Clamp.
- .1 Top of steel beam, top of channel, top of joist or angle.
- .2 Application: Cold and hot, plumbing and hydronic piping, NPS 6 and under and ductwork.

.3 Acceptable material:

	CCTF/Hunt	E. Myatt & Co	Taylor Pipe Supports	Anvil	Carpenter and Paterson Pipe Hangers Ltd.
Universal C-Clamp	56/56N/56NW		406/407	92/93/94	
C-Clamp	57	586	301	86	238

.4 For pipes and ducts parallel to steel structure:
- .1 Insert into floor slab above or
- .2 Steel member from structural member to structural member.
- .3 Double locking nuts.

2.3 MIDDLE ATTACHMENT (ROD)

.1 Cadmium plated steel threaded rod:
- .1 Acceptable Material:
  - .1 Carpenter & Paterson Pipe Hangers Ltd. Fig. 94.
  - .2 CCTF/Hunt Fig. 99P.
  - .3 Anvil Fig. 146.

2.4 PIPE ATTACHMENT

.1 Adjustable clevis hanger: to MSS-SP69, type 1, ULC listed.

.2 Long adjustable clevis hanger: to MSS-SP69, Type 1 ULC listed.

.3 Copper plated or epoxy coated adjustable clevis hanger:

.4 Acceptable material:

	CCTF/ Hunt	**E. Myatt & Co**	**Taylor Pipe Supports**	**Anvil**	**Carpenter and Paterson Pipe Hangers Ltd.**
Adjustable clevis hanger	32N	124	24Z	260	100
Long adjustable clevis hanger	32U	124L	24L	300	286
Copper plated or epoxy coated clevis hanger	30C/E	151CT or 56	52	CT65	100CT

3 Execution

3.1 PIPE SUPPORT SPACING

.1 Plumbing and Hydronic: Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below, whichever is more stringent
- .1 Plumbing piping: to National Plumbing Code of Canada.
- .2 Authority having jurisdiction.
- .3 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints and not less than one hanger per pipe length over 1200 mm (4’0”).
- .4 Within 300 mm (12") of each elbow.
- .5 Risers at each floor.
- .6 Minimum hanger rod size as per full size manufacturer's recommendation and table below, whichever is greater.

Pipe Size: NPS	Rod Diameter	Maximum Spacing Steel	Maximum Spacing Copper
up to ¾	10 mm (3/8")	2100 mm (7’0”)	1500 mm (5’0”)
1 to 1-1/4	10 mm (3/8")	2100 mm (7’0”)	1800 mm (6’0”)
1-1/2	10 mm (3/8")	2750 mm (9’0”)	2400 mm (8’0”)
2	10 mm (3/8")	3000 mm (10’0”)	2750 mm (9’0”)

3.2 PLUMBING AND HYDRONIC PIPE

.1 Upper Attachment as noted above.

.2 Middle attachment as noted above.

.3 Pipe Attachment Application
- .1 Insulated steel pipe: NPS 4 and under.
  - .1 Long adjustable clevis hanger.
- .2 Uninsulated copper pipe: All sizes.
  - .1 Copper plated or epoxy coated adjustable clevis hanger.
- .3 Insulated plumbing copper pipe: All sizes
  - .1 Copper plated or epoxy coated adjustable clevis hanger.

3.3 DUCT HANGERS

.1 In accordance with Section 24 31 13 Metal Ducts - Low Pressure to 500 Pa

3.4 MIDDLE ATTACHMENT (ROD)

.1 Trim excess threaded rod off within 13 mm (1/2") of attachment nut.

3.5 HANGER INSTALLATION

.1 Offset hanger so that rod is vertical in operating position.

.2 Adjust hangers to equalize load.

.3 Provide double nuts at middle attachment (rod) top and bottom.

.4 Where building structural members or inserts are not suitably located provide supplementary steel channels or angles, support these channels and angles only from the top of structural members. Drill holes in the channels and angles for insertion of hanger rods. If the holes are cut out with a torch, provide a back-up steel plates with drilled holes for inserting hanger rods. Secure each hanger rod to the channels and angles using a steel back-up plate where applicable and steel washers and a lock-nut system. All channels, angles and hanger rod upper supports shall have a load capacity of five (5) times the load to be supported from them.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

2 Products

2.1 MANUFACTURERS NAMEPLATES

.1 Provide metal nameplate on each piece of equipment, mechanically fastened complete with raised or recessed letters. Locate nameplates so that they are easily read. Do not insulate or paint over nameplates.

.2 Include registration plates (e.g. Pressure vessel, Underwriters' Laboratories and CSA Approval). Indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.2 SYSTEM NAMEPLATES

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

.2 Construction:
- .1 2.4 mm (3/32") thick, laminated plastic or white anodized aluminum, matte finish, square corners, letters accurately aligned and machine engraved into core.

.3 Equipment type, number and service or area or zone of building itserves to be identified.

.4 Sizes:
- .1 Conform to following table:

Size 1	10 mm x 50 mm (3/8" x 2")	1 line	5 mm (0.2") high letters
Size 2	13 mm x 75 mm (1/2" x 3")	1 line	6 mm (0.25") high letters
Size 6	25 mm x 100 mm (1" x 4")	1 line	13 mm (1/2") high letters

- .2 Use average of 25 letters/numbers (maximum) per nameplate.
- .3 Use Size 1.
  - .1 Control Components.

.4 Use Size 2.
  .1 Heat Pumps
.5 Use Size 6.
  .1 Control panels.
  .2 Junction boxes.
  .3 Relay panels.

.5 Mechanically fasten nameplates.

.6 Replacement heat pumps to be number as per existing.

2.3 EQUIPMENT CONCEALED IN CEILING

.1 In addition to the System Nameplates noted above provide a second identical plate on the underside of the ceiling grid or access door frame as close as possible to the location of the following:
  .1 Heat Pumps where ceilings removed

.2 Mechanically Fasten nameplates or fasten with contact cement.

2.4 ELECTRICAL COMPONENTS SUPPLIED BY DIVISION 21 TO 25

.1 Identify electrically fed equipment supplied by Division 25 as per Section 25 05 53 BAS Identification.

3 Execution

3.1 GENERAL

.1 Provide ULC and CSA registration plates as required by Respective agency.

3.2 MANUFACTURERS NAMEPLATES

.1 Locate nameplates so that they are easily read.

.2 Do not insulate or paint over plates.

3.3 SYSTEM NAMEPLATES

.1 In conspicuous location to facilitate easy reading from operating floor to properly identify equipment and/or system.

.2 Provide stand-offs for nameplates on hot surfaces and insulated surfaces.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

1.3 DEFINITIONS

.1 Refer to Section 21 05 01 Common Work Results for Mechanical - General.

.2 Legend
- .1 ASJ: All Service Jacket
- .2 SSL: Self-Sealing Lap
- .3 FSK: Foil-Scrim-Kraft; jacketing
- .4 PSK: Poly-Scrim-Kraft; jacketing
- .5 PVC: Polyvinyl Chloride

1.4 ENVIRONMENTAL REQUIREMENTS

.1 Maintain ambient conditions required by manufacturers of tapes, adhesives, mastics, cements and insulation materials.

.2 Follow manufacturer's recommended handling practices.

2 Products

2.1 GENERAL

.1 Components of insulation system to have maximum flame spread rating of 25 and maximum smoke developed rating of 50 in accordance with CAN/ULC-S102.

.2 Materials to be tested in accordance with ASTM C411.

2.2 PIPE INSULATION

.1 P-2 Formed Mineral Fiber with ASJ Vapour Barrier to 454° C
- .1 Application for piping, valves and fittings on:
  - .1 Hydronic piping.
  - .2 A/C drain lines.
  - .3 Where indicated.

.2 Material:
.1 CAN/CGSB 51.9 Mineral Fiber Thermal Insulation for Piping
.2 CGSB 51-GP-52 Vapour Barrier Jacket and Facing Material.
.3 Self-seal lap closure including ASJ butt strips.
.3 Thermal Conductivity "k" shall not exceed 0.034 W/m° C at 24° C mean temperature when tested in accordance with ASTM C335.
.4 Thickness:
.1 Hydronic:
.1 25 mm (1") on NPS 2 and under pipe.
.2 38 mm (1 ½") on NPS 2 ½ and NPS 3.
.3 50 mm (2") NPS 4 and over.
.5 All pipe insulation shall be by one manufacturer.
.6 Copper tube size for copper pipe.

.2 P-3 Flexible Mineral Fiber with Vapour Barrier to 120° C
.1 Application: Flexible pie connections at Heat Pumps.
.2 Material:
.1 CAN/CGSB 51.11 Mineral Fiber Blanket For Piping.
.2 CGSB 51-GP-52 Vapour Barrier Jacket and Facing Material.
.3 Thickness: 25 mm (1").

.3 Acceptable Material:

	Owens-Corning	**Manson Insulation Inc.**	**Knauf Fiber Glass**	**Johns Manville Insulations**
P-2	Fiberglas SSL-II	Alley K-APT	ASJ-SSL	Micro Lok AP-T
P-3	All service duct wrap	Alley Wrap FSK	Duct Wrap.	Microlite Fiber Glass Wrap Insulation

.1 P-A Formed Mineral Fiber with Vapour Barrier Flexible elastomeric thermal insulation, manufactured without the use of CFC's, HFC's or HCFC's formaldehyde free, low VOCs, fiber free, dust free and resists mold and mildew to 100° C
.1 Application for piping and fittings on:
.1 Heat pump flexible drain lines
.2 Material:
.1 CAN/CGSB 51.9 Mineral Fiber Thermal Insulation for Piping
.2 CGSB 51-GP-52 Vapour Barrier Jacket and Facing Material.
.3 Self-seal lap closure including ASJ butt strips.
.3 Thermal Conductivity "k": shall not exceed 0.25 BTU-in/hr.ft^2 °F
.4 Water Vapor Transmission: 0.05 perm-inch
.5 Flame-spread index of less than 25 and a smoke-developed index of less than 50 as tested by ASTM E 84 and CAN/ULC S-102.
.6 Adhesive: Armaflex 520 BLV Adhesive low V.O.C. adhesive
.7 Thickness: 25 mm (1").
.8 Acceptable Material:
.1 AP Armaflex Pipe Insulation

2.3 DUCT INSULATION

.1 D-2 Mineral Fiber Blanket with ASJ Vapour Barrier 4° to 120° C
- .1 Application: on concealed cold or dual temperature ducting.
  - .1 Concealed air conditioned supply ducts from heat pumps.
  - .2 Where indicated.
- .2 Material
  - .1 CAN/CGSB 51.11 Mineral Fiber Blanket.
  - .2 CGSB 51-GP-52 Vapour Barrier Jacket and Facing Material.
- .3 Thickness:
  - .1 One layer for air conditioned supply ducts.

.2 Acceptable Material:

	Owens-Corning	**Manson Insulation Inc.**	**Knauf Fiber Glass**	**Johns Manville Insulations**
D-2	All Service Faced Duct Wrap	Alley Wrap FSK	Duct Wrap - FSK	Microlite Fiber Glass Duct Wrap Insulation.

2.4 FASTENINGS

.1 Tape: self-adhesive, 100 mm (4") wide. ULC labeled for less than 25 flame spread and less than 50 smoke developed.
- .1 Standard of Acceptance:
  - .1 S. Fattal Insultape.

.2 Fire resistive lap seal adhesive: quick-setting for joints and lap sealing of vapour barriers.
- .1 Standard of Acceptance:
  - .1 Monsey Bakor Inc. 230-39.

.3 Fire resistive lagging adhesive: for cementing canvas lagging cloths to pipe insulation.
- .1 Standard of Acceptance:
  - .1 Monsey Bakor Inc. 120-09.

.4 For insulation system underside of roof drain body.
- .1 Contact adhesive: quick-setting for seams and joints.
- .2 Tape: self-adhesive PVC.

.5 Fire restrictive contact adhesive: quick setting.
- .1 Standard of Acceptance:
  - .1 Monsey Bakor 230-38.

.6 Pins:
- .1 Weld pins 4 mm (5/32") diameter, with 32 mm (1 1/4") diameter head for installation through the insulation. Length to suit thickness of insulation.
- .2 Standard of Acceptance:
  - .1 Duro Dyne, Clip-Pin

.3 Weld pins 4 mm (5/32") diameter, for installation prior to applying insulation. Length to suit thickness of insulation. Nylon retain clips 32 mm (1 1/4") round.

.4 Standard of Acceptance:

.1 Duro Dyne Spotter Pins with Spotter-Clips.

3 Execution

3.1 APPLICATION

.1 Apply insulation after required tests have been completed and approved by Consultant.

.2 Verify that all piping, equipment, and ductwork are tested and approved prior to insulation installation.

.3 Verify that all surfaces are clean, dry and without foreign material before applying insulation materials.

.4 Surfaces shall be clean and dry when installed and during application of insulation and finishes.

.5 Apply insulation materials, accessories and finishes in accordance with manufacturer's recommendations and as specified herein.

.6 All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

.7 On piping with insulation and vapour barrier, maintain integrity of vapour barrier over full length of pipe without interruption at sleeves, fittings and supports.

.8 On ductwork with insulation and vapour barrier, maintain integrity of vapour barrier over full length of duct or surface, without penetration for hangers, standing duct seams and without interruption at sleeves. Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm (4”) beyond insulated duct.

3.2 PIPE INSULATION INSTALLATION

.1 Multi-layered: staggered butt joint construction.

.2 Vertical pipe over NPS 3: insulation supports welded or bolted to pipe directly above lowest pipe fitting. Thereafter, locate on 15' centers.

.3 Expansion joints in insulation: terminate single layer and each layer of multiple layers in straight cut at intervals recommended by manufacturer. Leave void of 25 mm (1”) between terminations. Pack void tightly with P-3 flexible mineral insulation.

.4 Seal and finish exposed ends and other terminations with insulating cement.

.5 Expansion joints in piping: provide for adequate movement of expansion joint without damage to insulator or finishes.

.6 Fastenings
- .1 Secure pipe insulation by tape at each end and center of each section, but not greater than 900 mm (36") on centers.

3.3 DUCT INSULATION INSTALLATION

.1 General:
- .1 Adhere and seal vapour barrier using vapour seal adhesives.
- .2 Stagger longitudinal and horizontal joints, on multilayered insulation.

.2 Board Insulation fastenings:
- .1 On rectangular ducts, use 50% coverage of insulating cement and weld pins at 1 pin per square foot, but not less than 2 rows per side and bottom.
- .2 Secured with speed washers.
- .3 All joints, breaks and punctures sealed with appropriate pressure-sensitive foil tape or glass fabric and vapor barrier mastic.
- .4 Apply 20 gauge galvanized sheet metal corners to all duct work in mechanical rooms.
- .5 Seal duct insulation vapor barrier to air handling unit.
- .6 At exterior wall, Seal duct insulation vapor barrier to building envelope air barrier.

.3 Flexible Blanket Insulation fastenings:
- .1 Firmly butt all joints.
- .2 The longitudinal seam of the vapor barrier must be overlapped a minimum of 50 mm (2”).
- .3 All penetrations and damage to the facing shall be repaired using pressure-sensitive foil tape, or mastic prior to system startup.
- .4 Pressure-sensitive foil tapes shall be a minimum 75 mm (3”) wide and shall be applied with moving pressure using a squeegee or other appropriate sealing tool.
- .5 Secured to the bottom of rectangular ductwork over 600 mm (24”) wide using mechanical fasteners on 450 mm (36”) centers. Care should be exercised to avoid over-compression of the insulation during installation.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

2 Products

2.1 PIPE, FITTINGS, COUPLINGS AND JOINTS

.1 ASME/ANSI B16 series

.2 Steel Pipe to ASTM A-53/A-135 Grade B.
- .1 Application: Hydronic
- .2 NPS 2 and Smaller Pipe Joints:
  - .1 Schedule 40: Screwed or Roll Grooved Couplings.
- .3 NPS 2½ up to NPS 8 Pipe Joints:
  - .1 Schedule 40: Welded, Flanged, Roll Grooved Couplings.
- .4 Screwed fittings with Teflon tape.
- .5 Flanges: plain or raised face.
- .6 Pipe fittings, screwed, flanged or welded: to ASME/ANSI B16 series
  - .1 Cast iron pipe flanges: Class 125.
  - .2 Malleable iron screwed fittings: Class 150.
  - .3 Steel pipe flanges and flanged fittings, Steel butt-welding fittings
  - .4 Unions, malleable iron
  - .5 Bolts and nuts: to ASME/ANSI B18.2.1 and ASME/ANSI B18.2.2.

.3 Copper Tube: Type L hard drawn to ASTM B88M.
- .1 Application: Hydronic
  - .1 Solder/brazing: lead free to ASTM B32.
  - .2 Brazed with Sil-Fos BCuP5: to ANSI/AWS A5.8.
  - .3 Cast bronze threaded fittings.
  - .4 Wrought copper and copper alloy solder joint pressure fittings.
  - .5 Cast copper alloy solder joint pressure fittings.

2.2 ROLL GROOVED COUPLINGS AND FITTINGS

.1 Where rolled grooved couplings and fittings are used, they shall be of the same manufacturer.

.2 Grooved products to have current CRN Numbers.

.3 Ductile iron to ASTM A-536 or malleable iron to ASTM A-47 coupling housings painted with alkyd enamel.

.4 Rigid Grooved type Couplings: Housings cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with ANSI B31.1 and B31.9.

.5 Gaskets: Molded EPDM Compound to ASTM D-2000, -34° C to +120° C temperature range. Suitable all hydronic piping including hot water heating, glycol and chilled water supply and return piping.

.6 Ductile iron to ASTM A-536 or malleable iron to ASTM A-47 fittings painted with alkyd enamel.

.7 Coupling Bolts/Nuts: Heat treated carbon steel, track head to ASTM A-183 minimum tensile 110,000 psi.

.8 Application
- .1 Flexible couplings: At elbows except at pumps and coil connections.
- .2 Rigid Couplings: Elsewhere.

.9 Standard of Acceptance:
- .1 Victaulic Co. of Canada Style 07 Zeroflex couplings with Grade E gasket, and grooved-end fittings.
- .2 Victaulic Co. of Canada Style 107 Quick-Vic Installation ready rigid coupling, with EHP gasket for direct stab installation without field disassembly.
- .3 Victaulic Co. of Canada Style 77 Flexible Couplings
- .4 Victaulic Co. of Canada Style 117 Quick-Vic Installation ready flexible coupling, with EHP gasket for direct stab installation without field disassembly.

.10 Acceptable Manufacturers: Anvil Gruvlok

2.3 VALVES

.1 In accordance with Section 21 05 01 Common Work Results for Mechanical – General.

2.4 HANGERS SUPPORTS

.1 As per Section 23 05 29 Hangers and Supports.

2.5 INSULATION

.1 As per Section 23 07 00 Mechanical Thermal Insulation

3 Execution

3.1 INSTALLATION

.1 Cut piping square, ream, ensure free of cuttings and foreign material.

.2 Install pipes close to building structure to minimize furring, conserve headroom and space. Run piping parallel to walls. Group piping wherever possible.

.3 Slope piping in direction of flow wherever possible. Slope for positive drainage and venting.

.4 Use eccentric reducers for pipe size changes at wall fin connections to provide positive drainage or positive venting

.5 Where pipe sizes differ from connection sizes of equipment, install reducing fittings close to the equipment. Reducing bushings are not acceptable.

.6 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings. Install piping, unions and flanges so that any fixed piping does not interfere with removal of coils, tubes or tube bundles.

.7 Assemble piping using fittings manufactured to ANSI standards.

.8 Saddle type branch fittings may be used on mains if branch line is half size or smaller than main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle or installing mechanical T.

.9 Minimum size NPS 3/4.

.10 Forced water supply and return piping to be taken off main at 45° angle vertically from each main or branch. All runout made from main using four joint swing connection to permit expansion and avoid strain on equipment.

.11 Ensure that proper clearance around equipment permits performance of service maintenance, that height clearance for piping is adequate. Check final location with Consultant if different from that shown prior to installation. Allow removal space for removal of all coils. Install piping, unions and flanges so that any fixed piping does not interfere with removal of coils, tubes or tube bundles.

3.2 ROLL GROOVED COUPLINGS AND FITTINGS

.1 Roll grooved product manufacturer to supply on site product installation training.

3.3 FLUSHING AND CLEANING

.1 Refer to Section 23 25 00 HVAC Water Treatment Systems.

3.4 TESTING

.1 Test system in accordance with Section 21 05 01 Common Work Results for Mechanical – General.

.2 Repair any leaking joints, fittings or valves and retest.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

2 Products

2.1 MANUFACTURER

.1 Equipment, chemicals and service by one manufacturer.

.2 Acceptable Manufacturers:
- .1 Dearborn
- .2 Drew Chemicals
- .3 T. Donovan & Son Ltd.
- .4 State Industrial
- .5 Chem-Aqua

2.2 SUPPLY OF CHEMICALS

.1 Test heat pump loop.

.2 Bring treatment back to proper level.

2.3 TEST EQUIPMENT

.1 Provide for each type of system specified herein, one set of basic test equipment complete with carrying case and reagents for chemicals supplied. Include required specialized or supplementary equipment.

3 Execution

3.1 INSTALLATION

.1 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction.

.2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

3.2 WATER TREATMENT SERVICES

.1 Provide water treatment monitoring and consulting services for project warranty period. Service to include:

- .1 Initial water analysis and treatment recommendations.
- .2 System start-up assistance.
- .3 Operating staff training.
- .4 Visit plant every 2 months during period of operation and as required until system stabilizes and advice on treatment system performance.
- .5 Provide necessary recording charts and log sheets for operation during warranty period.
- .6 Provide necessary laboratory and technical assistance.
- .7 Instructions and advice to operating staff to be clear, concise and in writing.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

2 Products

2.1 GENERAL

.1 Single packaged reverse-cycle heating/cooling units.

.2 Canadian Standards Association (CSA).

.3 Rated in accordance with Air Conditioning, Heating, and Refrigeration Institute/International Standards Organization (AHRI/ISO) and Canadian Standards Association.

.4 Designed to operate with source liquid temperatures between -1.1° C and 43.3° C in cooling, and between -6.7° C and 32.2° C in heating.

.5 Factory Test

- .1 Run tested each unit at the factory. Quality control system shall automatically perform via computer: triple leak check, pressure tests, evacuate and accurately charge system, perform detailed heating and cooling mode tests, and quality cross check all operational and test conditions to pass/fail criteria.
- .2 Refrigerant piping: factory assembled, tested, charged, sealed, with pilot operated refrigerant reversing valve, high pressure and low temperature safety cut-outs ready to operate.

2.2 UNITS OF MEASURE

.1 Temperatures and all other points in the new heat pumps to be identified in metric units of measure. If this is not currently available, manufacturer to provide the metric update (when available) and update control program and graphics at no additional cost to the Board.

2.3 INCREMENTAL WATER SOURCE HEAT PUMP

.1 General:
- .1 Horizontal type, as indicated, consisting of factory-assembled package containing fan, air-to-refrigerant coil, compressor, 4-way reversing valve, water-to-refrigerant heat exchanger, controls

.2 Refrigerant Circuit
- .1 Sealed R-410A refrigerant circuit, consisting of a high efficiency hermetic compressor, a TXV (thermostatic expansion valve) for refrigerant metering, a finned tube refrigerant-to-air heat exchanger, a reversing valve, a refrigerant-to-water coaxial (tube-in-tube) heat exchanger, and high and low refrigerant service ports.
- .2 High-pressure safety switch
- .3 Low-pressure safety switch
- .4 Low-suction temperature sensor
- .5 Fusible refrigerant pressure relief plug.
- .6 Rotary type compressor designed for heat pump operation mounted on rubber vibration isolation grommets.
- .7 Four-way solenoid activated refrigerant reversing valve energized only during heating operation (fail to cooling).
- .8 Coaxial water-to-refrigerant heat exchanger constructed of convoluted cupronickel inner tube and steel outer tube and deeply fluted to enhance heat transfer and minimize fouling and scaling.
- .9 Heat exchanger designed with a refrigerant working pressure of 600 PSIG and a designed water side working pressure of no less than 400 PSIG.
- .10 Refrigerant-to-air heat exchanger constructed of corrugated lanced aluminum fins and rifled copper tube construction rated to withstand 450 PSIG working pressure.
- .11 Refrigerant gauge service access valves factory installed on the low and high-pressure refrigerant lines to facilitate field service.

.3 Compressor:
- .1 Welded, hermetic with crankcase heaters, vibration isolators.
- .2 Design and test to operate with outside air at minus 29°C on heating cycle without shutting off and at 1.6° C on cooling cycle with specified air flow.
- .3 Separate and independent refrigeration and control system for each compressor.
- .4 Controls to prevent compressor short cycling.

.4 Coils
- .1 Aluminum fins, mechanically bonded to seamless copper tubes with all joints brazed.
- .2 FPT connections: tested to 1.4 MPa
- .3 Connections securely mounted flush to the cabinet corner post allowing for connection to a flexible hose without the use of a back-up wrench.
- .4 Flexible hose with threaded swivel connections on supply and return lines to heat exchanger.

.5 Supply air fan
- .1 Forward curved, centrifugal, statically and dynamically balanced, supported from solid steel shaft running in heavy duty bearings having 200,000 h average life, direct drive with permanently lubricated motor bearings.
- .2 Factory motor wiring set for optimum fan performance, with means provided for easy field wiring modifications to an alternate speed.
- .3 Blower - side or end discharge. The blower discharge interchangeable from side to end-discharge or vice-versa by field exchange of the blower panel and fan mounting panel. Units shall have a removable orifice ring to facilitate blower wheel and motor removal without the need to disconnect duct work.
- .4 Air Section isolated from the compressor and control section with an insulated divider panel, to minimize the transmission of compressor noise, and to permit operational service testing with the compressor compartment cover removed, without having air bypass the air-to-refrigerant coil.
- .5 Filters: 50 mm thick pleated replaceable 30 % efficient installed in a factory mounted four-sided filter frame, arranged for "side-pull".

.6 Cabinet
- .1 Constructed of heavy gauge die-formed galvanized steel with welded corner bracing, complete with provision for connection to return ductwork, hanger brackets and vibration isolation.
- .2 Easily removable panels arranged for servicing all components.
- .3 Baked enamel finish.
- .4 Internally insulated for thermal and acoustic insulation and for attenuator section: fiber free foam insulation, inert, vermin and moisture proof, of density required for acoustic performance. Flame spread not more than 25 and smoke developed classification not more than 50.
- .5 All internal sheet metal parts subject to water exposure shall be galvanized or non-ferrous and coated with a baked-on, thermosetting plastic coating.
- .6 Four hanger bracket assemblies each comprised of heavy steel hanger bracket, integral rubber-in-shear vibration isolator, cap screw and plated isolator washer.

.7 Condensate drain pan
- .1 Under evaporator.
- .2 Design and construct condensate drain pans under indoor coils so that no water can accumulate and install to allow for easy cleaning
- .3 Stainless steel, double sloped drain pan.
- .4 Drain connections: minimum NPS 3/4.
- .5 Provide condensate pumps for all units.

.8 Electrical
- .1 Suitable for continuous operation with a supply voltage variation, measured at the factory power connection point, of ± 10% of the nameplate voltage.
- .2 A control box located within the unit containing controls for compressor, reversing valve and fan motor operation.
- .3 24-volt control circuit transformer and a terminal block for low voltage field wiring connections.

.4 Nameplated to accept time delay fuses or HACR circuit breaker for branch over current protection of the power source.

.9 Controls

.1 Microprocessor-based control system with BACnet MSTP Communication Module that communicates over a BACnet communications network.

.1 Incorporate a MCU and capable of supporting a full MSTP BACnet implementation.

.2 The physical interface to a BACnet BAS network through an industry standard RS-485 transceiver capable of existing on an RS-485 network of up to 64 nodes. The unit controller is factory programmed and tested with all the logic required to monitor and control heating and cooling operation. The controller sets the unit mode of operation, monitors water and air temperatures and can communicate fault conditions via a BACnet communications network.

.2 Capable of performing the performing the following unit operations:

.1 Enable heating and cooling to maintain space temperature set point at the room sensor
.2 Enable fan and compressor operation
.3 Monitor all safety controls
.4 Monitor discharge air temperature
.5 Monitor room air temperature
.6 Monitor leaving water temperature
.7 Relay status of vital unit functions
.8 Support optional control outputs
.9 Load leaving water temperature
.10 Command of temperature setpoint
.11 Cooling status
.12 Heating status
.13 Unoccupied/Occupied command
.14 Compressor shutdown (load shedding) command
.15 Cooling command
.16 Heating command
.17 Control read- write functions as noted on the drawings

.3 Protection: manual reset high and low pressure stats, loss-of-charge, indoor coil freeze stat, current temperature overload devices.

.4 Condensate Overflow. The presence of excessive condensate in the condensate drain pan is detected by a condensate sensor, which consists of a metal ring terminal mounted just below the top of the condensate pan. The analog input dedicated to condensate sensing must be capable of detecting the conductivity of water between the ring terminal and chassis ground. The conductivity trip point is 2.5 micro-ohms.

.10 TRM: Room Temperature Sensors

.1 Supplied by Heat pump manufacturer.

.2 Coordinate outputs with Section 25 30 02.

.3 Stainless steel blank plate mounted on a wall box complete with vandal resistant

screws.

.1 Applications: For Heat pumps HP-36, HP-37,HP-40, HP-50, HP-58, HP-136 and HP-140

.2 Standard of Acceptance: Greystone TE200 AS7 Thermistor with Ohmns to suit heat pump.

.4 Low Profile enclosure in a neutral color

.1 Applications: all other heat pumps not noted above.

.2 Mounted on a wall box

.3 Setpoint adjustment .

.4 Override.

.5 LED temperature display

.6 LED indication of current status

.11 50mm filter rack with MERV 8 filters

.12 Standard of Acceptance

.1 Florida Heat Pump

.13 Acceptable Manufacturer

.1 Water Furnace International.

.2 Daikin

3 Execution

3.1 INSTALLATION

.1 Install as per manufacturer's instruction.

.2 Install unit flat and level.

.3 Secure with hold-down bolts.

.4 Nothing to obstruct ready access to all components or to prevent removal of components for servicing. Piping, electrical conduits, lighting fixtures, etc. shall not be located under any ceiling suspended unit, so as to interfere with unit removal for service or replacement.

.5 No field provided apparatus, electrical or mechanical, shall be fastened to the heat pump cabinet with screws, without the prior written approval by the manufacturer’s representative.

.6 Provide a grounding conductor shall be provided, sized in accordance with the Canadian Electrical Code, for each heat pump unit.

3.2 START-UP

.1 Engage the services of factory authorized service technician representative to provide

equipment Start Up to verify installation for proper operation and compliance with manufacturer's recommendations, and to assist the contractor in making adjustments, and to assist in field testing as follows:

.1 Inspect for visible damage to casing, coils and internal parts.
.2 Inspect for visible traces of refrigerant leaks (oil, etc.) and then leak check.
.3 Inspect all electrical connections and torque to manufacturer's recommendations, both power and control. Verify correctness.
.4 Verify that filters are provided as specified and are installed properly.
.5 Verify that proper clearances for both operation and servicing have been provided.
.6 Verify that the unit has been cleaned of all construction dust and debris.
.7 Verify proper fan rotation.
.8 Start unit according to the manufacturer's written instructions.
.9 Observe initial unit operation to verify suitability for continuous operation for a period of time of sufficient duration to permit system air balancing.

.2 In the presence of and in cooperation with the unit manufacturer's representative, Section TAB Contractor, Division 25 Contractor and Electrical Contractor, start-up each heat pump unit and ensure that heat pump unit is capable of performing all steps in the sequence of operation.

.3 Submit start-up report including the following information:
.1 Complete unit description.
.2 Voltage each phase.
.3 Current draw by each piece of equipment.
.4 All equipment setpoints which are field adjustable.
.5 Refrigeration circuits operating conditions.
.6 All information on manufacturer's startup report.

3.3 DRIP PANS

.1 Provide trapped drain for each drain connection.

.2 Install so that no water can accumulate and arrange so as to be easily accessible for cleaning.

3.4 INCREMENTAL WATER SOURCE HEAT PUMP

.1 Make all duct connections through flexible connections.

.2 Level unit with fans running. Align ductwork and flexible connections. Misalignment with fan stopped not to strain or damage flexible connection.

.3 Nothing to obstruct ready access to all components or to prevent removal of components

for servicing.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

1.3 GENERAL

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

.2 Standard: TAB to be to most stringent of this section or TAB standards of AABC NEBB, SMACNA and ASHRAE.

.3 TAB of all systems, equipment, components and controls specified Mechanical Contractor.

1.4 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.5 EXCEPTIONS

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

1.6 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as to ensure completion before acceptance of project.

.2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

1.7 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Consultant adequacy of provisions for TAB and all other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Consultant in writing all proposed procedures which vary from standard.

.3 During construction, coordinate location and installation of all TAB devices, equipment, accessories, measurement ports and fittings.

1.8 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Mechanical Contractor.

1.9 OPERATION OF SYSTEMS DURING TAB

.1 Operate systems for length of time required for TAB and as required by Consultant for verification of TAB reports.

1.10 START OF TAB

.1 Notify Consultant 7 days prior to start of TAB.

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

.3 Liquid systems:
- .1 Flushed, filled, vented.
- .2 Correct pump rotation.
- .3 Strainers in place, baskets clean.
- .4 Isolating and balancing valves installed, open.
- .5 Calibrated balancing valves installed, at factory settings.
- .6 Chemical treatment systems complete, operational.

1.11 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:
- .1 HVAC systems: plus 10%, minus 5%.
- .2 Hydronic systems: plus or minus 10%.

1.12 ACCURACY TOLERANCES

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

1.13 INSTRUMENTS

.1 Prior to TAB, submit to Consultant list of instruments to be used together with serial numbers.

.2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.3 Calibrate within 3 months of TAB. Provide certificate of calibration to Consultant.

1.14 TAB REPORT

.1 Format to be in accordance with reference standard.

.2 TAB report to show all results in units specified on drawings and to include:
- .1 System schematics.

.3 Submit 3 copies of TAB Report to Consultant for verification and approval, in D-ring binders, complete with index tabs.

1.15 VERIFICATION

.1 All reported results subject to verification by Consultant.

.2 Provide manpower and instrumentation to verify up to 30% of all reported results.

.3 Number and location of verified results to be at discretion of Consultant.

.4 Bear costs to repeat TAB as required to satisfaction of Consultant.

1.16 SETTINGS

.1 After TAB is completed to satisfaction of Consultant, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings.

.2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

1.17 COMPLETION OF TAB

.1 TAB to be considered complete only when final TAB Report received and approved by Consultant.

1.18 AIR SYSTEMS

.1 TAB all systems, equipment, components, controls specified Mechanical Contractor.

.2 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls:
- .1 Air velocity.
- .2 Static pressure.
- .3 Velocity pressure.
- .4 Air flow rate.
- .5 Cross sectional area
- .6 RPM: Fan and Motor
- .7 Electrical power:
  - .1 Voltage
  - .2 Current draw

.3 Locations of equipment measurements: To include, but not be limited to, following as appropriate:
- .1 Inlet and Outlet of each:
  - .1 Fan
  - .2 Coil
  - .3 Filter
  - .4 Damper
  - .5 Other auxiliary equipment

.4 Locations of systems measurements to include, but not be limited to, following as appropriate:
- .1 Main ducts
- .2 Main branch ducts
- .3 Sub-branch ducts
- .4 Each supply, exhaust and return air inlet and outlet
- .5 All areas served by system

.5 Tempered humidified filtered outside air to heat pump.

1.19 HYDRONIC SYSTEMS

.1 Definitions: for purposes of this section, to include low pressure hot water heating systems.

.2 Measurements: to include, but not limited to, following as appropriate for systems, equipment, components, controls:
- .1 Flow
- .2 RPM
- .3 Electrical Power:
  - .1 Voltage.
  - .2 Current draw.

.3 Locations of equipment measurement: To include, but not be limited to, following as appropriate:
- .1 Inlet and outlet of each:
  - .1 Heat pump
  - .2 Pump
  - .3 Other auxiliary equipment.

.4 Locations of systems measurements to include, but not be limited to, following as appropriate:
- .1 Heat Pump loop
- .2 Hydronic at circuit balancing valves

2 Products (N/A)

3 Execution

3.1 TAB AGENCIES:

.1 Acceptable Agencies
- .1 Atlantic Indoor Air Audit Co.
- .2 Barrington Air Balance Service
- .3 Griffin Air Balance Limited
- .4 Scotia Air Balance 1996 Limited
- .5 System Balance Limited

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

2 Products

2.1 SEAL CLASSIFICATION

.1 Ductwork classification as follows:

Maximum Pressure	SMACNA Seal Class
500 Pa	C

.2 Class C: transverse joints and connections made air tight with gaskets, sealant and tape or combination thereof. Longitudinal seams unsealed.

2.2 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA or as indicated.

.3 Minimum 26 gauge

.4 Satin coat for all exposed ductwork outside mechanical rooms.

.5 Use oil free material and take all necessary measures to prevent contamination

.6 Joints: to ASHRAE and SMACNA and/or proprietary manufactured duct joint.

.1 Acceptable Material: for proprietary joints:

.1 Ductmate Canada Ltd.

.2 Exanno Nexus

2.3 RECTANGULAR DUCTWORK

.1 Cross break ducts 450 mm (18") and larger for stiffening.

.2 Same gauge on all sides and based on the greater cross sectional dimension.

.3 Reinforce flat slip joints of ducts over 450 mm (18").

2.4 ROUND DUCTWORK

.1 Factory fabricated conduit consisting helically wound galvanized steel straps with spiral lock seams.

.2 For concealed branch ductwork up to 350 mm (14") diameter, longitudinal seams.

.3 Rectangular ductwork may be convert to equivalent size round provided that the project space limitations are properly addressed.

.4 Use conical "T"s for 90^0 Branch takeoff

.5 Use long radius elbows where space permits.

.6 Galvanized steel of the following minimum gauges:

Duct Diameter	Straight Lengths of Spiral Duct Gauge	Round Duct fittings	Plain Duct Gauge
200 mm and smaller	26	24	24
225-350	26	24	24
375-650	24	20	N/A
685-915	22	20	N/A
940-1270	20	20	N/A

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radiused elbows:
- .1 Rectangular: Standard radius (Centerline radius 1.5 times width of duct) or short radius with single thickness turning vanes.
- .2 Round: Smooth radius or 5 piece. Centerline radius is 1.5 times diameter.

.3 Mitered elbows, rectangular:
- .1 To and including 400 mm: Single thickness turning vanes.
- .2 Over 400 mm: Double thickness turning vanes.

.4 Branch Ducts
- .1 Rectangular: Refer to Details on drawings.
- .2 Round: Conical T as per SMACNA

.5 Main supply duct branches without splitter damper. Provide branch and main duct balancing dampers.

.6 Sub branch duct with 45° entry and balancing damper on branch.

.7 Transitions:
- .1 Diverging: 20° maximum included angle.
- .2 Converging: 30° maximum included angle.

.8 Offsets: square elbows and/or full radiused elbows as indicated.

.9 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles as for transitions.

2.6 FIRESTOPPING

.1 Retaining angles all around duct, on both sides of fire separation.

.2 Firestopping material and installation must not distort duct.

2.7 SEALANT

.1 Sealant: non-flammable, water base duct sealant.

.2 Temperature range of -30° C to +93° C.

.3 Flame spread rating of not more than 25.

.4 Smoke developed classification of not more than 50.

.5 Standard of Acceptance:
- .1 Duro Dyne DSW

2.8 TAPE

.1 Poly-vinyl treated, open weave fiberglass tape.

.2 50 mm (2") wide.

.3 Standard of Acceptance.
- .1 Duro Dyne FT-2.

2.9 HANGERS AND SUPPORTS

.1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.

.2 Maximum size rectangular and round duct supported by strap hanger: 500 mm (20").

.3 Rectangular Hangers: angle iron with steel rods to ASHRAE and SMACNA following table:

Duct Size	Angle Size	Rod Size	Spacing
up to 750 mm	25 x 25 x 3mm	6 mm	2400 mm
751 to 900 mm	38 x 38 x 3 mm	6 mm	2400 mm
901 to 1500 mm	38 x 38 x 3 mm	10 mm	2400 mm
1501 to 2100 mm	50 x 50 x 3 mm	10 mm	1500 mm
2101 and over	50 x 50 x 6 mm	10 mm	1500 mm

.4 Round Hangers: strap/band with steel rods to ASHRAE and SMACNA following table:

Duct Size	Strap Size	Rod Size	Spacing
up to 610 mm	25 x 0.85 mm	6 mm	2400 mm
611 to 900 mm	25 x 1 mm	10 mm	2400 mm

.5 Upper attachment:
- .1 As per Section 23 05 29 Hangers and Supports

.6 Middle attachment (Rod):
- .1 As per Section 23 05 29 Hangers and Supports

3 Execution

3.1 GENERAL

.1 Install ducts in accordance with ASHRAE and SMACNA.

.2 Support risers in accordance with ASHRAE and SMACNA.

.3 Install breakaway joints in ductwork on each side of fire separation.

.4 Seal between ducts and walls of mechanical room.

.5 Where ducts are shown passing through rated fire separations provide fire dampers (in accordance with Section 24 33 16, Dampers Fire) and associated angle frames as per fire damper manufacturer's recommendations

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.
- .1 Minimum 25 mm (1") wide extending down 2 sides and 50 mm (2") under duct.
- .2 Fasten to sides and bottom of duct.

.2 Angle hangers: complete with locking nuts and washers.
- .1 Rod attached to angle within 50 mm (2") of the duct sides.

3.3 SEALING & TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed Tape in sealant and recoat with minimum of 1 coat of seal and to manufacturer's recommendation.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

2 Products

2.1 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame 1.6 mm (16 Ga.) thick with fabric clenched by means of double locked seams.

.2 Material: Fire resistant, self-extinguishing, neoprene coated glass fabric, temperature rated at -40° to +90° C, density of 1.3 kg/m 2.

3 Execution

3.1 INSTALLATION

.1 Install in accordance with recommendations of SMACNA

.2 Flexible connections.
- .1 Length of connection: 150 mm (6").
- .2 Minimum distance between metal parts when system in operation: 75 mm (3").

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

1.3 DEFINITIONS

.1 AEL: ratio between total test period less any system downtime accumulated within that period and test period.

.2 Downtime: results whenever BAS is unable to fulfill all required functions due to malfunction of equipment defined under the responsibility of BAS contractor. Downtime is measured by duration, in time, between the time that the Contractor is notified of failure and the time system is restored to proper operating condition. Downtime not to include following:

- .1 Outage of main power supply in excess of back-up power sources, provided that:
  - .1 Automatic initiation of back-up was accomplished.
  - .2 Automatic shut-down and re-start of components was as specified.
- .2 Failure of communications link, provided that:
  - .1 Controller automatically and correctly operated in stand-alone mode.
  - .2 Failure was not due to failure of any specified BAS equipment.
  - .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
    - .1 System recorded said fault.
    - .2 Equipment defaulted to fail-safe mode.
    - .3 AEL of total of all input sensors and output devices is at least 99 % during test period.

1.4 SYSTEM DESCRIPTION

.1 Work includes:

- .1 Start-up testing and verification of all systems supplied under this section.
- .2 Check out demonstration of proper operation of all components.
- .3 On-site operational tests.

.2 Following submission of report by contractor Consultant will review testing and verification as required.

.3 Provide test equipment including two-way radios.

.4 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no later than 2 months prior to tests.

.5 Inform and obtain approval from Consultant in writing at least 14 days prior to each test. Indicate:
- .1 Location and part of system to be tested.
- .2 Testing procedures, anticipated results.
- .3 Names of testing personnel.

.6 Co-ordinate with other trades.

.7 Correct deficiencies; re-test in presence of Consultant until satisfactory performance is obtained.

.8 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.

.9 Load system with project software.

1.5 QUALITY ASSURANCE

.1 Test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
- .1 Test and calibrate field hardware including stand-alone capability of each controller.
- .2 Verify each A-to-D convertor.
- .3 Test and calibrate each AI using calibrated Binary instruments.
- .4 Test each BI to ensure proper settings and switching contacts.
- .5 Test each BO to ensure proper operation and lag time.
- .6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
- .7 Test operating software.
- .8 Test application software. Provide samples of logs and commands.
- .9 Verify each CDL including energy optimization programs.
- .10 Debug software.

.2 Final Startup Testing
- .1 Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Consultant.
- .2 Provide:
  - .1 Two technical personnel capable of re-calibrating field hardware and modifying software.
  - .2 Detailed daily schedule showing items to be tested and personnel available.
  - .3 Key document for recording procedures to be listing of system database, including keyname, English description, point type and address, engineering units, low and high limits. Include space on listing for remarks and signatures of commissioning technician.

.3 Final Operational Testing
- .1 Purpose: to demonstrate that BAS functions in accordance with contract requirements.
  - .1 Prior to the commencement of 30 day test Contractor must demonstrate that operating parameters (setpoints, alarm limits and CDL's) have been implemented so as to ensure proper operation and operator notification in event of off-normal operation. Repetitive alarm conditions to be resolved so as to minimize reporting of nuisance conditions.
- .2 Test to last at least 30 consecutive 24 hour days.
- .3 Tests to include:
  - .1 Demonstration of correct operation of monitored and controlled points.
  - .2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
- .4 System will be accepted when:
  - .1 BAS equipment operates to meet overall performance requirements. Downtime must not exceed allowable time calculated for this site.
  - .2 Requirements of Contract have been met.
- .5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
- .6 Correct defects when they occur and before resuming tests.

1.6 VERIFICATION

.1 After installation of the system and completion of mechanical and electrical hook-up, perform point by point verification to confirm correct installation and functioning of equipment.

.2 Submit a point by point Equipment Inspection and Verification Report to the consultant.

.3 Following submission of the above point by point Equipment Inspection and Verification Report, notify the consultant in writing at least seven days prior to the Owner/Consultant point by point verification:
- .1 Provide all necessary testing equipment, communication equipment and personnel.
- .2 Perform Owner/Consultant verification in the presence of the Owner/Consultant.
- .3 Demonstrate the proper operation of each component.
- .4 Verify all Binary input alarm points by physically simulating an alarm condition.
- .5 Calibrate all temperature, humidity, and pressure sensors using accurate electronic testing, equipment as a reference.
- .6 Verify all control loops and programmed sequences of operation by simulating conditions for each mode of operation.

.4 Correct any deficiencies and re-test in the presence of the consultant, until designated part of the system performs satisfactorily.

2 Products N/A

3 Execution

3.1 GENERAL

.1 Install in accordance with manufacturer's instructions.

.2 Cooperate with other section of Mechanical Contractor to start-up equipment and provide documentation included but not limited to the following:
- .1 Boilers
- .2 Humidifier.
- .3 Testing, Adjusting & Balancing.

3.2 FIELD SERVICES

.1 Prepare and start logic control system under provisions of this section.

.2 Start-up, Check-out and Verification of systems: Allow sufficient time for start-up and verification prior to placing control systems in permanent operation. Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download.

.3 Provide Owner's Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.3 BAS BUILDING CONTROLLER VERIFICATION

.1 The following checkout and start-up procedure must be performed on each BAS panel prior to software installation and prior to commencement of point to point check-out.

.2 BAS Panel Checkout:
- .1 Verify that the enclosure is not mounted to a vibrating surface.
- .2 Verify that line voltage wiring enters the enclosure separate from all low voltage wiring. Line and low voltage wiring is required to be separated within field panels.
- .3 Verify that wiring is not routed from the bottom of the enclosure up through the center.
- .4 Check all point and trunk wiring for shorts, grounds, and induced/stray voltages. Also, verify all terminations are neat and dressed.
- .5 Verify that all points are properly terminated according to as-built drawings.
- .6 Verify that the correct point modules have been inserted to the proper termination blocks and the address keys have been placed in proper slots. Install corresponding module labels.
- .7 Verify that required LAN trunk wires have been terminated correctly.
- .8 Verify that the BAS panel has been powered with the proper voltage.
- .9 Using either the terminal workstation or the system technicians laptop personal computer load the BAS panel database.

3.4 VERIFICATION OVERVIEW

.1 Verification and field start-up to be performed by Factory Trained Authorized Manufacturer Service Technician.

.2 Include the following services:
- .1 Provide the initial system software, programming, customizing and data entry.
- .2 Manufacturer's representative must visit the site to test and commission the equipment. Provide written verification report detailing this phase of the work.
- .3 Provide Demonstration, Operating and Maintenance Instructions.

.3 Verification
- .1 Start-up testing and verification of all parts of the systems supplied under this section.
- .2 Verification performed by Factory Trained Authorized Manufacturer Service Technician(s) on site capable of re-calibrating field hardware and modifying software on site.
- .3 On-site operational tests.
- .4 Verify the wiring to all equipment is complete.
- .5 After installation of the system and completion of mechanical, control and electrical hook-up, perform point by point verification to confirm correct installation and functioning of equipment.
- .6 Cooperate with other sections of Mechanical Contract to start-up equipment and provide documentation included but not limited to the following: Testing, Adjusting & Balancing.
- .7 Check out demonstration of proper operation of all components.
- .8 After installation of the system and completion of mechanical, control and electrical hook-up, perform point by point verification to confirm correct installation and functioning of equipment.
- .9 Provide a copy of inspecting technician's report to user. Identify each device by location and certify the test results.

.4 The following checkout procedures must be performed on all input/output points defined in any field panel or LAN Device. These procedures represent the minimum requirements for verification of inputs. More in-depth verification may be necessary.

.5 Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.

.6 Analog Input Checkout
- .1 Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by disconnecting one of the wires at the sensor, and verifying that the reading at the field panel has reacted to this change.
- .2 Verify the point database to be correct, (i.e. alarm ability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value (COV) limit has been defined.

.3 Verify the sensor has the correct range and input signal. (i.e. 10-60° C, 4 - 20 mA). Verify that the device is mounted in the correct location and is wired and installed correctly per the design documentation package.

.4 Set-up and/or calibrate any associated equipment (i.e. panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.

.5 Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.

.7 Binary Input Checkout

.1 Verify the point address by verifying that the Binary input is correctly terminated at the controlled piece of equipment.

.2 Verify the point database is correct (i.e. point name, address, alarm ability, etc.).

.3 Set-up and/or calibrate the associated equipment, i.e. high/low temp detector, flow switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.

.4 With the controlled equipment running or energized as described in the Binary output checkout procedures, verify the correct operation of the Binary input point and associated equipment by putting the Binary input monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator's terminal and that the status led is giving the proper indication in each mode of operation (on/off).

.8 Analog Output Checkout

.1 Insure that the correct output device(s) are installed per the Control System Installation Drawings. (i.e. DPV's, PXP-#, # modules, I/P or P/I transducers, transformers, power supply, etc.). Verify that these devices are installed, wired and piped correctly. Verify that any configuration jumpers for PXP type devices are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.

.2 Verify the point database to be correct. (i.e., slope/intercept, engineering units, etc.). Verify that the correct COV limit has been defined. Refer to Manufacturer's Instructions for establishing correct COV values.

.3 Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.

.4 Verify that the controlled device is calibrated (i.e. 4-20 mA variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three point (high, low and mid-point) calibration procedure must take place. Verify proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.

.5 Set-up and or calibrate any associated equipment, (i.e. panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are

mounted in the correct location, and are wired or piped and installed correctly per the design documentation package.

.6 After verifying the set-up and operation of any associated equipment check for the correct operation of the logical point and associated equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to insure that all network terminals, Insight PCs host console devices, etc. can also command these outputs.

.9 Binary Output Verification

.1 Verify that the correct voltage is utilized in the circuit.

.2 Verify the point database to be correct (i.e. point name, address, etc.).

.3 Check and verify that the end device responds appropriately to the Binary output(s).

.4 After verifying the set-up and operation of any associated Binary input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e. off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.

.5 If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of same. Also check that any interlocked equipment such as end switches for damper operation or exhaust and return fans are wired correctly and operate correctly.

.6 Verify that the controlled piece or pieces of equipment can not be cause to change state via the Binary output if an associated hand-off-auto switch is in the hand /on or hand/off mode of operation, unless specified as a fireman's override point etc.

3.5 EQUIPMENT INSPECTION AND VERIFICATION REPORT - APPENDIX A

.1 Installation: Initialing this column verifies the proper location and mounting per the Manufacturer's installation instructions and control drawings.

.2 Point To Point Complete: This column indicates that the point checkout procedure is successfully completed.

.3 Procedure # Used: This column indicates the Procedure # used to check out the points and equipment.

.4 Date: This column is dated when the point checkout procedure is successfully completed.

.5 Contractor's Initials: This column is initialized by a Contractor's representative, verifying the completion of the checkout procedure.

.6 Comment Number: This column indicates a number referencing a comment on the Point Verification Comment Sheet. The comments are used to indicate any additional information or problems.

.7 Displayed Value: The displayed value column is the value displayed on the MMI device, i.e. PC, Laptop PC, Terminal.

.8 Actual Value: This column is for recording the measured value at the sensor, i.e. with an approved test instrument.

APPENDIX 'A'

EQUIPMENT INSPECTION AND VERIFICATION REPORT

Note: Points added by change order to be included.

BAS Technician: _____

Point Information									
	Name								
	Number								
	Type								
	Address								
	Fail Mode								
Start-Up and Verification	Installation								
	Point to Point								
	Procedure #								
	Date								
	BAS Technician								
	Comment #								
	Display Value								
	Actual Value								
	Calibration Needed								
	Notes								

APPENDIX 'B' PROJECT PUNCH LIST

BAS Technician: _____

Item	Description of Problem	Date	Int.	Action Taken	Date	Int.

APPENDIX 'C' POINT VERIFICATION COMMENT SHEET

BAS Technician: _____

The purpose of this form is to document such things as devices which have been mounted in a manner which deviates from the contract documents. Such deviations may occur due to customer requests or architectural requirements or constraints.
Entering such deviations on this form provides a permanent record for reference by the customer and/or service personnel at a later date.

Date:_____ BAS#: or LAN Device #_____

Comment #	Comment from Point Verification Sheet for Bas # or Lan Device

APPENDIX 'D' SYSTEM PERFORMANCE TEST FORM

PPCL Program Number_____ PPCL Revision Number_____

Date of Test_____ Equipment_____

Test Number_____

BAS Technician: _____

DESCRIPTION OF TEST: INPUT TO TRIGGER TEST: EXPECTED OUTCOME:

RESULT	PASS/FAIL	DATE	INITIAL

IF TEST FAILS SEE RETEST NUMBER_____

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

1.3 RELATED SECTIONS

.1 Section 25 05 02 BAS: Submittals.

.2 Section 25 01 11 BAS: Start-up Verification.

.3 Section 25 30 01 BAS: Building Controllers.

.4 Section 25 30 02 BAS: Field Control Devices.

.5 Section 25 30 03 BAS Field Wire and Components Installation

1.4 BAS IDENTIFICATION

.1 Conform to requirements of Section 23 05 53 Mechanical Identification, supplemented and modified by requirements specified in this section.

1.5 REFERENCE STANDARDS

.1 The latest edition of the following standards and codes in effect and amended as of proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:

- .1 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
- .2 ANSI/ASHRAE Standard 135, BACnet®.
- .3 CSA C22.1 Canadian Electrical Code, Part 1 Safety Standard for Electrical Installations.
- .4 Provincial and federal regulations and codes in effect as of contract date.
- .5 Except as otherwise indicated the system supplier shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

1.6 ACRONYMS, ABBREVIATIONS AND DEFINITIONS

.1 BACnet® Object List
- .1 AI - Analog Input - Defined as any variable input (temperature), (Humidity), (position), etc.
- .2 AO - Analog Output - Defined as any electrical variable output. 0–20mA, 4–20mA and 0–10VDC are the only acceptable analog outputs. The driver for analog outputs must come from both hardware and software resident in the controllers.
- .3 BI - Binary Input - Defined as any two-state input (alarm, status), etc.
- .4 BO - Binary Output - Defined as any two-state output (start/stop) (enable/disable), etc.

.2 Acronyms used in Building Automation System (BAS).
- .1 B-AAC- BACnet® Advanced Application Controller
- .2 B-ASC - BACnet® Application Specific Controller
- .3 BACnet® - Building Automation and Control Network
- .4 BAS - Building Automation System
- .5 B-BC - BACnet® Building Controllers,
- .6 CAD - Computer Aided Design
- .7 CDL - Control Description Logic
- .8 COSV - Change of State or Value
- .9 CPU - Central Processing Unit
- .10 HVAC - Heating, Ventilation and Air Conditioning
- .11 IDE - Interface Device Equipment
- .12 I/O - Input/Output
- .13 ISA - Industry Standard Architecture
- .14 LAN - Local Area Network
- .15 OS - Operating System
- .16 O&M - Operation and Maintenance
- .17 B-AWS - BACnet® Advanced Operator Workstation
- .18 PCI - Peripheral Control Interface
- .19 PCMCIA - Personal Computer Micro-Card Interface Adapter

.3 Definitions:
- .1 Point: a point may be logical or physical. Logical points are values calculated by system such as totals, counts, derived corrections i.e. as result of and/or statements in CDL's. Physical points are inputs or outputs which have hardware wired to controllers which are measuring or providing status conditions of contacts or relays providing interaction with related equipment (stop, start) or valve or damper actuators.

1.7 WORK INCLUDED

.1 Control all mechanical equipment, including all unitary equipment such as heat pumps, and any other listed equipment using native BACnet®-compliant components. Software

shall include password protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, demand limiting, full suite of field engineering tools including graphical programming and applications.

.2 Design and provide all equipment cabinets, panels, data communication network cables needed and all associated hardware. Provide all interconnecting cables between supplied cabinets, application controllers and input/output devices.

.3 Work covered by sections referred to above consists of fully operational BAS, including, but not limited to, following:

.1 Extension of existing building automation system (BAS) incorporating direct digital control for energy management, equipment monitoring and control.

.2 Provide all communication media, connectors, repeaters, bridges, hubs, and routers necessary for the internetwork.

.3 Provide all interconnecting cables between all operator's terminals and peripheral devices (such as printers, etc.) supplied under this section.

.4 Control devices as listed in I/O Summaries and shown on the drawings.

.5 All control points viewable and controllable from the owner's BAS server

.6 Provide graphics for all systems on the owner's BAS server Sensor wells, flow switches and all control valves as indicated for installation by other sections of Mechanical Contractor.

.7 Data communications equipment necessary to affect a BAS data transmission system.

.8 Field control devices.

.9 All software required to implement a complete and operational control system. Complete with full documentation for software and equipment.

.10 Complete operating and maintenance manuals and field training of operators, programmers and maintenance personnel.

.11 Acceptance tests, technical support during verification, full documentation.

.12 Control valve and damper actuation system.

.13 All necessary power required from local 120V/208V branch circuit panelboards for all controller equipment including the processor, applicable terminal devices and applicable field interface devices. Circuits to be for exclusive use of BAS equipment. Panel breakers to be identified on panel legends tagged and locks applied to breaker switches.

.14 All low voltage control transformers with suitable capacity to power all sensors, controller, etc. which require low voltage for operation.

.15 Except where otherwise noted, all wiring, conduit, boxes, miscellaneous material and labor associated with and required by the control system.

.16 Provide electrical permits as per this section.

.17 Data communication equipment necessary to affect a Building Automation System (BAS) data transmission system.

.18 Include all software and hardware required to access system by a lap top

1.8 COORDINATION

.1 Coordinate location of thermostats, temperature sensors, humidistats and other exposed control sensors with plans and room details before installation.

.2 Coordinate equipment from other divisions including “Intrusion Detection,” “Lighting Controls,” “Motor Control Centers,” “Panel boards,” and “Fire Alarm” to achieve compatibility with equipment that interfaces with those systems.

.3 Coordinate supply of conditioned electrical circuits for control units and operator workstation.

.4 Coordinate with the Owner’s IT department on locations for UNC’s Ethernet communication cabling and TCP/IP address.

1.9 QUALITY ASSURANCE

.1 Responsible for inspection and Quality Assurance (QA) for all materials and workmanship furnished.

.2 Component Testing: Maximum reliability shall be achieved through extensive use of high-quality, pre-tested components. Individually tested each and every controller, sensor and all other BAS components by the manufacturer prior to shipment.

.3 Tools, Testing and Calibration Equipment: Provide all tools, testing, and calibration equipment necessary to ensure reliability and accuracy of the system.

1.10 STANDARDS COMPLIANCE

.1 All equipment and material to be from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 In lieu of such evidence, submit certificate from testing organization, approved by Consultant, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

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

1.11 SYSTEM DESIGN RESPONSIBILITY

.1 Design and provide all conduit and wiring linking all elements of system, including future capability.

.2 Supply sufficient programmable controllers of all types to meet project requirements. Quantity and points contents to be approved by Consultant prior to installation.

.3 Location of controllers to be approved by Consultant prior to installation.

1.12 WARRANTY

.1 Control system failures during warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to Owner. Respond during normal business hours within 24 hours of Owner's warranty service request 24 hours Monday through Friday and 48 hours on Saturday and Sunday.

.2 The on-line support services via Internet shall allow the local BAS subcontractor to monitor and control the facility's building automation system. This remote connection to the facility shall be within 3 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.

.3 Provide updates to operator workstation or web server software, project-specific software, graphic software, database software, and firmware that resolve Contractor-identified software deficiencies at no charge during warranty period. If available, Owner can purchase in-warranty service agreement to receive upgrades for functional enhancements associated with above-mentioned items. Do not install updates or upgrades without Owner's written authorization.

.4 Provide for 16 hours of customized programming after verification by the original programmer to ensure the intent of the original design is implemented. These hours can be used for program modifications, data acquisition analysis, meeting with owners or owner's representatives. Each hour of time shall be documented as to requested information and completed resolution.

1.13 OWNERSHIP OF PROPRIETARY MATERIAL

.1 Project-specific software and documentation shall become Owner's property. This includes, but is not limited to:

- .1 Graphics
- .2 Record drawings
- .3 Database
- .4 Application programming code
- .5 Documentation

1.14 PERMITS, FEES AND INSPECTIONS

.1 Wiring: Refer to Section 25 30 03 BAS: Field Installation

.2 Line Voltage Control Wiring
- .1 Wiring shall be installed by an Electrician
- .2 Electrical Wiring Permits
  - .1 Submit to Electrical Inspection Department and Supply Authority necessary number of Control Drawings and Control Specifications for examination and approval prior to commencement of work
  - .2 Pay associated fees.
  - .3 Furnish Certificates of Acceptance from Inspection Department and authorities having jurisdiction on completion of work.

2 Products

2.1 GENERAL

.1 Control system installed to be "fail-safe".

.2 Provide all required adapters between "metric" and "Imperial" components.

.3 Capable of operating properly under environmental conditions of 0° C to 32° C and 10% to 95% non-condensing relative humidity.

2.2 PRODUCT

.1 Use new products the manufacturer is currently manufacturing and selling for use in new installations. Do not use this installation as a product test site unless explicitly approved in writing by Owner. Spare parts shall be available for at least seven years after completion of this contract.

.2 Each major component of equipment shall have the manufacturer's name and address and the model and serial number on a nameplate.

.3 Maintainability:
- .1 The equipment designed in such a way that the time necessary for any repair or maintenance will be reduced to a minimum by using easily accessible modules, components and test jacks.
- .2 Maintenance of any satellite panel or any peripheral device shall not affect the remainder of the system.
- .3 Means must be provided for monitoring and locating component and system failures quickly and easily:

.4 Integrate multiple building functions including equipment supervision and control, alarm management, energy management and historical data collection.

.5 System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. Each BAS Controller shall operate independently by performing its own specified control, alarm management, operator I/O and data collection. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

.6 BAS Controllers shall be able to access any data from, or send control commands and alarm reports directly to any other BAS Controller or combination of controllers on the network without dependence upon a central processing device. BAS Controllers shall also be able to send alarm reports to multiple operator workstations without dependence upon a central processing device.

2.3 ACCEPTABLE INSTALLER AND MATERIAL

.1 Native BACnet® Building Automation System (BAS) throughout project. Building Controllers (B-BC) to be currently listed by BACnet® Testing Laboratories (BTL)

.2 Acceptable Installer and Material:
.1 Extension of existing Advanced Energy Management with Alerton, Inc.

2.4 LOCKABLE CONTROL ENCLOSURES

.1 Enclosures to bear the appropriate CSA designation i.e. CSA Enclosure 1 - General Purpose, CSA Enclosure 3 - Weatherproof.

.2 To have hinged doors equipped with standard keyed-alike cabinet locks, keyed to same key.

.3 Either free-standing or wall mounted enameled steel cabinets with hinged and key-locked front door.

.4 Modular multiple panels as required to handle requirements with additional space to accommodate future capacity without adding additional cabinets.

.5 Cabinets: 12 gauge furniture steel (12 gauge) with baked enamel finish on exterior and rust inhibitive paint on interior, for surface mounting, with hinged door, latch lock, 2 keys, complete with perforated metal mounting backboard.

.6 Factory installed bonding and neutral termination strips.

.7 Provide for conduit entrance from top, bottom or sides of panel.

.8 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

3 Execution

3.1 EXAMINATION

.1 Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

.2 Notify the owners' representative in writing of conditions detrimental to the proper and timely completion of the work.

.3 Do not begin work until all unsatisfactory conditions are resolved.

3.2 INSTALLATION

.1 Install BAS in accordance with manufacturer's instructions.

.2 Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

3.3 ELECTRICAL ENCLOSURES

.1 House all electrical equipment associated with the control system in separate dedicated enclosures provided by this section.

.2 House all controllers associated with the control system in lockable enclosures provided by this section.

.3 Colour code enclosure as per Section 23 05 53 Mechanical Identification

.4 Provide size 2 nameplate identification.

.5 Under no circumstances utilize equipment enclosures such as junction boxes, etc., supplied by Electrical Contractor or other sections of Mechanical Contractor to house control system components. Refer to Section 25 30 02 BAS: Field Control Devices for current sensors and associated relay inside starters and MCC’s

.6 Maintain minimum 1 meter clear in front of enclosure.

.7 Top of lockable enclosure to be 1980 mm AFF.

.8 Wiring within panels: locate in trays or individually clipped to back of panel.

3.4 BAS OBJECT TYPE SUMMARY

.1 Provide all database generation.

.2 Displays: System displays shall show all analog and binary object types within the system. They shall be logically laid out for easy use by the owner. Provide outside air temperature indication on all system displays associated

.3 Run Time Totalization: At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan and hot water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.

.4 Trend log: All binary and analog object types (including zones) shall have the capability to be automatically trended.

.5 Alarm: All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner's requirements.

.6 Database Save: Provide back-up database for all stand-alone application controllers on disk.

APPENDIX "B" BAS Device and Building addressing

B.1 BACnet Device Addressing

The owner has adopted a standard numbering scheme that can be replicated by any manufacturer. The numbering system is based on the building number and must be kept in the form of:
AAA * 10000 = Building Master Panel Number (Area Controller)
AAA00000 where:
AAA Represents the building number. System and Sub-Network Level device addresses shall be based on a subset of the building master panel address.

Example:
This project is building # 100
100 * 10000 = 1000000: Master Panel Address
System/Sub-net level device address: 100xxxx where xxxx is the devices unique address.

B.2 BACnet MS/TP Network Addressing

The owner has adopted an MS/TP network addressing scheme that can be replicated by any manufacturer. MS/TP network numbers will be kept below the upper limit of 65534 (maximum interconnected BACnet networks).
The numbering system is based on the building number and must be kept in the form of:
AAA + 99 = MSTP Network Number
AAA99 where
AAA Represents the building number.

B.3 BACnet Standard

1. Each building master panel shall be capable of acting as a BBMB device. The owner has installed routers at the head office that will usually act as the BBMB device for each family of buildings but the ability to perform that function must exist within each building BAS system.
2. Provide the owner with the device MAC address prior to connecting to the owner's LAN. the owner will provide the IP address, Subnet Mask and Gateway Address to the controls vendor.
3. All devices that are connected directly to the owner's LAN must communicate using BACnet/IP. All other devices must communicate on an approved BACnet Data Link/Physical layer protocol. All secondary networks within buildings must be configured to communicate over MS/TP or Ethernet.
4. The owner has standardized on formats for descriptor acronyms, device addressing, MS/TP addressing, building addressing, and descriptor composition. We will provide all necessary documentation to follow these procedures.

APPENDIX "C" Point Descriptor Composition

C.1 Point Descriptor Composition

Object names must use the format as illustrated below for both physical and pseudo points.

A B C D where:

- **A** is used to designate building to which the point belongs
- **B** is used to represent the equipment referenced. (e.g. AH1, HX1, R46, etc….)
- **C** is used to designate with which mechanical system the object is associated, (e.g., CLG, HTG, MAD, SAT, SWT, LTG). It may also be used for clarification or for identification if more than one of C exists (e.g., CLG1, CLG2).
- **D** is used in case a further description of "C" is necessary, (e.g., XYZ R46 CLG VLV, XYZ AH1 SAT AL).

EXAMPLES:

Example: Project XYZ (building acronym = XYZ)

XYZ AH1 SAT	Air Handling Unit 1 Supply Air Temperature
XYZ AH1 SAT SP	Air Handling Unit 1 Supply Air Temperature Set Point
XYZ AH1 SFSS	Air Handling Unit 1 Supply Fan Start/Stop
XYZ AH1 SFST	Air Handling Unit 1 Supply Fan Status
XYZ AH1 WS	Air Handling Unit 1 Weekly Schedule
XYZ AH1 R102	Room 102 Space Temperature
XYZ AH1 R102	SP Room 102 Space Set Point
XYZ AH1 R102HTG	Room 102 Space Heating

All naming conventions are to be consistent within system groupings:
The above are examples only and may not be totally inclusive of all point ID's required. Obtain approval from Owner prior to programming or panel configuring, for any ID's required for but not indicated above.

C.2 Descriptor Acronyms

IMPORTANT: Each point descriptor must include the respective building acronym to associate it with its particular building. The Owner will provide the building acronym prior to programming commencing. See examples included at the end of the document.

AL	Alarm
CLS	Close
CMPR	Compressor
CP	Control Panel
CTRL	Controller
ENB	Enable
EV	Event
EWT	Entering Water Temperature
FDBK	Feedback
FILT	Filter
FSS	Fan Start-Stop
FST	Fan Status
HI	High
HP	High Pressure
HPL	Heat Pump Loop
HPLR	Heat Pump Loop Return Temperature
HPLS	Heat Pump Loop Supply Temperature
HPU	Heat Pump Unit
HPUR	Heat Pump Unit Return Temperature
HPUS	Heat Pump Unit Supply Temperature
LAT	Leaving Air Temperature
LO	Low
LWT	Leaving Water Temperature
NSB	Night Setback
OPN	Open
PSS	Pump Start/Stop
PST	Pump Status
RAT	Return Air Temperature
RET	Return
Rxxx	Room
SAT	Supply Air Temperature
SF	Supply Fan
SFSS	Supply Fan Start/Stop
SFST	Supply Fan Status
SP	Set Point
SPC	Space
SS	Start/Stop
ST	Status
STAT	Static Pressure
TMP	Temperature
VLV	Valve

APPENDIX "D" Object Tagging

Point: XYZ _AH1_SAT Address: 1000300.AI2 Description: Supply Air Temperature Part No. XXX – XXXX	Point: XYZ _HX1_VLV Address: 1000100.AO9 Description: Heating Water Exchanger: Steam Valve Part No. XXX – XXXX
Point: XYZ _AH2_FSS Address: 1000500.BO1 Description: Fan Start/Stop Relay Part No. XXX – XXXX	Point: XYZ _ DHWR_PST Address: 1000200.BI4 Description: Domestic Hot Water Return: Pump Current Sensor Part No XXX - XXXX

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

1.3 SUBMITTALS

.1 In accordance with Division 1 and Section 21 05 02 Common Work Results for Mechanical - Submittals, supplemented and modified by requirements specified in this section.

.2 Project records and Operating and Maintenance (O & M) manuals specified in this section are to be integrated with those specified in Section 21 05 02 Common Work Results for Mechanical - Submittals.

1.4 SHOP DRAWING SUBMITTALS

.1 Completely indexed and coordinated package to assure compliance with contract requirements and arranged in same sequence as specification and cross-referenced to specification section and paragraph number.
- .1 Product data sheets: Provide index and number pages

.2 Submit control diagrams,
- .1 Sequences of operation for each system,
- .2 All input/output object listings and an alarm point summary listing.
- .3 Complete bill of materials
- .4 Complete valve schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, design pressure drop, required Cv, Valve size, actual Cv, spring range, pilot range, required torque, actual torque.
- .5 Complete damper motor schedule listing including following information: designation, service, manufacturer, model, point ID, design flow rate, required torque, actual torque.
- .6 Provide BACnet® Conformance
- .7 Provide complete description and documentation of any proprietary (non-BACnet®) services and/or objects used in the system.
- .8 Specification sheets for each item to include manufacturer's descriptive literature, specification, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.

.9 Sketch of site-specific system architecture.
.10 Specification sheets for each item including memory provided, programming language, speed, type of data transmission.
.11 Electrical interface drawings specific to project showing Electrical Contract starters where applicable for safeties and automatic motor control using industry standard symbols.
.12 Spare point capacity of each controller by number and type.
.13 Controller locations.
.14 Dampers: sketches showing operator locations, required torque, actual torque.
.15 Interface wiring diagrams showing termination connections and signal levels for equipment to be supplied by others.
.16 Sensing element type and location.
.17 Transmitter type and range.

.3 Provide 1 non-fading "As-Built" copy copies showing control and/or adjustment procedures. Enclose in aluminum frame with non-glare glass cover or seal in plastic laminate in rigid metal bound loose leaf.

1.5 BAS DEMONSTRATION, OPERATING AND MAINTENANCE INSTRUCTION

.1 Provide the services of competent instructors who will give full instruction to designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements of the equipment and system specified.

.2 Provide a training manual for each trainee. The Manual shall describe in detail the data included in each training program. Provide all equipment and material required for classroom training.

.3 Provide equipment, visual and audio aids, and materials for classroom training.

1.6 BAS TRAINING PROGRAM

.1 Training to be project-specific.

.2 One working day (8:00 AM to 4:30 PM weekday) at a time mutually agreeable between the Contractor and Consultant. This phase shall be augmented with continuous on-the-job training during 30 days acceptance period. Include the following:

1.7 RECORD DRAWINGS

.1 Conform to requirements of Division 1 and Section 21 05 01 Common Work Results for Mechanical - General, supplemented and modified by requirements specified in this section.

.2 Final Control Diagrams
- .1 Changes to contract documents as well as addenda and contract extras.
- .2 Changes to interface wiring.
- .3 Major routing of conduit and control air lines.
- .4 Signal levels, setpoints, reset curves, schedules.

.3 Bind with specified Operating and Maintenance Manuals.

.4 Provide listing of alarm messages.

.5 Provide 1 non-fading "Record" copy copies showing control and/or adjustment procedures. Enclose in aluminum frame with non-glare glass cover or seal in plastic laminate in rigid metal bound loose leaf.

.6 Include complete coverage in concise language readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.

.7 Functional description to include:
- .1 Functional description of theory of operation.
- .2 Design philosophy.
- .3 Specific functions of design philosophy and system.
- .4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.
- .5 Explicit description of hardware and software functions, interfaces, requirements for components in functions and operating modes.
- .6 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented or planned for implementation in automatic mode.

.8 System operation to include:
- .1 Complete step-by-step procedures for operation of system including required actions at each OWS.
- .2 Operation of computer peripherals, input and output formats.
- .3 Emergency, alarm and failure recovery.
- .4 Step-by-step instructions for start-up, back-up equipment operation, execution of all systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.

.9 Software to include:
- .1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.
- .2 Detailed descriptions of program requirements and capabilities.

.3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.

.4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device

.5 Complete program cross reference plus any linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.

.6 Software for each Controller and single section referencing all Controller common parameters and functions.

.10 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, Controller interface firmware's, plus diagnostics and repair/replacement of system hardware.

.11 Test procedures and reports: record implementation, description of test procedures. Provide for measurement or observation of results.

.12 System configuration document:

.1 Basic system design and configuration.

.2 Provisions and procedures for planning, implementing, recording hardware and software modifications required during installation, test and operating lifetime of system.

.3 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.

.4 Full documentation of new system configurations.

.13 PROM programmer and test equipment manual: include full documentation on PROM's including as minimum PROM locations in system, stock number, Programmer/PROM unique considerations.

.14 Programmer control panel documentation: provide where panels are independently interfaced with BAS, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

2 Products N/A

3 Execution

3.1 MONITORING OF BAS TRAINING

.1 Consultant will monitor training program and retains right to modify schedule and content.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

1.3 IDENTIFICATION REQUIREMENTS

.1 Identify all electrical equipment by the use of Lamicoid plates.

.2 All enclosures receiving connections to the building power distribution system shall have their panel and circuit number identified by the use of Lamicoid plates. This includes equipment supplied by this contractor.

.3 Colour code all electrical junction, pull boxes and splitters inside and out with appropriate colored paint. **Apply all paint prior to installation and not with-in the confines of the building.**

.4 Colour code all conduit couplings with appropriate colored paint. **Apply all paint prior to installation and not with-in the confines of the building.**

.5 All junction boxes shall have the panel and circuit numbers contained with-in, identified on the cover plate.

.6 Identify all wiring through the use of self-laminating labels.

.7 Identify all control panels through the use of Lamicoid plates.

.8 Identify all relay panels through the use of Lamicoid plates.

.9 Identify all electrical devices (receptacles, relay panels, power supplies, etc.) and electrical equipment and electrical equipment in concealed ceiling spaces with two (2) Lamicoid plates, one on the device, junction box and equipment and one on the ceiling below.

2 Products

2.1 IDENTIFICATION NAMEPLATES

.1 Lamicoid identification plates.

.1 Lamicoid 3 mm thick plastic engraving sheet for all BAS systems, complete with rounded upper corners. Lamicoid characteristics are to be as follows, unless noted otherwise:

.1 Electrical equipment enclosures to have black face with white core Lamicoid plates.
.2 All ceiling mounted plates to have white face with black core.

.2 NAMEPLATE SIZES

Size 1	10 mm x 50 mm (3/8" x 2")	1 line	5 mm (0.2") high letters
Size 2	13 mm x 75 mm (1/2" x 3")	1 line	6 mm (0.25") high letters
Size 3	16 mm x 75 mm (3/4" x 3")	2 line	5 mm (0.2") high letters
Size 4	19 mm x 90 mm (3/4" x 3.5")	1 line	10 mm (3/8") high letters
Size 5	38 mm x 90 mm (1.5" x 3.5")	2 line	13 mm (1/2") high letters
Size 6	25 mm x 100 mm (1" x 4")	1 line	13 mm (1/2") high letters
Size 7	25 mm x 100 mm (1" x 4")	2 line	6 mm (1/4") high letters
Size 8	50 mm x 150 mm (2" x 6")	2 line	13 mm (1/2") high letters
Size 9	75 mm x 150 mm (3" x 6")	3 line	13 mm (1/2") high letters

.3 Identification to be in English.

2.2 COLOUR CODING OF ELECTRICAL BOXES

.1 Colour coding of splitters, junction boxes, pull boxes and outlet boxes as follow:

System	Primary Colour	Secondary Colour
0 to 50 volts	Violet	-
51 volts to 240 volts	YELLOW	-
Above 240 volts	ORANGE	-
Ground or Bond	GREEN	-
Building Automation System	RED	WHITE

.2 All various systems junction and/or pull boxes etc., where located above grid system, shall have location identified on underside or room side of T-bar spline, with (19 mm) or (6 mm on 19 mm) self-adhering colour coded circular shaped discs, affixed directly to spline in close proximity to where concealed box is located. The same type of discs to be installed on ceiling or wall access cover plates.
.1 6 mm (1/4") discs are all white in colour.
.2 19 mm (3/4") discs are colored as indicated.
.3 6 mm (1/4") to be affixed to center or middle of 19 mm (3/4") discs as system colours dictates.

.3 Refer to Part 3 of this section with regard to identification painting.

2.3 WIRING IDENTIFICATION

.1 Wiring Labels:
.1 Write on self-laminating labels.
.2 Panduit No's PLD-1, PLD-2.

2.4 NAMEPLATES FOR BAS FIELD DEVICES

.1 As a minimum, control device identification shall correspond to descriptors provided in the reviewed shop drawings with respect to panel designation or BAS point name.

.2 Identify intermediate and end control devices including sensors, controllers, monitoring devices etc. as follows:

- .1 Laminated plastic plates nameplates attached by chain or heavy duty plastic tie wraps.
- .2 Plastic encased cards
  - .1 Sizes: 50 x 100 mm minimum.
  - .2 Lettering: 6 mm minimum high produced from laser printer in black.
  - .3 Data to include: point name, schematic designation number, model, capillary length, size, range, set point, other pertinent data, function, fail-safe position.
  - .4 Attached by chain or heavy duty plastic tie wraps.
- .3 Field Device Tagging:
  - .1 90 x 24 x 4 mm white styrene plastic with 5mm diameter hole for chain or tie wrap mounting.
  - .2 Lettering:
    - .1 20 pt bold for point name
    - .2 12 pt reg for point descriptor
    - .3 10 pt reg for point address
    - .4 Miscellaneous text 8 pt regular
- .4 Full stick-on labels attached to plastic backing. Labels generated by Excel spreadsheet of point database then imported to any common label making machine (i.e. Brother P-touch). Labels and text can be any color.
- .5 90 x 24 x 4 mm clear plastic with 5mm diameter hole for chain or tie wrap mounting.

2.5 WARNING SIGNS

.1 Equipment (e.g. motors, starters) under remote automatic control: provide orange colored signs warning of automatic starting under control of BAS.

.2 Sign to read: "Caution: This equipment is under automatic remote control of BAS" or equivalent to Consultant's approval.

3 Execution

3.1 EQUIPMENT IDENTIFICATION

.1 Submit description of proposed equipment identification plates for engineer's approval.

.2 Do not manufacture Lamicoid plates prior to receiving written approval from the engineer.

.3 Lamicoid nameplates shall be applied to all electrical equipment including but not limited to the following:

.1 All electrical equipment enclosures for starters, disconnect switches, relay panels, panelboards, splitter troughs, transformers, thermal overload switches, etc.

.4 Lamicoid nameplate fastening method as follows:

.1 Concrete or concrete block: Contact type cement (Note: Peel off type not acceptable).

.2 Plasterboard: Contact type cement (Note: Peel off type not acceptable).

.3 Equipment enclosures: Pop rivets. (Note: Screws not acceptable).

.4 Ceiling and T-Bar spline: Contact type cement (Note: Peel off type not acceptable).

.5 Identify equipment as follows:

.1 Lamicoid nameplates installed on combination starters, magnetic starters, manual starter and all various systems controls, control panels, disconnect switches, shall contain the following information:

.1 Designated name of equipment.

.2 Designated name of power source.

.3 Branch circuit breaker number(s) where possible.

.4 Voltage(s).

.5 Size 8

Example:	**EXAMPLE:**
EXHAUST FAN NO. 5	***SUPPLY FAN NO. 3***
PANEL 1101 - CCT. NO. 17	***MCC 3101***
120V - 1 PH	***347/600V - 3 PH/4W***

.2 Lamicoid nameplates are to be installed on all junction and/or pull boxes sized 150 mm x 150 mm (6" x 6") and larger indicating name of system, designated panel name and electrical characteristics where applicable.

.3 Lamicoid nameplates are to be installed adjacent to each overcurrent device located in switchboards, CDP panels, MCC's, etc. They need only indicate designated name and/or number of equipment they feed. Each unused or spare overcurrent device is to be identified with a Lamicoid plate indicating it as being a spare. Size #5.

3.2 IDENTIFICATION OF JUNCTION BOXES, PULL BOXES, SPLITTER TROUGHS AND OUTLET BOXES

.1 All junction boxes and/or pull boxes, conduit fittings (and respective covers), complete with their respective cover plates as per the following:

.1 Colour code colors as noted in Part 2 of this section.

.2 Apply colour coding prior to pulling conductors into boxes.

.3 Inside and out where one colour is required, with cover plate painted completely.

.4 Where primary and secondary colours are indicated:

.1 Diagonally apply to each half of the inside and outside of box the primary and secondary colours.

.2 Diagonally apply to each half of the cover plate the primary and secondary colours.

.3 Provide a legend of colour coding used under Plexiglas. Locate in main electrical room.

.2 All junction boxes and/or pull boxes, where not concealed, provide color identification discs fastened to the outside of the box, after architectural painting is complete.

.3 Label ends of conduits (temperature sensor conduits, conduits through wall, etc.) red and white.

.4 Voltage and Originating Source Identification

.1 Identification of electrical junction boxes, pull boxes, splitter troughs: smaller than 150 mm x 150 mm.

.1 Identify on the coverplate, using permanent indelible black marker the panel and circuit numbers contained with.

.2 Group phase conductors with associated neutral conductor.

.2 Identification of electrical junction boxes, pull boxes, splitter troughs: 150 mm x 150 mm and larger.

.1 Provide Lamicoid plate fastened to coverplate, indicating:

.1 Voltage, phase and Originating panel.

.2 Size 6.

.3 Example: "120/208 v, 3Ø, 4w, panel 'A'."

.2 Using permanent indelible black marker, identify the circuits contained within.

3.3 IDENTIFICATION OF SYSTEM CONTROL PANELS

.1 Provide Size 6 Lamicoid plate fastened to equipment enclosure indicating:

.1 System name.

.2 Example: "Building Automation System Control Panel".

3.4 IDENTIFICATION OF WIRING

.1 Identification of wiring:

.1 Identify wiring with permanent indelible identifying markings, either numbered or colored plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Label each neutral conductor to indicate its associated phase conductors in each panelboard, distribution panel, pillbox and junction box it appears in. These labels are to be installed in a 'flagged' manner.

.3 All circuit conductors are to be individually tie wrapped to their corresponding labeled neutral conductor in all panelboards, pull boxes and junction boxes. Each neutral conductor is to be identified to indicate its corresponding phase conductors.

.4 Labeling of all branch circuit wiring including phase conductors, neutral, ground and/or bonding conductors to be done on both ends of all circuit wires plus in any junction and/or pull boxes located in between using approved product (refer to 2.3). These labels are to be installed in a 'flagged' manner around individual conductors.

.5 Indicate panel and circuit number i.e.: Panel '1101', cct. #10.

3.5 BAS IDENTIFICATION

.1 Provide engraved Lamicoid nameplates clearly indicating the service and designation for the following devices:
- .1 Duct and pipe mounted sensors.
- .2 Control panels.
- .3 Manual switches.
- .4 Control valves.
- .5 Damper operators.

.2 Provide point I/O summary inside each control panel, specific for that control panel.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

2 Products

2.1 BUILDING CONTROLLER (B-BC)

.1 Conform to BACnet Building Controller (B-BC) device profile as specified in ASHRAE/ANSI 135-2001, BACnet Annex L

.2 Listed as a certified B-BC in the BACnet® Testing Laboratories (BTL) Product Listing.

.3 All communication with operator workstation and all application controllers via BACnet®.

.4 BACnet® Router: BACnet Building Controller that provides BACnet packet routing between BACnet networks located on BACnet® Local Area Network (LAN):

.1 Intelligent controller designed for connecting multiple BACnet networks together involving a variety of different physical network media. T

.2 Designed for BACnet BBMD and BACnet packet routing applications; it provides no control I/O points.

.5 Fully programmable BACnet® Building Controllers that communicate on BACnet® Local Area Network (LAN) and BACnet® MS/TP Network (MS/TP):

.6 Capable of providing global control strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory preprogrammed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable.

.7 Object-oriented programming using control function blocks, supporting BAS functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be resident on workstation and the same tool used for all cont rollers.

.8 Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator's workstation or field computer.

.9 Battery-backed real-time (hardware) clock functions.

.10 Memory as needed to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative).

.11 Global control algorithms and automated control functions should execute via 32-bit processor.

.12 Installation includes memory-free gel-cell battery providing ongoing power conditioning and noise filtering for operation data integrity. It shall provide up to 5 minutes of powerless operation for orderly shutdown and data backup.

.13 Schedules support a minimum of 250 BACnet® Schedule Objects and 250 BACnet® Calendar Objects.

.14 Log as minimum 1000 trend logs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator's workstation.
- .1 Logs may be viewed both on-site or off-site via remote communication.
- .2 Building controller shall periodically upload trended data to networked operator's workstation for long term archiving if desired.
- .3 Archived data stored in database format shall be available for use in third party spreadsheet or database programs.

.15 Alarms generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
- .1 Each alarm may be dialed out.
- .2 Alarm log shall be provided for alarm viewing. Log may be viewed onsite at the operator's terminal or off-site via remote communications.
- .3 Controller must be able to handle up to 1500 alarm setups stored as BACnet® event enrollment objects - system destination and actions individually configurable.

.16 Provide an adequate number of BC's to achieve the performance specified.
- .1 Comprised of one or more independent, standalone, microprocessor-based BC's to manage the global strategies described in the System Software section.
- .2 Have sufficient memory to support its operating system, database, and programming requirements.
- .3 Share data between networked BC's.
- .4 The operating system of the BC's 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.
- .5 BC's that perform scheduling shall have a real-time clock.

.17 Communication: Each BC's support direct Ethernet. The BC's connected to the BACnet® network using the ISO 8802-3 (Ethernet) Data Link/ Physical layer protocol.

.1 A communications card shall perform BACnet® routing if connected to a network of Custom Application and Application Specific Controllers.

.2 Provide a service communication port using BACnet® Data Link/Physical layer protocol P-T-P for connection to a hand-held workstation/and/or modem.

.3 Secondary communication network support BACnet® MS/TP.

.18 Communicate with other BACnet objects on the internetwork using the Read (Execute and Initiate) and Write (Execute and Initiate) Property services as defined in ASHRAE Standard 135-2001.

.19 Serviceability: Provide diagnostic LEDs for power, communication, and processor. All wiring connections shall be made to field- removable, modular terminal strips or to a termination card connected by a ribbon cable.

.20 Memory: Have as a minimum standard SRAM of 256 KB, standard DRAM of 1MB and standard non-volatile 1 MB of flash memory in lieu of EPROM. Memory user extendible through RAM chip sockets and SIMMs for future memory expansion.

.21 Immunity to power and noise: Able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Maintain all database information including BIOS and programming information in the event of a power loss for at least 72 hours. Operation shall be protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 1 m.

.22 Support the following BACnet functional groups: Clock, Event Initiation, COV Event Response, Files, Device Communication and Time Master.

.23 Selected to provide a minimum of 15% spare I/O point/object capacity for each point/object type found at each location. If input /objects are not universal, 15% of each type is required. A minimum of one spare is required for each type of point/object used.

.24 Inputs/Outputs.

.1 Inputs: Controller input/output board shall support dry contact, 0-5 VDC and 0-10 VDC- voltage, 4-20 mA- current and thermistor-resistive signal types on an individual basis for connecting any status or sensing device. Analog resolution shall be 10-bit A to D.

.2 Outputs: Controller input/output board shall support plug-and-play I/O modules or built in HOA modules configured with manual-auto-off override switch, potentiometer and input channel for feedback status or and unrelated analog or digital input. Output supported shall be 0-10 VDC. All HOA's shall be supervised.

.3 Diagnostics: Controller input/output board shall have red LEDs providing input status indication.

.4 External Power: Controller input/output board shall have one on-board 24 VDC terminal for directly connected active transducers.

.25 Capability to create, delete and support the following BACnet® Objects:

.1 ANALOG INPUT, ANALOG OUTPUT AND ANALOG VALUE: Have the following writeable properties: Object Name; Object Value; Description; COV Increment; Out of Service and Units. In addition, support the properties: Device type; Reliability; Min./Max. Values; Update Interval and Resolution.

.2 BINARY INPUT, BINARY OUTPUT AND BINARY VALUE: Have the following writeable properties: Object Name; Object Value; Description; Polarity; Default Value; Min On/Off and Out of Service. In addition, support the properties: Device Type; Reliability; Active/Inactive Texts; Update Interval; Resolution; Change-of-State Time; Count Times and Time Reset.

.3 CALENDAR: Have the following writeable properties: Object Name; Object Value; Description; and Date List.

.4 DEVICE: Have the following writeable properties: Object Name; Description; Location; and UTC Offset.

.5 EVENT ENROLMENT: Have the following writeable properties: Object Name; Object Value; Description; Out-of-Service; Event & Notify Types; Parameters; Property Ref; Enable; and Notification Class.

.6 FILE: Have the following writeable properties: Object Name; Description; File Type; and File Access.

.7 LOOP (PID): Have the following writeable properties: Object Name; Object Value; Description; Polarity; Output and Input Refs.; Input Value & Units; Setpoint Value; PID Values; Bias; Write Priority and COV Increment. In addition, support the properties: Reliability; Update Interval; Proportional Constant & Units; Derivative Constant & Units.

.8 NOTIFICATION CLASS: Have the following writeable properties: Object Name; Object Value; Description; Priority and Ack Required.

.9 PROGRAM: This object shall have the following writeable properties: Object Name; Object Value and Description. In addition, this object shall support the property Reliability.

.10 SCHEDULE: Have the following writeable properties: Object Name; Object Value and Description; Effective period; Schedule; Exception; Controlled Properties and Write Properties.

.11 TREND LOG: Have the following writeable properties: Object Name; Description; Log Enable; Start/stop Times; Log Device Object Property; Log Interval; Stop When Full; Buffer Size; and Record Count.

2.2 CONTROLLER SOFTWARE

.1 Provide the following applications software for building and energy management. All software applications shall reside and operate in the system controllers. Editing of applications shall occur at the operator workstation.

.2 System Security: User access secured using individual security passwords and user names. Passwords restrict the user to the objects, applications, and system functions as assigned by the system manager. Record User Log On/Log Off attempts.

.3 Scheduling: Provide the capability to schedule each object or group of objects in the system.

.1 Weekly Schedule: Provide separate schedules for each day of the week. Each of these schedules should include the capability for start, stop and optimal start. Each schedule may consist of up to 5 start-stop pairs or 10 events. When a group of objects are scheduled together, provide the capability to adjust the start and stop times for each member.

.2 Exception: Operator shall be able to designate an exception schedule for each of the next 365 days. After an exception schedule has executed, system shall discard and replace exception schedule with standard schedule for that day of the week.

.3 Holiday Schedules: Provide the capability for the operator to define up to 24 special or holiday schedules. These schedules may be placed on the scheduling calendar and will be repeated each year. The operator shall be able to define the length of each holiday period.

.4 Alarm Reporting: Operator shall be able to determine the action to be taken in the event of an alarm. Alarms shall be routed to the appropriate workstations based on time and other conditions.

.5 Remote Communication: The system shall have the ability via Ethernet to communicate in the event of an alarm using BACnet® Point-To-Point.

.6 Maintenance Management: Monitor equipment status and generate maintenance messages based upon user-designated run-time, starts, and/or calendar date limits.

.7 Sequencing: Provide application software to properly sequence the start and stop of boilers and pumps to minimize energy usage in the facility.

.8 PID Control: A direct and reverse-acting PID (proportional-integral-derivative) algorithm and anti-windup shall be supplied. The algorithm shall calculate a time-varying analog value that is used to position an output or stage a series of outputs. The controlled variable, setpoint, and PID gains shall be user-selectable.

.9 Staggered Start: This application shall prevent all controlled equipment from simultaneously restarting after a power outage.

.10 Energy Calculations: Provide software to allow instantaneous power (e.g., kW) or flow rates (e.g., L/s) to be accumulated and converted to energy usage data. System shall calculate a sliding-window average (rolling average). Operator shall be able to adjust window interval to 15 minutes, 30 minutes, or 60 minutes.

.11 Anti-Short Cycling: All binary output objects shall be protected from short cycling. This feature shall allow minimum on-time and off-time to be selected.

.12 Demand Limiting.
- .1 System shall monitor building power consumption from building power meter pulse generator signals or from building feeder line watt transducer or current transformer.
- .2 When power consumption exceeds adjustable levels, system shall automatically adjust setpoints, de-energize low-priority equipment, and take other programmatic actions to reduce demand. When demand drops below adjustable levels, system shall restore loads as specified.

.13 On/Off Control with Differential. Provide an algorithm that allows a binary output to be cycled based on a controlled variable and setpoint. The algorithm shall be direct-acting or reverse-acting, and incorporate an adjustable differential.

.14 Run-time Totalization: Provide software to totalize run-times for all binary input objects. A high run-time alarm shall be assigned, if required, by the operator.

.15 Programming
- .1 Provide sufficient internal memory for the specified sequences of operation and trend logging.
- .2 Provide a minimum of 25% of available memory free for future use.
- .3 Point/object Naming: System point/object names shall be modular in design, allowing easy operator interface without the use of a written point/object index. Refer to Section 25 05 01

.16 Software Programming
- .1 Provide programming for the system and adhere to the sequences of operation provided.
- .2 Provide all other system programming necessary for the operation of the system, but not specified in this document. Imbed into the control program sufficient comment statements to clearly describe each section of the program. The comment statements shall reflect the language used in the sequences of operation. Use the appropriate technique based on the following programming types:
  - .1 Text-based:
    - .1 must provide actions for all possible situations
    - .2 must be modular and structured
    - .3 must be commented.
  - .2 Graphic-based
    - .1 must provide actions for all possible situations
    - .2 must be documented
  - .3 Parameter-based
    - .1 must provide actions for all possible situations
    - .2 must be documented

.17 Operator Interface
- .1 Standard Graphics. Provide graphics for all mechanical systems and floor plans of the building. This includes each glycol water system, hot water system, boiler,

air handler and all terminal equipment. Point/object information on the graphic displays shall dynamically update. Show on each graphic all input and output points/objects for the system. Also show relevant calculated points/objects such as setpoints

.2 Provide all the labor necessary to install, initialize, start up, and troubleshoot all operator interface software and their functions as described in this section. This includes any operating system software, the operator interface database and any third-party software installation and integration required for successful operation of the operator interface.

3 Execution

3.1 GENERAL

.1 Locate controllers in lockable enclosures as per Section 25 05 01 BAS: General Requirements

3.2 PROGRAMMING

.1 Provide all programming necessary for a fully functioning system.

.2 The control strategy for each system shall be performed by software within the control unit. Refer to the Control Drawings for the sequence of operation for each system.

.3 Tune each temperature control loop to provide control within +/- 0.5°C unless otherwise indicated.

.4 Provide time schedules for all start/stop points.

.5 Provide and program high and low limit alarms on all analog input points.

.6 Program the level of annunciation for each alarm to the requirements of the Owner.
- .1 Local to specific network control unit(s).
- .2 Operators Workstations.
- .3 Alarm printer.

.7 Outside air temperature to show on all screens.

.8 Program for trend logs as specified below.

.9 Program system to enable two types of all points log be printed: Log 1 - all points except room temperature and room control valves. Log 2 - all room temperature and room control valves.

.10 Point Label to be as per drawing. Submit labels with shop drawings.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

2 Products

2.1 GENERAL

.1 External trim materials to be corrosion resistant. Internal parts to be assembled in vibration-proof, assembly.

.2 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.3 Transmitters to be unaffected by external transmitters (e.g. walkie talkies).

.4 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.5 Devices to be installed in user occupied space must not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 TEMPERATURE SENSORS

.1 Thermistor:
- .1 Monitoring Range.
  - .1 -40° C to 55° C where exposed to outside air.
  - .2 -5° C to 55° C elsewhere.
- .2 Factory Calibration Point 25° C with accuracy of Calibration Point +/- 0.3° C.
- .3 Stainless steel probe.

.2 Resistance Temperature Detectors (RTD's):
- .1 Monitoring Range.
  - .1 -1° C to 49° C for ducts.
  - .2 21° C to 104° C for hot water and glycol systems.
- .2 Factory Calibration Point 21° C.
- .3 Accuracy Calibration Point.
  - .1 For -7° C to 49° C type +/- 0.7° C.
  - .2 Platinum or Nickel Wire Sensor.

.3 TRM: Room Temperature Sensors
.1 Supplied by Heat pump manufacturer. Coordinate outputs.

3 Execution

3.1 GENERAL

.1 Temperature transmitters, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in all cases when dissimilar metals make contact.

.2 Support field-mounted transmitters, sensors on pipe stands or channel brackets.

.3 Duct and AH unit mounted devises: Seal duct and AH unit to prevent air leakage.

.4 Wall mounted devices: Install on plywood panel properly attached to wall.

.5 Duct mounted devices: On insulated ducts, mount devices and associated wiring on standoffs.

3.2 TEMPERATURE SENSORS

.1 Mount room temperature sensors on electrical box.

.2 Stabilized to such a level as to permit on-the-job installations that will require minimum field adjustments or calibration.

.3 Assemblies readily accessible and adaptable to each type of application in such a manner as to allow for quick, easy replacement and servicing without special tools or skills.

.4 Locate duct sensors locations to sense the correct temperature of the air only, and not be located in dead air spaces. The location shall be within the vibration and velocity limits of the sensor. Where an extended surface element is required to properly sense the average temperature it shall be securely mounted within the duct to measure the best average temperatures. Elements shall be thermally isolated from brackets and supports to respond to air temperature only. Sensor element to be supported separately and not connected to coils or filter racks.

END OF SECTION

1 General

1.1 GENERAL

The General Conditions of the contract as well as provisions of Division 1 and Section 21 05 01 Mechanical General Requirements, Section 21 05 02 Mechanical Submittals and Section 21 05 03 Mechanical Contract Closeout are part of and to be read in conjunction with this Section.

1.2 REFERENCE STANDARDS

.1 In accordance with Section 21 05 01 Mechanical General Requirements.

1.3 WIRING

.1 If departures from the contract drawings are deemed necessary, details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with drawings for approval.

.2 Incorporate surge transient protection in the design of the system to protect all electrical components in all control equipment.

1.4 SYSTEM DESCRIPTION

.1 Electrical: Hard wiring between field control devices and BAS field panels.

2 Products

2.1 CONTROL SYSTEM WIRE AND CABLE

.1 Cable jacket:
- .1 FT6 jacket rated and bear the following labels: CSA 300 volts and FT6.
- .2 FT4 jacket rated and bear the following labels: CSA 600 volts and FT4.
- .3 Labeled with the following information, as a minimum:
  - .1 Cable type.
  - .2 FT rating.
  - .3 Temperature rating.
  - .4 CSA number.
  - .5 Rated voltage.
  - .6 Gauge and number of conductors.
- .4 Application:
  - .1 Control wiring to 600 volt starters to be FT4 in conduit.
  - .2 All control wiring in conduit may be FT4.
  - .3 All other control wiring to be FT6.
  - .4 Colored as follows:

System Description	Jacket Colour
BAS	Yellow

.2 Below 50V control wiring:
- .1 Minimum No. 14 stranded.
- .2 Minimum two conductor No. 18 AWG solid copper or No. 20 AWG, stranded twisted pair for field wiring of each digital device.
- .3 Minimum No. 22 AWG solid copper for multi-conductor wiring having four or more conductors.
- .4 Minimum two conductor No. 18 AWG, solid copper, or No. 20 AWG, stranded twisted pair, shielded for field wiring of each analog input.

2.2 BUILDING WIRES

.1 Stranded, soft drawn copper with RW90 XLPE insulation rated for a minimum of 600 VAC for all conductors (phase, neutral, bond, isolated ground).

.2 #12 AWG minimum wire size.

.3 Green colored RW90 X-link insulation for Grounding and bonding conductors.

.4 Multi-conductor AC-90 cables containing a single white colored conductor are not to be used where more than one neutral conductor is required.

2.3 JUNCTION, PULL BOXES AND CABINETS

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm (1 inch) minimum extension all around, for flush-mounted pull and junction boxes.

.3 Junction boxes larger than 120 mm (4 11/16") to have a bonding terminal strip installed.

.4 Cabinets:
- .1 Finish: ASA- 61 grey enamel.
- .2 Complete with bonding terminal strip.
- .3 Type D: 1.6 mm steel cabinet, built for surface or flush mounting. Flush cover lip 25 mm all around. Complete with screw on cover.
- .4 Type E: 1.6 mm steel cabinet, surface mount. Formed steel hinge with pull ring catch.
- .5 Type T: 1.6 mm steel cabinet, 1.9 mm cover, latch lock, 2 keys.

.5 Size to suit the wiring for the control system and to allow for future expansion capabilities specified for the system.

2.4 OUTLET AND CONDUIT BOXES

.1 100 mm (4") square or larger outlet boxes as required for special devices.

.2 Blank cover plates for boxes without wiring devices.

.3 120 V outlet boxes for 120 V switching devices.

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

.5 Where tile rings are installed, they must be the welded type with square corners (Rounded corners will not be acceptable). For single device installations use Iberville BC52-C-49XX. For two device installations use Iberville # 52-C-52-XX. Select appropriate depth of tile ring to suit application.

.6 Adjustable type tile rings such as Iberville # 52C-ADJ are not permitted on this project.

.7 Sheet Steel Device Boxes:

.1 One Device, Flush Installation, Suitable for Armoured Cable Entry : Electro-galvanized steel single, flush device boxes for use in dry flush installation, pressed steel, non-gangable, minimum size 75 mm (3") x 57 mm (2-1/4") x 63 mm (2.5") deep, minimum volume of 245 cubic centimetres (15 cu.in.), (Similar to Iberville # 1504-LSSAX).

.2 One or Two Device, Flush Installation, Suitable for Conduit Entry: Electro-galvanized steel single, flush device boxes for use in dry flush installation, shall be pressed steel, minimum size 100 mm (4") square x 54 mm (2 1/8") deep, minimum volume of 490 cubic centimetres (30 cu.in.) (Similar to Iberville # 52171-K). Provide single device square cornered tile cover (Similar to Iberville # BC52-C-49XX) or two device square cornered tile covers (Similar to Iberville # 52-C-52-XX).

.3 Provide an outlet box for all control outlets complete with single gang raised tile ring and stainless steel cover plate, unless noted otherwise. Minimum dimensions as follows: 100 x 100 x 53 mm (4" x 4"x 2 1/8") deep, minimum volume of 490 cubic centimetres (30 cu.in.) (Similar to Iberville # 52171-K).

.4 100-mm square or octagonal outlet boxes for lighting fixture outlets.

.8 Masonry Boxes:

.1 Boxes: Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls, minimum volume of 343 cubic centimeters (21 cu.in), 89 mm (3 ½") deep (Similar to Iberville # MBD).

.9 Surface Mount Conduit Boxes

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

.2 Metal type "FS" device plates to be used on all type "FS" boxes unless noted otherwise.

.10 Mounting Brackets

.1 Provide box mounting brackets for the installation of multiple boxes for drywall partitions, complete with tile rings.

.2 Acceptable material: Caddy RBS Type (16 or 24 as required).

.11 Fittings – General

.1 Knock-out fillers to prevent entry of foreign materials.

.2 Double locknuts and insulated bushings on sheet metal boxes.

2.5 CONDUITS

.1 Rigid galvanized steel threaded conduit.

.2 Electrical metallic tubing (EMT) with couplings.

.3 Liquid-tight flexible metal conduit.

.4 Metal flexible conduit.

2.6 WIRE AND BOX CONNECTORS 0-1000V

.1 Spring type pressure type connectors for all branch circuit wiring sized #10 AWG and smaller. Current carrying parts are to be made of copper or copper alloy and be complete with an appropriate size insulating cap. Cap is to completely fit or cover all enclosed conductors as required, with current carrying parts of sized to fit conductors as required.

2.7 CONDUIT FASTENINGS

.1 Fasten conduit to building construction or support system using straps, as follows:
- .1 One-hole steel straps to secure surface conduits and cables 35 mm (1-1/4") and smaller.
- .2 Two hole steel straps for conduits and cables 41 mm (1-1/2") and larger.

.2 Beam clamps to secure conduits to exposed steelwork.

.3 Channel type supports for one or more conduits.
- .1 U shape, minimum size 45 mm x 45 mm, 3 mm thick, surface mounted as required.

.4 10 mm (3/8") diameter threaded rods to support suspended channels.

2.8 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating same as conduit.

.2 Set screw, galvanized steel couplings for thinwall type EMT conduits

.3 Top or side connections to equipment enclosures equipped with sprinkler hoods
- .1 Conduits with rain tight EMT connectors.
- .2 Equipped with a rubber "O" Ring gasket.

.4 Connectors for thinwall type EMT conduits
- .1 Set screw, galvanized steel, complete with case hardened steel locknuts.
- .2 Provide insulated throats on connectors up to and including 27 mm (1").
- .3 Provide metal thread on bushings on all EMT connectors sized 35 mm (1-1/4") or larger.

.5 Two-screw, steel type connectors for armored cable similar to T & B #3301, 3312. Provide insulating bushings (anti-shorts) for armored cable connectors. The use of "snap-in" type connectors is not permitted.

.6 Nylon insulated, steel or malleable iron type connectors for flexible metal conduit similar to T & B Tite-Bite #3115 thru 3124. Provide insulating bushings (anti-shorts) for flexible metal conduit connectors. Plastic thread on bushings to be installed on all flexible metal conduit connectors sized 35 mm (1-1/4") or larger.

.7 Liquid-tight flexible metal conduit fittings:
- .1 Specifically listed for liquid tight flexible metal conduit.
- .2 Steel type, to match conduit size.
- .3 Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.
- .4 Safe edge ground type.
- .5 Connectors shall have insulated throats.
- .6 Standard of Acceptance: T & B #5300 series.

2.9 GROUNDING AND BONDING

.1 Insulated grounding conductors: green, insulation to this section.

.2 Ground bar: copper, size as indicated, complete with insulated supports, fastenings, connectors.

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

.4 All Ground Busbars: 6 mm electro-tin plated copper, complete with insulators, stainless steel brackets and fasteners, Erico # TMGB-A29L41PT

3 Execution

3.1 GENERAL

.1 Install all work in accordance with authorities having jurisdiction and manufacturer's requirements. In case of conflicting requirements, the more stringent shall apply.

.2 Install in a neat and ordered manner.

.3 Colour Coding: Refer to 25 05 032 BAS Identification.

.3 Fully enclose or properly guard electrical wiring, terminal blocks, high voltage above 70 V contacts and mark to prevent accidental injury.

.4 Check factory connections and joints. Tighten where necessary to ensure continuity.

.5 Holes through exterior wall and roofs: flash and make weatherproof.

.6 Where equipment, ducts or pipes are insulated, install control wiring on stand-offs.

.7 Do not cover with mechanical insulation.

.8 Secure approval for damper motor locations and supports.

.9 Run parallel or perpendicular to building lines. When installed in a wall cavity, conduit is to be installed vertically from outlet box to ceiling space, not run in an angled manner through the studs.

.10 Run conduits in flanged portion of structural steel, where possible.

.11 Group conduits wherever possible.

.12 Do not pass conduits through structural members except as indicated.

.13 Do not locate conduits closer than 75 mm (3 inch) parallel to hot water lines with a minimum of 25 mm (1 inch) at crossovers.

.14 Support electrical systems raceway independent of any type of suspended ceiling support rods, wires, etc. Toggle bolts shall not be used in Gypsum board construction.

.15 Do not install horizontal conduits runs in masonry walls.

.16 Do not install conduits in terrazzo or concrete toppings.

3.2 WIRE AND BOX CONNECTORS 0-1000V FOR CONTROL SYSTEMS

.1 Secureness tests in accordance with CSA C22.2 No.65.

.2 Remove insulation carefully from ends of conductors.

.3 “Plier-tightened” all wire connectors

3.3 INSTALLATION OF WIRES

.1 In conduit systems in accordance this section.

.2 All stranded conductors, (neutrals, bonds and phase conductors) prior to terminating under device bolts i.e., circuit breakers, light switches, receptacles etc., to be twisted together so as to form a single conductor.

.3 All branch circuit phase conductors feeding receptacles via junction and/or outlet boxes are to be complete with "pigtail" type leads to ensure minimal disruption of receptacle circuits if receptacles are removed for future maintenance.

.4 Where the application of colored tape is permitted, apply as follows:
- .1 Both ends of the conductor must be taped for all installed segments.
- .2 Each location where the conductor is visible, i.e.; all junction and pull boxes.
- .3 A minimum of 305 mm (12") of tape to be applied for all phase conductors.
- .4 All neutral, grounds and/or bond conductors must be taped for their entire visible length in all enclosures.

.5 Conductor tie-wrapping:
- .1 All circuit conductors are to be individually tie wrapped to their corresponding labeled neutral conductor in all panelboards, pullboxes and junction boxes. Suitable slack conductor length should be left to enable the ability to clamp the ground detector around the individually tie-wrapped circuit conductor and its corresponding labeled neutral. This wiring method is to be neat and of good workmanship quality.
- .2 The tie-wrapping of the neutral with its respective phase conductors is to be made at the closest point of entry into panelboards, pullboxes and junction boxes.

.6 Final connection
- .1 Provide separate pig-tail type leads in each receptacle outlet box for final connections to receptacles. Only connect these pig-tail leads to the phase and associated neutral conductors.

.7 Testing by this subcontractor
- .1 After all electrical wiring has been completed, test the grounded electrical distribution system to ensure there are no grounds, shorts and capacitive leakage in the system.
  - .1 All feeders or branch circuits which do not have neutral conductors are to have their respective phase conductors tye-wrapped together in accordance to the methods described previously.
  - .2 Test circuits and neutrals.

3.4 INSTALLATION OF PATHWAYS

.1 EMT type conduit wall-stub complete with flush installed device box are required in all partitions, regardless of construction material.

.2 Turned out stubs into accessible ceiling space within the same room as the outlet box or as required for routing to control devices and/or control panels, complete with nylon insulated throat, Arlington bushing or threaded type bushing. Minimum size to be 27 mm (1 inch).

.3 Ensure that both the device box and accompanying conduit sleeve are bonded to ground, as follows:

.1 Outlet box installed in partition utilizing metal studs, adjacent to receptacle box: Provide a #12 green insulated RW90 bonding conductor between receptacle device box and control outlet device box. Provide a push-on non-metallic insulated bushing on the end of the conduit stub, similar to Arlington Series EMT (T&B Insuliner sleeves not acceptable).

.2 Outlet box not otherwise bonded to ground: Where bonding connection is available from an overhead source (junction box, cable tray, etc.), provide a #12 green insulated RW90 bonding conductor from the bonding connection, through the conduit sleeve to the device box. Terminate bond wire at the device box. Provide a push-on non-metallic insulated bushing on the end of the conduit stub similar to Arlington Series EMT (T&B Insuliner sleeves not acceptable).

.4 When cables are required to pass through a partition separating a corridor from a room, or between rooms, EMT type conduit sleeves are required, sized in accordance with the information contained in this section. Sleeves shall be installed into accessible ceiling space, complete with nylon insulated throats or threaded type bushings. Provide a bonding bushing for all conduit sleeves. Seal the ends of all conduits after installation of cables. Firestop where required to maintain a fire resistance rating. Smoke seal where required.

.5 Provide suitably sized electrical junction boxes for all wiring supplied by this contractor, regardless of system voltage. This electrical box will contain all electrical connections associated with wiring for all electrical systems.

.6 When cables are required to pass from the cable tray through a partition separating the corridor from a room, two (2) 53 mm (2 inch) EMT type conduits are required. Conduits shall extend into the room accessible ceiling space; complete with nylon insulated throats or threaded type bushings. Provide a bonding conductor, connected to the cable tray for all conduits. Seal the ends of all conduits after installation of cables. Firestop where required to maintain a fire resistance rating. Smoke seal where required.

.7 Where grouping of various systems outlets or multiple type outlets in drywall type construction is required, the use of box mounting brackets as manufactured by Caddy #RBS16 or #RBS24 are to be installed between and secured to both metal studs. Secure brackets to metal studs using low profile sheet metal screws. Install suitable sized 102 mm (4”) square and/or 119 mm (4 11/16”) boxes complete with single gang raised tile rings.

.8 All surface wiring installed in rooms and/or other areas not having any hung, or drop type ceilings, or where otherwise installed on, or to wall surfaces etc., are to always be contained or sleeved in EMT type conduits.

.9 All non-concealed, surface type wiring installed on either ceilings and/or walls, is to also be sleeved in EMT type conduit.

.10 All concealed wiring routed through rooms with drywall or other inaccessible ceiling types are to be installed in a conduit system. The installation of access doors or recessed light fixtures in these areas does not change these types of ceilings from inaccessible to accessible.

.11 Provide suitably sized EMT conduit sleeves for controls system cables which pass through common walls between classrooms, workrooms, etc. Bond all sleeves to ground.

.12 Pull boxes are to be sized in conformance with CEC Rule 12-3036, unless noted otherwise. In addition, pull boxes installed on conduits used for the installation of control systems for straight pulls, shall conform to the following minimum requirements:

1. Minimum size of pull box: 150 x 150 x 100 mm (6 x 6 x 4 inch)
2. 35 mm (1-1/4 in): 150 wide x 510 long x 100 deep (6 x 20 x 4 inch).
3. 41 mm (1-1/2 in): 200 wide x 686 long x 100 deep (8 x 27 x 4 inch).
4. 50 mm (2 in): 200 wide x 914 long x 150 deep (8 x 36 x 4 inch).
5. 75 mm (3 in): 300 wide x 1220 long x 100 deep (12 x 48 x 6 inch).
6. 100 mm (4 in): 375 wide x 1525 long x 200 deep (15 x 60 x 8 inch

.13 In addition to the above requirements, BAS control circuit wiring 50 volts and less is to be installed as follows:

.1 Extend EMT conduits to within 760 mm (30 inches) of all various control devices associated with the operation of any given piece of mechanical equipment or device they might feed.

.2 For final connection between end of EMT conduit and applicable control device, use liquid tight metal type conduit complete with matching liquid tight type connectors.

.3 Bonding conductors are not required in flexible metal conduits where the conduit terminates in a non-metallic electrical box.

3.5 INSTALLATION OF HANGERS AND SUPPORTS

.1 BAS control cables installed within accessible ceiling spaces and not installed in a conduit system are to be secured directly to the steel deck, above the support structure. Provide supports at maximum 1200 mm (48”) intervals.

.2 Secure equipment to hollow and solid masonry, tile and plaster surfaces with lead anchors.

.3 Secure equipment to poured concrete with expandable inserts.

.4 Support equipment, conduit or cables using clips, spring-loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole steel straps to secure surface conduits and cables 35 mm (1-1/4 inch) and smaller.

.2 Two-hole steel straps for conduits and cables 41 mm (1-1/2 inch) and larger.

.3 Beam clamps to secure conduit to exposed steelwork.

.6 Securely fastened EMT in place within 1 meter (40 inches) of each outlet box, junction box, cabinet, couplings, fittings and changes in direction and the spacing between supports as follows:

.1 Not greater than 1500 mm (5') for 16 mm (1/2") and 21 mm (3/4") EMT

.2 Not greater than 1800 mm (6') for 27 mm (1") and 35 mm (1-1/4") EMT

.3 Not greater than 3050 mm (10') for 41 mm (1-1/2") EMT or larger.

.7 Suspended supports systems.

.1 Support single or multiple cables or conduits on a common steel support channel system supported by 10 mm (3/8") diameter threaded rod hangers, washers and nuts where direct fastening to building construction is impractical. Channel is to be sandwiched between nuts and washers located on both upper and underside portions of channels.

.2 Do not support a single conduit using a threaded rod and a conduit clip. This is not an acceptable means of installation as no lateral support is provided.

.8 For surface mounting of single and multiple conduits use channels. Channels are to be securely attached to hangers with the maximum spacing not greater than:

.1 Conduits of one size only:

.1	16 mm to 21 mm (½" to ¾") conduit	1524 mm (60")
.2	27 mm & 35 mm (1" to 1 ¼") conduit	1980 mm (78")
.3	41 mm (1 ½") & larger conduit	3050 mm (120")

.2 Conduits of mixed size: Arrange supports so that maximum spacing of supports conforms to above, based on smallest conduit diameter.

.9 All suspended types of junction and pull boxes are to be supported using a minimum of 10 mm (3/8") threaded rod complete with nuts and flat washers. Secure threaded rods to boxes using one flat washer and nut installed on both sides of box. Provide as follows:

.1 One rod required for all types of boxes sized 150 x 150 mm (6 x 6 inches) or smaller.

.2 Two rods required for all types of boxes larger than 150 x 150 mm (6 x 6 inches) but less than 304 x 304 mm (12 x 12 inches)

.3 Four rods required for all types of boxes 304 x 304 mm (12 x 12 inches) and larger.

.10 Cut-off all excess threaded rod to within 13 mm (1/2") of channel bottom.

.11 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.12 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.13 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.14 <u>Do not use supports or equipment installed by other trade contractors for conduit or cable support.</u>

.15 **Do not attach conduit and cable to supports installed as part of a suspended ceiling installation (gypsum board or T-Bar for example).**

.16 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

3.6 INSTALLATION OF SPLITTER, JUNCTION, PULL BOXES AND CABINETS

.1 Support boxes independently of connecting conduits.

.2 Install pull boxes in inconspicuous but accessible locations. Box cover to be hinged on the side. **Do not install boxes with hinge on top.**

.3 Install pull boxes so as not to exceed 27 m (90') of conduit run between pull boxes. Each run of raceway shall not have more than the equivalent of four 90 degree bends installed, including the bends located at an outlet or fitting.

.4 Where construction consists of metal Q deck and steel joists (Roof deck only), conduit boxes are to be installed in such a manner that the nearest outside surface of the electrical box is not less than 38 mm (1.5") from the nearest surface of the metal roof deck.

.5 Terminate all bonding conductors on bonding terminal strip installed inside junction box.

.6 Use Type E cabinets where junction and or pull boxes are required to be 150 x 150 mm (6" x 6") or larger.

.7 Use Type T cabinets when equipment is required to be housed in a lockable enclosure.

.8 Where construction consists of metal Q deck and steel joists (Roof deck only), conduit boxes are to be installed in such a manner that the nearest outside surface of the electrical box is not less than 38 mm (1.5") from the nearest surface of the metal roof deck.

.9 Location of junctions and/or pull boxes in suspended ceiling spaces, i.e., gypoc, T-bar, etc., are not to be greater than 760 mm (30") above finish ceiling.

.10 All suspended types of junction and pull boxes are to be supported using a minimum of 10 mm (3/8 inch) threaded rod c/w nuts and flat washers. Secure threaded rods to boxes using one flat washer and nut installed on both sides of box. Provide as follows:

- .1 One rod required for all types of boxes sized 150 x 150 mm (6" x 6") or smaller.
- .2 Two rods required for all types of boxes larger than 150 x 150 mm (6" x 6") but less than 304 x 304 mm (12" x 12").
- .3 Four rods required for all types of boxes 304 x 304 mm (12" x 12")) and larger.

.11 Where junction boxes and pull boxes are secured to building structural components, they shall be mounted and secured in such a manner so as not to be "cantilevered" (i.e, only supported on one side of the box). In rare instances where site constraints dictate the installation of a "cantilevered" box, threaded rods shall be installed to provide additional support on the opposite end.

.12 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material.

.13 Install multiple box mounting brackets and mount boxes.

.14 For flush installations mount outlets flush with finished wall using tile rings to permit wall finish to come within 6 mm (1/4") of opening.

.15 The front edges of boxes, cabinets and fittings installed in noncombustible walls or ceilings shall not be set in more than 6 mm (1/4").

.16 The front edges of boxes, cabinets and fittings installed in combustible walls (ie, millwork) shall be flush with surface.

.17 Provide correct size of openings in boxes for conduit, mineral insulated and armored cable connections. Reducing washers not to be used.

3.7 INSTALLATION OF CONDUITS

.1 When installed in a group, conduits shall be parallel and evenly spaced apart.

.2 Unless noted otherwise, conduits are to be installed as high as possible to conserve headroom, to reduce interference with other trades and cause minimum interference in spaces through which they pass.

.3 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.4 Where construction consists of metal Q deck and steel joists (Roof deck), conduits are to be installed as follows:

- .1 In such a manner that the nearest outside surface of the conduit is not less than 38 mm (1½") from the nearest surface of the metal roof deck. Typically, this would involve the installation of conduits on the underside of top flange, secured with beam clamps or canstrut.
- .2 Installation of conduits, raceways between the top flange of a steel support structure and a steel roof deck **is not permitted** due to the possible penetration of roof deck mechanical screws or fasteners.
- .3 Install associated boxes in such a manner that the nearest outside surface of the box is not less than 38 mm (1½") from the nearest surface of the metal roof deck.

.5 Where construction consists of metal Q deck and steel joists (non-roof deck), conduits are to be installed as follows:

- .1 Between the top flange of a steel support structure and the Q-deck, where size of conduit permits.
- .2 Where conduit sizes preclude this, install as high as possible in the space to conserve headroom.

.6 Use rigid galvanized steel threaded conduit where subject to injury.

.7 Use electrical metallic tubing (EMT) for the following:
- .1 Control outlets between device box and accessible ceiling space in all walls and partitions.
- .2 Sleeves for control wiring.
- .3 All wiring within electrical rooms and mechanical rooms.
- .4 All panel feeders.
- .5 Structured wiring fibre backbone cable, where not indicated in Innerduct.
- .6 All exposed wiring.
- .7 Where noted elsewhere in the contract documents.

.8 All conduit runs shall be a maximum of 30 meters (100') in length with a maximum of four (4) 90 degree bends between pull points. A pull box shall be placed in conduit runs where the sum of the bends exceeds 360 degrees, where the overall run exceeds 30 meters (100') or there is a reverse bend in the run.

.9 Pull boxes shall be placed in straight sections of conduit run and shall not be used in lieu of a bend. Conduit fittings shall not be used in place of pull boxes or bends. The use of C, LB, LL, LR and T type fittings are prohibited.

.10 The use of corner pulling ELLs or corner pulling elbows is not permitted.

.11 Liquid tight metal flexible conduit is not to be used as a general purpose raceway. Use liquid tight flexible metal conduit (maximum length permitted to be 1.5 M) and liquid tight conduit fittings for:
- .1 Final connection to vibrating equipment.
- .2 Final connection for primary, secondary and system ground conductors on all dry core transformers.

.12 Metal flexible conduit may be used for short runs for final connections (i.e.to security device boxes in suspended ceilings), unless noted otherwise. It must be securely fastened in place within 300 mm (12") of each junction box, cabinet and device. Install specified connectors and bushings. Where supports are required, do not derive support from ceiling support wires on supports of other trades. Do not use liquid tight metal flexible conduit in lieu of metal flexible conduit.

.13 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.14 Mechanically bend steel conduit over 19 mm (3/4") diameter.

.15 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.16 Install Polypropylene fish cord in empty conduits.

.17 Where conduits become blocked, remove and replace blocked section.

.18 Dry conduits out before installing wire.

.19 The installation of conduits above the structure, directly below roof insulation is strictly prohibited.

3.8 GROUNDING AND BONDING

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, install bonding conductor in each and every conduit.

.2 All conduits to be complete with minimum #12 green insulated bond conductor.

.3 Ensure all metal raceways are bonded to ground, including those used for control systems. Use a #6 green RW90 where a separate bonding conductor is run to a bonding bushing on an open end of a metal raceway.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 All metal raceways shall be bonded to ground including conduits housing low voltage and control systems.

.8 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.

.9 Make bonding connections in radial configuration only. Avoid loop connections.

.10 Equipment Bonding: Install bonding connections to typical equipment included in, but not necessarily limited to following list: control transformers, control panels, etc.

3.9 GROUNDING BARS

.1 Install copper grounding busbars, mounted on insulated supports where indicated.

.2 Bond items as indicated to ground bus, using long barrel, copper, two bolt compression connectors.

.3 Where a pass through connector bolted to the ground busbar is required, use Burndy #KVS28.

END OF SECTION

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 INTENT

.1 It is the intent of these specifications to outline the method, materials, and quality of equipment to be furnished and installed hereinafter specified and/or shown on the drawings.

1.3 DEFINITIONS

.1 "CONCEALED" - electrical services and equipment in hung ceiling spaces and non-accessible chases and furred spaces.

.2 "EXPOSED" - will mean "not concealed" as defined herein.

.3 “PROVIDE”- means supply and install. Wherever in the Contract Documents the word "provide" is used in any form, it shall mean that the Work concerned shall include both supply and installation of the products required for completion of that part of the Work.

2 CODES AND STANDARDS

.1 Do complete installation in accordance with CSA C22.1-15 except where specified otherwise.

.2 Ensure that all electrical equipment is field marked to warn persons of the potential electric shock and arc flash hazards, as per CSA C22.1-15, Rule 2-306.

.3 CSA Z462-15 Workplace Electrical Safety Standard.

.4 Comply with CSA Certification Standards and Electrical Bulletins in force at time of tender submission.

.5 Abbreviations for electrical terms: to CSA Z85-1983.

3 CARE, OPERATION AND START-UP

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

.2 Arrange and pay for the services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

4 VOLTAGE RATINGS

.1 Operating voltages: to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

5 PERMITS, FEES, CONTRIBUTION TO CONSTRUCTION FEES AND UTILITY INSPECTION SERVICES

.1 Electrical Permits
- .1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work. Send copy of approval to Engineer.
- .2 Pay associated fees.
- .3 Furnish Certificates of Acceptance from Inspection Department and authorities having jurisdiction on completion of work.

6 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance Division 1.

.2 Equipment and material to be CSA certified, and manufactured to standard quoted.

.3 Factory assembled control panels and component assemblies.

.4 Arrange and pay for field certification by CSA, as may be required.

7 ELECTRIC MOTORS EQUIPMENT AND CONTROLS

.1 Supplier and installer responsibility is indicated on the drawings.

.2 Control wiring and conduit is the responsibility of the electrical contractor, except for conduit, wiring and connections which are related to control systems specified in the mechanical contract documents and shown on mechanical drawings.

8 FINISHES

.1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel.

.1 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean, prime, and paint exposed hangers, racks, fastenings to prevent rusting.

.4 Where wire guards are specified in other sections, they are to be constructed of stainless steel. Painted steel is not acceptable.

9 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

.2 All stranded conductors (including phase, neutrals, grounds and bonds) prior to terminating under device bolts; i.e. light switches, receptacles etc., are to be twisted together so as to form a single conductor.

.3 Ensure all bonding conductors entering electrical enclosures, such as panel tubs, splitters, junction and pull boxes 150 mm x 150 mm (6 in. x 6 in.) and larger, etc. are terminated on terminal strips which are electrically continuous and fastened to the metal non-current carrying portion of the enclosure with a minimum of two bolts, c/w lock washers.

10 MANUFACTURER'S AND CSA LABELS

.1 Visible and legible after equipment is installed.

11 WARNING SIGNS

.1 Provide warning signs, as specified and/or to meet requirements of Inspection Department.

12 PROTECTION

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage.

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

13 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads and lighting operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Test and record phase and neutral currents on panelboards, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

14 CONDUIT AND CABLE INSTALLATION

.1 Install cables, conduits, and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.2 Where conduits cross building expansion joints, provide conduit expansion joints with telescoping sleeve and insulated bushings.

15 SLEEVES AND FIRESTOPPING

.1 Where conduits, cables and cable troughs pass through assemblies, provide firestopping. Refer to Architectural Drawings for location of assemblies.

.2 Terminate sleeves flush with floor except in mechanical rooms, where sleeves will terminate 50 mm (2 in.) above finished floor.

.3 Where conduit and cables pass through fire separations, including, walls, membranes, etc, arrange and make good fire rating of floors and walls after cables have been installed. The installation shall be in strict accordance with manufacturer’s recommendations and to suit UL and/or ULC requirements. Review the proposed firestopping method and material with the engineer, prior to installation.

16 FIELD QUALITY CONTROL

.1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks - the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.

.2 Conduct and pay for tests of the following:

- .1 Power distribution system including phasing, voltage, grounding and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Motors, heaters and associated control equipment including sequenced operation of system where applicable.

.3 Furnish Manufacturer's, certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Submit test results for Engineer's review.

17 SUPPLY CONDUCTOR INSULATION

.1 Ensure that the insulation rating on branch circuits feeding all electrical loads comply with the 2015 edition of the CEC, and the manufacturer's recommendations.

18 DRAWINGS

.1 Electrical drawings are not intended to show structural details or architectural features.

.2 The electrical drawings are not to be scaled.

.3 Electrical drawings, except where dimensioned, indicate general layouts only. Investigate structural and finish conditions and the work of all other trades affecting this work and arrange work accordingly.

.4 Coordinate the elevation of all outlet boxes with architectural drawings and report any conflicts to Engineer prior to installation.

.5 All electrical junction boxes must be accessible at the completion of the project. Coordinate the location of each junction box with the proposed location of mechanical services prior to installation.

.6 Layouts on the electrical drawings are based on the specified equipment (Standard of Acceptance), including electrical power connections, number of conductors and conduit sizes, and physical dimensions. Alternate equipment and systems proposed by the Contractor for use on this project (Acceptable Manufacturers) which necessitate changes in service connections, numbers of conductors and conduit sizes to perform the specified functions may be considered by the Engineer, however, any required modifications or additions to the electrical contract or the work of other trade contractors shall be done at no additional cost to the Owner. Furthermore, if it is found that the provisions made regarding space conditions and code required clearances are not met, the right is reserved by the Consultant to require installation of the equipment specified (Standard of Acceptance).

19 ACCESS DOORS

.1 The electrical contractor is to provide access doors to concealed electrical junction boxes, pull boxes and miscellaneous equipment for operating, inspecting, adjusting and servicing. Access doors are to be supplied which meet or exceed the fire resistance rating of the partition or ceiling in which they are being installed.

.2 Do not use access doors provided by other trade contractors for accessing concealed electrical services.

.3 Flush mounted 600 mm x 600 mm (24 in. x 24 in.) for body entry and 300 mm x 300 mm (12 in. x 12 in.) for hand entry unless otherwise noted. Doors to open 180 degrees, have rounded safety corners, concealed hinges, screwdriver latches and anchor straps.

.4 Material:

- .1 Special areas such as tiled or marble surfaces: use stainless steel with brushed satin or polished finish as directed by Consultant.
- .2 Remaining areas: use prime coated steel.
- .3 Fire rated where installed in fire rated construction.
- .4 Provide panels in glazed tile walls of 2.5mm (12 gauge) 304 stainless steel #4 finish, with recessed frames secured with counter-sunk flush-head screws.
- .5 Provide panels in plaster surfaces with recessed doors with welded metal lath ready to accept plaster and with a plaster grommet for door key access.
- .6 Provide other access doors of 2.5mm (12 gauge), flush with concealed hinges, anchor strap and lock, all factory prime coated.
- .7 Supply details of doors prior to installation.
- .8 Mark all lay-in tiles that are used for access in a manner approved by the Consultant.

.5 Installation:

- .1 Locate so that concealed items are accessible.
- .2 Locate so that hand or body entry (as applicable) is achieved.
- .3 Installation is specified in applicable sections.

.6 Acceptable Manufacturers:
- .1 Acudor
- .2 LeHage
- .3 SMS
- .4 Zurn

20 CONNECTION OF EQUIPMENT

.1 Provide all connections required by the equipment supplied by this Division.

.2 Provide all connections required by equipment supplied by the Owner or by other Divisions. Examine all Drawings and Specifications and identify all requirements.

.3 Provide all necessary accessories to make connections, including flexible connectors, etc.

21 SPRINKLER PROOF HOODS

.1 All distribution equipment within ventilated enclosures (panelboards, etc) located in the building shall be protected from the direct spray from sprinkler heads to the satisfaction of the Inspection Authority by the use of non-combustible hoods.

.2 Distribution conduits exiting or entering equipment enclosures equipped with sprinkler hoods shall be installed with raintight EMT connectors equipped with a rubber "O" Ring gasket.

22 CO-ORDINATION

.1 Co-ordinate the Work of this Division with all other Divisions for locations of openings, spaces, services, sleeves, ducts, pipes, supports, connections, etc. Where conflicts occur, reroute conduits, cable troughs, outlets, lighting, equipment, etc as required. Advise Engineer of proposed changes, and obtain written authorization, prior to proceeding.

.2 The layout of electrical equipment within mechanical rooms is approximate only.

23 INSTALLATION REQUIREMENTS

.1 Install all products and services to follow building planes. Installation shall permit free use of space and maximum headroom to the satisfaction of the Consultant.

.2 Confirm the exact location of fixtures, outlets and connections. Confirm location of connection points for equipment supplied under other Divisions.

.3 Install all equipment and appurtenances to allow free access for adjustment, maintenance and/or replacement.

.4 Provide all hangers, supports and fasteners such that no undue stresses are imposed on the structure and systems. Ensure that the load onto structures does not exceed the maximum loading per square metre as shown on structural drawings. Equipment supports not supplied by equipment manufacturer are to be fabricated using structural grade steel.

.5 Exterior supports are to be galvanized, unless noted otherwise.

.6 Install all products and services in accordance with the respective manufacturer's recommendations.

.7 High velocity explosive activated tools shall not be used. Only low velocity system types are permitted.

.8 Provide caps and seal all open ends of installed conduits to prevent the entrance of foreign substances.

.9 Install all services capped for future possible use such that easy access is provided for future connections.

24 FIELD REVIEW

.1 The Consultant and Owner shall have access to the site at all times for review of the work.

.2 Correct any deficiencies as they are reported during the performance of the Work.

25 CUTTING AND PATCHING

.1 It is the responsibility of the Electrical Contractor to provide all required cutting and patching associated with the installation of electrical systems, devices, conduit, wire, etc., unless noted otherwise.

.2 Restore all surfaces to a finish acceptable to the Owner.

26 MATERIAL

.1 Standard of Acceptance:

.1 Means that item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

.2 Acceptable Manufacturer:

.1 Means that item, manufactured by named and specified manufacturer, shall be deemed acceptable provided it meets the specification and referenced standard regarding performance and quality of material and workmanship, as outlined under Standard of Acceptance (above).

.3 Refer to Instructions to Bidders for requirements of additional Acceptable Manufacturers or Acceptable Material.

27 TORQUES FOR WIRE TERMINATION

.1 For proper termination of conductors, it is very important that field connections be made properly tight.

.2 Where possible, obtain and comply with Manufacturer's instructions on the equipment.

.3 In the absence of Manufacturer's instructions, make terminations in conformance with the values given in Tables D6 and D7 of the 2015 CEC.

28 CABLE TIES AND TYE WRAPS

.1 Cable ties and tye wraps are only permitted to be used to provide limited support for bundling purposes only. These devices are not intended to provide the primary support for conduits or cables.

.2 Cable Ties are not to be used for the support of cable or conductor runs between boxes and fittings.

29 WORKING SPACE ABOUT ELECTRICAL EQUIPMENT

.1 Arrange installation as required to maintain minimum working space around electrical equipment in conformance with CSA C22.1-15.

30 LOW V. O. C. MATERIALS

.1 All site applied coatings, adhesives & sealants must be low VOC content.

.2 Provide Material Safety Data Sheets for all products & materials of these types incorporated into the work.

31 EXISTING SERVICES

.1 The Electrical Contractor shall ensure that all light, power, heat, fire alarm, telephone and other electrical systems and services remain operational during the course of the work in the existing building, and if necessary, this Contractor shall be responsible for providing such temporary services by cutting off, altering, adapting, relocating and connecting existing services and disconnecting and removing such temporary or existing services upon providing new permanent services as detailed on all drawings. The site shall be examined to determine the extent of the temporary services and all co-ordination shall be made with the Owner's Representative. All costs shall be included in the Tender Price.

.2 Existing redundant equipment, wiring etc. not being re-used under new schemes, shall be removed whether shown on drawings or not. This contractor shall repair all openings resulting from the removal of existing electrical equipment and services. All unused outlet boxes (where it is not practical to remove same) shall be blanked with stainless steel cover plates. All costs shall be included in the Tender.

.3 Portions of the existing ceiling systems may need to be removed by the mechanical contractor to allow access to the heat pumps being replaced. The electrical contractor is to disconnect, remove, reinstall and reconnect all electrical devices and equipment which resides in the ceilings being removed and reinstated. Coordinate exact locations of work with mechanical contractor. Carry all associated costs in the electrical tender price.

32 PROJECT PHASING AND HOURS OF WORK

.1 Refer to Instructions to Bidders for information pertaining to project phasing and hours of work. Work within occupied areas and work causing a disruption to school operations will be performed outside regular business hours as determined by a representative of the HRSB in conjunction with the Architect.

******END OF SECTION******

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 HOURLY LABOUR RATE

.1 Submit the proposed hourly labour rate for review in a timely manner after contract award.

.2 Refer to General Conditions of Contract.

1.3 EQUIPMENT IDENTIFICATION

.1 As per 26 05 03 submit proposed nomenclature for all lamicoid plates for engineer's approval.

1.4 SHOP DRAWINGS

.1 In accordance with Division 1

.2 Assembled in groups and bound in sets.

.3 On cover/front page indicate total number of pages in submission.

.4 Consecutively number each page.

.5 Where specified in Division 1, submit electronic copies of shop drawings. In addition to the electronic shop drawing, submit one hard copy to the office of the electrical consultant.

.6 Provide shop drawings for the following Sections:

- .1 Section 26 05 04 - Through-Penetration Firestopping for Electrical Systems.
- .2 Section 26 28 16.02 - Molded Case Circuit Breakers.
- .3 Section 26 28 23 - Disconnect Switches Fused and Non-Fused.
- .4 Section 26 27 26 - Wiring Devices
- .5 Section 26 28 13.01 - Fuses - Low Voltage.

1.5 PROGRESS CLAIMS

.1 Progress claims are to be submitted with the following breakdown:
- .1 Mobilization.
- .2 Distribution.
- .3 Electrical Systems Testing and Verification.
- .4 Commissioning.

.2 The first electrical progress claim may be withheld until such time as the required breakdown is submitted.

1.6 OPERATING AND MAINTENANCE MANUAL

.1 Operation and maintenance manual to be approved by, and final copies deposited with Consultant before final inspection.

.2 Operation data to include:
- .1 Schematics for each system.
- .2 Description of each system and its controls.
- .3 Description of operation of each system.
- .4 Operation instruction for each system and each component.
- .5 Description of actions to be taken in event of equipment failure.
- .6 Colour coding chart.

.3 Maintenance data shall include:
- .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
- .2 Data to include schedules of tasks, frequency, tools required and task time.

.4 Performance data to include:
- .1 Equipment manufacturer's performance data sheets with point of operation as left after system verification is complete.
- .2 Equipment performance verification test results.
- .3 Insulation resistance testing and panelboard phase current measurement records.
- .4 Special performance data as specified elsewhere.

.5 Approvals:
- .1 Submit 2 copies of draft Operation and Maintenance Manual to Consultant for approval. Submission of individual data will not be accepted unless so directed by Consultant.
- .2 Make changes as required and re-submit as directed by Consultant.

.6 Provide maintenance data for the following:
- .1 Section 26 28 16.02 - Molded Case Circuit Breakers.
- .2 Section 26 28 23 - Disconnect Switches Fused and Non-Fused.

.7 Provide one copy of all approved shop drawings for each maintenance manual.

1.7 START UP REPORT MANUAL

.1 Custom designed and containing material pertinent to this project only and to provide full and complete coverage of subjects referred to in this section.

.2 Operating and maintenance manual to be approved by and final copies deposited with Consultant before final inspection.

.3 Organize by specification section.

.4 Conform to requirements of Division 1, supplemented and modified by requirements specified in this section.

.5 Start Up and Performance data to include:
- .1 Equipment manufacturer's performance data sheets after commissioning is complete.
- .2 Start up and verification reports as per Section 26 05 02, Electrical Contract Closeout.
- .3 Final inspection report from NSPI.
- .4 Signed off training records.

.6 Submittals:
- .1 Submit a copy of the complete Start Up Report Manual to Consultant for Review.
- .2 Refer to Division 1 for quantity of Manuals (minimum 3).
- .3 Hard-back, 25 mm (1") 3 ring, D-ring binders.
- .4 Binders to be 2/3 maximum full.
- .5 Provide index to full volume in each binder.
- .6 Identify contents of each manual on cover and spine.
- .7 Include names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.
- .8 Provide full Table of Contents in each manual. Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

1.8 RECORD DRAWINGS

.1 Site records:
- .1 Provide sets of white prints as required for each phase of the work. Mark thereon all changes as work progresses and as changes occur. This shall include change orders, site instructions and changes to electrical systems.
- .2 Make available for reference purposes and inspection at all times.
- .3 Produce record drawings in accordance with Division 1.

.2 Where products are specified by manufacturer and/or model, update AutoCAD file to show installed manufacturer and model.

.3 Record Drawings:

.1 Prior to start of Testing and System verification finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 1/2" (13 mm) high as follows: -"RECORD DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW ELECTRICAL SYSTEMS AS INSTALLED" (DATE).

.3 Submit to Consultant for approval and make corrections as directed.

******END OF SECTION ******

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 FUNCTIONAL PERFORMANCE TESTING (FPT)

.1 Refer to Section 26 91 13 Electrical Systems Testing and Verification for Functional Performance Testing (FPT).

.2 The correction of all electrical deficiencies identified throughout the project associated with the Work shall be a condition of Substantial Performance and shall be corrected prior to achieving Substantial Performance.

.3 Deficiencies discovered during the FPT process are to be immediately rectified by the Electrical Contractor. A condition of Substantial Performance shall be the correction of all electrical deficiencies identified throughout the project associated with this work.

.4 The contractor shall return copies of the deficiency lists to Owner via the Engineer with all corrected items signed off.

.5 The FPT Deficiency list will form part of the Substantial Performance Inspection list specified in Division 1.

1.3 CLOSEOUT DOCUMENTATION

.1 Section 26 05 00: Common Work Results for Electrical
- .1 Copy of electrical permits from Utility.

.2 Section 26 05 01 - Electrical Submittals:
- .1 Shop drawing and product data.
- .2 Operating and Maintenance Manual.
- .3 Record drawings.

.3 Section 26 05 03: Identification.
- .1 Submission of proposed equipment identification lamicoid plates for approval.

.4 Section 26 91 13: Electrical Systems Testing and Verification.
- .1 Verification and Test Forms.

1.4 DOCUMENTATION REQUIRED FOR SUBSTANTIAL PERFORMANCE

.1 Section 26 05 00: Common Work Results for Electrical
- .1 Copy of final inspection from Utility.

.2 Section 26 91 13: Electrical System Testing & Verification.
- .1 Correction of all electrical deficiencies.
- .2 The contractor shall return copies of the deficiency lists to Owner via the Engineer with all corrected items signed off.
- .3 The FPT Deficiency list will form part of the Substantial Performance Inspection list specified in Division 1.

1.5 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS

.1 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.2 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.

.3 Instruction duration time requirements at Substantial Performance as follows:
- .1 Power Distribution System
  (2 Hours)

2 Products N/A

3 Execution N/A

********END OF SECTION ********

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 IDENTIFICATION REQUIREMENTS

.1 All electrical equipment shall be identified by the use of Lamicoid plates. This includes all distribution equipment.

.2 All equipment and enclosures receiving connections to the building power distribution system shall have their panel and circuit number identified by the use of Lamicoid plates. This includes equipment supplied by the electrical contractor, the mechanical contractor and all other divisions.

.3 All electrical junction, pull boxes and splitters installed in areas with drop ceilings shall be colour coded inside and out with appropriate coloured paint. **All paint is to be applied prior to installation and not with-in the confines of the building.**

.4 All electrical junction, pull boxes and splitters installed in areas without drop ceilings (exposed) shall be colour coded on the inside only with appropriate coloured paint. **All paint is to be applied prior to installation and not with-in the confines of the building.** Install an appropriately coloured dot on the exterior of the cover plate to indicate box function.

.5 All conduit couplings installed in areas with drop ceilings shall be colour coded with appropriate coloured paint. **All paint is to be applied prior to installation and not with-in the confines of the building.**

.6 Where conduits are installed in a room where no conduit couplings are visible, appropriate colour bands are required to identify the conduit function.

.7 All junction boxes installed in areas with drop ceilings shall have the panel and circuit numbers contained with-in, identified on the exterior of the cover plate.

.8 All junction boxes installed in areas without drop ceilings (exposed structure) shall have the panel and circuit numbers contained with-in, identified on the interior of the cover plate.

.9 All wiring installed under this contract shall be identified through the use of self-laminating labels.

.10 All receptacles installed under this contract shall be identified through the use of Lamicoid plates.

.11 All control panels and time clocks shall be identified through the use of Lamicoid plates.

.12 All electrical devices and electrical equipment (disconnect switches, etc.) in concealed ceiling spaces shall be identified with two (2) Lamicoid plates, one on the device, junction box and equipment and one on the ceiling below.

2 Products

2.1 IDENTIFICATION NAMEPLATES

.1 Lamicoid identification plates.

.1 Lamicoid 1.5 mm thick plastic engraving sheet for all electrical systems, complete with rounded upper corners. Lamicoid characteristics are to be as follows, unless noted otherwise:

.1 Electrical equipment enclosures to have black face with white core Lamicoid plates.

.2 All ceiling mounted plates to have white face with black core.

.2 NAMEPLATE SIZES

Size 1	10 mm x 50 mm (3/8” x 2”)	1 line	5 mm (0.2”) high letters
Size 2	13 mm x 75 mm (1/2” x 3”)	1 line	6 mm (0.25”) high letters
Size 3	16 mm x 75 mm (3/4” x 3”)	2 line	5 mm (0.2”) high letters
Size 4	19 mm x 90 mm (3/4” x 3.5”)	1 line	10 mm (3/8”) high letters
Size 5	38 mm x 90 mm (1.5” x 3.5”)	2 line	13 mm (1/2”) high letters
Size 6	25 mm x 100 mm (1” x 4”)	1 line	13 mm (1/2”) high letters
Size 7	25 mm x 100 mm (1” x 4”)	2 line	6 mm (1/4”) high letters
Size 8	50 mm x 150 mm (2” x 6”)	2 line	13 mm (1/2”) high letters
Size 9	75 mm x 150 mm (3” x 6”)	3 line	13 mm (1/2”) high letters

.3 Identification to be in English.

2.2 COLOUR CODING OF ELECTRICAL BOXES

.1 The colour coding of splitters, junction boxes, pull boxes and outlet boxes will follow the schedule as listed:

System	Primary Colour	Secondary Colour
0volts to 50volts	VIOLET	-
51 volts to 240 volts	YELLOW	-
Above 240 volts	ORANGE	-
Fire Alarm	RED	-
Ground or Bond	GREEN	

DC	YELLOW	BLACK
Energy Management	RED	WHITE

.2 All various systems junction and/or pull boxes etc., where located above grid system, shall have location identified on underside or room side of t-bar spline, with (19 mm) or (6 mm on 19 mm) self adhering colour coded circular shaped discs, affixed directly to spline in close proximity to where concealed box is located. The same type of discs to be installed on ceiling or wall access cover plates.
- .1 6 mm (1/4") discs are all white in colour.
- .2 19 mm (3/4") discs are coloured as indicated.
- .3 6 mm (1/4") to be affixed to center or middle of 19 mm (3/4") discs as system colours dictates.

.3 All junction boxes and/or pull boxes, conduit fittings (and respective covers), complete with their respective cover plates as per the following:
- .1 Inside and out where one colour is required, with cover plate painted completely.
- .2 Inside where two colours are required, with cover plate painted diagonally with both colours.

.4 All junction boxes and/or pull boxes, where not concealed, are to have discs fastened to the outside of the box when architectural painting is complete.

2.3 WIRING IDENTIFICATION

.1 Wiring Labels:
- .1 Write on self-laminating labels.
- .2 Panduit No's PLD-1, PLD-2.

3 Execution

3.1 EQUIPMENT IDENTIFICATION

.1 Submit description of proposed equipment identification plates for engineer's approval.

.2 Do not manufacture Lamicoid plates prior to receiving written approval from the engineer.

.3 Lamicoid nameplates shall be applied to all electrical equipment including but not limited to the following:
- .1 All electrical equipment enclosures for starters, disconnect switches, relay panels, panelboards, splitter troughs, transformers, thermal overload switches, etc.

.4 Lamicoid nameplate fastening method shall be as follows:
- .1 Concrete or concrete block.
  - .1 Contact type cement (Note: Peel off type not acceptable).

.2 Plasterboard.
.1 Contact type cement (Note: Peel off type not acceptable).
.3 Equipment enclosures.
.1 Pop rivets. (Note: Screws not acceptable).
.4 Ceiling and T-Bar spline.
.1 Contact type cement (Note: Peel off type not acceptable).

.5 Identify equipment as follows:
.1 Lamicoid nameplates installed on distribution panelboards, motor control centres, splitter troughs, shall indicate the following:
.1 Designated name of equipment.
.2 Amperage of overcurrent protection device.
.3 Voltages, number of phases and wires.
.4 Designation of power source.
.5 Size 9.

EXAMPLE:
PANEL 1101 - 150 AMPS
120/208V - 3PH - 4W
FED FROM DISTRIBUTION PANEL DP1150

.6 Lamicoid nameplates installed on combination starters, magnetic starters, manual starter and all various systems controls, control panels, disconnect switches, shall contain the following information:
.1 Designated name of equipment.
.2 Designated name of power source.
.3 Branch circuit breaker number(s) where possible.
.4 Voltage(s).
.5 Size 8

Example:
EXHAUST FAN NO. 5
PANEL 1101 - CCT. NO. 17
120V - 1 PH

EXAMPLE:
SUPPLY FAN NO. 3
M.C.C. 3101
347/600V - 3 PH/4W

.7 Lamicoid nameplates installed on fusible type disconnect switches are to also indicate maximum fuse size, where sized smaller than actual rated switch size.

.8 Lamicoid nameplates are to be installed on all junction and/or pull boxes sized 150 mm x 150 mm (6" x 6") and larger indicating name of system, designated panel name and electrical characteristics where applicable.

3.2 MECHANICAL EQUIPMENT CONNECTED TO THE ELECTRICAL DISTRIBUTION SYSTEM

.1 Lamicoid nameplate for each item of mechanical equipment (heat pumps, etc.) fed from the electrical distribution system, shall contain the following information:
.1 Designated name of equipment.

.2 Designated name of power source.
.3 Branch circuit breaker number(s) where possible.
.4 Voltage(s).
.5 Size 8

Example:	**EXAMPLE:**
HEAT PUMP 280	***SUPPLY FAN NO. 3***
PANEL 1101 - CCT. NO. 17	***M.C.C. 3101***
120V - 1 PH	***347/600V - 3 PH/4W***

3.3 IDENTIFICATION OF JUNCTION BOXES, PULL BOXES, SPLITTER TROUGHS AND OUTLET BOXES

.1 Colour Coding
  .1 Identification of electrical junction boxes, pull boxes, splitter troughs.
    .1 Colour code as per 2.3.
    .2 Apply colour coding prior to pulling conductors into boxes.
    .3 Where primary colour only is indicated:
      .1 Colour inside and outside of box.
      .2 Colour all cover plates.
    .4 Where primary and secondary colours are indicated:
      .1 Paint inside and outside of box with the primary colour.
      .2 Diagonally apply to each half of the cover plate the primary and secondary colours.
      .3 Provide a legend of colour coding used under Plexiglas. Locate in main electrical room.

.2 Voltage and Originating Source Identification
  .1 Identification of electrical junction boxes, pull boxes, splitter troughs: smaller than 150 mm x 150 mm.
    .1 Identify on the coverplate, using permanent indelible black marker the panel and circuit numbers contained with.
    .2 Group phase conductors with associated neutral conductor.
  .2 Identification of electrical junction boxes, pull boxes, splitter troughs: 150 mm x 150 mm and larger.
    .1 Provide Lamicoid plate fastened to coverplate, indicating:
      .1 Voltage and phase.
      .2 Originating panel.
      .3 Size 6.
      .4 Example: "120/208 v, 3Ø, 4w, panel 'A'."
    .2 Using permanent indelible black marker, identify the circuits contained within.

3.4 IDENTIFICATION OF WIRING

.1 Identification of wiring:

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Label each neutral conductor to indicate its associated phase conductors in each panelboard, distribution panel, pillbox and junction box it appears in. These labels are to be installed in a 'flagged' manner.

.3 All circuit conductors are to be individually tie wrapped to their corresponding labeled neutral conductor in all panelboards, pull boxes and junction boxes. Each neutral conductor is to be identified to indicate its corresponding phase conductors.

.4 Labeling of all branch circuit wiring including phase conductors, neutral, ground and/or bonding conductors to be done on both ends of all circuit wires plus in any junction and/or pull boxes located in between using approved product (refer to 2.3). These labels are to be installed in a 'flagged' manner around individual conductors.

.5 Indicate panel and circuit number i.e.: Panel '1101', cct. #10.

END OF SECTION

.1 General

1.1 REFERENCE STANDARDS

.1 In accordance with Section 26 05 00.

1.2 DEFINITIONS

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

1.3 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION

.1 Only tested firestop systems shall be used for penetrations for the passage of cables, conduit and other electrical equipment through the following:
- .1 Fire-rated vertical barriers (walls and partitions)
- .2 Horizontal barriers (floor/ceiling assemblies)
- .3 Vertical service shaft walls and partitions.

1.4 RELATED WORK BY OTHERS

.1 Coordinate work of this section with work of others as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
- .1 Concrete
- .2 Masonry
- .3 Finishes
- .4 Special Construction

1.5 REFERENCES

.1 Test Requirements: ULC-S115-M or CAN4-S115-M, "Standard Method of Fire Tests of Through Penetration Fire Stops".

.2 Underwriters Laboratories of Canada (ULC) of Scarborough runs CAN4-S115-M under their designation of ULC-S115-M and publishes the results in their "FIRE RESISTANCE RATINGS DIRECTORY" that is updated annually.

.3 Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. UL tests that meet the requirements of ULC-S115-M are given a cUL listing and are published by UL in their “Products Certified for Canada (cUL) Directory.

.4 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.

.5 CAN/ULC-S102-M, Standard Test Method for Surface Burning Characteristics of Building Materials.

.6 National Building Code of Canada.

.7 CSA C22.1-12, Canadian Electrical Code, Part 1 Safety Standard for Electrical Installations.

1.6 QUALITY ASSURANCE

.1 A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details.

.2 Firestop System installation must meet requirements of CAN4-S115-M or ULC S-115-M tested assemblies that provide a fire rating as shown in Section 2. "Penetrations through a Fire Separation Wall" and "Penetrations through a Fire Wall or Horizontal Fire Separation" below.

.3 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

.4 Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

.5 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgment drawings must follow requirements set forth by the International Firestop Council (September 7, 1994).

1.7 SUBMITTALS

.1 Submit Product Data: Manufacturer’s specifications and technical data for each material including the composition and limitations, documentation of ULC or cUL firestop systems to be used and manufacturer's installation instructions to comply with Division One (1).

.2 Manufacturer's engineering judgment identification number and drawing details when no ULC or cUL system is available for an application. Engineer judgment must include both project name and contractor's name who will install firestop system as described in drawing.

.3 Submit material safety data sheets provided with product delivered to job-site.

1.8 INSTALLER QUALIFICATIONS

.1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

1.9 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.

.2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.

.3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.

.4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.

.5 Do not use damaged or expired materials.

1.10 PROJECT CONDITIONS

.1 Do not use materials that contain flammable solvents.

.2 Scheduling

.1 Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.

.2 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

.3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

.4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

.5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

2 Products

2.1 FIRESTOPPING, GENERAL

.1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.

.2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

.3 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.4 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.5 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.

2.2 ACCEPTABLE MANUFACTURERS

.1 Subject to compliance with through penetration firestop systems listed in U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory, provide products of the following manufacturers as identified below:

.1 Hilti (Canada) Limited, Mississauga, Ontario 1-800-363-4458

.2 Other manufacturers listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

2.3 MATERIALS

.1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.

.2 Cast-in place firestop devices are installed prior to concrete placement for use with non-combustible and combustible plastic pipe (closed and open piping systems), or electrical cable bundles, penetrating concrete floors, the following products are acceptable:
- .1 Hilti CP 680 Cast-In Place Firestop Device
- .2 Equivalent products listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.3 Sealants or caulking materials for use with non-combustible items including rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
- .1 Hilti FS-ONE Intumescent Firestop Sealant
- .2 Hilti CP 620 Fire Foam
- .3 Equivalent products listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

.4 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including PVC jacketed, flexible cable or cable bundles and plastic pipe, the following products are acceptable:
- .1 Hilti FS-ONE Intumescent Firestop Sealant
- .2 Hilti CP 620 Fire Foam
- .3 Equivalent products listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory

.5 Intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
- .1 Hilti FS-ONE Intumescent Firestop Sealant
- .2 Hilti CP 618 Firestop Putty Stick
- .3 Hilti CP 620 Fire Foam
- .4 Equivalent products listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory

.6 Non curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles, the following products are acceptable:
- .1 Hilti CP 618 Firestop Putty Stick
- .2 Equivalent products listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory

.7 Wall opening protective materials for use with U.L.C. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
- .1 Hilti CP 617 Firestop Putty Pad
- .2 Equivalent products listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory

.8 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
- .1 Hilti FS 635 Trowelable Firestop Compound

.2 Hilti FS 657 FIRE BLOCK
.3 Hilti CP 620 Fire Foam
.4 Equivalent products listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory .

.9 Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trough, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
.1 Hilti FS 657 FIRE BLOCK
.2 Equivalent products listed in the U.L.C Fire Resistance Directory – Volume III or UL Products Certified for Canada (cUL) Directory.

2.4 PENETRATIONS THROUGH A FIRE SEPARATION WALL

.1 For penetrations through a Fire Separation wall provide a firestop system with a "F" Rating as determined by ULC or cUL as indicated below:

Fire Resistance Rating of Separation	Required ULC or cUL "F" Rating of Firestopping Assembly
30 minutes	20 minutes
45 minutes	45 minutes
1 hour	45 minutes
1.5 hours	1 hour
2 hours	1.5 hours
3 hours	2 hours
4 hours	3 hours

.2 For combustible pipe penetrations through a Fire Separation provide a firestop system with a "F" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

2.5 PENETRATIONS THROUGH A FIRE WALL OR HORIZONTAL FIRE SEPARATION

.1 For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

3 Execution

3.1 PREPARATION

.1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
.1 Verify penetrations are properly sized and in suitable condition for application of materials.
.2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

.3 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

.4 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

.5 Do not proceed until unsatisfactory conditions have been corrected.

3.2 COORDINATION

.1 Coordinate location and proper selection of cast-in-place Firestop Devices. Ensure device is installed before placement of concrete.

.2 Provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interferences.

3.3 INSTALLATION

.1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory.

.2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration joint materials.

.1 Seal all holes or voids made by penetrations to ensure an air and water resistant seal.

.2 Protect materials from damage on surfaces subjected to traffic.

3.4 FIELD QUALITY CONTROL

.1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

.2 Keep areas of work accessible until inspection by applicable code authorities.

.3 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

.4 Install a warning card that is clearly visible adjacent to all large and medium openings that may be re-penetrated. This card should contain the following information:

.1 Warning that the opening has being fire stop protected

.2 Indicate the fire stop system used (ULC or cUL)

.3 F rating or FT rating

.4 Fire stop product(s) used

.5 Person to contact and phone number in case of modification or new penetration of fire stop system.

3.5 ADJUSTING AND CLEANING

.1 Remove equipment, materials and debris, leaving area in undamaged, clean condition.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

.3 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

********END OF SECTION 26 05 04********

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 REFERENCES

.1 CSA C22.2No.65-1956(R1965) Wire Connectors.

2 Products

2.1 MATERIALS

.1 Spring type pressure type connectors for all branch circuit wiring sized #10 AWG and smaller. Current carrying parts are to be made of copper or copper alloy and be complete with an appropriate size insulating cap. Cap is to completely fit, or cover all enclosed conductors as required, with current carrying parts of sized to fit conductors as required.

3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors.

.2 All wire connectors are to be “plier-tightened’. Finger tight is not acceptable.

.3 Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

********END OF SECTION *******

1. General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Division 1.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility.

2 Products

2.1 BUILDING WIRES

.1 Unless indicated conductors (phase, neutral, bond, isolated ground) installed on this project shall be stranded, soft drawn copper, with RW90 XLPE insulation rated for a minimum of 600 VAC. The minimum wire size will be #12 AWG.

.2 Grounding and bonding conductors to have green coloured RW90 X-link insulation.

.3 Unless noted otherwise, phase colour coding as per C.E.C. rule 4-036, will apply.

.4 All phase conductors sized from #12 AWG up to and including #2 AWG to have appropriate coloured insulation (red, black & blue).

.5 All neutral, grounds and/or bond conductors sized #12 AWG up to and including #3/0 AWG to have appropriate coloured insulation (white or green).

.6 Coloured tape may only be utilized when phase conductors sized larger than noted in item 4 are used.

.7 Coloured tape may only be utilized when neutral, grounds or bond conductors sized larger than noted in item 5 are used.

.8 Multi-conductor AC-90 cables containing a single white coloured conductor are not to be used where more than one neutral conductor is required.

2.2 ARMORED CABLE

.1 Conductor: copper, size as indicated.

.2 Type AC-90.

.3 Bonding conductor sized to CEC Table 16.

.4 AC-90 cable connectors shall be as follows:
- .1 Two-screw, steel-type similar to T & B #3301, 3312.

2.3 TECK CABLE

.1 Conductor: copper, size as indicated.

.2 Insulation Type: RW90-XLPE

.3 Ground conductor sized to CEC Table 16.

.4 Interlocking aluminum tape armour

.5 Outer jacket: PVC flame retardant to FT-4 requirements.

.6 Connectors to be Star Teck or equal.

3 Execution

3.1 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:
- .1 The preferred wiring method for installing electrical feeders for this project is conductors installed in a conduit system, as per Section 26 05 34. The contractor may be permitted to install Teck cable as an alternate wiring method only in areas where it is deemed to be not practical to install a conduit system.
- .2 In conduit systems in accordance with Section 26 05 34.

.3 All stranded conductors, (neutrals, bonds and phase conductors) prior to terminating under device bolts i.e., circuit breakers, light switches receptacles etc., to be twisted together so as to form a single conductor.

.4 All branch circuit phase conductors feeding light fixtures via junction and/or outlet boxes are to be complete with "pigtail" type leads to ensure minimal disruption of lighting circuits if fixtures are removed for future maintenance.

.5 Each line voltage switch is to be wired with the neutral conductor extended to the device box.

.6 All branch circuit phase conductors feeding receptacles via junction and/or outlet boxes are to be complete with "pigtail" type leads to ensure minimal disruption of receptacle circuits if receptacles are removed for future maintenance.

.7 Where the application of coloured tape has been approved, apply as follows:

.1 Both ends of the conductor must be taped for all installed segments.

.2 Each location where the conductor is visible, i.e.; all junction and pull boxes.

.3 A minimum of 305 mm (12”) of tape to be applied for all phase conductors.

.4 All neutral, grounds and/or bond conductors must be taped for their entire visible length in all enclosures.

.2 Use of AC-90 Cable.

.1 The use of AC-90 cable is acceptable for this project as a general wiring method with several exceptions. Refer to Section 26 05 34, Item 3.1.7 where conduit requirements are defined.

.2 AC-90 cable is to be installed as per the following guidelines:

.1 All types of armoured cables are to be installed concealed, parallel and perpendicular to building lines and shall be adequately secured to the building structure at not less than 1.5M (5 foot) intervals or as otherwise indicated, in such manner as to ensure they are protected from potential mechanical damage. Install independent supports for cabling in ceiling spaces, and do not use those of other trades. Do not secure cables to mechanical systems piping or ducts, suspended ceiling support wires. The laying of cables directly atop ceiling grid system is strictly prohibited.

.2 Where possible, always install and secure cables directly to underside of metal decking and/or ceiling slabs where located in concealed ceiling spaces. Install supports to firmly secure AC90 to metal decking midway between OWSJ and when any change in direction occurs.

.3 The grouping together of AC-90 cables to form a “bundle” for securing purposes is acceptable providing the following procedures are adhered:

.1 In addition to securing type AC-90 cables at 1.5 M(5 foot) intervals to structure, multiple or bundled groups of armoured cables shall be tye-wrapped together at mid-point between each structure support and are to be secured together (between each structure support).

.2 Grouping of AC-90 cables shall be limited to a maximum of eight (8) current carrying conductors, including associated oversized neutral conductors where phase sharing occurs.

.4 The following examples incorporate uses of both, common and dedicated (separate) branch circuit neutral conductors:

.1 Maximum of two runs of #12/4 conductor cables, including common (oversized) branch circuit neutral in each.

.2 Maximum of two runs of #12/3 conductor cables, including (oversized) branch circuit neutrals (if not 3 phase, 3 wire), plus one run of #12/2 cable.

.3 Maximum of four runs of #12/2 conductor cables, each including a separate, dedicated branch circuit neutral conductor.

.5 Where dedicated or separate branch circuit neutral conductors are non phase sharing, they need not be sized larger than phase conductors they accompany unless specifically indicated otherwise.

.6 All AC-90 fixture feeds shall originate from the sides of outlet boxes and not from the box cover. Where 3 and/or 4 fixture drops extend from any one outlet box, the box shall not be sized smaller than 120 mm (4-11/16") square.

.7 Fixture drop is defined as that portion of AC-90 cable or flexible conduit being used to make final connection between accessible type junction or outlet box located in ceiling space (above T-Bar ceiling only) and its respective light fixture.

.1 Fixture drops are not to exceed 4.5 M (15 feet) in total length unless specifically indicated otherwise.

.2 There shall be not more than 4 drops permitted to be fed from any one box regardless of its size. All AC-90 cables used for fixture drops are to be secured within 300 mm (12 in.) of the junction box and the light fixture connection point. Each light fixture is to be complete with its own separate fixture drop originating from a junction box located within the ceiling of the same room as the fixture.

.3 With the exception of where “modular” type wiring has been approved for a particular application, within a T-Bar ceiling space, each light fixture shall be wired with a separate whip emanating from an overhead junction box.

.8 Separate pig-tail type leads shall be provided in each light fixture junction/outlet box for final connections to fixture drops. These pig-tail leads are to be only connected to light fixture returns and associated neutral conductors.

.3 <u>The use of AC-90 cable for branch circuit home runs is not acceptable</u>.

.1 A home run is defined as that portion of the branch circuit wiring that runs between the applicable panelboard and the room or area in which it terminates, and makes its first splice, for drop off, to the applicable branch circuit device.

.2 Where the branch circuit has multiple splices and/or drop offs to multiple rooms, the use of AC90 for the drop off is permitted, however, the home run conduit shall be continued until the final room destination or drop off is reached.

.3 The use of AC-90 cable between rooms is not permitted.

.4 AC90 cables are not permitted to enter panelboards under any circumstances.

.3 Conductor Tie-wrapping:

.1 All circuit conductors are to be individually tie wrapped to their corresponding labeled neutral conductor in all panelboards, pullboxes and junction boxes. Suitable slack conductor length should be left to enable the ability to clamp the ground detector around the individually tie-wrapped circuit conductor and its corresponding labeled neutral. This wiring method is to be neat and of good workmanship quality.

.2 The tie-wrapping of the neutral with its respective phase conductors is to be made at the closest point of entry into panelboards, pullboxes and junction boxes.

.3 The main switchboard, CDP's, panelboards, MCC's etc. are to have their respective feeder phase and neutral conductors tye-wrapped together and enough slack conductor length to enable the ability to clamp the ground detector around each set of feeders. This wiring method is to be neat and of good workmanship quality.

.4 Final connection to receptacles and light fixtures:

.1 Separate pig-tail type leads shall be provided in each receptacle outlet box for final connections to receptacles and in each light fixture outlet box for final connection to the light fixture. These pig-tail leads are to be only connected to the phase and associated neutral conductors.

.5 Final connection to motors:

.1 The conductor phase colour coding as per C.E.C. rule 4-036 will carry through from the incoming service point to the motor starter and to the final connection to each motor. In the instance that a three phase motor requires transposition of phase conductors to achieve proper rotation, the change is to take place at the motor terminal box. Changing the motor feeder phase conductors at any other point in the distribution system (for example at the MCC or starter) will not be acceptable.

.6 Testing:

.1 Perform testing in conformance with NSP Electrical Inspection Bulletin B-2-132 and CEC Rule 2-136. Contractors are to verify by testing that all interior wiring is; free from shorts, broken, open, or incorrect connections, proper polarity, and that neutrals are free from connections to ground beyond the supply side of the consumer’s service box except as permitted in section 10 of the Canadian Electrical Code Part 1. (CEC).

.2 Prior to testing, ensure that all feeders or branch circuits which do not have neutral conductors are to have their respective phase conductors tye-wrapped together in accordance to the methods described previously.

.3 Prior to testing, ensure that voltage-sensitive devices such as ground fault circuit interrupters, arc-fault circuit interrupters, electronic ballasts, Surge Protective Devices (SPD) and other electronic equipment are not subjected to voltages that will damage the device.

.4 Megger testing is to be performed on all branch circuit wiring on the load side of a consumer's main overcurrent device, including main feeders and sub-feeders. Contractors shall record their results for all testing performed and shall have the testing results available for viewing by the inspection department upon request at the time of inspection.

********END OF SECTION ********

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 REFERENCES

.1 CSA 22.2 No. 41.

2 Products

2.1 EQUIPMENT

.1 Insulated grounding conductors: green, insulation to Section 26 05 21 Wires and Cables 0-1000 V.

.2 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.

3 Execution

3.1 INSTALLATION GENERAL

.1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used, install bonding conductor in each and every conduit.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect exposed grounding conductors from mechanical injury.

.4 Use mechanical connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 All metal raceways shall be bonded to ground including communications conduits.

.7 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw.

.8 Make bonding connections in radial configuration only. Avoid loop connections.

.9 Every metal conduit used to house a system ground conductor must be bonded to ground at each end.

3.2 EQUIPMENT BONDING

.1 Install bonding connections to typical equipment included in, but not necessarily limited to following list: Heat pump equipment, starters, control panels.

********END OF SECTION *******

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility.

2 Product

2.1 SUPPORT CHANNELS

.1 U shape, size 45 mm X 45 mm, 3 mm thick, surface mounted as required.

3 Execution

3.1 INSTALLATION

.1 Secure equipment to hollow and solid masonry, tile and plaster surfaces with lead anchors.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Support equipment, conduit or cables using clips, spring-loaded bolts, cable clamps designed as accessories to basic channel members.

.4 Fasten exposed conduit or cables to building construction or support system using straps.
- .1 One-hole steel straps to secure surface conduits and cables 35 mm (1-1/4 inch) and smaller.
- .2 Two-hole steel straps for conduits and cables 41 mm (1-1/2 inch) and larger.
- .3 Beam clamps to secure conduit to exposed steelwork.

.5 Suspended supports systems.

.1 Support single or multiple cables or conduits on a common steel support channel system supported by 10 mm (3/8") diameter threaded rod hangers, washers and nuts where direct fastening to building construction is impractical. Channel is to be sandwiched between nuts and washers located on both upper and underside portions of channels.

.2 Do not support a single conduit using a threaded rod and a conduit clip. This is not an acceptable means of installation as no lateral support is provided.

.6 For surface mounting of single and multiple conduits use channels. Channels are to be securely attached to hangers with the maximum spacing not greater than:

.1 Conduits of one size only:

.1	16 mm to 21 mm (1/2" to ¾") conduit	1524 mm (60")
.2	27 mm & 35 mm (1" to 1 ¼") conduit	1980 mm (78")
.3	41 mm (1 ½") & larger conduit	3050 mm (120")

.2 Conduits of mixed size:

.1 Arrange supports so that maximum spacing of supports conforms to above, based on smallest conduit diameter.

.7 All suspended types of junction and pull boxes are to be supported using a minimum of 10 mm (3/8") threaded rod c/w nuts and flat washers. Secure threaded rods to boxes using one flat washer and nut installed on both sides of box. Provide as follows:

.1 One rod required for all types of boxes sized 150 X 150 mm (6 X 6 inches) or smaller.

.2 Two rods required for all types of boxes larger than 150 X 150 mm (6 X 6 inches) but less than 304 X 304 mm (12 X 12 inches)

.3 Four rods required for all types of boxes 304 X 304 mm (12 X 12 inches) and larger.

.8 All excess rod is to be cut-off within 13 mm (1/2") of channel bottom.

.9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.11 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.12 Do not use supports or equipment installed by other trade contractors for conduit or cable support except with permission of other trade and approval of Engineer.

.13 Do not attach electrical conduit and cable to supports installed as part of a suspended ceiling installation (gypsum board or T-Bar for example).

.14 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

********END OF SECTION********

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Division 1.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility.

2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners, and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

.4 All splitters to be complete with grounding and/or bonding terminal strip (factory installed) in addition to required phase or neutral terminations.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

.3 Junction boxes larger than 120 mm (4 11/16) to have a bonding terminal strip installed.

.4 Where junction and or pull boxes are required to be 150 mm X 150 mm (6 inch X 6 inch) or larger provide hinged covers.

2.3 CABINETS

.1 Type D: 1.6 mm steel cabinet, built for surface or flush mounting. Flush cover lip 25 mm all around. Finish - ASA-61 grey enamel. Complete with screw on cover. Complete with bonding terminal strip.

.2 Type E: 1.6 mm steel cabinet, surface mount. Formed steel hinge with pull ring catch. Finish ASA-61 grey enamel. Complete with bonding terminal strip.

.3 Type T: 1.6 mm steel cabinet, 1.9 mm cover, latch lock, 2 keys. Finish - ASA - 61 grey enamel. Complete with bonding terminal strip.

3 Execution

3.1 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install all raceways in conformance with CEC, Section 12.

.2 Install pull boxes in inconspicuous but accessible locations. Box cover to be hinged on the side. **Do not install boxes with hinge on top.**

.3 Install pull boxes so as not to exceed 27 m (90 feet) of conduit run between pull boxes. Each run of raceway shall not have more than the equivalent of four 90 degree bends installed, including the bends located at an outlet or fitting. Ensure each pull box is bonded to ground.

.4 Terminate all bonding conductors on bonding terminal strip installed inside junction box.

.5 Minimize the use of electrical box extensions to provide additional capacity in junction boxes. Utilize 150 mm X 150 mm (6 inch X 6 inch) or larger in lieu of box extensions.

.6 Where junction and or pull boxes are required to be 150 mm X 150 mm (6 inch X 6 inch) or larger Type E cabinets shall be used.

.7 Type T cabinets shall be used when equipment is required to be housed in a lockable enclosure.

.8 Where construction consists of metal Q deck and steel joists (Roof deck only), conduit boxes are to be installed in such a manner that the nearest outside surface of the electrical box is not less than 38 mm (1.5 inch) from the nearest surface of the metal roof deck.

.9 Location of junctions and/or pull boxes in suspended ceiling spaces, i.e., gyp-rock, T-bar, etc., are not to be greater than 760 mm (30 inch) above finish ceiling.

.10 All suspended types of junction and pull boxes are to be supported using a minimum of 10 mm (3/8 inch) threaded rod c/w nuts and flat washers. Secure threaded rods to boxes using one flat washer and nut installed on both sides of box. Provide as follows:

.1 One rod required for all types of boxes sized 150 X 150 mm (6 X 6 inches) or smaller.

.2 Two rods required for all types of boxes larger than 150 X 150 mm (6 X 6 inches) but less than 304 X 304 mm (12 X 12 inches).

.3 Four rods required for all types of boxes 304 X 304 mm (12 X 12 inches) and larger.

.11 Where junction boxes and pull boxes are secured to building structural components, they shall be mounted and secured in such a manner so as not to be "cantilevered" (ie, only supported on one side of the box). In rare instances where site constraints dictate the installation of a "cantilevered" box, threaded rods shall be installed to provide additional support on the opposite end.

.12 Colour Coding: Refer to 26 05 31. All electrical junction, pull boxes splitters and cabinets shall be colour coded inside and out with appropriate coloured paint. **All paint is to be applied prior to installation and not with-in the confines of the building.**

********END OF SECTION ********

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 RELATED WORK:

.1 Section 26 05 34 – Conduits, Conduit Fastenings and Conduit Fittings.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility.

2 Products

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1-15.

.2 100-mm (4 inch) square or larger outlet boxes as required for special devices.

.3 Multi-Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 Where tile rings are installed on this project, they must be the welded type with square corners (Rounded corners will not be acceptable). For single device installations use Iberville BC52-C-49XX. For two device installations use Iberville # 52-C-52-XX. Select appropriate depth of tile ring to suit application.

2.2 SHEET STEEL DEVICE BOXES

.1 One or Two Device, Flush Installation:

.1 Electro-galvanized steel single, flush device boxes for use in dry flush installation, shall be pressed steel, minimum size 100 mm (4 inch) square x 54 mm (2.125 inch) deep, minimum volume of 490 cubic centimetres (30 cu.in.), (similar to Iberville # 52171-K). Provide single device square cornered tile cover (similar to Iberville # BC52-C-49XX) or two device square cornered tile covers (similar to Iberville # 52-C-52-XX).

2.3 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls, minimum volume of 343 cubic centimetres (21 cu.in), 89 mm (3.5 in.) deep, (similar to Iberville # MBD).

2.4 SURFACE MOUNT CONDUIT BOXES

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

.2 Metal type "FS" device plates to be used on all type "FS" boxes unless noted otherwise.

2.5 FITTINGS - GENERAL

.1 Knock-out fillers to prevent entry of foreign materials.

.2 Double locknuts and insulated bushings on sheet metal boxes.

2.6 COLOUR CODING

.1 Colour coding of system as per 26 05 03.

3 Execution

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material.

.3 For flush installations mount outlets flush with finished wall using tile rings to permit wall finish to come within 6 mm (1/4”) of opening.

.4 The front edges of boxes, cabinets and fittings installed in noncombustible walls or ceilings shall not be set in more than 6 mm (1/4”).

.5 The front edges of boxes, cabinets and fittings installed in combustible walls (ie, millwork) shall be flush with surface.

.6 Provide correct size of openings in boxes for conduit, mineral insulated and armored cable connections. Reducing washers not to be used.

.7 Install multi-gang boxes where more than one device is required. Sectional (gangable) boxes are not to be used on this project.

********END OF SECTION 26 05 32********

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 LOCATION OF CONDUIT

.1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

1.3 REFERENCES

.1 Canadian Standards Association
- .1 CAN/CSA C22.2 No. 18-98 (R2003), Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware, A National Standard of Canada.
- .2 CSA C22.2 No. 45-M1981 (R2003), Rigid Metal Conduit.
- .3 CSA C22.2 No. 56-04, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
- .4 CSA C22.2 No. 83-M1985 (R2003), Electrical Metallic Tubing.
- .5 CSA C22.2 No. 211.2-M1984 (R2003), Rigid PVC (Unplasticized) Conduit.
- .6 CAN/CSA C22.2 No. 227.3-05, Nonmetallic Mechanical Protection Tubing (NMPT), A National Standard of Canada (February 2006).

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility.

2 Products

2.1 CONDUITS

.1 Rigid galvanized steel threaded conduit: size as indicated.

.2 Electrical metallic tubing (EMT): with couplings, size as indicated.

.3 Rigid PVC conduit: size as indicated.

.4 Liquid-tight flexible metal conduit: size as indicated.

.5 Meal flexible conduit: size as indicated.

.6 ENT conduit is not permitted for use on this project.

2.2 CONDUIT FASTENINGS

.1 Fasten conduit to building construction or support system using straps, as follows:
- .1 One-hole steel straps to secure surface conduits and cables 35 mm (1-1/4 inch) and smaller.
- .2 Two hole steel straps for conduits and cables 41 mm (1-1/2 inch) and larger.

.2 Beam clamps to secure conduits to exposed steelwork.

.3 Channel type supports for one or more conduits.

.4 10-mm (3/8 inch) diameter threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings: manufactured for use with conduit specified. Coating same as conduit.

.2 Couplings for thinwall type EMT conduits shall be set screw, galvanized steel, unless noted otherwise.

.3 Conduits exiting equipment enclosures equipped with sprinkler hoods shall be installed with rain tight EMT connectors. These connectors will be equipped with a rubber “O” Ring gasket. In addition, any conduit couplings in the vertical portion of the conduit run over equipment enclosures equipped with sprinkler hoods shall be rain tight.

.4 Connectors for thinwall type EMT conduits shall be set screw, galvanized steel, c/w case hardened steel locknuts. Insulated throats are to be provided on connectors up to and including 27 mm (1 inch). Metal thread on bushings to be installed on all EMT connectors sized 35 mm (11/4 inch) or larger.

.5 Flexible metal conduit connectors shall be nylon insulated, steel or malleable iron type similar to T & B Tite-Bite #3115 thru 3124. Provide insulating bushings (anti-shorts) for flexible metal conduit connectors. Plastic thread on bushings to be installed on all flexible metal conduit connectors sized 35 mm (11/4 inch) or larger.

.6 Liquid-tight flexible metal conduit fittings:
- .1 Specifically listed for liquid tight flexible metal conduit.
- .2 Steel type, to match conduit size.

.3 Fittings must incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.
.4 Safe edge ground type.
.5 Connectors shall have insulated throats.
.6 T & B #5300 series or equal.

2.4 FISH CORD

.1 Polypropylene.

3 Execution

3.1 INSTALLATION

.1 Unless noted otherwise, conduits are to be installed as high as possible to conserve headroom, to reduce interference with other trades and cause minimum interference in spaces through which they pass.

.2 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.

.3 Where construction consists of metal Q deck and steel joists (Roof deck), conduits are to be installed as follows:
.1 In such a manner that the nearest outside surface of the conduit is not less than 38 mm (1.5 inch) from the nearest surface of the metal roof deck. Typically, this would involve the installation of conduits on the underside of top flange, secured with beam clamps or canstrut.
.2 Installation of conduits, raceways between the top flange of a steel support structure and a steel roof deck **is not permitted** due to the possible penetration of roof deck mechanical screws or fasteners.
.3 Install associated boxes in such a manner that the nearest outside surface of the box is not less than 38 mm (1.5 inch) from the nearest surface of the metal roof deck.

.4 Where construction consists of metal Q deck and steel joists (non-roof deck), conduits are to be installed as follows:
.1 Between the top flange of a steel support structure and the Q-deck, where size of conduit permits.
.2 Where conduit sizes preclude this, install as high as possible in the space to conserve headroom.

.5 Use rigid galvanized steel threaded conduit where subject to injury.

.6 Use electrical metallic tubing (EMT) for the following:
.1 All branch circuit wiring.
.2 All panel feeders.
.3 Where noted elsewhere in the contract documents.

.7 EMT shall be installed as a complete system and shall be securely fastened in place within 1 metre (39 inches) of each outlet box, junction box, cabinet, couplings, fittings and changes in direction and the spacing between supports as follows:

.1 Not greater than 1500 mm (five feet) for 16 mm (1/2 inch) and 21 mm (3/4 inch) EMT

.2 Not greater than 1800 mm (six feet) for 27 mm (1 inch) and 35 mm (1-1/4 inch) EMT

.3 Not greater than 3050 mm (ten feet) for 41 mm (1-1/2 inch) EMT or larger.

.8 Install supports to firmly secure conduits to metal decking when any change in direction occurs.

.9 All conduit runs shall be a maximum of 30 meters (100 feet) in length with a maximum of four (4) 90 degree bends between pull points. A pull box shall be placed in conduit runs where the sum of the bends exceeds 360 degrees, where the overall run exceeds 30 meters (100 feet) or there is a reverse bend in the run.

.10 Pull boxes shall be placed in straight sections of conduit run and shall not be used in lieu of a bend. Conduit fittings shall not be used in place of pull boxes or bends. The use of C, LB, LL, LR and T type fittings are prohibited on this project unless written permission is provided by the Engineer.

.11 Pull boxes are to be sized in conformance with CEC Rule 12-3036, unless noted otherwise.

.12 The use of corner pulling ELLs or corner pulling elbows is not permitted.

.13 Conduits shall be installed in a neat and ordered manner. When installed in a group, conduits shall be parallel and evenly spaced apart.

.14 Liquid tight metal flexible conduit is not to be used as a general purpose raceway. Use liquid tight flexible metal conduit (maximum length permitted to be 1.5 M) and liquid tight conduit fittings for:

.1 Final connection to all mechanical equipment (fans, heat pumps, terminal units, etc.) and all vibrating equipment.

.15 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.16 Mechanically bend steel conduit over 19-mm (3/4 inch) diameter.

.17 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.18 Install fish cord in empty conduits.

.19 Where conduits become blocked, remove and replace blocked section.

.20 Dry conduits out before installing wire.

.21 The installation of conduits above the structure, directly below roof insulation is strictly prohibited.

.22 All conduits to be complete with minimum #12 green insulated bond conductor.

.23 Ensure all metal raceways are bonded to ground. Where a separate bonding conductor is run to a bonding bushing on an open end of a metal raceway, a #6 green RW90 shall be used.

3.2 SURFACE AND CONCEALED CONDUITS

.1 Run parallel or perpendicular to building lines. When installed in a wall cavity, conduit is to be installed vertically from outlet box to ceiling space, not run in an angled manner through the studs.

.2 Run conduits in flanged portion of structural steel, where possible.

.3 Group conduits wherever possible.

.4 Do not pass conduits through structural members except as indicated.

.5 Do not locate conduits closer than 75-mm (3 inch) parallel to hot water lines with a minimum of 25 mm (1 inch) at crossovers.

.6 Support of electrical systems raceway shall be independent of any type of suspended ceiling support rods, wires, etc. Toggle bolts shall not be used in Gypsum board construction.

3.3 CONCEALED CONDUITS

.1 Do not install horizontal runs in masonry walls.

.2 Do not install conduits in terrazzo or concrete toppings.

********END OF SECTION ********

.1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 RELATED SECTIONS

.1 Section 26 05 00 – Common Work Results for Electrical.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material for recycling in accordance with Waste Management Plan.

.4 Divert unused metal and wiring materials from landfill to metal recycling facility.

1.4 REFERENCES

.1 Canadian Standards Association (CSA International).

.1 CSA-C22.2 No. 5-02, Moulded-Case Circuit Breakers, Molded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

1.5 SUBMITTALS

.1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.

.2 Include time-current characteristic curves for breakers.

2 Products

2.1 BREAKER GENERAL

.1 Bolt-on molded case circuit breaker, quick make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees Celsius ambient.

.2 Plug-in molded case circuit breakers, not accepted.

.3 Common-trip breakers with single handle for multipole applications.

.4 Magnetic instantaneous trip elements in circuit breakers, to operate only when the value of current reaches setting.

.5 Short Circuit Interrupting Ratings:

.1 All circuit breakers must be fully rated to withstand the voltage and available fault current at their terminals at the installed location in the distribution system.

.2 Series rated combinations (Integrated Equipment Rating) of circuit breakers, as per CEC, Rule 14-014 is not acceptable and cannot be applied to this project.

.3 Unless otherwise noted, all panelboard assemblies are to be fully rated for a symmetrical short circuit fault current of not less than 10 KA @ 240 volts and 14 KA @ 600 volts.

.5 All circuit breakers sized 225 amps and above are to be supplied with extension handles.

2.2 THERMAL MAGNETIC BREAKERS

.1 Molded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping. Under overload conditions and instantaneous tripping for short circuit protection.

.2 All circuit breakers rated 150 amps and above are to be supplied with adjustable magnetic trip units, unless noted otherwise.

2.3 STANDARD OF ACCEPTANCE

.1 Cutler-Hammer, to match existing.

3 Execution

3.1 INSTALLATION

.1 Install circuit breakers as indicated.

3.2 COMMISSIONING

.1 Carry out the commissioning in conformance with Section 26 91 13.

******END OF SECTION******

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Division 1.

2 Products

2.1 DISCONNECT SWITCHES

.1 Non-fusible and fusible disconnect switch in CSA Enclosure as indicated.

.2 Heavy duty, specification grade type.

.3 Provision for padlocking in on-off switch position.

.4 Mechanically interlocked door to prevent opening when handle in ON position.

.5 Quick-make, quick-break action.

.6 ON-OFF switch position indication on switch enclosure cover.

.7 Fuse clips to accommodate Class J only.

.8 Supply HRC-I-J fuses for all fused disconnect switches, unless indicated otherwise.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 03.

2.3 MANUFACTURERS

.1 Standard of Acceptance:
- .1 Cutler-Hammer.

.2 Acceptable Manufacturer:
- .1 Square D.
- .2 Siemens.

3 Execution

3.1 INSTALLATION

.1 Install disconnect switches where indicated.

.2 Provide a disconnect switch installed on the line side of each heat pump. Do not use an across-the-line type of motor starter as a disconnecting means in lieu of a disconnect switch (CEC Rule 28-602 (3b)).

.3 Install fuses in disconnect switches, where indicated.

******END OF SECTION******

1 General

1.1 GENERAL

.1 The General Conditions of the contract as well as provisions of Division 1 are part of and to be read in conjunction with this Section. The Executed Agreement including General Conditions and Supplementary Conditions (Section 00 73 00), applicable sections of Division 0 and Division 1, Section 26 05 00 Common Work Results for Electrical, Section 26 05 01 Electrical Submittals and Section 26 05 02 Electrical Contract Closeout, applicable drawings and amendments are part of and to be read in conjunction with this Section.

1.2 RELATED WORK

.1 General requirements: Division 1.

.2 Common Work Results for Electrical - Section 26 05 00.

1.3 GENERAL

.1 The verification of all electrical systems installed on this project is the responsibility of the Electrical Contractor. Manufactured systems or components shall be commissioned by factory trained technicians representing the manufacturer, in the presence of the Owner's designated representatives, and under the direction of the electrical contractor.

.2 The electrical contractor will provide assistance to the Owner's representatives and ensure that the manufacturer's representative is on site during functional performance testing (FPT).

.3 Tests shall be performed by qualified electricians or technicians as required by the nature and complexity of the test.

.4 The correction of all electrical deficiencies identified throughout the project associated with this work shall be a condition of Substantial Performance and shall be corrected prior to achieving Substantial Performance.

1.4 SCOPE

.1 Systems verification are called for throughout the individual specifications, however, this does not relieve this section from providing all testing and verification necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

.2 Provide labour tools and supervision to conduct functional testing as described/specified herein and in related sections including but not limited to the following equipment and systems:

.1 Panelboards.

.2 Circuit breakers.

1.5 QUALITY ASSURANCE

.1 The Electrical Contractor is responsible for quality assurance and whenever necessary, to ensure compliance with operating requirements, CSA, these contract documents, the Authority having Jurisdiction and other requirements and codes as applicable.

1.6 CONTRACTOR'S RESPONSIBILITIES

.1 Prepare each system for testing and verification.

.2 Co-ordinate the efforts of testing and verification.

.3 Provide personnel, operate systems at designated times, and under conditions required for proper testing and adjusting.

.4 Provide all necessary test and calibration equipment, temporary facilities, meters, sensors, load banks, etc. necessary to simulate and verify correct operating conditions.

.5 Co-ordinate and pay for all costs associated with testing and verification, including but not limited to costs for: travel, labour, equipment, testing agencies, manufacturers, testing and any other costs incurred to test and verify equipment and systems.

.6 Make test instruments available to Engineer to facilitate spot checks during testing.

.7 Retain possession of test instruments and remove at completion of services.

.8 Verify system installation is complete and in continuous operation.

.9 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

1.7 SUBMITTALS

.1 The Contractor shall submit the following documentation prior to FPT:
- .1 Record drawings.
- .2 Operations and maintenance manuals.
- .3 A letter of acceptance from the local inspection authority. A copy is to be included in the operations and maintenance manuals.
- .4 A letter of guarantee. A copy is to be included in the operations and maintenance manuals.
- .5 Copies of the following test results (A copy is to be included in the operations and maintenance manuals):
  - .1 Insulation/megger tests.
  - .2 Load balance tests on all distribution panels.
  - .3 Load tests on all heat pumps.

.2 Completed verification forms included with this section. When there are multiples of referenced equipment, devices or systems, electrical contractor is responsible for obtaining a suitable number of forms to complete the verification process for the entire project.

1.8 INSTRUCTION OF OWNER'S STAFF

.1 Provide the following:
- .1 Necessary instruction of equipment and systems operation to Owner's staff.
  - .1 At least 72 hours advance notifications in writing.
  - .2 Provision of factory trained technicians where necessary.
  - .3 Provision of presentation with the use of as-built drawings and data books required in other sections of these specifications.

.2 Conduct presentation on project premises.

1.9 FUNCTIONAL PERFORMANCE TESTING (FPT)

.1 The Owner will commence a Functional Performance Testing Program independent of other processes specified, upon receipt of written verification from the General Contractor that:
- .1 All systems are complete and operational in all respects.
- .2 All specified reports and documents have been submitted and approved.
- .3 All tests, commissioning and start-up processes described elsewhere in the specification are complete.
- .4 All demonstrations have been completed and documented.
- .5 All defects and deficiencies identified during the commissioning of all electrical systems have been corrected.

.2 During this program, the Owner will verify the operation of all systems. The FPT process may involve real or simulated conditions to determine the systems full operational capabilities. Copies of all specified reports and documents are to be made available to the site during the period.

.3 During the FPT process, the Electrical Contractor will provide within 48 hours notice, the following:
- .1 An onsite representative familiar with all aspects of the work to assist with coordination of trades during FPT as needed.
- .2 A full time onsite senior electrical or technical representative for each building system to assist with the FPT of systems and equipment.
- .3 Equipment manufacturer’s technical representatives shall be available for onsite and telephone consultation from time to time as required throughout the FPT.
- .4 All tools and test equipment required to operate the systems in real or simulated mode.

.4 FPT shall be performed on all electrical systems referenced in the contract documents which may include, but not be limited to, the following:
.1 Power Distribution System.

.5 Deficiencies or discrepancies discovered during the FPT process are to be immediately rectified by the Electrical Contractor. A condition of Substantial Performance shall be the correction of all electrical deficiencies identified throughout the project associated with this work. The Electrical Contractor shall also provide exceptional arrangements for labor and materials required to correct deficiencies which prevent the satisfactory completion of the FPT process.

.7 This section specifies the functional testing requirements for electrical systems and equipment. The functional testing process, requirements and test method definitions are described in Sections 01 91 01 and the Commissioning Plan.

.8 Prerequisites for functional testing are as follows:
.1 All equipment, components and devices applicable to the test must be started and this start up must be documented. This includes completion of the checklists, testing of equipment, switchgear, main distribution panels, generators, sub-panels, etc., completed labelling and identification, etc.
.2 All punch list items for this equipment corrected.
.3 These functional test procedures reviewed and approved by installing contractor.
.4 Test requirements and sequences of operation attached.

1.10 FINAL REPORT

.1 Assemble all testing data and verification reports and submit them to the Engineer.

.2 Each form shall bear signature of recorder, date of test, and all relevant information in clear and legible form.

.3 Identify each instrument used, and latest date of calibration of each.

.4 Include written confirmation by Owner's representatives that all verification, testing, instruction and demonstrations have been completed to the Owner's satisfaction.

1.11 TEST EQUIPMENT

.1 All test equipment necessary to fulfill the testing requirements of this section and/or as required in the electrical specifications including the Commissioning Plan shall be provided as part of the work of this section.

2 Products N/A

3 Execution

3.1 INSULATION RESISTANCE TESTING

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument, up to 600 volts with a 1000 V unit.

.2 Check resistance to ground before terminating cables and wires.

3.2 PANELBOARD PHASE CURRENT MEASUREMENT

.1 Energize all possible loads.

.2 Measure each phase and record voltage and current.

3.3 OTHER TESTS

.1 Perform other tests, not mentioned in this section, but specified in individual specification sections, to the approval of the Engineer.

3.4 VERIFICATION TESTS AND FORMS.

.1 Perform tests as required to properly complete the verification forms included in this section.

.2 Deficiencies or discrepancies discovered during this process are to be immediately rectified by the Electrical Contractor. The Electrical Contractor shall provide exceptional arrangements for labor and materials as may be required to correct these deficiencies.

Form V-26 24 16.01-Panelboards

EQUIPMENT DETAILS: (Identification)

Manufacturer: _____ Model: _____ Serial #: _____

Room #: _____ Designation: _____ Bus Rating: _____

Item	Yes	No	Comments
Nameplate label ……..	☐	☐	
Filler pieces in place …..	☐	☐	
Cable phase identified correctly……..	☐	☐	
Cable lugs bolted to MRT……	☐	☐	
Bus bolts torqued to MRT……..	☐	☐	
Properly grounded……..	☐	☐	
Interior and exterior Cleaned……	☐	☐	
Insulation resistance measured……	☐	☐	
Spare breakers installed……..	☐	☐	
Lamicoid identification plate……	☐	☐	
Panel directory typed and complete…….	☐	☐	
Hinged door and front cover installed…..	☐	☐	
Branch circuit breaker operation checked.	☐	☐	
Breaker lock on devices installed……..	☐	☐	
Breaker bolts torqued to MRT……	☐	☐	
All tools removed, doors covers replaced…	☐	☐	
	☐	☐	

FIELD MEASUREMENTS:	**Current**
	L1 _____
Voltage	L2 _____
L1-L2 _____	L3 _____
L2-L3 _____	N _____
L3-L1 _____	

SIGN OFF:
Electrical
Contractor: _____ Signature: _____ Date: _____

******END OF SECTION******

HALIFAX WEST HIGH SCHOOL
HEAT PUMP REPLACEMENT
PHASE 2

283 THOMAS RADDALL DR. HALIFAX, NS

PREPARED FOR:

Halifax Regional
School Board

PREPARED BY:

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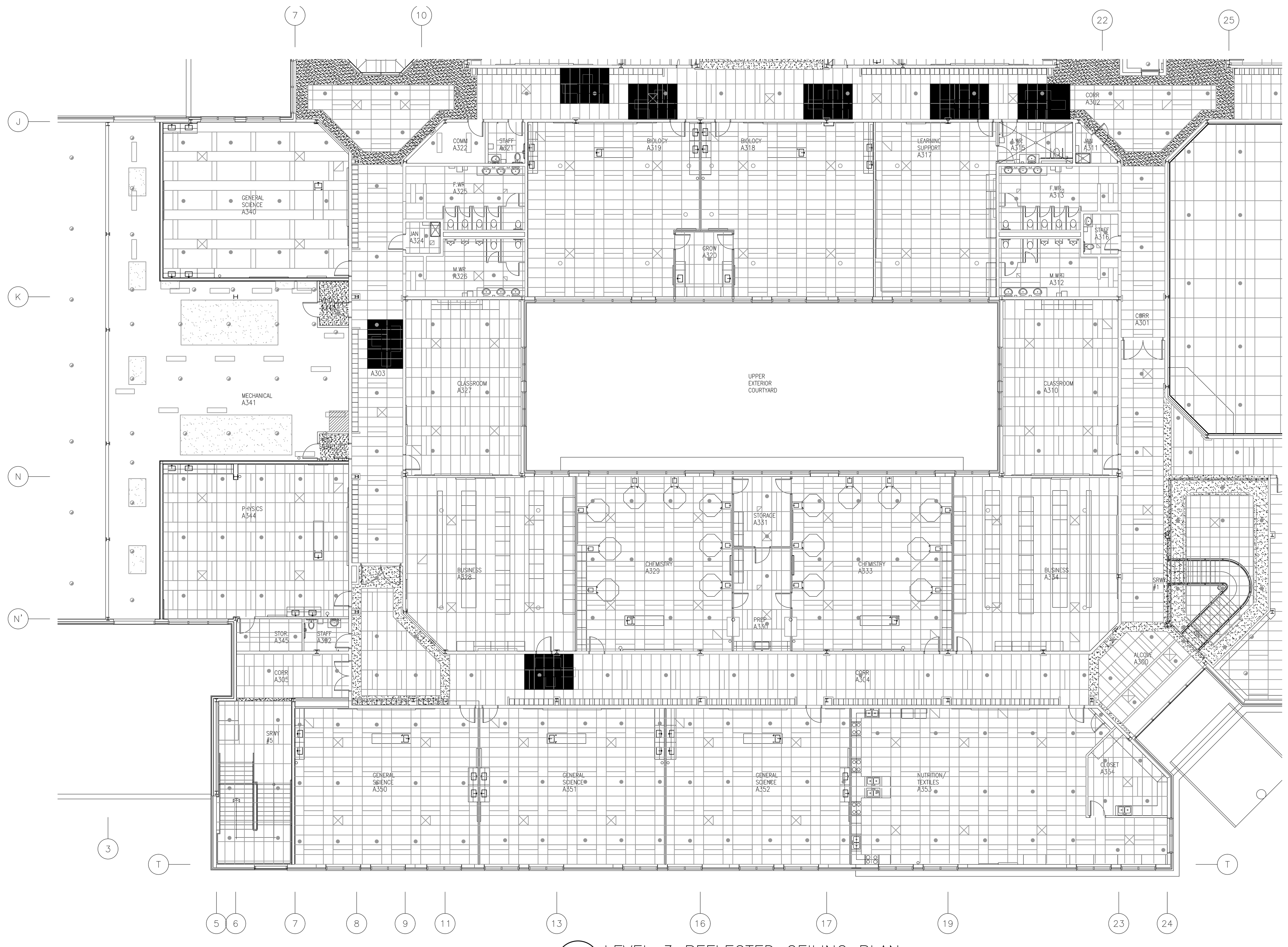
DRAWING LIST

JULY 2016

DUMAC# 16-037



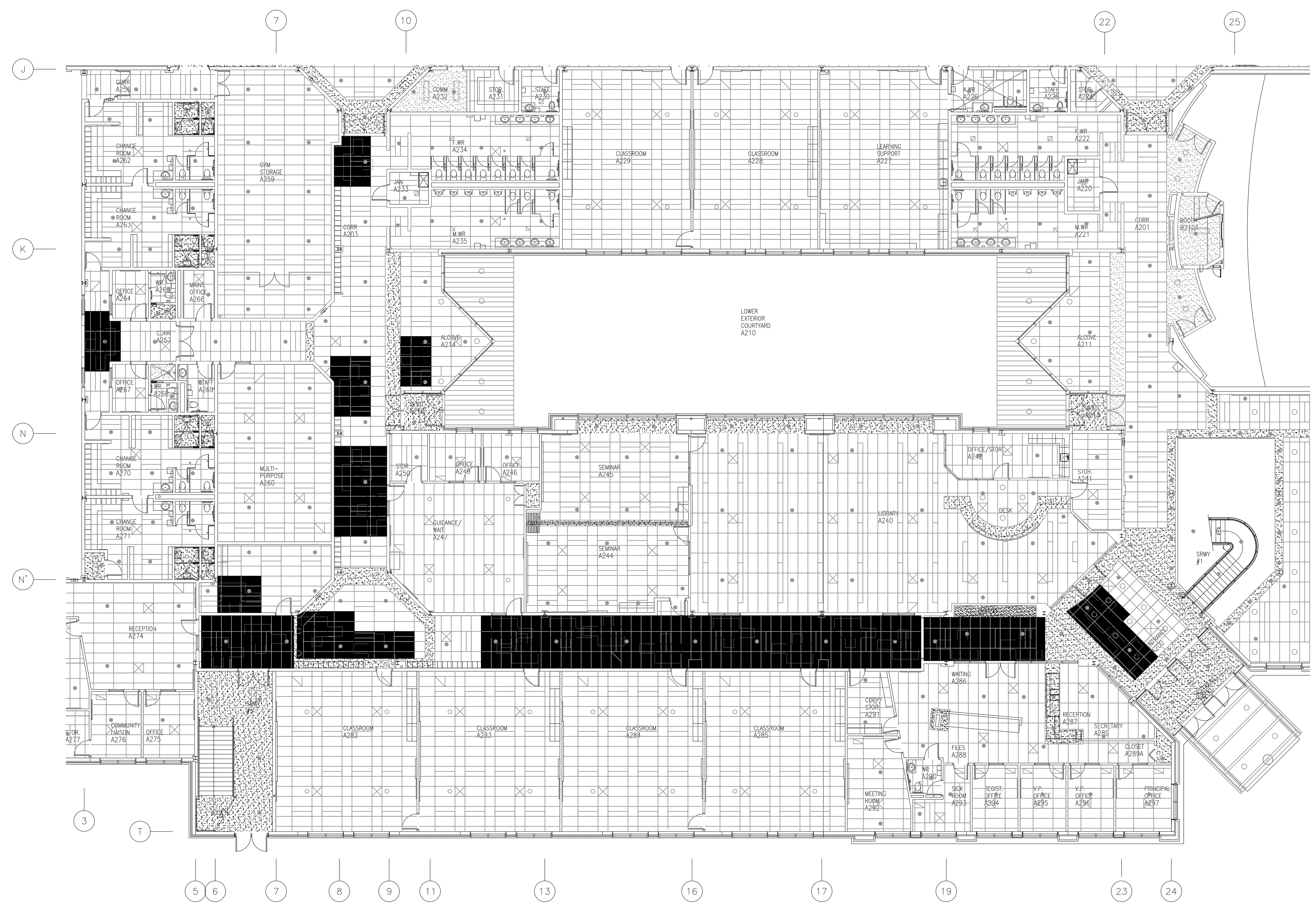
2 / M-101 LEVEL 3 REFLECTED CEILING PLAN

NTS

SCOPE OF WORK:

DEMOLITION / NEW CONSTRUCTION LEGEND :

REMOVE GYPSUM BOARD BULKHEAD AND/OR CEILING TILE AS REQUIRED FOR REMOVAL & REPLACEMENT OF HEAT PUMP. REINSTALL WITH EXISTING CEILING TILE, REPLACE ANY DAMAGED OR STAINED TILES. PATCH AND REPAIR GYPSUM BOARD BULKHEAD AS REQUIRED.



1 / M-101 LEVEL 2 REFLECTED CEILING PLAN

NTS

DUMAC# 16-037

Halifax Regional School Board

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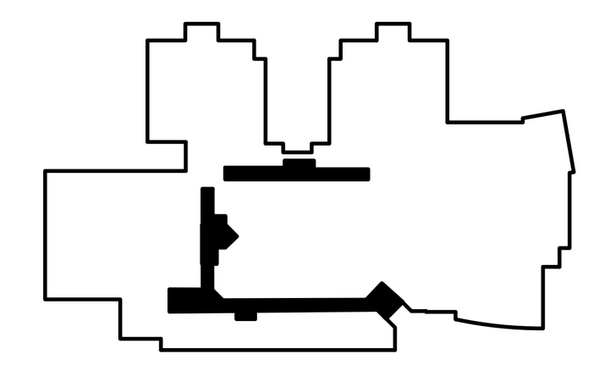
KEY PLAN



GRAPHIC SCALE

DATE	MARK	ISSUE
20160718	1	ISSUED FOR TENDER

STAMP

REGISTERED PROFESSIONAL ENGINEER M.G. DOYLE 3092 PROVINCE OF NOVA SCOTIA

SCALE	NTS
DRAWN BY:	STAFF
CHECKED BY:	MGD
REVIEWED BY:	MGD
APPROVED BY:	MGD
AS-BUILT CHECK	
DATE:	JULY 2016

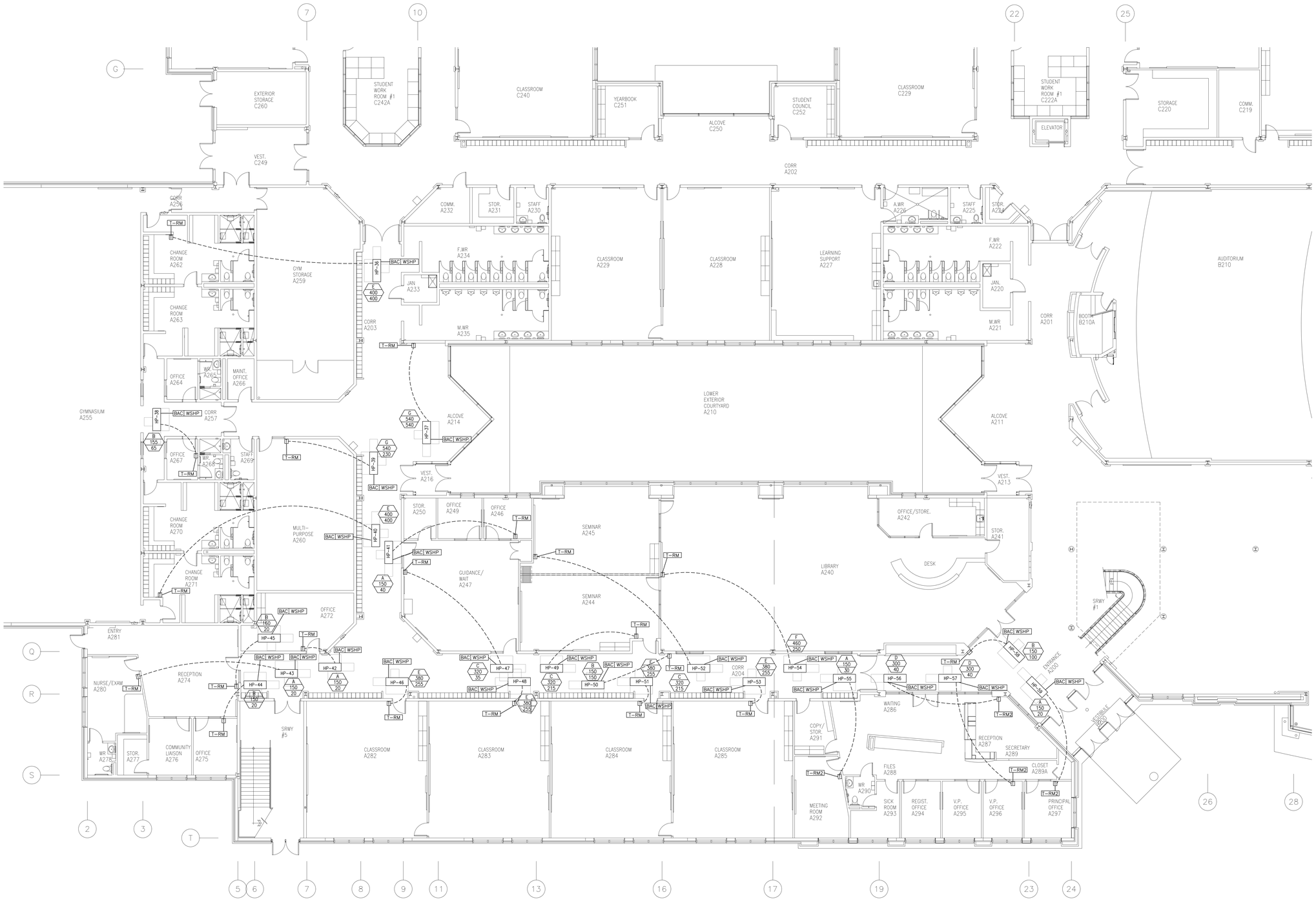
PROJECT
HALIFAX WEST HIGH SCHOOL HEAT PUMP REPLACEMENT – PHASE 2
283 THOMAS RADDALL DR. HALIFAX, NS

PROJECT NO.:

SHEET TITLE
REFLECTED CEILING PLAN LEVEL 2 & 3

INTERNAL NO.:

M-101



MECHANICAL LEGEND

- HP-## — WATER SOURCE HEAT PUMP
- TYPE, MIN, MAX — WATER SOURCE HEAT PUMP TAG, MIN & MAX FLOW, L/S
- WALL MOUNTED TEMPERATURE SENSOR SUPPLIED WITH HEAT PUMP
- WIRING BY CONTROLS CONTRACTOR

CONTRACTOR TO VERIFY TYPE, LOCATION, ORIENTATION AND CLEARANCE OF ALL HEAT PUMPS PRIOR TO ORDERING.

ORIGINAL BUILDING DRAWINGS INCLUDED TO AID IN REBALANCING THE SYSTEM.

NOTES:

1. PORTIONS OF THE EXISTING CEILING ARE BEING REMOVED AND REINSTALLED TO ALLOW FOR THE REMOVAL AND INSTALLATION OF MECHANICAL EQUIPMENT. MECHANICAL CONTRACTOR IS TO DISCONNECT, REMOVE AND REINSTALL, ALL MECHANICAL DEVICES, EQUIPMENT AND SYSTEMS IN THESE CEILINGS TO ALLOW FOR THE INSTALLATION OF NEW EQUIPMENT. STORE ALL DEVICES AND EQUIPMENT IN A SAFE LOCATION FOR REINSTALLATION.
2. CARRY ALL ASSOCIATED WORK IN MECHANICAL TENDER.

DUMAC# 16-037

Halifax Regional School Board

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KEY PLAN

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M.G. DOYLE 3092 REGISTERED PROFESSIONAL ENGINEER PROVINCE OF NOVA SCOTIA

SCALE	1:100
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REVIEWED BY:	MGD
APPROVED BY:	MGD
AS-BUILT CHECK	
DATE:	JULY 2016

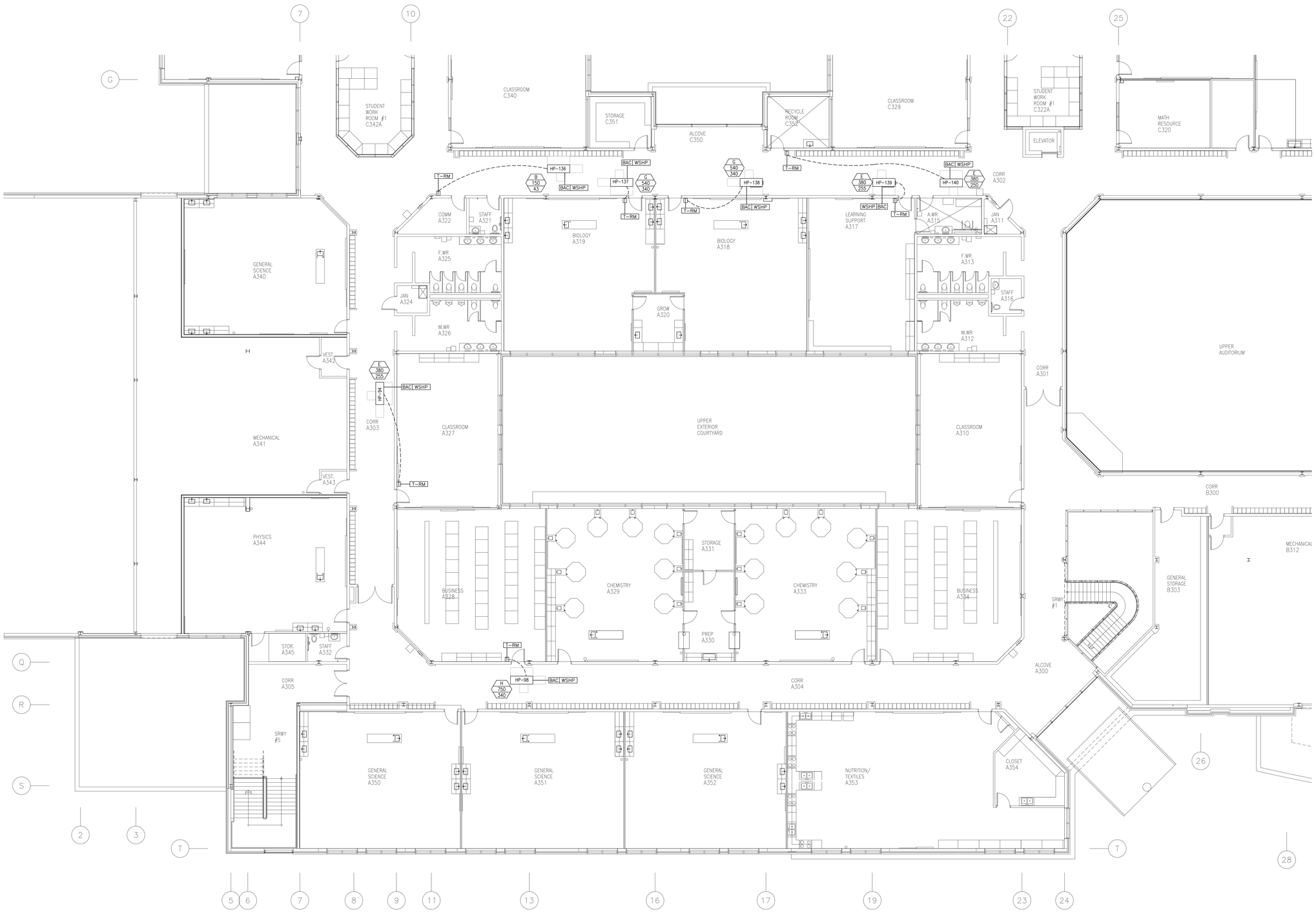
PROJECT
HALIFAX WEST HIGH SCHOOL HEAT PUMP REPLACEMENT – PHASE 2
283 THOMAS RADDALL DR. HALIFAX, NS

PROJECT NO.:

SHEET TITLE
HEAT PUMP LAYOUT & CONTROLS LEVEL 2

INTERNAL NO.:

M-102



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APPROVED BY:	MGD
AS-BUILT CHECK	
DATE:	JULY 2016

PROJECT
HALIFAX WEST HIGH SCHOOL HEAT PUMP REPLACEMENT – PHASE 2
283 THOMAS RADDALL DR. HALIFAX, NS

PROJECT NO.:

SHEET TITLE
HEAT PUMP LAYOUT & CONTROLS LEVEL 3

INTERNAL NO.:

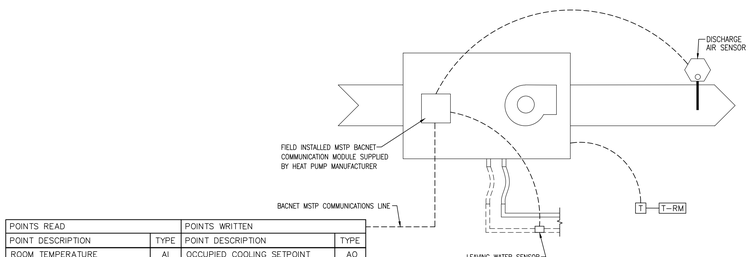
M-103

DUMAC# 16-037

AIR SYSTEM SCHEDULE

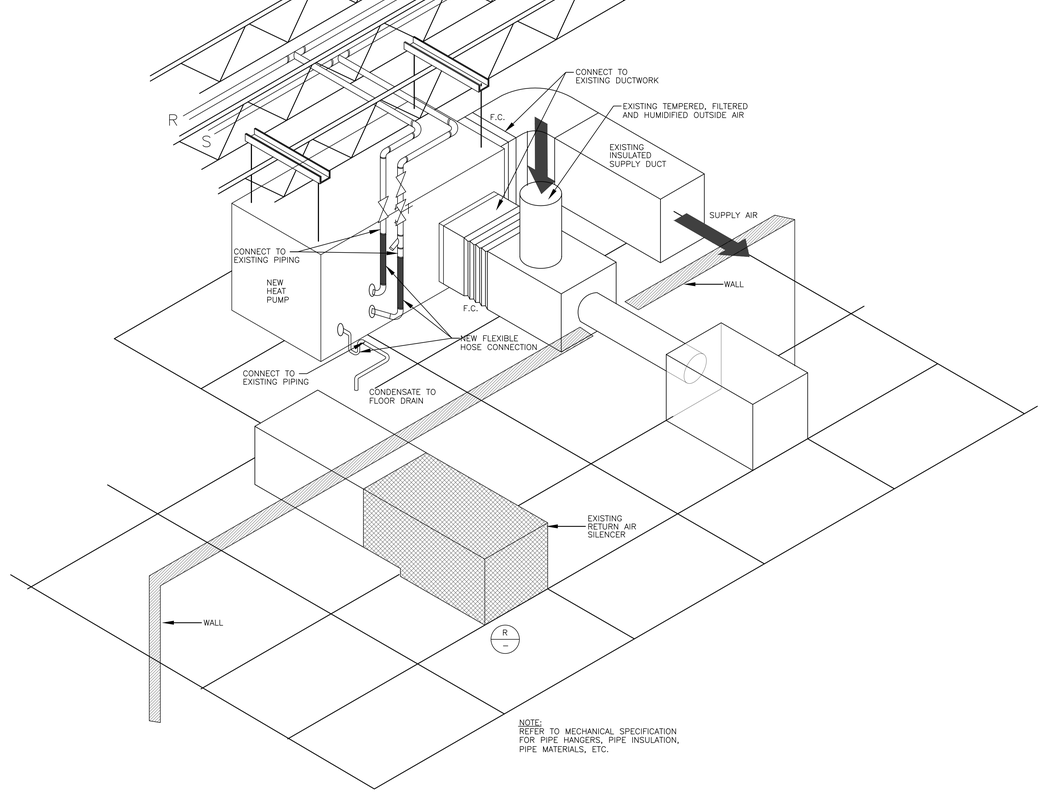
SYMBOL	STANDARD OF ACCEPTANCE		AIRFLOW	WATER FLOW	NET COOLING CAPACITY (WATTS)							HEATING CAPACITY (WATTS)					VOLTS	ACCESSORIES AND/OR REMARKS
	MANUFACTURER	MODEL	l/s	l/s	EDB	EWB	EWT	TOTAL	SENSIBLE	HR	EER	EDB	EWT	CAP	HE	COP		
A	FLORIDA HEAT PUMP	LVO12–IHZN	150	0.19	26	19	29	3253	2374	4044	12.8	18	21	4162	3312	4.6	208/1	–
B	FLORIDA HEAT PUMP	LVO15–IHZN	160	0.25	26	19	29	3927	2755	4806	14.0	18	21	4953	3869	4.5	208/1	–
C	FLORIDA HEAT PUMP	LVO24–IHZN	340	0.38	26	19	29	7034	5011	8499	14.2	18	21	8528	6829	4.5	208/1	–
D	FLORIDA HEAT PUMP	LVO18–IHZN	340	0.32	26	19	29	6213	4806	7503	14.2	18	21	7415	6154	5.1	208/1	–
E	FLORIDA HEAT PUMP	LVO24–IHZN	380	0.38	26	19	29	7034	5011	8499	14.2	18	21	8528	6829	4.5	208/1	–
F	FLORIDA HEAT PUMP	LVO30–IHZN	425	0.47	26	19	29	9027	6594	10844	15.1	18	21	10668	8763	5.1	208/3	–
G	FLORIDA HEAT PUMP	LVO36–IHZN	565	0.57	26	19	29	11166	8323	13511	14.9	18	21	13364	10814	4.9	208/3	–
H	FLORIDA HEAT PUMP	LVO48–IHZN	755	0.76	26	19	29	14273	10551	17438	14.4	18	21	17145	13716	5.0	600/3	–

ALL UNITS SUPPLIED WITH FIELD OR FACTORY INSTALLED BACNET COMMUNICATION MODULE,
DISCHARGE AIR SENSOR, ROOM TEMPERATURE SENSOR AND LEAVING WATER SENSOR.



POINTS READ		POINTS WRITTEN	
POINT DESCRIPTION	TYPE	POINT DESCRIPTION	TYPE
ROOM TEMPERATURE	AI	OCCUPIED COOLING SETPOINT	AO
LEAVING WATER TEMPERATURE	AI	UNOCCUPIED COOLING SETPOINT	AO
DISCHARGE AIR TEMPERATURE	AI	OCCUPIED HEATING SETPOINT	AO
FAN ON/AUTO STATUS	MSI	UNOCCUPIED HEATING SETPOINT	AO
HEAT/COOL/AUTO STATUS	MSI	ROOM BYPASS TIME SETPOINT	AO
CURRENT ALARM	MSV	OCCUPIED SETPOINT DIFFERENTIAL	AO
WSHP STATUS	MSV		
PREVIOUS ALARM	MSV		

1 / M–104 HEAT PUMP CONTROL
NTS



NOTE:
REFER TO MECHANICAL SPECIFICATION FOR PIPE HANGERS, PIPE INSULATION, PIPE MATERIALS, ETC.

2 / M–104 HEAT PUMP SCHEMATIC
NTS

Halifax Regional School Board

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KEY PLAN

GRAPHIC SCALE

DATE	MARK	ISSUE
20160718	1	ISSUED FOR TENDER

STAMP
REGISTERED PROFESSIONAL ENGINEER
M.G. DOYLE
3092
PROVINCE OF NOVA SCOTIA

SCALE	AS NOTED
DRAWN BY:	STAFF
CHECKED BY:	MGD
REVIEWED BY:	MGD
APPROVED BY:	MGD
AS–BUILT CHECK	
DATE:	JULY 2016

PROJECT
HALIFAX WEST HIGH SCHOOL HEAT PUMP REPLACEMENT – PHASE 2
283 THOMAS RADDALL DR. HALIFAX, NS

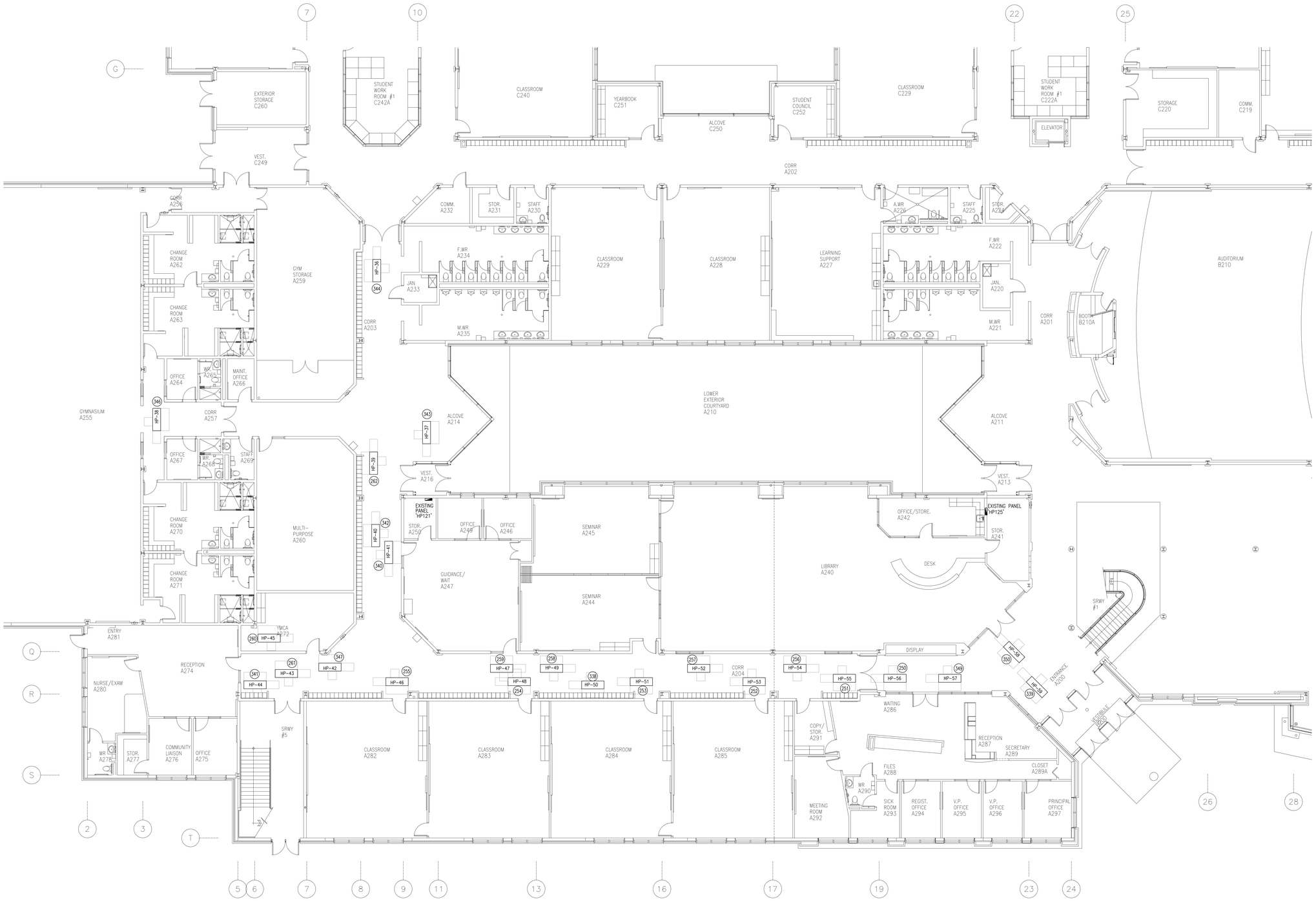
PROJECT NO.:

SHEET TITLE
HEAT PUMP DETAILS

INTERNAL NO.:

M-104

DUMAC# 16–037



NOTE:
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Halifax Regional School Board

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KEY PLAN

GRAPHIC SCALE

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D.M. DUMARESQ 3369 REGISTERED PROFESSIONAL ENGINEER PROVINCE OF NOVA SCOTIA

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CHECKED BY:	DMD
REVIEWED BY:	DMD
APPROVED BY:	DMD
AS-BUILT CHECK	
DATE:	JULY 2016

PROJECT
HALIFAX WEST HIGH SCHOOL HEAT PUMP REPLACEMENT – PHASE 2
283 THOMAS RADDALL DR. HALIFAX, NS

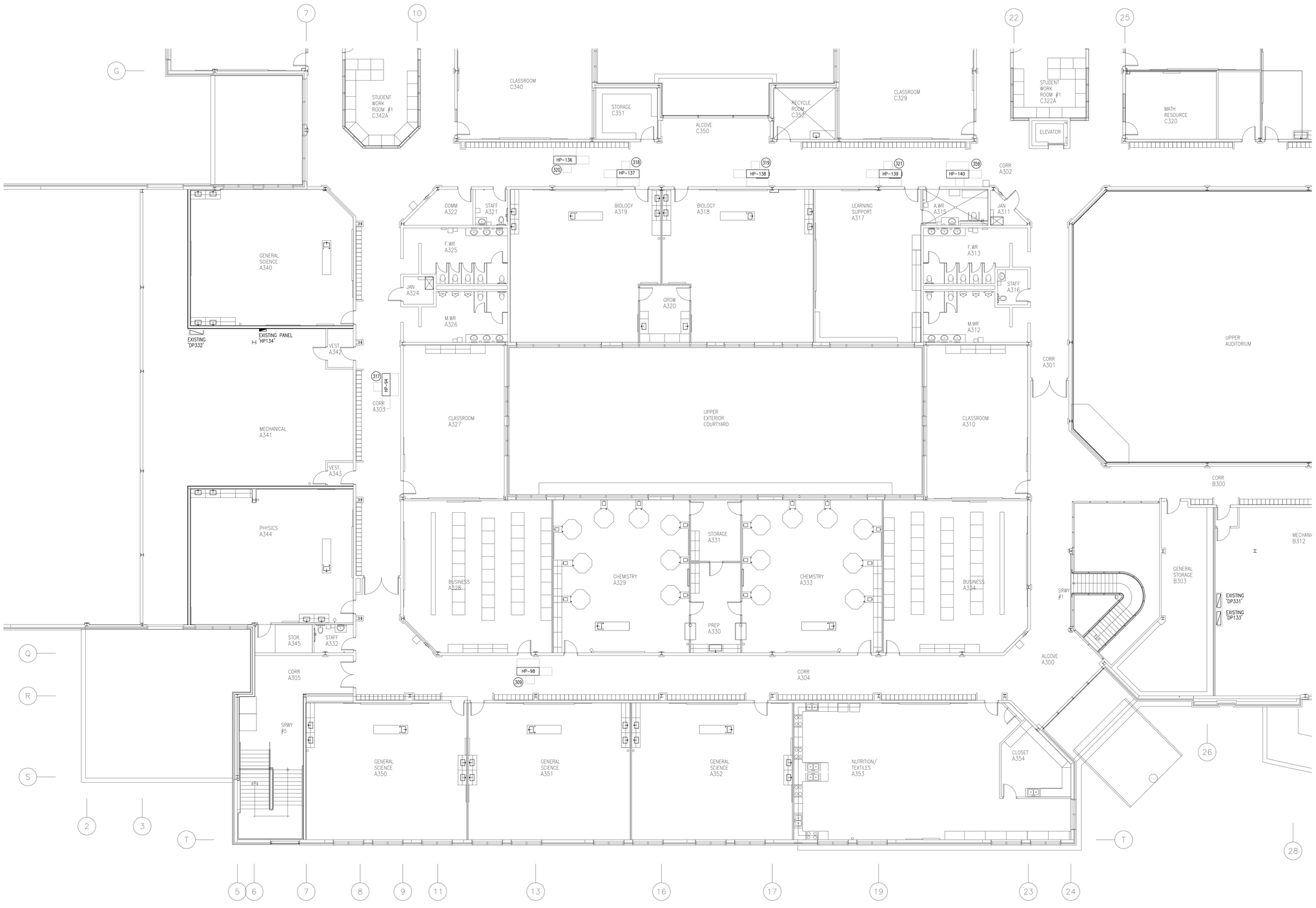
PROJECT NO.:

SHEET TITLE
MECHANICAL EQUIPMENT CONNECTIONS LEVEL 2

INTERNAL NO.:

E-101

DUMAC# 16-037



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Halifax Regional School Board

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KEY PLAN

GRAPHIC SCALE

DATE	MARK	ISSUE
20160718	1	ISSUED FOR TENDER

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REGISTERED PROFESSIONAL ENGINEER — PROVINCE OF NOVA SCOTIA — C.M. Doherty — 3369

SCALE	1:100
DRAWN BY:	STAFF
CHECKED BY:	DMD
REVIEWED BY:	DMD
APPROVED BY:	DMD
AS-BUILT CHECK	
DATE:	JULY 2016

PROJECT
HALIFAX WEST HIGH SCHOOL HEAT PUMP REPLACEMENT - PHASE 2
283 THOMAS RADDALL DR. HALIFAX, NS

PROJECT NO.:

SHEET TITLE
MECHANICAL EQUIPMENT CONNECTIONS LEVEL 3

INTERNAL NO.:

E-102

DUMAC# 16-037

EXISTING CUTLER HAMMER PANEL — SEE NOTE 5

VOLTS 120/208 | PHASE 3 | WIRE 4 | PANEL HP111 | LOCATION MAIN ELECT ROOM C174-LOWER FL | FED FROM DP111 | TYPE | MAINS 225 AMPS | ENTER AT | MTG.

DESIGNATION	WATTS A	WATTS B	WATTS C	CIR. No.	BKR NO	A B C	BKR NO	CIR. NO.	WATTS A	WATTS B	WATTS C	DESIGNATION
HP EQ#205	1102			1	2P		2P	2	1102	1102		HP EQ#201
		1102		3	15A		15A	4				
HP EQ#206			1102	5	2P		2P	6			1102	HP EQ#202
	1102			7	15A		15A	8	1102			
HP EQ#207		1102		9	2P		2P	10		1102		HP EQ#203
			1102	11	15A		15A	12			1102	
HP EQ#208	1102			13	2P		3P	14				
		1102		15	15A		20	16				
SPARE				17	15A		A	18				
HP EQ#209	612			19	2P		3P	20				
		612		21	15A		20A	22				
				23				24				
				25				26				
				27			2P	28				
EF-26 EQ#116			500	29	15A		15A	30				
SF-11 EQ#139	500			31	15A		3P	32				
HP EQ#322		1100		33	2P		15	34				
			1100	35	15A		A	36				
HP EQ#323	1100			37	2P		3P	38				
		1100		39	15A		30	40				
HP EQ#324			1100	41	2P		A	42				
	1100			43	15A		3P	44				
SEE NOTE 2 — HP EQ#344, (E) HP-36		1100		45	2P		30	46				
			1100	47	15A		A	48				
				49				50				
				51				52				
				53				54				
				55				56				
				57				58				
				59				60				
				61				62				
				63				64				
				65				66				
				67				68				
				69				70				
				71				72				

ø'A' TOTAL
ø'B' TOTAL
ø'C' TOTAL

TOTAL LOAD _____ KW _____ AMP

EXISTING CUTLER HAMMER PANEL — SEE NOTE 5

VOLTS 120/208 | PHASE 3 | WIRE 4 | PANEL HP134 | LOCATION MECHANICAL A341 | FED FROM DP131 | TYPE | MAINS 225 AMPS | ENTER AT | MTG.

DESIGNATION	WATTS A	WATTS B	WATTS C	CIR. No.	BKR NO	A B C	BKR NO	CIR. NO.	WATTS A	WATTS B	WATTS C	DESIGNATION
HP EQ#311	983			1	3P		3P	2	983			
		983		3	30		30	4		983		HP EQ#310
			983	5	A		A	6			983	
HP EQ#308	1343			7	3P		3P	8	1343			
		1343		9	30		30	10		1343		HP EQ#306
			1343	11	A		A	12			1343	
HP EQ#305	1343			13	3P		3P	14	1343			
		1343		15	30		30	16		1343		HP EQ#318, (G) HP-137 — SEE NOTE 3
			1343	17	A		A	18			1343	
SEE NOTE 3 — HP EQ#319, (G) HP-138	1343			19	3P		3P	20	1100			
		1343		21	20		20	22		1100		HP EQ#321, (E) HP-139 — SEE NOTE 2
			1343	23	A		A	24			1100	
HP EQ#304	983			25	3P		2P	26	1102			
		983		27	30		15A	28		1102		HP EQ#317, (E) HP-94 — SEE NOTE 2
			983	29	A		2P	30			943	
HP EQ#307	983			31	3P		15A	32	943			HP EQ#320, (B) HP-136 — SEE NOTE 1
		983		33	30		15A	34				
			983	35	A		15A	36			500	EF-16 EQ#107
HP EQ#357	750			37	2P		3P	38	500			EF-33 EQ#123
		750		39	15A		40	40		500		EF-36 EQ#126
HP EQ#358	1100			41	15A		15A	42			500	EF-15 EQ#143
		1100		43	2P		20A	44	700			EF-17 EQ#62
SEE NOTE 2 — HP EQ#359, (E) HP-140	1100			45	2P		15A	46		500		EF-30 EQ#120
		1100		47	15A		2P	48			1500	HEAT WHEEL EQ#66
				49	2P		20A	50	1500			
				51	15A		15A	52		100		RDT. DET. EQ#67
				53	15A		15A	54				
				55			15A	56				
				57			15A	58				
				59			15A	60				
				61			15A	62				
				63			15A	64				
				65				66				
				67				68				
				69				70				
				71				72				

ø'A' TOTAL
ø'B' TOTAL
ø'C' TOTAL

TOTAL LOAD _____ KW _____ AMP

22 KAIC @ 240VAC

EXISTING CUTLER HAMMER PANEL — SEE NOTE 5

VOLTS 120/208 | PHASE 3 | WIRE 4 | PANEL HP121 | LOCATION STOR. A250 | FED FROM DP131 | TYPE | MAINS 225 AMPS | ENTER AT | MTG.

DESIGNATION	WATTS A	WATTS B	WATTS C	CIR. No.	BKR NO	A B C	BKR NO	CIR. NO.	WATTS A	WATTS B	WATTS C	DESIGNATION
				1	2P		2P	2	852			HP EQ#260, (B) HP-45 — SEE NOTE 1
				3	15A		15A	4		852		
				5	2P		2P	6			852	HP EQ#261, (A) HP-43 — SEE NOTE 1
				7	15A		15A	8	852			
				9	2P		2P	10		1102		HP EQ#255, (E) HP-46 — SEE NOTE 1
				11	15A		15A	12			1102	
SEE NOTE 2 — HP EQ#258, (C) HP-49				13	2P		2P	14	1102			HP EQ#254, (E) HP-48 — SEE NOTE 2
				15	15A		15A	16		1102		
				17	2P		2P	18			1102	HP EQ#253, (E) HP-51 — SEE NOTE 2
				19	15A		15A	20	1102			
SEE NOTE 1 — HP EQ#257, (C) HP-52				21	2P		2P	22				
				23	15A		20A	24				
SEE NOTE 1 — HP EQ#259, (C) HP-47	730			25	2P		2P	26				
		730		27	15A		20A	28				
SEE NOTE 1 — HP EQ#338, (B) HP-50			800	29	2P		2P	30				
	800			31	15A		15A	32				
SEE NOTE 1 — HP EQ#340, (A) HP-41		530		33	2P			34				
			530	35	15A			36				
SEE NOTE 1 — HP EQ#341, (B) HP-44	530			37	2P		3P	38	956			HP EQ#342, (E) HP-40 — SEE NOTE 2
		530		39	15A		15A	40		956		
SPARE				41	3P			42				
				43	30			44				
				45	A			46				
SEE NOTE 3 — HP EQ#343, (G) HP-37	1343			47	3P			48				
		1343		49	20			50				
			1343	51	A			52				
SEE NOTE 3 — HP EQ#262, (G) HP-39	1343			53	3P			54				
		1343		55	20			56				
SEE NOTE 1 — HP EQ#346, (B) HP-38			560	57	A			58				
	560			59	2P			60				
SEE NOTE 1 — HP EQ#347, (A) HP-42		560		61	15A			62				
			560	63	2P			64				
				65	15A			66				
				67				68				
				69				70				
				71				72				

ø'A' TOTAL
ø'B' TOTAL
ø'C' TOTAL

TOTAL LOAD _____ KW _____ AMP

EXISTING CUTLER HAMMER PANEL — SEE NOTE 5

VOLTS 120/208 | PHASE 3 | WIRE 4 | PANEL HP125 | LOCATION STOR. A241 | FED FROM DP132 | TYPE | MAINS 225 AMPS | ENTER AT | MTG.

DESIGNATION	WATTS A	WATTS B	WATTS C	CIR. No.	BKR NO	A B C	BKR NO	CIR. NO.	WATTS A	WATTS B	WATTS C	DESIGNATION
SEE NOTE 2 — HP EQ#252, (E) HP-53	1102			1	2P		3P	2				
		1102		3	15A		15	4				
				5	2P			6				
				7	15A		2P	8	983			
SEE NOTE 2 — HP EQ#250, (D) HP-56		1102		9	2P		15A	10		983		HP EQ#251, (A) HP-55 — SEE NOTE 2
SEE NOTE 2 — HP EQ#350, (B) HP-58	560		1102	11	15A		15A	12				
		560		13	2P		3P	14				
SEE NOTE 2 — HP EQ#349, (D) HP-57			1102	15	15A		20	16				
	1102			17	2P		A	18				
HP EQ#337		600		19	15A		3P	20				
			600	21	2P		15	22				
SEE NOTE 4 — HP EQ#256, (F) HP-54	983			23	15A		A	24				
		983		25	3P		15A	26				EF-32 EQ#122
			983	27	15A		15A	28				EF-41 EQ#130
HP EQ#329	700			29	A			30				
		700		31	2P			32				
SEE NOTE 2 — HP EQ#339, (A) HP-59			530	33	30A			34				
	530			35	2P			36				
				37	15A			38				
				39				40				
				41				42				

ø'A' TOTAL
ø'B' TOTAL
ø'C' TOTAL

TOTAL LOAD _____ KW _____ AMP

BUSSED SPACE

3X	20A/3P HFD EQ#312	SPACE
3X	15A/3P HFD EQ#309, (H) HP-98 — NOTE 1	15A/3P HFD CH1 VEST A216 EQ#53 — 3X
3X	15A/3P HFD	15A/3P HFD CH2 STAIR 5 SPARE EQ#147 — 3X
3X	15A/3P HFD EQ#154	15A/3P HFD CH1 ENTRY A281 EQ#48 — 3X
3X	20A/3P HFD EQ#313	15A/3P HFD CH2 VEST C249 EQ#49 — 3X
3X	20A/3P HFD EQ#314	20A/3P HFD UH1 EXT. STOR C260 EQ#157 — 3X
3X	20A/3P HFD EQ#315	100A/3P HFD PANEL 332 — 3X

BUSSED SPACE

1 / E-103 DISTRIBUTION PANEL 'DP332'

600/347V 3ø 4W-400A MAINS
P4LAC4-40X
MECHANICAL A341

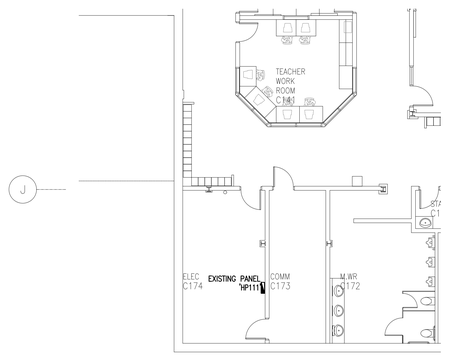
N.T.S.

ELECTRICAL LEGEND:

- (359) — INDICATES MECHANICAL EQUIPMENT NUMBER, REFER TO DWG E-104 FOR MOTOR STARTER & CONTROL LIST
- EXISTING LIGHTING AND BRANCH CIRCUIT PANEL BOARD
- EXISTING DISTRIBUTION PANEL
- HP-20 — HEAT PUMP, SEE MECHANICAL DRAWINGS. NUMBER DESIGNATES HEAT PUMP IDENTIFICATION.
- EXISTING
- NEW

NOTES:

1. DISCONNECT EXISTING HEAT PUMP AND RECONNECT NEW HEAT PUMP TO EXISTING BREAKER. EXISTING TOGGLE TYPE DISCONNECT SWITCH TO BE REPLACED WITH NON-FUSED, SPECIFICATION GRADE, HEAVY DUTY, BLADE TYPE DISCONNECT SWITCH MOUNTED IN ACCESSIBLE CEILING SPACE ADJACENT TO UNIT. INSTALL LAMICOID IDENTIFICATION ON DISCONNECT. EXTEND EXISTING CIRCUITRY WHERE REQUIRED. FINAL CONNECTION TO HEAT PUMP TO BE MADE USING LIQUID TIGHT METAL FLEXIBLE CONDUIT. REMOVE ALL REDUNDANT CONDUIT, BOXES, WIRE, ETC.
2. DISCONNECT EXISTING HEAT PUMP AND RECONNECT NEW HEAT PUMP TO A NEW 15A/2P BREAKER. BREAKER TYPE TO MATCH EXISTING. EXISTING TOGGLE TYPE DISCONNECT SWITCH TO BE REPLACED WITH NON-FUSED, SPECIFICATION GRADE, HEAVY DUTY, BLADE TYPE DISCONNECT SWITCH MOUNTED IN ACCESSIBLE CEILING SPACE ADJACENT TO UNIT. INSTALL LAMICOID IDENTIFICATION ON DISCONNECT INDICATING PANEL AND CIRCUIT NUMBER. RUN 2#12 RW90 Cu.+#12B IN 21mm LIQUID TIGHT METAL FLEXIBLE CONDUIT FROM DISCONNECT SWITCH TO HEAT PUMP. REMOVE ALL REDUNDANT CONDUIT, BOXES, WIRE, ETC.
3. DISCONNECT EXISTING HEAT PUMP AND RECONNECT NEW HEAT PUMP TO A NEW 20A/3P BREAKER. BREAKER TYPE TO MATCH EXISTING. EXISTING TOGGLE TYPE DISCONNECT SWITCH TO BE REPLACED WITH NON-FUSED, SPECIFICATION GRADE, HEAVY DUTY, BLADE TYPE DISCONNECT SWITCH MOUNTED IN ACCESSIBLE CEILING SPACE ADJACENT TO UNIT. INSTALL LAMICOID IDENTIFICATION ON DISCONNECT INDICATING PANEL AND CIRCUIT NUMBER. RUN 3#12 RW90 Cu.+#12B IN 21mm LIQUID TIGHT METAL FLEXIBLE CONDUIT FROM DISCONNECT SWITCH TO HEAT PUMP. REMOVE ALL REDUNDANT CONDUIT, BOXES, WIRE, ETC.
4. DISCONNECT EXISTING HEAT PUMP AND RECONNECT NEW HEAT PUMP TO A NEW 15A/3P BREAKER. BREAKER TYPE TO MATCH EXISTING. EXISTING TOGGLE TYPE DISCONNECT SWITCH TO BE REPLACED WITH NON-FUSED, SPECIFICATION GRADE, HEAVY DUTY, BLADE TYPE DISCONNECT SWITCH MOUNTED IN ACCESSIBLE CEILING SPACE ADJACENT TO UNIT. INSTALL LAMICOID IDENTIFICATION ON DISCONNECT INDICATING PANEL AND CIRCUIT NUMBER. RUN 3#12 RW90 Cu.+#12B IN 21mm LIQUID TIGHT METAL FLEXIBLE CONDUIT FROM DISCONNECT SWITCH TO HEAT PUMP. REMOVE ALL REDUNDANT CONDUIT, BOXES, WIRE, ETC.
5. -TRACE AND IDENTIFY ALL CIRCUITS FED FROM THIS PANEL.
-PROVIDE NEW TYPED PANEL DIRECTORY. DIRECTORY IS TO BE SINGLE SIDED. FOR EXAMPLE, A 72 CIRCUIT PANEL WILL SHOW ALL BREAKERS FROM 1-72 ON A SINGLE SIDE.
-INCLUDE HEAT PUMP DESIGNATION ADJACENT TO EQUIPMENT NUMBER. FOR EXAMPLE, "EQ#358, HP#95".



2 / E-103 PARTIAL FLOOR PLAN – ELECTRICAL ROOM C174

1:100

Halifax Regional School Board

DUMAC

DUMAC ENERGY LTD.
CONSULTING ENGINEERS
752 BEDFORD HIGHWAY
HALIFAX, N.S.
Tel: (902) 457-1300
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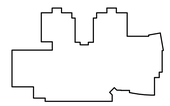
KEY PLAN



GRAPHIC SCALE

DATE	MARK	ISSUE
20160718	1	ISSUED FOR TENDER

STAMP

SCALE	AS NOTED
DRAWN BY:	STAFF
CHECKED BY:	DMD
REVIEWED BY:	DMD
APPROVED BY:	DMD
AS-BUILT CHECK	
DATE:	JULY 2016

PROJECT
HALIFAX WEST HIGH SCHOOL HEAT PUMP REPLACEMENT – PHASE 2
283 THOMAS RADDALL DR. HALIFAX, NS

PROJECT NO.:

SHEET TITLE
EXISTING PANEL SCHEDULES, ELECTRICAL LEGEND, DISTR. PANEL ELEVATION, AND PARTIAL ELEC. FLOOR PLAN

INTERNAL NO.:

E-103

DUMAC# 16-037

MOTOR STARTER AND CONTROL LIST

E–DIVISION 16 / M–DIVISION 15 / U–USERS EQUIPMENT / X–PROVIDE

1–STOP–START, 2–ON–OFF, 3–HAND–OFF–AUTO, 4–PILOT LIGHT, 5–CONTROL RELAY, 6–TIMING RELAY, 7–DOUBLE VOLTAGE RELAY, 8–AQUASTAT, 9–ELECTRO PNEUMATIC SWITCH, 10–PNEUMATIC ELECTRO SWITCH, 11–SOLENOID, 12–MOTORIZED DAMPER, 13–FLOAT SWITCH, 14–PRESSURE SWITCH, 15–FLOW SWITCH, 16–AIRFLOW SWITCH, 17–CONTROL TRANSFORMER, 18–THERMOSTAT, 19–INTEGRAL CONTROL PANEL, 20–FIRE ALARM SHUTDOWN, 21–FREEZE PROTECTION, 22–FIRE PROTECTION, 23–HIGH LIMIT, 24–LOW LIMIT, 25–BUILDING AUTOMATION SYSTEM, 26–ALTERNATOR, 27–INTERVAL TIMER, 28–RECEPTACLE, 29–TOGGLE SWITCH UP, 30–REMOTE PANEL

EQUIPMENT NO.	LOCATION	EQUIPMENT	STARTER: SUPPLIED UNDER	STARTER: INSTALLED UNDER	STARTER: WIRED UNDER	EQUIPMENT RATING: KW	VOLTAGE	PHASE	PANEL & CIRCUIT NO.	STARTER: IN COVER: MANUAL	STARTER: IN COVER: TOGGLE LOCK	STARTER: IN COVER: PILOT LIGHT	STARTER: MAGNETIC	STARTER: COMBINATION	STARTER: FUSE TYPE	STARTER: OVERLOAD TRANS	STARTER: AUXILARY CONTACT	STARTER: BREAKER TYPE	STARTER: STD FUSED TYPE	STARTER: NON FUSED TYPE	STARTER: NOTE	STARTER: IN COVER: HAND–OFF–AUTO	STARTER: IN COVER: ON LIGHT RED	STARTER: IN COVER: SLOW LIGHT AMBER	STARTER: IN COVER: FAST LIGHT BLUE	STARTER: IN COVER: CSA ENCLOSURE TYPE	STARTER: LEGEND ABOVE	STARTER: MOTOR	STARTER: ON–OFF	STARTER: SUPPLIED UNDER	STARTER: INSTALLED UNDER	STARTER: WIRED UNDER	LOCATE AT MOTOR: DISCONNECT SWITCH	LOCATE AT MOTOR: SPEED DRIVE	LOCATE AT MOTOR: TOGGLE LOCK	LOCATE AT MOTOR: LEGEND ABOVE	LOCATE AT MOTOR: COYOTE DRIVE	LOCATE AT MOTOR: NOTE	LOCATE AT MOTOR: SUPPLIED UNDER	LOCATE AT MOTOR: INSTALLED UNDER	LOCATE AT MOTOR: WIRED UNDER	REMOTE CONTROL: LEGEND ABOVE	REMOTE CONTROL: LOCK	REMOTE CONTROL: LEGEND ABOVE	REMOTE CONTROL: NOTES	REMOTE CONTROL: SUPPLIED UNDER	REMOTE CONTROL: INSTALLED UNDER	REMOTE CONTROL: WIRED UNDER	REMOTE CONTROL: LEGEND ABOVE	REMOTE CONTROL: LOCK	REMOTE CONTROL: LEGEND ABOVE	REMOTE CONTROL: NOTES	REMOTE CONTROL: SUPPLIED UNDER	REMOTE CONTROL: INSTALLED UNDER	REMOTE CONTROL: WIRED UNDER	INTERLOCK WITH EQUIP. NO.	INTERLOCK WITH EQUIP. NO.	INTERLOCK WITH EQUIP. NO.	INTERLOCK WIRED BY	FEEDER DETAILS FROM	EQUIPMENT NO.
250	CORRIDOR A204	HEAT PUMP "D" HP–56	M	M	E	1.70	208	1	HP125–9,11																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	250
251	CORRIDOR A204	HEAT PUMP "A" HP–55	M	M	E	1.06	208	1	HP125–8,10																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	251
252	CORRIDOR A204	HEAT PUMP "E" HP–53	M	M	E	2.20	208	1	HP125–1,3																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	252
253	CORRIDOR A204	HEAT PUMP "E" HP–51	M	M	E	2.20	208	1	HP121–18,20																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	253
254	CORRIDOR A204	HEAT PUMP "E" HP–48	M	M	E	2.20	208	1	HP121–14,16																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	254
255	CORRIDOR A204	HEAT PUMP "E" HP–46	M	M	E	2.20	208	1	HP121–10,12																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	255
256	CORRIDOR A204	HEAT PUMP "F" HP–54	M	M	E	2.95	208	3	HP125–25,27,29																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	256
257	CORRIDOR A204	HEAT PUMP "C" HP–52	M	M	E	1.50	208	1	HP121–21,23																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	257
258	CORRIDOR A204	HEAT PUMP "C" HP–49	M	M	E	1.50	208	1	HP121–13,15																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	258
259	CORRIDOR A204	HEAT PUMP "C" HP–47	M	M	E	1.50	208	1	HP121–25,27																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	259
260	YMCA A274	HEAT PUMP "B" HP–45	M	M	E	1.13	208	1	HP121–2,4																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	260
261	CORRIDOR A204	HEAT PUMP "A" HP–43	M	M	E	1.13	208	1	HP121–6,8																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	261
262	CORRIDOR A203	HEAT PUMP "G" HP–39	M	M	E	1.03	208	3	HP121–53,55,57																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	262
309	CORRIDOR A304	HEAT PUMP "H" HP–98	M	M	E	6.33	600	3	DP332																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	309
317	CORRIDOR A303	HEAT PUMP "E" HP–94	M	M	E	2.20	208	1	HP134–26,28																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	317
318	CORRIDOR A302	HEAT PUMP "G" HP–137	M	M	E	4.03	208	3	HP134–14,16,18																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	318
319	CORRIDOR A302	HEAT PUMP "G" HP–138	M	M	E	4.03	208	3	HP134–19,21,23																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	319
320	CORRIDOR A302	HEAT PUMP "B" HP–136	M	M	E	1.13	208	1	HP134–30,32																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	320
321	CORRIDOR A302	HEAT PUMP "E" HP–139	M	M	E	2.20	208	1	HP134–20,22																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	321
338	CORRIDOR A204	HEAT PUMP "B" HP–50	M	M	E	1.70	208	1	HP121–29,31																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	338
339	ENTRANCE A200	HEAT PUMP "A" HP–59	M	M	E	1.06	208	1	HP125–35,37																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	339
340	CORRIDOR A203	HEAT PUMP "A" HP–41	M	M	E	1.06	208	1	HP121–33,35																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	340
341	CORRIDOR A204	HEAT PUMP "B" HP–44	M	M	E	1.06	208	1	HP121–37,39																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	341
342	CORRIDOR A203	HEAT PUMP "E" HP–40	M	M	E	4.03	208	3	HP121–38,40																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	342
343	CORRIDOR A203	HEAT PUMP "G" HP–37	M	M	E	4.03	208	3	HP121–47,49,51																		19		M	M	E	X						E	E	E	25		M	M	M											3#12+#12B–16mmC	343
344	CORRIDOR A203	HEAT PUMP "E" HP–36	M	M	E	2.20	208	1	HP111–45,47																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	344
																																																							345
346	CORRIDOR A257	HEAT PUMP "B" HP–38	M	M	E	1.13	208	1	HP121–59,61																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	346
347	CORRIDOR A204	HEAT PUMP "A" HP–42	M	M	E	1.06	208	1	HP121–63,65																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	347
349	CORRIDOR A204	HEAT PUMP "D" HP–57	M	M	E	1.70	208	1	HP125–17,19																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	349
350	ENT. A200	HEAT PUMP "B" HP–58	M	M	E	1.13	208	1	HP125–13,15																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	350
359	CORRIDOR A302	HEAT PUMP "E" HP–140	M	M	E	2.20	208	1	HP134–49,51																		19		M	M	E	X						E	E	E	25		M	M	M											2#12+#12B–16mmC	359

DUMAC# 16–037

Halifax Regional School Board

DUMAC ENERGY LTD.
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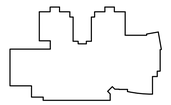
KEY PLAN



GRAPHIC SCALE

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APPROVED BY:	DMD
AS–BUILT CHECK	
DATE:	JULY 2016

PROJECT
HALIFAX WEST HIGH SCHOOL HEAT PUMP REPLACEMENT – PHASE 2
283 THOMAS RADDALL DR. HALIFAX, NS

PROJECT NO.:

SHEET TITLE
EXISTING MOTOR STARTER AND CONTROL LIST

INTERNAL NO.:

E-104