T E N D E R
Tender # 2021-085303T –
HVAC & Control System Upgrades – Municipal Operations Building

Emailed tenders addressed Chris Roberts, CPPB, SCMP, Procurement Manager, Supply Chain Management, with the title:

"Tender # 2021-085303T –
HVAC & Control System Upgrades –
Municipal Operations Building"

will be received until 2:30 pm, Tuesday, August 31, 2021 for the upgrading of the HVAC and control systems in the Municipal Operations Building, located at 175 Rothesay Avenue, in accordance with the enclosed specifications, drawings, terms and conditions.

The lowest or any tender not necessarily accepted.

Chris Roberts, CPPB, SCMP
Procurement Manager
Supply Chain Management

Issued for Tender: Thursday, August 11, 2021

City of Saint John

Contract Specifications

TENDER NO. 2021-085303T
HVAC AND CONTROL SYSTEM UPGRADES –
MUNICIPAL OPERATIONS BUILDING

City of Saint John

CONTRACT SPECIFICATIONS

FOR

TENDER NO. 2021-085303T
HVAC AND CONTROL SYSTEM UPGRADES – MUNICIPAL OPERATIONS BUILDING

AUGUST 2021

City of Saint John

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DIVISION 1 – PROJECT DESCRIPTION

PROJECT DESCRIPTION

1.1 GENERAL DESCRIPTION

The work consists generally of supplying all labour, materials, and equipment for the upgrading of the HVAC and Control Systems at the Municipal Operations Building at 175 Rothesay Avenune as per the Specifications and Drawings.

1.2 CONTRACT DOCUMENTS

a) General Specifications, City of Saint John, New Brunswick, with all applicable Divisions as listed in the Table of Contents of the Contract Specifications.

b) Contract Specifications,
Tender No.: 2021-085303T
Contract: HVAC and Control System Upgrades – Municipal Operations Building
City of Saint John, New Brunswick

c) List of Drawings

Sheet No.	Title
MD-1	Level 1 Demolition
MD-2	Level 2 Plan – Demolition
M-1	Level 1 HVAC Plan
M-2	Level 2 HVAC Plan
M-3	Roof Plan & Details
M-4	Controls
E-1	Electrical Plans & Electrical Notes

1.3 AUTHORIZED ENQUIRIES CONTACT

During the procurement phase of this project, all inquiries shall be referred to:

Chris Roberts, SCMP, CPPB
Procurement Manager
Supply Chain Management
City of Saint John
175 Rothesay Avenue, Saint John, NB
supplychainmanagement@saintjohn.ca

City of Saint John

CONTRACT SPECIFICATIONS

DIVISION 2

INSTRUCTIONS TO TENDERERS AND TENDERING PROCEDURES

AUGUST 2021

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DIVISION 2 – INSTRUCTIONS TO TENDERERS AND TENDERING PROCEDURES

INSTRUCTIONS TO TENDERERS AND TENDERING PROCEDURES

2.1 TRADE TREATIES AND TENDERING POLICY

2.1.01 Internal Trade Agreements

Tenderers should note that the within procurement is subject to internal trade agreements including the Canadian Free Trade Agreement and the Atlantic Procurement Agreement and the Agreement on opening public procurement for Quebec and NB.

2.1.02 Tendering Policy

Tenderers should note that the within Procurement shall conform with The City of Saint John "Tendering Policy for Construction Contracts" which is attached hereto as Appendix "A".

2.2 MATERIAL DISCLOSURES

2.2.01 General

The City makes the following material disclosures with respect to this Request for Tender. While the City has used considerable efforts to ensure the accurate representation of all information in this Request for Tender, including these material disclosures, such information is supplied solely as a guideline for Tenderers. The City does not warrant or guarantee the accuracy of such information, nor is such information necessarily comprehensive or exhaustive. Nothing in this Request for Tender is intended to relieve Tenderers of the obligation to form their own opinions and reach their own conclusions with respect to the matters addressed in this Request for Tender.

2.2.02 Permits Required for Project

Except as stated otherwise in the Tender Document, any and all permits and approvals required by the Authorities having jurisdiction, and arrangements for all inspections of the Work by these Authorities shall be obtained and paid for by the Contractor. The cost of such approvals, permits and inspection shall be included in the Tender Price.

2.2.03 Deemed Examination and Acceptance

Tenderers should note that by submission of a Tender they will be deemed to have examined and accepted the Specifications and Drawings, visited the site, and informed themselves as to existing conditions and limitations.

2.2.04 Availability of Services

The Tenderer shall ascertain from the relevant Authorities the availability of services, including, but not limited to, electricity, sewer, water, telephone, natural gas and transportation to the project and shall ascertain what prior notice each Authority will require for the installation of the service to the project.

2.2 MATERIAL DISCLOSURES (Cont'd)

2.2.05 Tax

a) Tenderers are advised to make special note of all applicable tax procedures.

b) The City is required to pay the Harmonized Sales Tax (HST).

c) The total tendered amount shall include the appropriate taxes on all labour, material and equipment to be incorporated into the Work.

d) Tenderers shall submit their Tenders on the basis that the total amount of the Tender shall include all taxes for which the City is liable.

e) Any increase or decrease in costs to the Tenderer due to the changes in such taxes and duties, after the date of the Tender Closing, shall increase or decrease the value of the Contract accordingly.

2.2.06 Performance Guarantees Required Prior to Contract Execution

Within five (5) Working Days following the City's notice of selection, the selected Tenderer shall provide the City with the required Performance Guarantees, in the form of either:

a) A Performance Bond and a Labour and Material Payment Bond, each at fifty percent (50%) of the Tender Price covering the faithful performance of the full Contract. The bonds shall be in favour of *The City of Saint John* and show *The City of Saint John* as obligee; or

b) A certified cheque in the amount of twenty percent (20%) of the Tender Price covering the faithful performance of the full contract.

2.2.07 Insurance

Tenders should refer to Division 6 (section 6.8) for details regarding insurance requirements.

2.2 MATERIAL DISCLOSURES (Cont'd)

2.2.08 WorkSafeNB Certificate and Business Corporations Act Certificate

a) New Brunswick Tenderers shall provide to the City a WorkSafeNB certificate which confirms proper registration and good standing with WorkSafeNB and a *Business Corporations Act* Certificate which confirms proper registration with the Province of New Brunswick - Corporate Affairs (of which the Contractor must be in good standing) within five (5) Working Days following the City's notice of selection.

b) Out-of-province Tenderers shall provide to the City a WorkSafeNB certificate which confirms proper registration and good standing with WorkSafeNB or a letter or certificate issued under the equivalent applicable legislation in the province of origin of the Tenderer confirming extension of coverage from said legislation to the Province of New Brunswick for the term of the Contract. Subject to paragraph c), out-of-province Tenderers shall also provide a *Business Corporations Act* Certificate which confirms proper registration with the Province of New Brunswick - Corporate Affairs (of which the Contractor must be in good standing) within five (5) Working Days following the City's notice of selection.

c) Tenderers from Nova Scotia may submit the appropriate *Business Corporations Act* Certificate from the Province of Nova Scotia.

2.2.09 New Brunswick Construction Safety Association

If the total Tender Price for the work, inclusive of HST, is two hundred and fifty thousand dollars ($250,000.00) or more, Tenderers shall supply a Letter of Good Standing under the Certificate of Recognition Program from the New Brunswick Construction Safety Association. Out-of-Province Tenderers shall supply an equivalent from the Tenderer's Province of origin acceptable to the Engineer.

2.2.10 Timetable for Completion of the Work

The Substantial Completion date of the Work is March 31, 2022.

2.3 SCHEDULE FOR THE TENDER PROCESS

Issue Date of Request for Tender	Thursday, August 12, 2021
Site Visit	Wednesday, August 18, 2021, 2:00 pm, ADT
Deadline for Enquiries	Monday, August 23, 2021, 4:00 pm, ADT
Deadline for Issuing Addenda	Tuesday, August 24, 2021, 4:00 pm, ADT
Tender Closing	Tuesday, August 31, 2021, 2:30 pm, ADT

The Schedule for the Tender Process is tentative only and may be changed by the City in its sole discretion at any time prior to Tender Closing.

2.4 TENDER DOCUMENTS

2.4.01 Tender Documents to be Obtained in Prescribed Manner

Tender Documents shall be obtained by visiting the City's website at www.saintjohn.ca, "Current Tenders and Proposals".

Tenderers must register on the City's official list of bidders for this project, as follows:

(i) registration of the full legal name, contact person, telephone number and email address of the Tenderer obtaining the Tender Documents; or, if applicable,

(ii) the registration of the full legal name, contact person, telephone number and email address of the Tenderer on whose behalf the Tender Documents are being obtained.

The names of the Tenderers having complied with the above criteria will be consolidated onto the City's official bidders list. Only Tenderers listed on the City's official bidders list shall be entitled to submit a Tender. Any Tender received from a Tenderer who has not obtained the Tender Documents from the City of Saint John and is not registered on the City's official list of bidders for this project in the manner set out above will not be evaluated.

2.5 COMMUNICATIONS AFTER ISSUANCE OF TENDER

2.5.01 Tenderers to Review Tender Documents

Tenderers shall promptly examine all Tender Documents and:

a) shall report any errors, omissions or ambiguities; and

b) may direct enquiries or seek additional information

in writing by email before the Deadline for Enquiries to the Authorized Enquiries Contact or the Designated Alternate Contact (in the event of absence) as set out below. No such communications are to be directed to anyone other than the Authorized Enquiries Contact or the Designated Alternate Contact.

Authorized Enquiries Contact	**Designated Alternate Contact**
Chris Roberts, SCMP, CPPB Procurement Manager Supply Chain Management City of Saint John Email: chris.roberts@saintjohn.ca	Monic MacVicar, CPPB Procurement Specialist Supply Chain Management City of Saint John Email: monic.macvicar@saintjohn.ca

It is the Tenderer's responsibility to seek clarification from the City on any matter it considers unclear. The City shall not be responsible for any misunderstanding on the part of the Tenderer concerning this Tender or its process.

The City intends to confirm receipt of a Tenderer's communication by way of an email in reply. If a Tenderer has not received a reply, the Tenderer may wish to resend its communication as the lack of reply may have resulted from a technical problem. The City is under no obligation to respond to enquiries or provide additional information but may do so at its sole discretion.

2.5 COMMUNICATIONS AFTER ISSUANCE OF TENDER (Cont'd)

2.5.02 Email Communication

The following provisions shall apply to any communications with the Authorized Enquiry Contact or the Designated Alternate Contact by email where such email communication or delivery is permitted by the terms of this Tender:

a) The City does not assume any risk or responsibility or liability whatsoever to any Tenderer:

(i) for ensuring that any email system being operated for the City is in good working order, able to receive transmissions, or is not engaged in receiving other transmissions such that a Tenderer's transmission cannot be received;

(ii) if a permitted email communication or delivery is not received by the City, or is received in less than its entirety, within any time limit specified by this Tender; and

(iii) for any error that may occur in the submission of communications or enquiries.

b) All permitted communications submitted by a Tenderer by email to the Authorized Enquiries Contact or the Designated Alternate Contact shall be deemed to have been received on the dates and times indicated on the Authorized Enquiry Contact's or the Designated Alternate Contact's email system

2.5.03 Addenda: Responses to Enquiries and Amendments or Clarifications to Tender Documents

The City may, in its sole and absolute discretion, through the Authorized Enquiry Contact or the Designated Alternate Contact, respond to enquiries and/or amend the Tender Documents before Tender Closing.

Written Addenda are the only means of responding to enquiries or amending the Tender Documents. Only the Authorized Enquiry Contact or the Designated Alternate Contact, and no other employee or agent of the City, is authorized to respond to enquiries and amend the Tender Documents by issuing an Addendum.

Responses to enquiries, changes, clarifications or corrections prepared and circulated by the City form part of the Tender Documents and will be issued as Addenda. Responses will be made in writing and distributed by email to all Tenderers who are registered on the City's official bidders list in accordance with the procedure outlined in section 2.4.01 b) above, as of the date the response is prepared by the City. Each Addendum will contain a signature page(s) which each Tenderer is required to sign and include with its Tender submission. While the City will make reasonable efforts to deliver each Addendum to all Tenderers, it makes no guarantee of timely delivery of any Addendum to any Tenderer.

2.5.03 Addenda: Responses to Enquiries and Amendments or Clarifications to Tender Documents (Cont'd)

The City will not identify the source of the question in the response. If a Tenderer requests that an enquiry be treated as confidential, the City, in its sole discretion, will either treat the enquiry or any reply as confidential or inform the Tenderer that it will not respond to the enquiry unless the Tenderer withdraws in writing its request that the enquiry be treated as confidential.

Orally communicated information shall not be binding upon the City. Information offered from sources other than the Authorized Enquiry Contact or the Designated Alternate Contact with regard to the content, intent or interpretation of this Tender is not official, may be inaccurate and should not be relied on in any way, by any Tenderer, for any purpose.

2.6 SUBMISSION OF TENDER

2.6.01 Location of Tender Box for the Submission of Tender

175 Rothesay Avenue, 2nd Floor
Saint John, New Brunswick

2.6.02 Tenders Must be Submitted Only in the Prescribed Manner

a) Tenders must be submitted in the prescribed *Form of Tender* together with the prescribed *Schedule of Quantities and Unit Prices*. The *Form of Tender* and the *Schedule of Quantities and Unit Prices* shall be filled out in ink or typewritten and bear the signature in longhand.

b) Tenderers must submit one completely filled out original *Form of Tender* signed by an authorized representative and should include the following information written on the outside of the sealed envelope:

(i) Tender No.;

(ii) Title of Work;

(iii) The full legal name and return address of the Tenderer; and

(iv) Tender Closing date and time.

c) Each Tender shall be accompanied by a Tender (Bid) Bond or certified cheque in the amount of ten percent (10%) of the Tender Price.

d) Each Tender must be sealed and be addressed to the attention of the Purchasing Agent, City of Saint John, 2nd Floor,175 Rothesay Avenue, Saint John, New Brunswick, E2J 2B4.

e) All Tenders shall include a surety consent letter or agreement to bond as per the requirements in the Form of Tender.

2.6 SUBMISSION OF TENDER (Cont'd)

2.6.03 Contingency Allowance

The Tender Price shall include the contingency allowance as specified in the *Schedule of Quantities and Unit Prices*, to cover additional costs that may occur during the execution of the Contract attributed to approved additional work not originally contemplated. No part of this allowance shall be expended without the written direction of the Engineer, and any part not so expended shall be deducted from the contingency allowance.

2.6.04 Tenders Must be Placed in the Tender Box Before Tender Closing

It is the responsibility of each Tenderer to ensure that its Tender is placed in the Tender Box before Tender Closing. Tenders submitted by fax or by any other electronic transmission will not be considered.

Tenders submitted after Tender Closing will be deemed late, Disqualified and returned to the Tenderer unopened. For the purpose of calculating time, the City clock at the location of the Tender Box shall govern.

The City is not responsible for any Tender that has not been placed in the Tender Box by the Tenderer. The City assumes no responsibility for improperly addressed or delivered Tenders, Tenders that are left outside of the Tender Box, or sent by electronic transmission.

2.6.05 Amending or Withdrawing Tender Prior to Tender Closing

At any time prior to Tender Closing, a Tenderer may amend or withdraw a submitted Tender by placing an amending letter signed by the person who signed the Tender in a sealed envelope in the Tender Box before the Tender Closing.

The amending letter should clearly specify that the Tenderer intends to withdraw its Tender or, in the case of an amendment, clearly indicate the part of the Tender that the amending letter is intending to replace. In the case of a unit price contract, the amending letter shall show the revision to the Tender Price. In the case of a lump sum contract, the amending letter shall state the amount to be added or subtracted from the Tender Price.

The sealed envelope should clearly state the full legal name of the Tenderer, as well as the Tender No., Title of Work, and Tender Closing date and time as stated in section 2.6.02 b).

Amending letters that are left outside of the Tender Box, or sent by mail, by facsimile, electronically, or by other means will not be considered.

2.6.06 Tenderers Shall Bear the Costs of Preparing and Submitting a Tender

Under no circumstances will the City be responsible for a Tenderer's costs of preparing or submitting a Tender.

2.6 SUBMISSION OF TENDER (Cont'd)

2.6.07 Tenders in English

All Tenders are to be in English only. Any Tenders that are not entirely in the English language may be disqualified.

2.6.08 Tender Acceptance Period

Tenders submitted before Tender Closing shall remain open to acceptance in the form submitted by the Tenderer for a period of sixty (60) calendar days after Tender Closing. Failure of the Tenderer to keep the Tender open for sixty (60) calendar days will result in the enforcement of the Tender (Bid) Bond or the cashing of the certified cheque submitted in lieu of the Tender (Bid) Bond pursuant to section 2.6.02 c).

2.6.09 Tender Documents Incorporated into Tender

By submission of a Tender, a Tenderer is deemed to have accepted and incorporated all the instructions and terms and conditions contained in the Tender Documents into its Tender. Submission of a Tender shall also confirm that the Tenderer is satisfied as to the correctness and sufficiency of the Tender, the Tender Price and the prices entered in the *Schedule of Quantities and Unit Prices*.

2.7 AMENDMENT OR WITHDRAWAL OF TENDER POST TENDER CLOSING

2.7.01 No Amendment Post Tender Closing

No Tenderer is permitted to amend or withdraw its Tender after Tender Closing. A Tenderer who discovers an error in his Tender after Tender Closing may leave the Tender as is or request permission from Common Council to withdraw its Tender. A request to withdraw a Tender after Tender Closing must be delivered, along with the reasons for the request, to the Common Clerk for consideration by Common Council within twenty-four (24) hours of Tender Closing.

2.7.02 Withdrawal Requests

Common Council, in its sole discretion, will decide whether or not to grant the withdrawal request based on the information supplied by the Tenderer and a recommendation from City staff. Where Common Council, in its sole discretion, decides to not allow the withdrawal, Common Council may require the Tenderer to perform the Contract or forfeit the Tender (Bid) Bond or the certified cheque submitted in lieu thereof pursuant to section 2.6.02 c).

2.8 TENDER EVALUATION PROCESS

2.8.01 Delivery of Tender Box to Tender Opening Room

Immediately following Tender Closing, the Purchasing Agent shall deliver the Tender Box to the tender opening room where it will be opened by the Tender Opening Committee. Tenderers who have properly registered and who are on the official bidders list will receive an electronic invitation to view the tender opening via Microsoft Teams.

2.8.02 Tender Opening Process

All Tenders shall be removed from Tender Box, opened, evaluated pursuant to Section 2.8.03, then read and recorded by the Tender Opening Committee in public at the Tender Opening Location. The Tender Opening Committee shall open each Tender individually. Tenders submitted by Tenderers who are not registered on the City's official bidders list according to the procedure outlined in section 2.4.01 b) will not be evaluated. The Tender Opening Committee will conduct the evaluation of the Tenders in two stages.

2.8.03 Stage 1: Evaluation of Mandatory Requirements

Stage 1 will consist of a review to determine which Tenders comply with all of the mandatory requirements. Tenders which do not comply with all of the mandatory requirements set out below, shall be Disqualified and not evaluated further.

Tenders shall be deemed as not complying with the mandatory requirements where:

a) The Tender is not in a sealed envelope which bears on its face the full legal name and address of the Tenderer, the Tender number, Title of Work and Tender Closing date and time.

b) The Tender is illegible or its pricing terms or conditions cannot be understood by the Tendering Opening Committee.

c) Where it is a Tender for more than one item and where it is required that all items be bid, there is a failure to bid an item or it does not contain a unit price or extended total of all items to be bid.

d) The Tender contains a bid on an item not included in the *Schedule of Quantities and Unit Prices*.

e) The Tender does not contain the total tender price, the unit prices or the fixed price written in words or does not have the words "dollars" and, where applicable, "cents" set out in the written total tender price, unit prices or fixed price on the *Schedule of Quantities and Unit Prices*.

f) The Tender is not accompanied by the required Tender (Bid) Bond or certified cheque pursuant to section 2.6.02 c).

g) The Tender does not include a fully completed prescribed Form of Tender, signed by an authorized agent, which bears the Tenderer's corporate seal, pursuant to section 2.6.02 a) and Division 4.

2.8.03 Stage 1: Evaluation of Mandatory Requirements (Cont'd)

h) The Tender does not include all required documents specified in the Form of Tender, does not comply with the provisions of the Tender Documents, or does not include the signature page(s) of all addenda issued to the Tenderers signed by the Tenderer.

i) The Form of Tender contains a change in price that is not initialed by the person signing the Form of Tender.

j) The Tender contains an unsolicited alternative or a qualification to the terms of the Tender Documents.

k) Where a Tenderer submits more than one Tender in response to the Request for Tender, all such Tenders shall be Disqualified.

Tenders which are Disqualified by the Tender Opening Committee will be returned to the Tenderer at the address contained in the Tender or in person if the Tenderer is present at the Tender Opening. Tender Prices of Disqualified Tenders will not be announced at the Tender Opening.

2.8.04 Stage 2: Evaluation of Tender Price

Stage 2 will consist of a recording of the Tender Prices by the Tender Opening Committee.

2.8.05 Selection of the Successful Tenderer

At the conclusion of Stage 1 and Stage 2 of the evaluation process and, subject to the approval of selection by Common Council and the reserved rights of the City, the selected Tenderer will enter into the Contract, as set out in the Tender Documents.

2.9 NOTICE OF SELECTION AND EXECUTION OF CONTRACT

2.9.01 Selection of Tenderer

Notice of selection by the City to the selected Tenderer will be in writing. Within five (5) Working Days following the City's notice of selection, the Tenderer shall provide to the City:

a) those items listed at section 6.8.04 ("Insurance Policies and Certificates");

b) an executed Form of Agreement (Division 5); and

c) the required Performance Guarantees pursuant to section 2.2.06

This provision is solely to the benefit of the City and may be waived by the City at its sole discretion.

2.9 NOTICE OF SELECTION AND EXECUTION OF CONTRACT (Cont'd)

2.9.02 Over-Budget Bids

If the Tender Price of the lowest compliant Tender exceeds the City's project budget or the Engineer's estimate for the Project, the City may proceed with negotiations with the lowest compliant Tenderer. Said negotiations shall be conducted within a prescribed timeframe to identify changes in scope and/or quantities of work, in exchange for a corresponding bid price reduction. Where the City and lowest compliant Tenderer establish acceptable changes and a corresponding bid price reduction, those changes shall be documented as post-bid addendum.

Any such negotiations or resulting recommendations shall be conditional and subject to the approval of Common Council and, in accordance with the Limitation of Liability and Waiver set out in section 2.12 below, there shall be no liability resulting from any failure to award a contract.

Where acceptable changes and a corresponding bid price reduction cannot be successfully negotiated with the lowest compliant Tenderer, the City may proceed with a new tender call at a later date.

2.9.03 Failure to Enter into the Contract

In addition to all of the City's other remedies, such as the enforcement of the Tender (Bid) Bond, if a selected Tenderer fails to execute the Contract, or satisfy any of the applicable conditions set out above at section 2.9.01 within five (5) Working Days of the notice of selection, the City may, in its sole and absolute discretion and without incurring any liability rescind the selection of the Tenderer and proceed with the selection of the next lowest compliant Tenderer.

2.10 CONFIDENTIAL INFORMATION AND MEDIA COMMUNICATIONS

2.10.01 Tenderer's Confidential Commercial Information

The City is committed to an open and transparent Tendering Process while understanding the Tenderers' need for protection of confidential commercial information. To assist the City in meeting this commitment, Tenderers will cooperate and extend all reasonable accommodation to this endeavour.

2.10.02 Tenderer Not to Communicate With Media and Public

To ensure that all public information generated about the Work is fair and accurate, and will not inadvertently or otherwise influence the outcome of the Tendering Process, all public information generated in relation to the Work, including communications with the media and the public, must be coordinated with, and is subject to the prior approval of, the City.

2.10.02 Tenderer Not to Communicate With Media and Public (Cont'd)

Tenderers will notify the City of requests for information or interviews from the media.

Tenderers will ensure that all of the Tenderers' Subcontractors and others associated with the Tenderer comply with the foregoing requirements.

2.11 RESERVED RIGHTS

The City reserves the right to:

a) Reject an unbalanced Tender. For the purpose of this section, an unbalanced tender is a tender containing a unit price which deviates substantially from, or does not fairly represent reasonable and proper compensation for the unit of work bid or one that contains prices which appear to be so unbalanced as to adversely affect the interests of the City. The City reserves the right to use tenders submitted in response to this Request for Tender or for other like or similar work as a guideline in determining if a bid is unbalanced.

b) Amend or modify the scope of the Work, and/or cancel or suspend the Tender award, at any time for any reason;

c) Require Tenderers to provide additional information after the Tender Closing to support or clarify their Tender;

d) Not accept any or all Tenders;

e) Not accept a Tender from a Tenderer who is itself, or whose principals, owners or directors are also principals, owners or directors of another entity which is, involved in litigation, arbitration or any other similar proceeding against the City;

f) Reject any or all Tenders without any obligation, compensation or reimbursement to any Tenderer or any of its team members;

g) Withdraw this Request for Tender and cancel or suspend the Tendering Process;

h) Extend, from time to time, any date, any time period or deadline provided in this Tender (including, without limitation, the Tender Closing), upon written notice to all Tenderers;

i) Assess and reject a Tender on the basis of:

(i)information provided by references;

(ii)the Tenderer's past performance on previous contracts;

(iii)the information provided by a Tenderer pursuant to the City exercising its clarification rights under this Tendering Process;

(iv)the Tenderer's experience with performing the type and scope of work specified including the Tenderer's experience as a general contractor;

(v)other relevant information that arises during this Tendering Process;

2.11 RESERVED RIGHTS (Cont'd)

j) Waive formalities and accept Tenders which substantially comply with the requirements of this Request for Tender;

k) Verify with any Tenderer or with a third party any information set out in a Tender;

l) Disqualify any Tenderer whose Tender contains misrepresentations or any other inaccurate or misleading information;

m) Disqualify any Tenderer who has engaged in conduct prohibited by the Tender Documents;

n) Disqualify any Tenderer who is guilty of an offence listed in Schedule C of the New Brunswick Regulation 2014-93 under the Procurement Act;

o) Disqualify any Tenderer for documented significant or persistent deficiencies in fulfilling or performing a substantive requirement or obligation under a prior contract or contracts. The disqualification for past performance shall be conducted in accordance with sections 64 thru 81 of the New Brunswick Regulation 2014-93 under the Procurement Act;

p) Make changes, including substantial changes, to the Tender Documents provided that those changes are issued by way of addenda in the manner set out in these Instructions to Tenderers;

q) Select any Tenderer other than the Tenderer whose Tender reflects the lowest cost to the City;

r) Cancel this Tendering Process at any stage, for any reason;

s) Cancel this Tendering Process at any stage and issue a new Request for Tender for the same or similar deliverables;

t) Accept any Tender in whole or in part; or

u) Accept a Tender which contains the following errors:

(i) error in mathematics – whether this involves the extension of a unit price or an error in addition, the mistake will be corrected and the correct total will be used for evaluation purposes and will be binding on the Tenderer.

(ii) conflict between the written and numerical bid prices. In all cases, the total bid price will be corrected to reflect the written bid price, whether lump sum or unit price.

(iii) failure to include the contingency allowance in the total Tender Price. If the contingency allowance was not included in the addition, the Tender Price shall be corrected to reflect its inclusion.

and these reserved rights are in addition to any other express rights or any other rights which may be implied in the circumstances and the City shall not be liable for any expenses, costs, losses or any direct or indirect damages incurred or suffered by any Tenderer or any third party resulting from the City exercising any of its express or implied rights under this Request for Tender.

2.11 RESERVED RIGHTS (Cont'd)

By submitting a Tender, the Tenderer authorizes the collection by the City of the information set out at paragraph 2.11 i) in the manner contemplated in that subparagraph.

2.12 LIMITATION OF LIABILITY AND WAIVER

Each Tenderer, by submitting a Tender, agrees that:

a) Neither the City nor any of its employees, agents, advisors or representatives will be liable, under any circumstances, for any Claim arising out of this Tendering Process including but not limited to costs of preparation of the Tender, loss of profits, loss of opportunity or for any other Claim; and

b) The Tenderer waives any Claim for any compensation of any kind whatsoever, including Claims for cost of preparation of the Tender, loss of profit or loss of opportunity by reason of the City's decision to not accept the Tender submitted by the Tenderer, to award a Contract to any other Tenderer or to cancel this Tendering Process, and the Tenderer shall be deemed to have agreed to waive such right or Claim.

2.13 INVOICES

a) In light of the requirements of Section 169 of the *Excise Tax Act*, R.S.C. 1985,c. E-15, and amendments thereto, the selected Tenderer shall provide to the City properly documented invoices with all requests for payments. This includes a government issued business number and the amount of tax included on the invoice.

b) Failure to provide properly documented invoices may result in delays in processing payments or outright rejection of the payment request.

City of Saint John

APPENDIX 'A'

TENDERING POLICY FOR CONSTRUCTION CONTRACTS

City of Saint John

TENDERING POLICY FOR CONSTRUCTION CONTRACTS

PREAMBLE

Whereas the City of Saint John seeks to duly represent the public interest in the management of its public tendering process for construction contracts;

And whereas taxpayers/ratepayers have the right to expect the benefits of free and open competition, that is, the best goods and services at the lowest possible prices;

And whereas municipal tendering should duly respect the place of other stakeholders, including vendors and contractors, in the process;

And whereas the values of integrity, effectiveness, due process and efficiency must be inherent in the process;

Common Council establishes this tendering policy for construction contracts.

POLICY AND APPLICABLE STATUTES

Persons and/or companies that submit tenders for construction contracts are deemed to have understood and agreed to the requirements of this policy and all applicable tender documentation, as well as all applicable Municipal by-laws and Federal or Provincial statutes. Applicable federal and provincial statutes include, but are not limited to: the *Canada Competition Act*; the *New Brunswick Public Procurement Act*; the *New Brunswick Crown Construction Act*; and the *New Brunswick Municipalities Act*.

APPLICATION OF POLICY

The City of Saint John seeks to optimize fair, open and independent competition for municipal construction work and to afford interested and qualified contractors the opportunity to seek the business.

This policy has been established for construction contracts valued in excess of $100,000 (before HST). The procedures detailed herein shall apply to all publicly advertised tender calls issued on behalf of the City of Saint John for construction contracts, but do not apply to publicly advertised tenders for the supply of goods and/or services or to invited bids or calls for proposal.

The following divisions of tender specifications for construction contracts form part of this policy: *Instruction to Tenderers and Tendering Procedures* (Division 2); *Form of Tender* (Division 4); and *Form of Agreement* (Division 5).

PUBLIC NOTICE OF TENDER/TENDER ADVERTISEMENT

A public notice of tender shall be issued for all construction contracts valued in excess of one hundred thousand dollars ($100,000). The notice shall state the contract number, a brief description, the date and the time for the closing of tenders, the location of the locked box for receipt of tenders, and the date, time and location of the tender opening.

TENDER DOCUMENTATION

The following documentation shall be provided to those persons or companies who wish to submit a tender, at an appropriate cost as determined by the Chief City Engineer:

1. Division 1: *Project Description* – as determined by the Chief City Engineer or his designate;
2. Division 2: *Instruction to Tenderers and Tendering Procedures* – forming part of this policy;
3. Division 3: *Particular Specifications* - as determined by the Chief City Engineer or his designate;
4. Division 4: *Form of Tender* - forming part of this policy, and including a Certificate of Independent Tender Determination;
5. Division 5: *Form of Agreement* - forming part of this policy;
6. A notice that Division 6: *General Administration of Contract* and Division 7: *Construction of Municipal Services* of the General Specifications apply to all contracts, and that it is the responsibility of the tenderer to familiarize himself with the provisions in Divisions 6 and 7, as well as those of any other division in the General Specifications determined by the Chief City Engineer or his designate to be applicable to the contract; and
7. Applicable contract drawings, as determined by the Chief City Engineer or his designate.

TENDER PROCESSING

Tenders shall be received and processed in accordance with the provisions set out in Division 2: *Instruction to Tenderers and Tendering Procedures*.

TENDER OPENING COMMITTEE

A tender opening committee is hereby established, consisting of a chairman and two members, as follows:

*Chairman:*Purchasing Agent or his designate

*Member:*Chief City Engineer or his designate

Member: A member of staff designated by the City Manager

The committee shall proceed in accordance with the provisions set out in Division 2.

TENDER REJECTION AND AWARD OF CONTRACT

The City of Saint John reserves the right to reject any or all tenders, or to accept a tender other than the lowest tender and to accept the tender deemed to be in its best interests, based on evaluation of relevant criteria, including quality, service and price.

Common Council shall make the decision as to whether or not a contract shall be awarded and to whom it will be awarded.

GENERAL SPECIFICATIONS

The Chief City Engineer may, from time to time, revise the technical provisions of the General Specifications to reflect changes in technology, methods or construction industry practices.

APPROVAL AND EFFECTIVE DATE

This policy, adopted by Common Council on November 19, 2003, shall become effective on January 1st, 2004.

City of Saint John

CONTRACT SPECIFICATIONS

DIVISION 3

PARTICULAR SPECIFICATIONS

AUGUST 2021

City of Saint John

TABLE OF CONTENTS

DIVISION 3 – PARTICULAR SPECIFICATIONS

PARTICULAR SPECIFICATIONS

This division shall be read in conjunction with and take precedence where they may prove at variance with the City of Saint John, General Specifications.

3.1 SPECIFICATIONS FOR THIS PROJECT

See Attached

MUNICIPAL BUILDINGS DEEP ENERGY RETROFITS
MUNICIPAL OPC HVAC & CONTROLS (PKG B5)

PROJECT #12-19-082

PREPARED FOR
CITY OF SAINT JOHN
SAINT JOHN, NEW BRUNSWICK

"ISSUED FOR TENDER"

JULY 2021

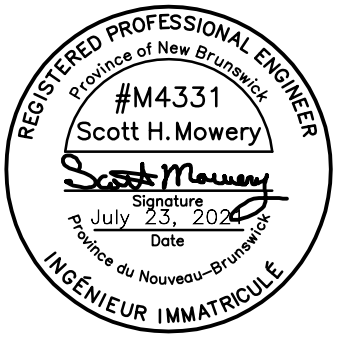
MCW Maricor

120 MILLENNIUM DRIVE, SUITE 201
QUISPAMSIS, NEW BRUNSWICK
E2E 0C6

DRAWING LIST

Mechanical

MD-1 Level 1 Demolition
MD-2 Level 2 Demolition
M-1 Level 1 HVAC Plan
M-2 Level 2 HVAC Plan
M-3 Roof Plan & Details
M-4 Controls



Electrical

E-1 Electrical Plans & Electrical Notes

END OF SECTION

Part 1 General

1.1 WORK COVERED BY CONTRACT DOCUMENTS

.1 Work of this Contract comprises of the replacement of the roof top AC units, new VAV Boxes & new EMCS system:

.1 Municipal OPS

.2 General Overview:

.1 This Contractor will be considered the Prime Contractor for this work. This Contractor is responsible for all trades, material and coordination aspects of the job. Errors or omissions by sub-trades will be the responsibility of this Contractor.

.2 Complete all work as noted within specifications and drawings inclusively. Confirm on-site the exact existing system and devices that can be re-used.

.3 Provide Commissioning, Training and Operations and Maintenance Manuals.

.4 Remove existing rooftop air condition units as per Drawings.

.5 Provide and install new rooftop heat pumps as noted on Drawings.

.6 Provide new VAV Boxes as noted on Drawings.

.7 Remove exiting EMCS and replace with a new BACNet EMCS as per Drawings.

.8 Provide all required modifications to electrical systems (i.e. including relays, transducers, contactors, transformers, switches, etc.) to make all systems a complete operational package.

.9 Provide power wiring, transformers, control wiring, and all other devices to power new devices.

.10 Remove all equipment and material made redundant by this work,. Contractor to familiarize their firm with the extent of removals.

.11 Provide all cutting and patching. Repair damaged surfaces to match existing.

.12 Obtain all required licenses and permits.

.13 Clean up all areas during and at the completion of work.

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

.15 All re-used material shall be provided with a full Contractor Warranty including: all work, components and equipment to have a labour, parts and material warranty as detailed in the specification.

1.2 CONTRACTOR USE OF PREMISES

.1 Limit use of premises for storage, and for access, to allow:

.1 Owner occupancy.

.2 Level of security not to be jeopardized.

.2 Co-ordinate use of premises under direction of City of Saint John Project Manager.

.3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

.4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.

.5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Consultant.

.6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

1.3 WORK BY OTHERS

.1 Co-operate with other Contractors in carrying out their respective works and carry out instructions from Engineer.

.2 Co-ordinate work with that of other Contractors. If any part of work under this Contract depends for its proper execution or result upon work of another Contractor, report promptly to Consultant, in writing, any defects which may interfere with proper execution of Work.

1.4 WORK SEQUENCE

.1 Construction Work will be completed in stages to minimize occupant disruptions.

.2 All space entry shall be coordinated with City of Saint John Project Manager in advance.

.3 Do not close off public usage of facilities until use of one stage of work will provide alternate usage.

.4 Maintain fire access/control.

1.5 OWNER OCCUPANCY

.1 Owner will occupy premises during entire construction period for execution of normal operations.

.2 Co-operate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.

1.6 EXISTING SERVICES

.1 Notify Owner, Consultant, and utility companies of intended interruption of services and obtain required permission.

.2 Where Work involves breaking into or connecting to existing services give Owner and MCW Project Manager 10 days' notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to tenant operations. Preferably after normal working hours of occupants or on weekends.

.3 Provide alternative routes for personnel, pedestrian and vehicular traffic.

.4 Establish location and extent of service lines in area of work before starting Work. Notify City of Saint John Project Manager of findings.

.5 Submit schedule to and obtain approval from City of Saint John Project Manager for any shut-down or closure of active service or facility including heating, steam, power and communications services. Adhere to approved schedule and provide notice to affected parties.

.6 Where unknown services are encountered, immediately advise City of Saint John Project Manager and confirm findings in writing.

.7 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.

1.7 DOCUMENTS REQUIRED

.1 Maintain at job site, one copy each document as follows:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Reviewed Shop Drawings.
.5 List of Outstanding Shop Drawings.
.6 Change Orders.
.7 Other Modifications to Contract.
.8 Field Test Reports.
.9 Copy of Approved Work Schedule.
.10 Manufacturer's installation and / or application instructions
.11 Building, Electrical, Plumbing permits;
.12 Health and Safety Plan and Other Safety Related Documents.
.13 Other documents as specified.

1.8 CONTRACT DRAWINGS AND SITE EXAMINATION

.1 Any Drawings supplied by the Consultant are performance drawings, are diagrammatic in nature and are intended to convey the Scope of Work and to indicate general arrangement and approximate location of apparatus. The Drawings do not intend to show architectural and structural details. The Consultant takes no responsibility for the accuracy of the existing building drawings.

.2 Not all offsets, fittings and accessories which may be required, are shown in the Drawings. Investigate structure and finish conditions affecting this Work and arrange Work accordingly, providing such fittings, valves and accessories required to meet the conditions. Conserve head room and interfere as little as possible with the use of space.

.3 Because of the small scale of Drawings, if is not possible to indicate 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 required to meet the conditions.

.4 Do not scale Drawings. Obtain accurate dimensions by site measurement.

.5 Visit and inspect the site of the Work to verify location and elevation of existing services which may affect Work of this Contract (electrical, ductwork, etc.) before proceeding with Work. Ensure all sub-contractors visit and inspect the site.

.6 Make, at no additional cost, the locations of materials and/or equipment necessary to accommodate structural conditions (pipes or ducts around beams, columns, etc.).

.7 Alter, at no additional cost, the locations of materials and/or equipment as directed that do not necessitate additional material.

.8 Electrical outlets, junction boxes, switches or other electrical equipment shall be moved to any point within a 10’ radius when relocation is requested by the Consultant before the Work has been substantially completed, without additional cost.

.9 Branch circuit wiring shall be installed with circuits arranged exactly as shown on the Drawings. Cable runs shall be modified to suit the installation.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 ACCESS AND EGRESS

.1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to building operations, occupants, public and normal use of premises. Make arrangements with City of Saint John Representative to facilitate work as stated.

.2 Maintain existing services to building and provide for personnel and vehicle access.

.3 Where security is reduced by work provide temporary means to maintain security.

.4 City of Saint John Representative will assign sanitary facilities for use by Contractor's personnel. Keep facilities clean.

.5 Closures: protect work temporarily until permanent enclosures are completed.

.6 Provide City of Saint John Representative with 48 hours' notice of any disruption of service (water, electrical and heating).

.7 Contact City of Saint John Representative for project specific restrictions.

1.3 SPECIAL REQUIREMENTS

.1 Submit schedule in accordance with Division 01

.2 Ensure that Contractor personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.

.3 Keep within limits of work and avenues of ingress and egress.

.4 Deliver materials outside of peak traffic hours unless otherwise approved by Consultant or MCW Project Manager.

1.4 SECURITY CLEARANCES

.1 Provide list of workers on-site to City of Saint John Representative. Provide orientation of contractor's staff.

.2 **Security and after hours' access**: After hours' access to a building may be granted by the City of Saint John Representative. Once approval is granted access is obtained through City of Saint John. Without approval of the City of Saint John Representative, no access will be granted. All work should commence during normal business hours.

1.5 BUILDING SMOKING ENVIRONMENT

.1 Comply with smoking restrictions. Smoking is not permitted on campus.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Alternate work to Bid.

.2 Separate work to Bid.

.3 Itemized Bid work.

1.2 RELATED SECTIONS

.1 Section 00 – Front End Specification

1.3 DEFINITIONS

.1 The work under alternative prices shall include as part of each alternative price, miscellaneous labour and products, adjustments in completion time, overheads and profit, incidental to or required to fully integrate the alternate into the work whether or not specifically mentioned as part of the alternate.

1.4 REQUIREMENTS

.1 Referenced specification sections stipulate pertinent requirements for products and methods to achieve the work stipulated under each alternate.

.2 Coordinate affected related work and modify surrounding work to integrate the work under each alternate.

.3 Provide new material and equipment as specified and to acceptance of the Consultant.

.1 Manufacturer's names are listed to set a standard of quality, performance, capacity, appearance and serviceability. Other manufacturers may be deemed acceptable, and their products may be used in the work subject to conditions stipulated by the Consultant.

.4 Requests for acceptance of manufacturers not listed shall be submitted not less than seven (7) working days prior to closing date of the Bid. Submissions must bear proof of acceptance by the Consultant.

.5 Subsequent substitutions of manufacturers and products will only be permitted in situations where proposed materials are found to be unsuitable for the intended retrofit or the proposed materials become unavailable. Under such circumstances the Consultant shall specify alternate manufacturers or products in keeping with the proposed standard of quality, performance, capacity, appearance and serviceability.

.6 Should specified manufacturers not be available, list alternate manufacturer(s) in Bid.

.7 Assume full responsibility for ensuring that when providing other acceptable manufacturer(s) all costs and requirements including but not limited to space, weight, connections, power and wiring requirements are considered, and included in the Bid. Equipment requiring greater than specified energy requirements or unduly limiting service space requirements will not be accepted.

.8 All electrical equipment, material, wiring and devices to conform to the Canadian Electrical Code for the purpose for which they are to be used and bear the approval of the C.S.A. or have special approval of the inspection authority. All equipment to be designed and manufactured in accordance with applicable EEMAC and ANSI specifications.

1.5 AWARD/SELECTION OF ALTERNATIVES

.1 Immediately following the award of the Bid, notify each party involved, in writing, of the status of each alternate. Indicate whether Alternate and Separate Price work have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated modifications to alternates.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 DEFINITIONS

.1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.

.2 Bar Chart (GANTT Chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars. Generally Bar Chart should be derived from commercially available computerized project management system.

.3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.

.4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.

.5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.

.6 Master Plan: summary-level schedule that identifies major activities and key milestones.

.7 Milestone: significant event in project, usually completion of major deliverable.

.8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.

.9 Project Planning, Monitoring and Control System: Site Construction Manager to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

.1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.

.2 Plan to complete Work in accordance with prescribed milestones and time frame.

.3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.

.4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit to the City of Saint John within 5 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

.3 Submit Project Schedule to the City of Saint John within 5 working days of receipt of acceptance of Master Plan.

1.4 MASTER PLAN

.1 Structure schedule to allow orderly planning, organizing and execution of Work as Bar Chart (GANTT).

.2 The City of Saint John will review and return revised schedules within 5 working days.

.3 Revise impractical schedule and resubmit within 5 working days.

.4 Accepted revised schedule will become Master Plan and be used as baseline for updates.

1.5 PROJECT SCHEDULE

.1 Develop detailed Project Schedule derived from Master Plan.

.2 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:

.1 Award.
.2 Shop Drawings, Samples.
.3 Permits.
.4 Mobilization.
.5 Demolition.
.6 Ventilation Work (per building).
.7 Plumbing Work (per building).
.8 Controls Work (per building).
.9 Commissioning Site.
.10 Training.
.11 Inspections.
.12 Documentation.

1.6 PROJECT SCHEDULE REPORTING

.1 Update Project Schedule on bi-weekly basis reflecting activity changes and completions, as well as activities in progress.

.2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.7 PROJECT MEETINGS

.1 Discuss Project Schedule at regular site meetings, identify activities that are behind schedule and provide measures to regain slippage. Activities considered behind schedule are those with projected start or completion dates later than current approved dates shown on baseline schedule.

.2 Weather related delays with their remedial measures will be discussed and negotiated.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE

.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 and no claim for extension by reason of such default will be allowed.

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

.3 Present shop drawings, product data, samples and mock-ups in Imperial units.

.4 Where items or information is not produced in Imperial units converted values are acceptable.

.5 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.

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

.7 Verify field measurements and affected adjacent Work are co-ordinated.

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

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

.10 Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Refer to General Condition of Contract.

.2 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.

.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.

.4 Allow 10 days for Consultant's review of each submission.

.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 Owner's Project Coordinator prior to proceeding with Work.

.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.

.7 Accompany submissions with transmittal letter in duplicate containing:

- .1 Date.
- .2 Project title and number.
- .3 Contractor's name and address.
- .4 Identification and quantity of each shop drawing, product data and sample.
- .5 Other pertinent data.

.8 Submissions include:

- .1 Date and revision dates.
- .2 Project title and number.
- .3 Name and address of:
  - .1 Subcontractor.
  - .2 Supplier.
  - .3 Manufacturer.
- .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
- .5 Details of appropriate portions of Work as applicable:
  - .1 Fabrication.
  - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
  - .3 Setting or erection details.
  - .4 Capacities.
  - .5 Performance characteristics.
  - .6 Standards.
  - .7 Operating weight.
  - .8 Wiring diagrams.
  - .9 Single line and schematic diagrams.
  - .10 Relationship to adjacent work.

.9 After Consultant's review, distribute copies.

.10 Submit one (1) Electronic copy of shop drawings for each requirement requested in specification Sections and as Consultant may reasonably request.

.11 Submit one (1) Electronic copy of product data sheets or 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.

.12 Submit one (1) Electronic copy of test reports for requirements requested in specification Sections and as requested by 8 Consultant.

.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.

.13 Submit one (1) Electronic copy of certificates for requirements requested in specification Sections and as requested by Consultant.

.1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.14 Submit one (1) Electronic copy of manufacturer’s instructions for requirements requested in specification Sections and as requested by Consultant.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.15 Submit one (1) Electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by 8 Consultant.

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

.16 Submit three (3) copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.

.17 Delete information not applicable to project.

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

.19 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.

1.3 SAMPLES

.1 Submit for review samples in duplicate as requested in respective specification Sections. Label samples with origin and intended use.

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

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

.4 Adjustments made on samples 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 Make changes in samples which Consultant may require, consistent with Contract Documents.

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

1.4 CERTIFICATES AND TRANSCRIPTS

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

.2 Submit transcription of insurance immediately after award of Contract.

1.5 MOCK-UPS

.1 Erect mock-up in accordance with 01 45 00 – Quality Control.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Province of New Brunswick

.1 Occupational Health and Safety Act, S.N.B. 1983.

1.2 SUBMITTALS

.1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:

.1 Results of site specific safety hazard assessment.

.2 Results of safety and health risk or hazard analysis for site tasks and operation.

.3 Submit 3 copies of Contractor's authorized representative's work site health and safety inspection reports to Owner’s Project Coordinator and authority having jurisdiction.

.4 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.

.5 Submit copies of incident and accident reports.

.6 Submit WHMIS MSDS - Material Safety Data Sheets.

.7 Owner’s Project Coordinator will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to Owner’s Project Coordinator within 5 days after receipt of comments.

.8 Owner’s Project Coordinator review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.

.9 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 FILING OF NOTICE

.1 File Notice of Project with Provincial authorities prior to beginning of Work.

1.4 SAFETY ASSESSMENT

.1 Perform site specific safety hazard assessment related to project.

1.5 MEETINGS

.1 Schedule and administer Health and Safety meeting with Owner's Project Coordinator prior to commencement of Work.

1.6 REGULATORY REQUIREMENTS

.1 Do Work in accordance with Section 01 41 00 - Regulatory Requirements.

1.7 GENERAL REQUIREMENTS

.1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.

.2 Owner's Project Coordinator may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

.1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

.1 Comply with Occupational Health and Safety Act, General Regulation, N.B. Reg.

.2 Comply with Occupational Health and Safety Regulations, 1996.

.3 Comply with Occupational Health and Safety Act, General Safety Regulations, O.I.C.

.4 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

1.10 UNFORSEEN HAZARDS

.1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Owner's Project Coordinator verbally and in writing.

1.11 CORRECTION OF NON-COMPLIANCE

.1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Owner's Project Coordinator.

.2 Provide Owner's Project Coordinator with written report of action taken to correct non-compliance of health and safety issues identified.

.3 Owner's Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.12 WORK STOPPAGE

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

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 REFERENCES AND CODES

.1 Perform Work in accordance with National Building Code of Canada (NBC) 2010 including amendments up to tender closing date and other codes of provincial or local application provided that in case of conflict or discrepancy, more stringent requirements apply.

.2 Meet or exceed requirements of:

.1 Contract documents.

.2 Specified standards, codes and referenced documents.

.3 NFPA and CSA codes for Boiler Combustion Systems.

.4 Canadian Electrical Code.

.5 DAL Structural Cabling Guidelines.

1.2 SMOKING RESTRICTIONS

.1 Municipal OPC is a Smoke Free Building. All smoking activity is to occur off-property.

1.3 PERMITS

.1 Contractor shall be responsible to obtain and maintain all required Permits, including all required inspections to the satisfaction of Authorities having Jurisdiction. This shall include all permits required by law for work, including but not limited to Building Permits, Electrical Permits, Plumbing Permits, Traffic Permits, Sidewalk Permits, and Fuel Safety Permits.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSPECTION

.1 Allow City of Saint John Representative and Consultant access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by City of Saint John Representative and Consultant instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

1.2 INDEPENDENT INSPECTION AGENCIES

.1 Provide equipment required for executing inspection and testing by appointed agencies.

.2 Employment of inspection/testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.3 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by Consultant at no cost to City of Saint John. Pay costs for retesting and re-inspection.

1.3 ACCESS TO WORK

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.4 PROCEDURES

.1 Notify appropriate agency, City of Saint John Representative, Consultant in advance of requirement for tests, in order that attendance arrangements can be made.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.5 REJECTED WORK

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant and/or City of Saint John Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in the opinion of City of Saint John Representative or the Consultant, the Contractor is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, City of Saint John Representative will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by Consultant.

1.6 REPORTS

.1 Submit one (1) electronic copy and one (1) hard copy of inspection and test reports to City of Saint John Representative.

.2 Provide copies to subcontractor of work being inspected or tested and/or manufacturer or fabricator of material being inspected or tested.

.3 Provide all testing, inspection and commissioning reports as identified in specification for mock-up.

1.7 EQUIPMENT AND SYSTEMS

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Temporary utilities.

1.2 RELATED SECTIONS

.1 Section 01 52 00 - Construction Facilities.

.2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.3 INSTALLATION AND REMOVAL

.1 Provide temporary utilities controls in order to execute work expeditiously.

.2 Provide all temporary lighting or other such utilities.

.3 Remove from site all such work after use.

1.4 ELECTRICAL SUPPLY

.1 The owner will supply electricity for construction purposes at no cost to the Trade Contractor.

.2 Use of Municipal OPC electrical power is permitted and will not be charged to the contractor. If temporary connections are required, it is the responsibility of the contractor to provide necessary connections. No connections for temporary power will be made without authorization of the City of Saint John Representative. No electrical shutdowns shall occur without 48 hour notification to the City of Saint John Representative.

1.5 WELDING

.1 Contractor to provide power for all welding operations (permanent or temporary). All costs for providing temporary power shall be included in Bid Price.

.2 Where welding power connections are not available and a portable generator welder is required all costs shall be included in Bid Price.

.3 As part of the site walk thru the Contractor to determine their requirements.

.4 Trade Contractor to provide portable HEPA filter and extractors for all welding operations in the Buildings.

1.6 UTILITY CONNECTIONS

.1 Contractor to provide all temporary power supplies for work under this agreement.

.2 Where indicated, provide permanent or temporary utility connections for performance of the work.

1.7 WATER SUPPLY

.1 Owner will supply potable water for construction use at no cost to the Contractor.

.2 The Contractor to provide at his own expense necessary piping, connections, valves, hoses and all such items to enable the Contractor to provide a temporary service connection and make same available to all trades throughout the project. The Contractor to arrange for connection with the Owner to disconnect and remove temporary service when no longer required and pay for all.

.3 Use of Municipal OPC water supply is permitted and will not be charged to the contractor. If temporary connections are required, it is the responsibility of the contractor to provide necessary connections. No connections for temporary water use will be made without authorization of the Project Manager. No water shutdowns shall occur without 48 hour notification to the City of Saint John Representative.

1.8 TEMPORARY HEATING & COOLING

.1 Provide temporary heat or cooling (if required) and ventilation in enclosed areas as required to:

.1 Facilitate progress of work.

.2 Protect work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

.4 Provide ambient temperatures and humidity levels for work, storage, installation and curing of materials.

.5 Provide adequate ventilation to meet health regulations for safe working environment (welding).

.6 Be responsible for damage to work due to failure in providing adequate heat or cooling and protection during construction.

1.9 TEMPORARY VENTILATION

.1 Ventilating:

.1 Prevent accumulations of dust, fumes, welding fumes, mists, vapours or gases in areas occupied during construction.

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas, service areas, etc. during welding or other operations.

.3 Provide local exhaust or smoke eaters to limit and/or eliminate fumes due to welding, soldering, hot work, or any other processes involved to carry out the work.

.4 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.

.5 Ventilate storage spaces containing hazardous or volatile materials.

.6 Ventilate temporary sanitary facilities.

.7 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.

1.10 FIRE PROTECTION

.1 Provide and maintain temporary fire protection equipment during performance of work.

.2 Burning rubbish and construction waste materials is not permitted on site.

.3 Should fire protection systems be disabled, minimum 48 hour notification is required to be given to the City of Saint John Representative. No shutdown shall exceed six hours in a twenty-four hour day without authorization of the provincial Fire Marshall's office. Fire station captain shall be notified if shutdown exceeds two hours.

1.11 TEMPORARY COMMUNICATION REQUIREMENTS

.1 Contractor to make separate provision for telephone, fax, and computer hook-ups at its own cost. Use of Municipal OPC communication infrastructure is not permitted.

1.12 TEMPORARY FIRE ALARM ANNUNCIATION

.1 Should fire alarm enunciators be inaudible, contractor shall provide temporary hook-up to existing fire alarm system to provide audible annunciation in event of building fire alarm.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Construction Access.

.2 Elevators.

.3 Site Storage.

.4 Construction Office.

1.2 RELATED SECTIONS

.1 Section 01 14 00 - Work Restrictions.

.2 Section 01 51 00 - Temporary Utilities.

.3 Section 01 56 00 - Temporary Barriers and Enclosures.

1.3 INSTALLATION AND REMOVAL

.1 Provide construction facilities in order to execute work expeditiously.

1.4 SCAFFOLDING

.1 Provide and maintain scaffolding, ramps, ladders, work platforms, swing staging, platforms, temporary stairs, all other temporary services required to execute the work.

1.5 HOISTING

.1 Provide all cranes required for moving materials and equipment.

.2 Hoisting equipment to be operated by qualified operators.

1.6 ELEVATORS

.1 The elevator in existing building may be used, with prior written permission from the City of Saint John Representative, for access and moving of construction materials and equipment. The use of elevators in existing buildings shall be coordinated with the City of Saint John Representative who will co-ordinate this with the City of Saint John Representative. In most cases the Contractor's use of the elevator will be restricted to specified hours throughout the day. The Contractor is responsible for the safe use of the elevator and protecting all finishes.

.2 Provide protective coverings for finish surfaces of cars and entrances.

.3 Interior of elevators shall be lined with plywood to act as protection against damage and shall remain in place for the duration of the project. Contractor to remove plywood cladding once all renovations are complete. Protection must be to the approval of City of Saint John Representative.

.4 Accept liability for damage, safety of equipment and overloading of existing equipment.

1.7 SITE STORAGE / LOADING

.1 Confine work and operations of employees to areas within the Agreement documents. Do not unreasonably encumber premises with products.

.2 As there is limited storage area in the area of work, provide just in time delivery of materials.

.3 Do not load or permit to load any part of work with a weight or force that will endanger the work.

.4 As necessary, the Contractor shall provide their own storage and means of securing the storage facilities, and shall carry all necessary insurances for any storage facility used as well as the contents stored in the trailer and on the grounds.

1.8 PARKING

.1 Refer to Section 01 14 00 – Work Restrictions.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

.1 Provide and maintain, in a clean and orderly condition, lockable weatherproof storage of tools, equipment and materials.

.2 Use of premise for storage – City of Saint John premises, outside the area of work, shall not be used for site office, storage, or any other purpose.

1.10 SANITARY FACILITIES

.1 For work in existing buildings an existing washroom will be available for use by the Contractor and workers. The City of Saint John Representative will designate the washroom to be used. This facility must be kept clean by the Contractor at all times. The washing of paint brushes, mixing of grout and other non personal hygiene activities in the washroom is strictly prohibited. Such non personal hygiene operations shall be carried out in a mechanical room designated by the City of Saint John Representative.

1.11 FIRST AID

.1 Provide such equipment as required by the Occupational Health and Safety Act, to supply first aid service to anyone who may be injured on the work site. In case of serious injury or death, report the accident immediately to the proper authorities and to the City of Saint John Representative.

.2 Trade Contractor assigned Supervisor (site representative) to provide First Aid training certificate to the City of Saint John Representative.

1.12 CONSTRUCTION ACCESS AND TRAFFIC MAINTENANCE

.1 Construction access to the work areas within existing building for workmen and delivery of materials will be designated by the City of Saint John Representative. No other existing exits or entrances shall be used by workers for access or for delivery of materials.

.2 The Contractor to conduct construction operations with minimum interference to adjacent roadways, sidewalks and access facilities in general and shall keep such areas free from materials, debris and equipment at all times.

.3 The Contractor shall not close or obstruct existing roadways, sidewalks, parking areas or delivery points and to not place or store materials or park cars on same.

.4 The Contractor shall obtain approval of his proposed haul routes from the City of Saint John Representative.

.5 Haul routes to be kept clean and free of dust.

.6 The Contractor shall cooperate in all ways with the City of Saint John Representative in all matters concerning necessary interference with normal operation of the Owner's facilities. Minimizing disruption of normal building operation and vehicular movements around campus properties is an essential requirement in undertaking the work.

.7 It is the requirement of the Contractor to provide items such as but not limited to signage, traffic barriers, personnel barriers, to fully notify building occupants of all construction activities.

1.13 CONSTRUCTION PARKING

.1 Provide and maintain adequate access to Owner's facility.

.2 Coordinate and cooperate with Owner to determine suitable parking areas.

.3 Clean access areas where used by Contractor's equipment.

.4 Repair and bring back to pre-existing conditions areas used for parking.

.5 Reference Section 1.8 – PARKING.

1.14 SITE OFFICE

.1 Outside the area of work, the City of Saint John premises shall not be used for site office.

1.15 SIGNAGE

.1 The City of Saint John requires signage to be posted clearly identifying area of construction and required personal protective equipment within the construction area. This signage should be posted at all entrances to the area.

1.16 DAMAGE

.1 Any damage to the City of Saint John property shall be made good prior to completion of the work.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Barriers.

.2 Environmental Controls.

.3 Traffic Controls.

.4 Fire Routes.

1.2 RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

.2 Section 01 52 00 - Construction Facilities.

1.3 REFERENCES

.1 Canadian Standards Association (CSA).

1.4 INSTALLATION AND REMOVAL

.1 Provide temporary controls in order to execute work expeditiously.

.2 Remove from site all such work after use.

1.5 GUARD RAILS AND BARRICADES

.1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.

.2 Provide barricades to isolate work areas from public areas. Provide a fixed Architectural barrier to permit public access to washroom facilities on the lower level. Provide temporary lighting and a man-door to access the construction zone.

.3 Provide as required by governing authorities, or the City of Saint John Representative, as indicated.

1.6 FLOOR BARRICADES AND SIGNAGE (WHEN WORKING IN PUBLIC AREAS) – LIGHTING WORK, VENTILATION, CONTROLS AND OTHERWISE

.1 Provide a 24” x 32” Metal “A” frame sign with red graphics.

.2 Two signs shall be located at each Work area and in public spaces (both ends – e.g. hallways) or one sign at the entrance to a room where work is ongoing.

.3 Red/Yellow caution tape shall be applied from sign to walls to cordon off Work area from the public. Comply with requirements of the site safety manual.

.4 Trade Contractor shall have a pair of signs for each work crew.

.5 Where work is occurring in a room, the work signs shall be located at the entrance to the room.

.6 All scaffolding shall be boarded to a height of 8 feet high with a material in a manner that prevents climbing.

.7 Signage must be posted clearly identifying area of construction and required personal protective equipment within the construction area.

1.7 DUST TIGHT SCREENS

.1 Provide dust tight screens or partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.

.2 Maintain and relocate protection until such work is complete.

1.8 ACCESS TO SITE

.1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for Owner's personnel access to facilities and Trade Contractor's access to Work.

1.9 PUBLIC TRAFFIC FLOW

.1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect public.

1.10 FIRE ROUTES

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

1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

.1 Protect surrounding private and public property from damage during performance of work.

.2 Be responsible for damage incurred.

1.12 PROTECTION OF BUILDING FINISHES

.1 Provide protection for finished and partially finished building finishes and equipment during performance of work.

.2 Provide necessary screens, covers, and hoardings.

.3 Be responsible for damage incurred due to lack of or improper protection.

.4 UNBSJ property shall be made good prior to completion of the work.

Part 2 Products

2.1 NOT USED

.1 Not Used

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 REFERENCES

.1 Within text of each specifications section, reference may be made to reference standards.

.2 Conform to these reference standards, in whole or in part as specifically requested in specifications.

.3 If there is question as to whether products or systems are in conformance with applicable standards, Consultant reserves right to have such products or systems tested to prove or disprove conformance.

.4 Cost for such testing will be borne by the Owner in event of conformance with Contract Documents or by Contractor in event of non-conformance.

1.2 QUALITY

.1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.

.2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.

.3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is a precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.4 Should disputes arise as to quality or fitness of products, decision rests strictly with Consultant and Owner’s Representative based upon requirements of Contract Documents.

.5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 AVAILABILITY

.1 Immediately upon securement of product orders, review product delivery requirements and anticipate foreseeable supply delays for items. If delays in supply of products are foreseeable, notify Consultant and City of Saint John Representative of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.2 In event of failure to notify the City of Saint John Representative at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the City of Saint John Representative reserves the right to substitute more readily available products of similar character, at no increase in Contract Price or Contract Time.

1.4 STORAGE, HANDLING AND PROTECTION

.1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.

.2 Store packaged or bundled products in original and undamaged condition with manufacturer's seal and labels intact. Do not remove from packaging or bundling until required in Work.

.3 Store products subject to damage from weather in weatherproof enclosures.

.4 Store cementitious products clear of earth or concrete floors, and away from walls.

.5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

.6 Store sheet materials, lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.

.7 Store and mix paints in heated and ventilated room. Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

.8 Remove and replace damaged products at own expense and to satisfaction of the City of Saint John Representative.

.9 Touch-up damaged factory finished surfaces to City of Saint John Representative and Consultant's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.5 TRANSPORTATION

.1 Pay costs of transportation of products required in performance of Work.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 LOCATION OF EQUIPMENT AND FIXTURES

.1 Location of equipment, fixtures and outlets indicated or specified are to be considered as approximate.

.2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

.3 Inform City of Saint John Representative of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by City of Saint John Representative.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit written request in advance of cutting or alteration which affects:

.1 Efficiency, maintenance, or safety of operational elements.
.2 Visual qualities of sight-exposed elements.
.3 Work of Owner or separate contractor.
.4 Building Structure.
.5 Interruption of Life Safety Systems.
.6 Interruption of Main Potable Water Service or Building Steam Service.

.3 Include in request:

.1 Identification of project.
.2 Location and description of affected Work.
.3 Statement on necessity for cutting or alteration.
.4 Description of proposed Work, and products to be used.
.5 Alternatives to cutting and patching.
.6 Effect on Work of Owner or separate contractor.
.7 Written permission of affected separate contractor.
.8 Date and time work will be executed.

.4 Owner requires one week of written advanced notice before any work commences in the Buildings

1.2 MATERIALS

.1 Required for original installation.

1.3 PREPARATION

.1 Inspect existing conditions, including elements subject to damage or movement during cutting and patching.

.2 After uncovering, inspect conditions affecting performance of Work.

.3 Beginning of cutting or patching means acceptance of existing conditions.

.4 Provide supports to assure structural integrity of surroundings; provide devices and methods to protect other portions of project from damage.

1.4 EXECUTION

.1 Execute cutting, fitting, and patching to complete Work.

.2 Fit several parts together, to integrate with other Work.

.3 Remove and replace defective and non-conforming Work.

.4 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.

.5 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.

.6 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.

.7 Restore work with new products in accordance with requirements of Contract Documents.

.8 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.9 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material.

.10 Refinish surfaces to match adjacent finishes: Refinish continuous surfaces to nearest intersection. Refinish assemblies by refinishing entire unit.

.11 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

1.5 WASTE MANAGEMENT AND DISPOSAL

.1 As per Section 01 74 19 –Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by Owner or other Contractors.

.2 Remove waste materials from site at daily regularly scheduled times or dispose of as directed by City of Saint John Representative. Do not burn waste materials on site.

.3 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.4 Provide on-site containers for collection of waste materials and debris.

.5 Provide and use marked separate bins for recycling.

.6 Dispose of waste materials and debris off site.

.7 Clean interior areas prior to start of finishing work, and maintain areas free of dust and other contaminants during finishing operations.

.8 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.

.9 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.2 FINAL CLEANING

.1 When Work is Substantially Performed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.

.3 Prior to final review remove surplus products, tools, construction machinery and equipment.

.4 Remove waste products and debris other than that caused by Owner or other Contractors.

.5 Remove waste materials from site at regularly scheduled times or dispose of as directed by City of Saint John Representative. Do not burn waste materials on site.

.6 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.

.7 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

.8 During final cleaning the contractor is not to strip and wax any floors. Custodial staff will take responsibility for stripping and applying wax on waxable floors.

.9 Make good all existing interior and exterior surfaces and finishes and assemblies to match adjacent surfaces and finishes and assemblies.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 00 – Summary of Work.

1.2 DEFINITIONS

.1 Class III: non-hazardous waste - construction renovation and demolition waste.

.2 Cost/Revenue Analysis Workplan (CRAW): based on information from Waste Reduction Workplan, and intended as financial tracking tool for determining economic status of waste management practices.

.3 Demolition Waste Audit (DWA): relates to actual waste generated from project.

.4 Inert Fill: inert waste - exclusively asphalt and concrete.

.5 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.6 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.7 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.8 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.9 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.10 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.11 Separate Condition: refers to waste sorted into individual types.

.12 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

.13 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.

.14 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.

.15 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

1.3 DOCUMENTS

.1 Maintain at job site, one copy of following documents:

.1 Material Source Separation Plan.

1.4 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

.1 Prepare MSSP and have ready for use prior to project start-up.

.2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by Departmental Representative.

.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide containers to deposit reusable and recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.6 Locate separated materials in areas which minimize material damage.

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

.1 Transport to approved and authorized recycling facility.

.8 Collect, handle, store on-site, and transport off-site, salvaged materials in combined condition.

.1 Ship materials to site operating under Certificate of Approval.

.2 Materials must be immediately separated into required categories for reuse or recycling.

1.5 STORAGE, HANDLING AND PROTECTION

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Protect, stockpile, store and catalogue salvaged items.

.4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.5 Protect structural components not removed for demolition from movement or damage.

.6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Departmental Representative.

.7 Protect surface drainage, mechanical and electrical from damage and blockage.

.8 Separate and store materials produced during dismantling of structures in designated areas.

.9 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.1 On-site source separation is recommended.
.2 Remove co-mingled materials to off-site processing facility for separation.
.3 Provide waybills for separated materials.

1.6 DISPOSAL OF WASTES

.1 All hazardous material disposal (Asbestos Containing Material's, refractory bricks with metals) shall be as per hazardous material specification sections.

.2 Do not bury rubbish or waste materials.

.3 Do not dispose of waste, volatile materials, mineral spirits, oil, paint thinner into waterways, storm, or sanitary sewers.

.4 Keep records of construction waste including:

.1 Number and size of bins.
.2 Waste type of each bin.
.3 Total tonnage generated.
.4 Tonnage reused or recycled.
.5 Reused or recycled waste destination.

.5 Remove materials from deconstruction as deconstruction/disassembly Work progresses.

.6 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.7 USE OF SITE AND FACILITIES

.1 Execute work with least possible interference or disturbance to normal use of premises.

1.8 SCHEDULING

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 WASTE MANAGEMENT AND DISPOSAL

.1 Provide on-site facilities for collection, handling and storage of anticipated quantities of reusable and/or recyclable materials.

.2 Source separate materials to be re-used or recycled, into specified sort areas.

.3 Dispose of construction (unable to be reduced/reused/recycled) into separated waste streams as outlined by the local waste management program.

3.2 APPLICATION

.1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.3 CLEANING

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/recycled into specified sort areas.

3.4 USE OF OWNERS GARBAGE BINS

.1 No construction related rubbage is to be placed in Owner’s garbage bins. Contractors will be fined up to $1,000.00 for each instance where this can be proven.

3.5 SALVAGE

.1 Contractor shall be responsible for all disassembly, removals, disposal and salvage of all demolition waste, including all equipment which must be removed to complete the Scope of Work, and which has not been designated for reuse by the City of Saint John.

END OF SECTION

Part 1 General

1.1 INSPECTION AND DECLARATION

.1 Contractor's Inspection: Contractor and Subcontractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.

.1 Notify the City of Saint John in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request City of Saint John, Consultant Construction Manager Inspection.

.2 City of Saint John Construction Manager Inspection: City of Saint John Construction Manager, Consultant and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.

.3 Completion: submit written certificate that following have been performed:

.1 Work has been completed and inspected for compliance with Contract Documents.

.2 Defects have been corrected and deficiencies have been completed.

.3 Equipment and systems have been tested, adjusted and are fully operational.

.4 Operation of systems have been demonstrated to Owner's personnel.

.5 Work is complete and ready for final inspection.

.4 Final Inspection: when items noted above are completed, request final inspection of Work by MCW Construction Manager. If Work is deemed incomplete by City of Saint John Construction Manager or Consultant complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when City of Saint John Construction Manager considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.

.6 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.

.7 Final Payment: when City of Saint John Construction Manager considers final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Site Construction Manager complete outstanding items and request re-inspection.

.8 Payment of Holdback: after issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount.

1.2 CLEANING

.1 Remove waste and surplus materials, rubbish and construction facilities from the site.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.

.3 Copy will be returned with Consultant's comments.

.4 Revise content of documents as required prior to final submittal.

.5 Two weeks prior to Substantial Performance of the Work, submit to the Consultant one final copy of operating and maintenance manuals for review.

.6 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacturer as products provided in the Work.

.7 Furnish evidence, if requested, for type, source and quality of products provided.

.8 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.

.9 Pay costs of transportation.

1.2 FORMAT – OPERATIONS AND MAINTENANCE (O&M)

.1 Organize data as instructional manual.

.2 Operations and Maintenance (O&M) information shall be submitted in electronic format and in one (1) paper copy indexed and bound into a binder.

.1 File formats should be PDF.

.2 When multiple sections are used, correlate data into related consistent groupings.

.3 Arrange content by systems, under Section numbers and sequence of Table of Contents.

.4 Provide individual files within electronic media for each section or subsection of related groupings numbered sequentially. File naming conventions shall indicate section number and what the file contains (e.g. file containing heat pump data shall be named “04 – Equipment – Heat pump data.pdf”).

.5 Provide one file with all information (e.g. file containing O&M for project should be named “O&M for Building ABC, Project ABC”).

.6 Cover: Identify each CD with printed label title. List title of project and identify subject matter of content (e.g. “Project Record Documents for Building ABC, Project ABC”.)

.7 Provide section dividers in electronic version for each separate product or system, with typed description of product and major component part of equipment.

.8 Text: Manufacturer's printed data or typewritten data.

.3 Provide indexed and searchable electronic document format.

1.3 CONTENTS - EACH VOLUME

.1 Table of Contents: provide title of project;

.1 Date of submission; names.

.2 Addresses and telephone numbers of Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.4 Warranty – Scan of hard copy, signed, original warranty included.

.2 For each trade:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.4 One (1) set of accurate as-built drawings, full scale.

1.4 WARRANTIES AND BONDS

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan, 30 days before planned pre-warranty conference, to MCW Project Manager for approval.

.3 Warranty management plan to include required actions and documents to assure that Owner receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Submit, warranty information made available during construction phase, to City of Saint John Representative.

.6 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.7 Leave date of beginning of time of warranty until Date of Substantial Performance is determined. Warranty for items put into use will commence on Date of Substantial Performance.

.8 Conduct joint four (4) month and nine (9) month warranty inspection, measured from time of substantial performance, with Consultant and Owner's Representative.

.9 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.

.2 Provide list for each warranted equipment, item, and feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.3 Contractor's plans for attendance at four (4) and nine (9) month post-construction warranty inspections.

.4 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.

.10 Respond in a timely manner to oral or written notification of required construction warranty repair work.

1.5 AS-BUILTS AND SAMPLES

.1 Maintain, at site one record copy of:

- .1 Contract Drawings.
- .2 Specifications.
- .3 Addenda.
- .4 Change Orders and other modifications to Contract.
- .5 Reviewed shop drawings, product data, and samples.
- .6 Field test records.
- .7 Inspection certificates.
- .8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Engineer.

1.6 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line drawings, provided by the Owner

.2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:

- .1 Measured depths of elements of foundation in relation to finish first floor datum.
- .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by change orders.
- .6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications required by individual specifications sections.

1.7 EQUIPMENT AND SYSTEMS

.1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.

.3 Include installed colour coded wiring diagrams.

.4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

.5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.6 Provide servicing and lubrication schedule, and list of lubricants required.

.7 Include manufacturer's printed operation and maintenance instructions.

.8 Include sequence of operation by controls manufacturer.

.9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.

.12 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

.13 Additional requirements: as specified in individual specification sections.

1.8 MATERIALS AND FINISHES

.1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.

.2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.3 Additional Requirements: as specified in individual specifications sections.

1.9 SPARE PARTS

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue items. Submit inventory listing to City of Saint John Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.10 MAINTENANCE MATERIALS

.1 Provide maintenance and extra materials, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue items. Submit inventory listing to City of Saint John Representative. Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

1.11 SPECIAL TOOLS

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to site; place and store.

.4 Receive and catalogue items. Submit inventory listing to City of Saint John Representative. Include approved listings in Maintenance Manual.

1.12 STORAGE, HANDLING AND PROTECTION

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and to satisfaction of MCW – Site Construction Manager.

1.13 PROJECT RECORD DRAWINGS

.1 Submission of Project Record Drawings, showing the built condition, shall be in DWG and PDF formats with file naming convention used in City of Saint John drawing guidelines.

1.14 WASTE DISPOSAL RECORDS

.1 Provide waste disposal weight report for project (See Construction Waste Management and Disposal).

.2 Provide current MSDSs for any controlled products that will remain on the site for ongoing operations and/or maintenance.

1.15 WARRANTY

.1 Warrant the equipment for a period of one (1) year from the date of acceptance by the Consultant and City of Saint John Representative.

.2 Warranties, bonds and other certificates shall be in the Owner’s name and delivered in original paper format, as well as electronic PDF format.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Division 01

1.2 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two weeks prior to date of final inspection.

.2 The City of Saint John Representative will provide list of personnel to receive instructions, and will co-ordinate their attendance at agreed-upon times.

.3 Demonstrate operation of Control Systems.

1.3 QUALITY CONTROL

.1 When specified in individual Sections require manufacturer to provide authorized representative to demonstrate operation of equipment and systems, instruct Owner's personnel, and provide written report that demonstration and instructions have been completed.

1.4 SUBMITTALS

.1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for City of Saint John Representative’s approval.

.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Give time and date of each demonstration, with list of persons present.

1.5 CONDITIONS FOR DEMONSTRATIONS

.1 Equipment has been inspected and put into operation.

.2 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.6 PREPARATION

.1 Verify that conditions for demonstration and instructions comply with requirements.

.2 Verify that designated personnel are present.

1.7 DEMONSTRATION AND INSTRUCTIONS

.1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at scheduled agreed upon times, at the designated location.

.2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.3 Review contents of manual in detail to explain aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instructions.

1.8 TRAINING

.1 Reference Division 01

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements relating to commissioning verification of project's equipment and systems, specifying general requirements for start-up and functional performance verification and testing of components, equipment, sub-systems, systems, and integrated systems. Commissioning verification will be conducted by Third-Party Commissioning Agent engaged by the Owner.

.2 Related Sections:

.1 Section 01 79 00 – Demonstration and Training

1.2 SCOPE OF WORK

.1 Provide material, tools, labour and supervision necessary to assist the commissioning agent in the verification of commissioning of the equipment and systems as outlined in the drawings, specifications and functional performance test forms.

.2 Contractors and Manufacturer Representative are to participate in the commissioning process and cooperate fully with the Third-Party Commissioning Agent (CxA).

.3 Once the contractor’s commissioning is completed as outlined in the Contract Documents, provide material, tools, labour and supervision to verify in detail with the CxA that the equipment and systems have been commissioned in accordance with this and related Sections.

.4 Commissioning to be a line item of contractor`s cost breakdown.

1.3 GENERAL

.1 Commissioning is a planned program of tests, procedures and checks systematically carried out on equipment, systems and integrated systems of the finished project to verify that they meet the owner`s project requirements. Commissioning is performed after systems and integrated systems are completely installed, functional and the contractor`s responsibilities have been completed and approved.

.2 Objectives

.1 Verify installed equipment, systems and integrated systems operate in accordance with the owner`s project requirements, the contract documents and design criteria and intent.

.2 Verify that O&M personnel have been fully trained in all aspects of the installed equipment and systems.

.3 Verify that proper documentation relating to the commissioned equipment and systems are compiled and provided to the Owner.

.3 A third-party commissioning agent will perform commissioning verification of the new equipment and control sequences. This will include start-up verification and functional performance testing activities.

.4 Contractor participates in the commissioning process, operating equipment and systems, troubleshooting and making adjustments as required.

.1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be operated interactively with each other as intended in accordance with contract documents and design criteria.

.2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.

.5 Start-up verification forms and functional performance test forms will be provided by the Commissioning Agent for completion by the contractor.

1.4 COMMISSIONING (CX) OVERVIEW

.1 Contractor to participate fully in the commissioning process by providing required documentation and conducting the functional performance tests as led by the CxA.

.2 Functional performance testing will be done using a random sampling methodology. Depending on the quantity and nature of a particular component, equipment or system, the CxA will decide to commission a sampling strategy of between 10% to 100%. Sampling percentage is at the sole discretion of the CxA.

.3 Contractor to review functional performance test forms prior to testing for suitability with the installed equipment and systems. All concerns related to items such as invalidation of warranty, operating equipment outside recommended parameters, testing that may damage the equipment or systems, etc. are to be brought to the attention of the CxA, Design Team and Owner prior to testing.

.4 Cx to be a line item of Contractor's cost breakdown.

.5 Pay costs associated with starting, testing, adjusting and relevant instruments and supplies required to perform duties outlined in this and related Sections.

.6 Cx activities supplement field quality and testing procedures described in relevant technical sections of the Contract Documents. Cx activities do not relieve the Contractor from the contractual requirements outlined in other specification sections of the Contract Documents. Cx activities do not circumvent or relieve the Contractor from warranty requirements, responsibilities or obligations.

.7 Ensure all systems have been started, adjusted to design criteria, and are functionally operational, ready for independent testing. The CxA will not begin Functional Performance Testing until satisfied that all requirements have been met. The CxA reserves right to request inspection reports and sign-off from Contractor or Consultant that equipment and systems are ready for Functional Performance Testing.

.8 Employ experienced personnel for equipment start up and commissioning, who are able to interpret results of readings and tests, and report the system status in a clear and concise manner.

.9 Provide all equipment required to perform testing, balancing, and commissioning of systems. Calibrate instruments used in start-up; provide calibration certificates if requested by the CxA.

.10 Utilize equipment check certificates and other commissioning documents required by the CxA.

.11 Verify that equipment is installed in accordance with Contract Documents, and reviewed shop drawings.

.12 Commissioning will be considered complete once:

.1 Completed Cx documentation has been received, reviewed for suitability and approved by the CxA and the Owner.

.2 Equipment, components and systems have been commissioned and all issues have been addressed to the satisfaction of the Owner.

.3 O&M training has been completed.

1.5 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

.1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by the CxA to ensure effective performance.

.2 Costs for corrective work, additional tests and inspections to determine acceptability and proper performance of such items to be borne by the Contractor. Above costs to be in the form of progress payment reductions or hold-back assessments.

1.6 PRE-REQUISITES FOR FUNCTIONAL PERFORMANCE TESTING

.1 Prerequisites for functional testing are as follows:

.1 All related equipment has been started up and start-up reports and pre-functional checklists are submitted and approved ready for functional testing.

.2 All control system functions for this and all interlocking systems are programmed and operable per contract documents, including final setpoints and schedules with debugging, loop tuning and sensor calibrations completed.

.3 Piping system flushing complete and required report approved.

.4 Water treatment system complete and operational.

.5 Vibration control report approved (if required).

.6 Test and balance (TAB) complete and approved for the air and hydronic systems.

.7 All A/E deficiency list items for the equipment specified are corrected.

.8 Functional test procedures have been reviewed and approved by installing contractor.

.9 Safeties and operating ranges reviewed by the CxA and the Contractor.

.10 Test requirements and sequences of operation provided.

.11 Schedules and setpoints provided.

.12 False loading equipment, system and procedures ready.

.13 Crankcase heaters have been on long enough for start-up.

.14 Sufficient clearance around equipment for servicing.

.15 Record of all values for pre-test setpoints changed to accommodate testing has been made and a check box provided to verify return to original values (control parameters, limits, delays, lockouts, schedules, etc.)

.16 Other miscellaneous checks of the pre-functional checklist and start-up reports completed successfully.

.17 Points verification report from Control Contractor has been provided.

1.7 COMMISSIONING DELIVERABLES

.1 CxA will provide functional performance test forms prior to testing for review by the contractor. Functional performance tests will be based on equipment shop drawings, control system shop drawings and sequence of operation provided by the design team.

.2 Contractor to provide following documentation to support the commissioning process:

.1 Points verification forms

.2 Variable frequency drive manufacturer start-up report

.3 Manufacturer start-up reports for mechanical equipment such as boilers, air handling units, fans, pumps, etc., where applicable.

.4 As-built sequence of operation

.5 Training agenda and attendance form

1.8 EQUIPMENT AND SYSTEMS TO BE COMMISSIONED

.1 The following equipment and systems will be included in the commissioning process. This list is not considered final. Functional performance test forms will outline testing required.

.1 All control system input and output devices including, but not limited to, thermostats, sensors, valves, dampers, actuators, motors, etc.

.2 Variable frequency drives

.3 New or relocated equipment including, but no limited to, boiler, air handling units, fans, pumps, variable air or constant volume boxes, fan coils, etc.

.4 Sequences of operations

.5 Operator work station screen, links and graphics

.6 Other system components as required by the CxA, Design Team or Owner

1.9 OWNER TRAINING

.1 Contractor to deliver training program as outlined in the Contract Documents.

.2 Contractor to provide detailed agenda of each training session and an attendance form, signed by all participants.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 DESCRIPTION

.1 Work under this section, includes furnishing and installation of through penetration fire and smoke seals for openings in floors, walls and other elements of construction that are in accordance with ULC-S115-M95.

1.2 REFERENCES

.1 ULC-S115-M95, Standard Method of Fire Tests of Fire-stop Systems.

1.3 SAMPLES

.1 Submit samples in accordance with Division 01 – General Requirements.

1.4 SHOP DRAWINGS

.1 Submit shop drawings and product data in accordance with Division 01 – General Requirements.

.2 Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation.

1.5 QUALITY ASSURANCE

.1 Performance:

.1 Materials shall have been tested to provide a fire resistance rating equal to or surpassing that required by the design document.

.2 A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of fire-stop 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.

.3 For those fire-stop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgement 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 judgement drawings must follow requirements set forth by the International Fire-stop Council (September 7, 1994, as may be amended from time to time).

.4 Applicator Qualifications:

.1 Experienced installer of UL or ULC classified fire stop systems or industry equivalent.

.2 Licensed applicator by the product manufacturer.

1.6 PROJECT CONDITIONS

.1 Existing conditions:

.1 Installer shall verify that existing conditions and substrate are acceptable for the proposed application before starting the work. Unsatisfactory conditions must be corrected before proceeding.

Part 2 Products

2.1 GENERAL

.1 Provide fire-stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the fire-stopping under conditions of service and application, as demonstrated by the fire-stopping manufacturer based on testing and field experience.

.2 Provide components for each fire-stopping system that are needed to install fill material. Use only components specified by the fire-stopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.

.3 Acceptable Material: Hilti (Canada) Limited, A/D Fire Protection Systems Inc., Johns Manville, 3M Canada, or an approved alternate.

.1 Manufacturer used shall provide a written schedule indicating specific areas products will be used, as per schedule indicated below.

2.2 MATERIALS

.1 Fire-stopping and smoke seal systems: in accordance with ULC-S115.

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended.

.2 Provide materials classified by a qualified third party test facility tested in a system to provide fire resistance equal to at least the rating of construction assembly being penetrated, or as dictated by the local code authority.

.3 All penetrations to be fire stopped for 1 hour unless noted otherwise.

.2 Cast-in-place fire-stop devices for use with non-combustible and combustible plastic pipe (closed and open piping systems) penetrating concrete floors.

.3 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT).

.4 Sealants or caulking materials for use with sheet metal ducts.

.5 Sealants, caulking or spray materials for use with fire-rated construction joints and other gaps.

.6 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe.

.7 Intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles.

.8 Non-curing, re-penetrable intumescent sealants, caulking or putty materials for use with flexible cable or cable bundles.

.9 Wall opening protective materials for use with U.L.C. listed metallic and specified non-metallic outlet boxes.

.10 Fire-stop color or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems).

.11 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.

.12 Non-curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.

.13 Sealants or caulking materials used for openings between structurally separate sections of wall and floors.

.14 For non-combustible pipes, tubing, ducts, optical fibre cables, electrical wires and cables, totally enclosed non-combustible raceways, electrical outlet boxes and similar building services that penetrate through a Fire Separation provide a fire-stop system with an “F” rating as determined by ULC or cUL.

.15 For penetrations through a Fire Wall or through a horizontal Fire Separation between a major occupancy area, provide a fire-stop system with a “FT” rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

.16 For joints provide a fire-stop system with an Assembly Rating as determined by ULC-S115-M95, ULC-S115-M95 or UL 2079 which is equal to the fire resistance rating of the construction being penetrated.

.17 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.18 Primers: to manufacturer’s recommendation for specific material, substrate and end use.

.19 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.

.20 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.

.21 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire-stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 INSTALLATION

.1 Install fire-stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and un-penetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

.1 Notify Engineer when ready for inspection and prior to concealing or enclosing fire-stopping materials and service penetration assemblies.

.2 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 been 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.

3.4 CLEAN UP

.1 Perform cleaning operations in accordance with manufacturer's recommendations.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 78 00 – Closeout Submittals.

.2 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.3 Section 07 92 00 - Joint Sealants.

1.2 REFERENCES

.1 Master Painters Institute (MPI).

.1 MPI Architectural Painting Specifications Manual, latest edition.

.2 Canadian General Standards Board (CGSB).

.3 National Fire Code of Canada 2005.

.4 Health Canada/ Workplace Hazardous materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

1.3 PRODUCT DATA

.1 Submit manufacturer’s technical product data for each primer and paint product. Submit in accordance with Section 01 33 00 - Submittals.

.2 Submit full records of all products used. List each product in relation to finish formula and include the following:

.1 Finish formula designation.
.2 Product type and use.
.3 CGSB number.
.4 Manufacturer's product number.
.5 Colour number [numbers].
.6 Manufacturer's Material Safety Data Sheets (MSDS).
.7 Maximum VOC classification.
.8 Ecologo certification.

.3 Submit manufacturer's application instructions for each product specified.

1.4 QUALITY ASSURANCE

.1 Conform to latest MPI requirements for interior painting work including preparation and priming.

.2 Standard of acceptance:

.1 Walls: no defects visible from a distance of 1000mm at 90° to surface.

.2 Ceilings: no defects visible from floor at 45° to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.5 DELIVERY STORAGE AND HANDLING

.1 Pack, ship, handle and unload materials in accordance with manufacturers written instructions. Deliver and store materials in original containers, sealed, with labels intact.

.2 Indicate on containers or wrappings:

.1 Manufacturer's name and address.

.2 Type of paint.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials.

.5 Provide and maintain dry, temperature controlled, secure storage.

.6 Observe manufacturer's recommendations for storage and handling.

.7 Store materials and supplies away from heat generating devices.

.8 Store materials and equipment in well ventilated area with temperature range 7 - 30° C.

.9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Architect/Project Manager. After completion of operations, return areas to clean condition to approval of Architect/Project Manager.

.11 Provide adjacent to work area, min. one 9 kg Type ABC dry chemical fire extinguisher.

.12 Remove only in quantities required for same day use.

.13 Fire Safety Requirements

.1 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.

.2 Ventilation:

.1 Ventilate area of work as directed by Architect/Project Manager by use of approved portable supply and exhaust fans.

.3 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturers recommendations.

.4 Substrate and ambient temperature must be within limits prescribed in paint standard and by manufacturer to approval of Architect/Project Manager.

.5 Maintain minimum substrate and ambient air temperature of 5° C for Alkyd and 7° C for latex paints. Maximum relative humidity 85% unless noted otherwise. Maintain supplemental heating until paint has cured sufficiently.

.6 Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.

.7 Apply paint only when surface to be painted is dry, properly cured and adequately prepared.

.8 Painting in occupied facilities to be carried out to approval of Architect/ Project Manager such that painted surfaces will have dried and cured sufficiently before occupants are affected.

.9 Provide minimum 270 lx on surfaces to be painted.

1.7 SCHEDULING

.1 Submit work schedule for painting to Architect/Project Manager for approval. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Obtain written authorization from Architect/Project Manager for any changes in work schedule.

.3 Schedule painting operations of occupied areas and of large areas for which paint type will emit strong odors to be carried out during the weekend off-hours periods to prevent disruption of occupants in and about the building.

1.8 EXTRA MATERIALS

.1 Submit maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

.2 Submit one (1) litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.

.3 Storage of extra materials is to be as directed by Architect/Project Manager.

Part 2 Products

2.1 MATERIALS

.1 Qualified products: only paint materials listed on the CGSB Qualified Products List are acceptable for use on this project.

.2 Paint materials for each coating formula to be products of a single manufacturer unless noted otherwise by the Architect.

.3 Whenever possible, select products exhibiting low odour characteristics. If two products are otherwise equivalent, select the product with the lowest odour.

2.2 COLOURS

.1 Paint colours: to match existing.

.2 Repairs to walls or finished areas will require the Contractor to completely refinish a full section of wall to nearest corner or edge to allow matching of tones.

.3 Perform all colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials allowed only with Architect/Project Manager's written permission.

.4 Frequency of colour change on walls. Bulkheads and ceilings:

.1 Bulkheads and columns, particularly in large open areas and along exterior walls, may have change of colour from remainder of other surfaces.

.2 Smaller rooms such as enclosed offices, boardrooms, etc. may have one or two of the four walls of a different colour than remainder of room.

.5 Selection of colours will be from manufacturer’s full range of colours:

.1 Where specific products are available in a restricted range of colours, the selection will be based on the limited range.

2.3 PAINT FINISHES

.1 Formula 1 (Alkyd): for gypsum board, walls apply, new and existing:

.1 one coat latex primer sealer CAN/CGSB-1.119.

.2 two coats semi gloss enamel CAN/CGSB-1.57.

.3 CPCA System INT-4-A, premium. Finish coat: semi gloss.

.2 Formula 2 (Alkyd): for gypsum board, ceilings and bulkheads apply, new and existing:

.1 one coat latex primer sealer CAN/CGSB-1.119.

.2 two coats low gloss enamel CAN/CGSB-1.202.

.3 CPCA System INT-4-A, premium. Finish coat: low gloss.

.3 Formula 3 for concrete floors:

.1 two part Corotech V155 epoxy pre primer 155-00 followed by 155-90.

.2 two part Corotech V400 polymide epoxy coating 400-70 followed by 400-91.

.3 imbed Silica sand between the two coats of the V400 application.

.4 Formula 4 (Alkyd): for shop primed ferrous metal surfaces, including steel doors and P.S. frames, new and existing:

.1 touch up with shop primer as provided by fabricator.

.2 one coat marine alkyd metal primer CGSB 1-GP-48M.

.3 two coats semi gloss enamel CAN/CGSB-1.57.

.4 CPCA System INT-12-A, premium. Finish coat: semi gloss.

.5 Painting of existing surfaces: application of spot primer coat is acceptable for previously painted surfaces provided that:

.1 Existing paint type is same or compatible with new paint.

.2 Paint manufacturer recommendations are followed for required surface preparation and bond between existing and new coatings.

.3 Final paint finish is uniform in colour and appearance for wall surface.

2.4 MIXING PAINT

.1 Re-Mix ingredients in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and uniform composition.

.2 Mixing and application of Corotech V155 and V400 products is to be untaken in stick accordance with manufacturer's written instructions and by personnel experienced in the application of two component products.

2.5 NUMBER OF COATS

.1 Where dark colours are selected or existing dark tones are being recovered by a lighter paint colour, use an appropriately tinted primer and apply sufficient number of finish coats to fully hide existing colours.

.2 Formula 3 for concrete floors requires a one coat application of each of the components with a tack free state scheduled at 12 hours for the V155 pre-primer and one hour for the V400 products specified. and as such requiring the room temperature to be maintained at 25 degrees Celsius and ventilation to the maximum obtainable.

Part 3 Execution

3.1 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply all paint materials in accordance with paint manufacturers written application instructions.

3.2 EXISTING CONDITIONS

.1 Prior to commencement of work, thoroughly investigate work area conditions and existing substrates to be repainted for:

.2 Problems related to proper and complete preparation of surfaces to be painted.

.3 Compatibility between existing paint and paint coatings specified.

.4 Report to Architect/Project Manager damages, defects, unsatisfactory or unfavourable conditions, potential paint bond problems between existing and new coatings, and other issues that will adversely affect work.

.5 Where paint compatibility issues arise, obtain paint manufacturers recommendations on paint type and direction to be followed. Submit written data to Architect/Project Manager who will advise on course of action.

3.3 PREPARATION

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, door stops, accessories and all other surface mounted fittings and fastenings prior to undertaking any painting operations. Store for re-installation after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Architect/Project Manager.

3.4 PROTECTION

.1 Protect existing building surfaces, finishes and equipment not to be painted from paint spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by Architect/Project Manager.

.2 Cover or mask floors, windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.

.3 Protect items that are permanently attached such as Fire Labels on doors and frames.

.4 Protect factory finished products and equipment.

.5 Protect building occupants in and about the building.

.6 Place “WET PAINT” signs in occupied areas to approval of Architect/Project Manager.

3.5 PATCHING

.1 Patch and repair surfaces before painting.

.2 Remove extraneous screws, nails, screw inserts, miscellaneous hangers and other objects from walls.

.3 Remove sealant beads, old masking and cellulose tapes, paint ridges and other residues. Cut and remove high ridges from surfaces.

.4 Repair cracks in broken gypsum board and plaster surfaces. Fill all holes, cracks, depressions and spalls in surfaces to be painted. Use a shrinkage-free plaster patching compound and fiberglass tape.

.5 Fill dents in steel surfaces by use of purpose made body filler.

.6 Patchwork and repairs to be flush and level with adjacent surfaces, smooth and inconspicuous after final painting has been completed.

3.6 CLEANING

.1 Clean all surfaces to be painted as follows:

.1 Remove all dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths.

.2 Wash surfaces with solution of Biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements.

3.7 QUALITY ASSURANCE

.1 Standard of Acceptance:

.1 Walls/Steel. No defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings. No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 APPLICATION

.1 Method of application to be as approved by Architect/Project Manager.

.2 Apply paint by brush and roller. Conform to manufacturer's application instructions unless specified otherwise. Do not use any type of spray equipment.

.3 Brush application:

.1 Work paint into cracks, crevices and corners. Paint surfaces not accessible to brushes by spray, daubers or sheepskins.

.2 Brush out runs and sags.

.3 Remove runs, sags and brush marks from finished work and repaint.

.4 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between each coat to remove visible defects.

.7 Finish surfaces both above and below sight lines as specified for surrounding surfaces. Finish closets and alcoves as specified for adjoining rooms.

.8 Finish top, edges and cutouts of doors.

3.9 PAINTING OF PATCHWORK

.1 Paint existing walls and ceilings which have been patched or marred by work.

.1 Apply paint to full wall/ceiling surfaces up to well defined borders, corners, changes in surface or wall finish to blend-in new finish with existing and provide a continuous finished appearance in paint colour, tone and texture for entire room.

3.10 RESTORATION

.1 Clean and re-install all hardware items that were removed before undertaken painting operations.

.2 Remove paint splashes on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.3 Protect freshly completed surfaces from paint droppings and dust to approval of Architect/Project Manager. Avoid scuffing newly applied paint.

.4 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Architect/Project Manager.

3.11 EPOXY PREPRIMER POLYMIDE EPOXY COATING

.1 The contractor is to ensure that the application of these products is in strict adherence with the manufacturer's written instructions as required to accomplish a drying schedule with Tack Free state of 12 hours for the pre-primer and 1 hour for the polymide epoxy coating. This will require the Contractor to provide supplementary heating and ventilation sufficient to accomplish the stated objective.

.2 The completion of the concrete floor painting is to be a minimum 18 hours before the commencement of the commencement of the regular Monday work day.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Division 1 – General Requirements.

.2 All Mechanical Sections.

1.2 RELATED DOCUMENTS

.1 South Coast Air Quality Management District (AQMD) – Rule 1168: Adhesives and Sealant Applications; complete with all amendments up to and including January 7, 2005.

1.3 SCOPE OF WORK

.1 The work of the Mechanical Sections includes all labour, materials and equipment necessary for the installation complete of the mechanical systems shown on the drawings and described in these specifications.

.2 It is the requirement of this work to provide all systems complete functioning in intended system operation, notwithstanding that every item necessarily required may not be specifically mentioned.

1.4 SUBMITTALS

.1 Submittals: in accordance with Division 1.

.2 Shop drawings to be approved by Engineer to show:

.1 Mounting arrangements.

.2 Operating and maintenance clearances.

.3 Shop drawings and product data accompanied by:

.1 Detailed drawings of bases, supports, and anchor bolts.

.2 Acoustical sound power data, where applicable.

.3 Points of operation on performance curves.

.4 Manufacturer to certify current model production.

.5 Certification of compliance to applicable codes.

.4 In addition to transmittal letter referred to in Division 1.

.5 Closeout Submittals:

.1 Provide operation and maintenance data for incorporation into manual specified in Division 1.

.2 Operation and maintenance manual approved by, and final copies deposited with, Engineer before final inspection.

.3 Operation data to include:

.1 Control schematics for systems including environmental controls.

.2 Description of systems and their controls.

.3 Description of operation of systems at various loads together with reset schedules and seasonal variances.

.4 Operation instruction for systems and component.

.5 Description of actions to be taken in event of equipment failure.

.6 Valves schedule and flow diagram.

.7 Colour coding chart.

.4 Maintenance data to include:

.1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.

.2 Data to include schedules of tasks, frequency, tools required and task time.

.5 Performance data to include:

.1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.

.2 Equipment performance verification test results.

.3 Special performance data as specified.

.6 Approvals:

.1 Submit required copies of draft Operation and Maintenance Manual to Departmental Representative and Engineer for approval. Submission of individual data will not be accepted.

.2 Make changes as required and re-submit as directed by Departmental Representative and Engineer.

.7 Additional data:

.1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.

.8 Site records:

.1 Departmental Representative will provide 1 set of reproducible mechanical drawings. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.

.2 Transfer information weekly to reproducible, revising reproducible to show work as actually installed.

.3 Use different colour waterproof ink for each service.

.4 Make available for reference purposes and inspection.

.9 As-built drawings:

.1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).

.3 Submit to Departmental Representative and Engineer for approval and make corrections as directed.

.4 Perform testing, adjusting and balancing for HVAC using as-built drawings.

.5 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

.10 Submit copies of as-built drawings for inclusion in final TAB report in accordance with Division 1.

1.5 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Division 1.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 1.

1.6 EQUIPMENT INSTALLATION

.1 In accordance with Manufacturer's instructions unless otherwise indicated.

.2 Use valves and either unions or flanges for isolation and ease of maintenance and assembly.

1.7 CLEARANCES

.1 Provide space for disassembly, removal of equipment and components as recommended by Manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment or components.

1.8 TRIAL USAGE

.1 General

.1 Commissioning requirements in accordance with Division 1.

.2 Engineer may use equipment and systems for test purposes prior to acceptance. Supply labour, material and instruments required for testing.

.2 Use of systems during construction

.1 Use of mechanical systems during construction.

.2 Use of new and existing permanent heating and ventilating systems for supplying temporary heat or ventilation is permitted only under following conditions:

.1 Entire system is complete, commissioned, pressure tested, cleaned and flushed out.

.2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.

.3 Building has been closed in, areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.

.4 There is no possibility of damage.

.5 Supply ventilation systems are protected by 60% filters, inspected daily, changed every 2 weeks or more frequently as required.

.6 Return systems have approved filters over openings, inlets and outlets.

.7 Systems will be:

.1 Operated as per Manufacturer's recommendations and instructions.

.2 Operated by Contractor.

.3 Monitored continuously by Contractor.

.8 Warranties and Guarantees are not relaxed.

.9 Regular preventive and other Manufacturer's recommended maintenance routines are performed by Contractor at own expense and under supervision of Departmental Representative and Engineer.

.10 Refurbish entire system before static completion; clean internally and externally, restore to "as-new" condition and replace filters in air systems.

.3 Filters specified in this Section are over and above those specified in other Sections of this project.

1.9 FIRESTOPPING

.1 All Sub-Contractors shall coordinate all fire rated assembly penetrations with General Contractor. Fire stopping to be by the General Contractor.

.2 Firestopping and smoke seal materials at openings around mechanical equipment as required to maintain firestop system rating equal to assembly.

.3 Sub-Contractor shall provide required clearances between outside surface of pipe and inside surface of sleeve, core drilled hole or listed fire rated system.

1.10 TESTS

.1 Give 48 hours written notice of date for all tests.

.2 Insulate or conceal work only after testing and approval by Engineer.

.3 Conduct tests in presence of Engineer and local authority having jurisdiction where applicable.

.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 or test medium.

1.11 INTERPRETATION OF PLANS AND SPECIFICATIONS

.1 These specifications are to be considered as an integral part of the plans which accompany them and neither the plans not the specifications shall be used alone. Any item which is omitted in one but which is reasonably implied in the other shall be considered properly and sufficiently specified and must, therefore, be provided by this Contractor.

.2 Misinterpretation of the plans or specifications shall not relieve this Contractor of responsibility; final interpretation of details and clauses remains with the Engineer.

.3 Where uncertainty exists in the passing of pipes and location of equipment, the General Contractor and or project manager shall be consulted before work is started. Where such materials and equipment have been installed so as to cause interference with the inside treatment of the building, they shall be removed and relocated without additional cost to the Owner.

.4 The plans do not necessarily show all valves, duct offsets, access panels, connections, balancing fittings, bases, isolators, flexible connections, drains, etc., and this Contractor shall not avail himself of these obvious omissions, but shall install the work complete in essential details so that it will function properly, can be easily balanced and so that repairs and removal of equipment can easily be made.

.5 Building dimensions shall not be scaled from the Mechanical plans but shall be obtained from on-site dimensions of the building. Any discrepancy between the drawings and the building shall be questioned before proceeding with any installation.

1.12 CO-OPERATION OF CONTRACTORS

.1 This Contractor shall become familiar with the work of other contractors and in laying out and installing the work shall co-operate with the other Contractors, so as to facilitate the progress of the work as a whole and avoid interference or delays. Where interference exists, this Contractor shall notify the General Contractor and/or project manager and the engineer before installing the work.

Any changes in the work or alterations of the Mechanical Contractor's schedule of procedure required for such co-operation will not be considered as a claim for extra compensation.

.2 Due to the complexities of many sub-trades, and the restrictive space available in this project, it is required that all trades co-operate closely so as to install all systems in their allotted locations as indicated on the drawings, or coordination on site.

1.13 ERRORS AND OMISSIONS

.1 The drawings are not intended to show every item of accessory equipment, but the Contractor shall tender on and install all essential details to provide for efficiency of operation and ease of maintenance.

.2 Should this Contractor discover errors or discrepancies in the plans or specification, he shall refer the matter to the Engineer for change or clarification and shall not proceed with that portion of the work until advised by the Engineer to do so.

1.14 MAINTENANCE

.1 Furnish spare parts in accordance with Division 1.

.2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Division 1.

.3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

1.15 DELIVERY, STORAGE, AND HANDLING

.1 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section Division 1.

.2 Store and handle materials in accordance with Construction Plan and Manufacturer's written instructions.

1.16 MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

.1 General

.1 Electrical motors, drives and guards for mechanical equipment and systems.

.2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on Electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.

.3 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

.4 Motor shall be inverter duty rated for use with VFD's where required.

.2 Premium efficiency motor specifications TEFC Motors 1-200 HP.

.1 All motors furnished shall be designed, manufactured, and tested in accordance with the latest applicable standards of NEMA, ANSI, IEEE, and ASTM. As a minimum requirement, all motors shall conform to the latest applicable sections of NEMA Standard No. MG-1. Motors must meet or exceed CEE Premium Efficiency™ full load efficiencies.

The Consortium for Energy Efficiency (CEE), a national, non-profit public benefits corporation, promotes the manufacture and purchase of energy-efficient products and services.

.2 Per CEE Premium Efficiency™ Criteria, minimum efficiencies for TEFC motors shall be equal to or greater than those shown below:

HP	1200 RPM	1800 PM	3600 RPM
1	82.5	85.5	78.5
1.5	87.5	86.5	85.5
2	88.5	86.5	86.5
3	89.5	89.5	88.5
5	89.5	89.5	89.5
7.5	91.7	91.7	91.0
10	91.7	91.7	91.7
15	92.4	92.4	91.7
20	92.4	93.0	92.4
25	93.0	93.6	93.0

HP	1200 RPM	1800 PM	3600 RPM
30	93.6	93.6	93.0
40	94.1	94.1	93.6
50	94.1	94.5	94.1
60	94.5	95.0	94.1
75	95.0	95.4	94.5
100	95.4	95.4	95.0
125	95.4	95.4	95.4
150	95.8	95.8	95.4
200	95.8	96.2	95.8

.3 Premium efficiency motor specifications ODP motors 1-200 HP.

.1 All motors furnished shall be designed, manufactured, and tested in accordance with the latest applicable standards of NEMA, ANSI, IEEE, and ASTM. As a minimum requirement, all motors shall conform to the latest applicable sections of NEMA Standard No. MG-1.

Motors must meet or exceed CEE Premium Efficiency™ full load efficiencies. The Consortium for Energy Efficiency (CEE), a national, non-profit public benefits corporation, promotes the manufacture and purchase of energy-efficient products and services.

.2 Per CEE Premium Efficiency™ Criteria, minimum efficiencies for TEFC motors shall be equal to or greater than those shown below:

HP	1200 RPM	1800 PM	3600 RPM
1	82.5	85.5	80.0
1.5	86.5	86.5	85.5
2	87.5	86.5	86.5
3	89.5	89.5	86.5
5	89.5	89.5	89.5
7.5	91.7	91.0	89.5
10	91.7	91.7	90.2
15	92.4	93.0	91.0
20	92.4	93.0	92.4
25	93.0	93.6	93.0
30	93.6	94.1	93.0
40	94.1	94.1	93.6
50	94.1	94.5	93.6
60	95.0	95.0	94.1
75	95.0	95.0	94.5
100	95.0	95.4	94.5
125	95.4	95.4	95.0
150	95.8	95.8	95.4
200	95.4	95.8	95.4

1.17 BELT DRIVES

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise indicated.

.3 For motors under 7.5 kW: standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave determined during commissioning.

.6 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

.8 Supply one set of spare belts for each set installed in accordance with Division 1 – General Requirements.

1.18 DRIVE GUARDS

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;

.1 Expanded metal screen welded to steel frame.

.2 Minimum 1.2 mm thick sheet metal tops and bottoms.

.3 38 mm dia holes on both shaft centres for insertion of tachometer.

.4 Removable for servicing.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.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 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, 19 mm mesh.

.2 Net free area of guard: not less than 80% of fan openings.

.3 Securely fasten in place.

.4 Removable for servicing.

Part 2 Products

2.1 MATERIALS

.1 Materials and products in accordance with Division 1.

Do verification requirements in accordance with Division 1.

2.2 VOC LIMITS

.1 The purpose of this section is to reduce emissions of volatile organic compound (VOCs) and to eliminate emissions of chloroform, ethylene dichloride, methylenechloride, perchloroethylene, and trichloroethylene from the application of adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, or any other primers.

This section applies to all commercial and industrial sales and applications of adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, or any other primers, unless otherwise specifically exempted by this rule.

.2 Requirements

.1 Unless otherwise specified in paragraph .2 a person shall not apply any adhesives, adhesive bonding primers, adhesive primers, or any other primer, which have a VOC content in excess of 250 g/L less water and less exempt compounds.

.2 A person shall not apply adhesives, adhesive bonding primers, adhesive primers, sealants, sealant primers, or any other primer, which have a VOC content in excess of the limits specified below:

.3 VOC Limit*, Less Water and Less Exempt Compounds in Grams per Liter

Fig. 1

Architectural Applications	Current VOC Limit
Cove Base Adhesives	50
Multipurpose Construction Adhesives	70
Structural Glazing Adhesives	100
Single Ply Roof Membrane Adhesives	250

Fig. 2

Specialty Applications	VOC Limits and Effective Dates**			
	Current VOC Limit	1-1-05	7-1-05	1-1-07
PVC Welding	**510**			
CPVC Welding	**490**			
ABS Welding	400		**325**	
Plastic Cement Welding	350	**250**		
Adhesive Primer for Plastic	650		**550**	
Computer Diskette Manufacturing	350			
Contact Adhesive	80			
Special Purpose Contact Adhesive	250			
Tire Retread	100			

Specialty Applications	VOC Limits and Effective Dates**			
Adhesive Primer for Traffic Marking Tape	150			
Structural Wood Member Adhesive	140			
Sheet Applied Rubber Lining Operations	850			
Top and Trim Adhesive	540			250

** The specified limits remain in effect unless revised limits are listed in subsequent columns.

.1 For adhesives, adhesive bonding primers, or any other primer not regulated by the above two tables and applied to the following substrates, the following limits shall apply:

Fig. 3

Substrate Specific Applications	Current VOC Limit
Metal to Metal	**30**
Plastic Foams	**50**
Porous Material (except wood)	**50**
Wood	**30**
Fiberglass	**80**

.2 If an adhesive is used to bond dissimilar substrates together the adhesive with the highest VOC content shall be allowed.

Fig. 4

Sealants	Current VOC Limit
Architectural	**250**
Marine Deck	760
Nonmembrane Roof	300
Roadway	250
Single-Ply Roof Membrane	450
Other	420

Fig. 5

Sealant Primers	Current VOC Limit
Architectural **Non Porous** **Porous**	 **250** **775**
Modified Bituminous	500
Marine Deck	760
Other	**750**

* For low-solid adhesives or sealants the VOC limit is expressed in grams per liter of material as determined in paragraph .3; for all other adhesives and sealants, VOC limits are expressed as grams of VOC per liter of adhesive or sealant less water and less exempt compounds as determined in paragraph .4.

.3 GRAMS OF VOC PER LITER OF MATERIAL is the weight of VOC per volume of material, to be used for a low-solids adhesive or sealant, and can be calculated by the following equation:

$$\text{Grams of VOC per Liter of Material} = \frac{W_s - W_w - W_{es}}{V_m}$$

Where:
- W_s = weight of volatile compounds, in grams
- W_w = weight of water, in grams
- W_{es} = weight of exempt compounds, in grams
- V_m = volume of material, in liters

.4 GRAMS OF VOC PER LITER OF ADHESIVE OR SEALANT, LESS WATER AND LESS EXEMPT COMPOUNDS is the weight of VOC per combined volume of VOC and adhesive or sealant solids, and can be calculated by the following equation:

$$\text{Grams of VOC per Liter of Adhesive or Sealant, Less Water and Less Exempt Compounds} = \frac{W_s - W_w - W_{es}}{V_m - V_w - V_{es}}$$

Where:
- W_s = weight of volatile compounds, in grams
- W_w = weight of water, in grams
- W_{es} = weight of exempt compounds, in grams
- V_m = volume of material, in liters
- V_w = volume of water, in liters
- V_{es} = volume of exempt compounds, in liters

For adhesives or sealants that contain reactive diluents, the VOC content of the adhesive or sealant is determined after curing. The grams of VOC per liter of any adhesive or sealant, except a low solids adhesive or sealant shall be calculated by the following equation:

$$\text{Grams of VOC per Liter of Adhesive or Sealant, Less Water and Less Exempt Compounds} = \frac{W_{rs} - W_{rw} - W_{res}}{V_{rm} - V_{rw} - V_{res}}$$

Where:
- W_{rs} = weight of volatile compounds not consumed during curing, in grams
- W_{rw} = weight of water not consumed during curing, in grams
- W_{res} = weight of exempt compounds not consumed during curing, in grams
- V_m = volume of material prior to reaction, in liters
- V_w = volume of water, in liters
- V_{es} = volume of exempt compounds, in liters

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

.1 Prime and touch up marred finished paintwork to match original.

.2 Restore to new condition, finishes which have been damaged.

3.2 CLEANING

.1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

3.3 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Division 1 and submit report.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed.

3.4 DEMONSTRATION

.1 City of Saint John Representative and Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.

.2 Trial usage to apply to following equipment and systems:

.1 Roof Top Heat Pumps.

.3 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

.4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.

.5 Instruction duration time requirements as specified in appropriate sections.

.6 City of Saint John Representative may record these demonstrations on video tape for future reference.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.

.2 Related Sections:

.1 Division 1.

.2 Section 23 05 05 – Installation of Pipework.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)

.1 ASTM A125-1996 (R2007), Specification for Steel Springs, Helical, Heat-Treated.

.2 ASTM A307-10, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.3 ASTM A563-07a, Specification for Carbon and Alloy Steel Nuts.

.2 Factory Mutual (FM)

.3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)

.1 MSS SP58-2009, Pipe Hangers and Supports - Materials, Design and Manufacture.

.2 ANSI/MSS SP69-2003, Pipe Hangers and Supports - Selection and Application.

.3 MSS SP89-2003, Pipe Hangers and Supports - Fabrication and Installation Practices.

.5 Underwriter's Laboratories of Canada (ULC)

1.3 SYSTEM DESCRIPTION

.1 Design Requirements:

.1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.

.2 Base maximum load ratings on allowable stresses prescribed by MSS SP58.ASME B31.1 or

.3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.

.4 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.

.5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

1.4 SUBMITTALS

.1 Submittals: in accordance with Division 1.

.2 Submit shop drawings and product data for following items:

.1 Bases, hangers and supports.

.2 Connections to equipment and structure.

.3 Structural assemblies.

.3 Quality assurance submittals: submit following in accordance with Division 1.

.1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual Division 1.

1.5 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Division 1.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Division 1 and Division 23 – Common Work Results for HVAC.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 1 – General Requirements.

Part 2 Products

2.1 GENERAL

.1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.

.2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

2.2 PIPE HANGERS

.1 Finishes:

.1 Pipe hangers and supports: galvanized after manufacture.

.2 Use hot dipped galvanizing process.

.3 Ensure steel hangers in contact with copper piping are copper plated or epoxy coated.

.2 Upper attachment structural: suspension from lower flange of I-Beam:

.1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.

.1 Rod: 13 mm.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, to MSS-SP58 and MSS-SP69.

.3 Upper attachment structural: suspension from upper flange of I-Beam:

.1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, to MSS SP69.

.2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut.

.4 Upper attachment to concrete:

.1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6 mm minimum greater than rod diameter.

.2 Concrete inserts: wedge shaped body with knockout protector plate to MSS SP69.

.5 Shop and field-fabricated assemblies:

.1 Trapeze hanger assemblies.

.2 Steel brackets.

.6 Hanger rods: threaded rod material to MSS SP58:

.1 Ensure that hanger rods are subject to tensile loading only.

.2 Provide linkages where lateral or axial movement of pipework is anticipated.

.7 Pipe attachments: material to MSS SP58:

.1 Attachments for steel piping: carbon steel galvanized.

.2 Attachments for copper piping: copper plated black steel.

.3 Use insulation shields for hot pipework.

.4 Oversize pipe hangers and supports.

.8 Adjustable clevis: material to MSS SP69, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.

.1 Ensure "U" has hole in bottom for rivetting to insulation shields.

.9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.

.10 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.

.1 Finishes for steel pipework: galvanized.

.2 Finishes for copper, glass, brass or aluminum pipework: galvanized, with formed portion plastic coated or epoxy coated.

.11 Acceptable materials: Grinnell, E. Myatt & Co., Erico.

2.3 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel to MSS SP58, type 42.

.2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.

.3 Bolts: to ASTM A307.

.4 Nuts: to ASTM A563.

.5 Acceptable materials: Grinnell, E. Myatt & Co., Erico.

2.4 INSULATION PROTECTION SHIELDS

.1 Insulated cold piping:

.1 64 kg/m^3 density insulation plus insulation protection shield to: MSS SP69, galvanized sheet carbon steel. Length designed for maximum 3 m span.

.2 Insulated hot piping:

.1 Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

2.5 EQUIPMENT SUPPORTS

.1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel.

2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES

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

2.7 HOUSE-KEEPING PADS

.1 Provide templates to ensure accurate location and size of pads.

.2 House keeping pads by others.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with:

.1 Manufacturer’s instructions and recommendations.

.2 Vibration Control Devices:

.1 Install on piping systems at pumps, fans and as indicated.

.3 Clamps on riser piping:

.1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
.2 Bolt-tightening torques to industry standards.
.3 Steel pipes: install below coupling or shear lugs welded to pipe.
.4 Cast iron pipes: install below joint.

.4 Clevis plates:

.1 Attach to concrete with 4 minimum concrete inserts, one at each corner.

.5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.

.6 Use approved constant support type hangers where:

.1 Vertical movement of pipework is 13 mm or more,
.2 Transfer of load to adjacent hangers or connected equipment is not permitted.

3.3 HANGER SPACING

.1 Plumbing piping: to Canadian Plumbing Code and authority having jurisdiction.

.2 Fire protection: to applicable fire code.

.3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.

.4 Copper piping: up to NPS 1/2: every 1.5 m.

.5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.6 Within 300 mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	

.7 Pipework greater than NPS 12: to MSS SP69.

3.4 HANGER INSTALLATION

.1 Install hanger so that rod is vertical under operating conditions.

.2 Adjust hangers to equalize load.

.3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

3.5 HORIZONTAL MOVEMENT

.1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.

.2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

3.6 FINAL ADJUSTMENT

.1 Adjust hangers and supports:

.1 Ensure that rod is vertical under operating conditions.

.2 Equalize loads.

.2 Adjustable clevis:

.1 Tighten hanger load nut securely to ensure proper hanger performance.

.2 Tighten upper nut after adjustment.

.3 C-clamps:

.1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

.4 Beam clamps:

.1 Hammer jaw firmly against underside of beam.

3.7 FIELD QUALITY CONTROL

.1 Site Tests: conduct following tests in accordance with Division 1.

.2 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed.

.4 Applicable Systems: Vibration Isolation.

.3 Verification requirements in accordance with Division 1.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.

1.2 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.

.2 CAN/CGSB-24.3-92, Identification of Piping Systems.

.2 National Fire Protection Association (NFPA)

.1 NFPA 13-2010, Standard for the Installation of Sprinkler Systems.

1.3 SUBMITTALS

.1 Product Data:

.2 Submittals: in accordance with Division 1 – General Requirements.

.3 Product data to include paint colour chips, other products specified in this section.

1.4 QUALITY ASSURANCE

.1 Quality assurance submittals: submit following in accordance with Division 1.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Division 1.

.2 Indicate VOC/s for all adhesives and solvents during application and curing.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Division 1.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 1.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

.1 Metal or plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.

.2 Lettering and numbers raised or recessed.

.3 Information to include, as appropriate:

.1 Equipment: manufacturer's name, model, size, serial number, capacity.

.2 Motor: voltage, Hz, phase, power factor, duty, frame size.

2.2 SYSTEM NAMEPLATES

.1 Colours:

.1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

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

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size #5.

.2 Equipment in Mechanical Rooms: use size #9.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Departmental Representative and Engineer.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Propane: to CSA/CGA B149.1 and authority having jurisdiction.

.2 Sprinklers: to NFPA 13.

2.5 IDENTIFICATION OF PIPING SYSTEMS

.1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.

.2 Pictograms:

.1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.

.3 Legend:

.1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.

.4 Arrows showing direction of flow:

.1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.

.2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.

.3 Use double-headed arrows where flow is reversible.

.5 Extent of background colour marking:

.1 To full circumference of pipe or insulation.

.2 Length to accommodate pictogram, full length of legend and arrows.

.6 Materials for background colour marking, legend, arrows:

.1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.

.2 Other pipes: pressure sensitive [plastic-coated cloth] [vinyl] with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150°C and intermittent temperature of 200°C.

.7 Colours and Legends:

.1 Where not listed, obtain direction from Departmental Representative.

.2 Colours for legends, arrows: to following table:

Background colour:	**Legend, arrows:**
Yellow	BLACK
Green	WHITE
Red	WHITE

.3 Background colour marking and legends for piping systems:

Contents	**Background colour marking**	**Legend**
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Make-up water	Yellow	MAKE-UP WTR
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Storm water	Green	STORM
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Propane	Yellow	PROPANE
Fire protection water	Red	SPRINKLERS

2.6 IDENTIFICATION DUCTWORK SYSTEMS

.1 50 mm high stencilled letters and directional arrows 150 mm long x 50 mm high.

.2 Colours: back, or co-ordinated with base colour to ensure strong contrast.

2.7 CONTROLS COMPONENTS IDENTIFICATION

.1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.

.2 Inscriptions to include function and (where appropriate) fail-safe position.

2.8 LANGUAGE

.1 Identification in English.

2.9 VOC LIMITS

.1 Refer to Division 20 – Common Work Results for Mechanical.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 TIMING

.1 Provide identification only after painting specified Section 09 91 00 - Interior Painting has been completed.

3.3 INSTALLATION

.1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.

.2 Provide ULC and or CSA registration plates as required by respective agency.

3.4 NAMEPLATES

.1 Locations:

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

.2 Standoffs:

.1 Provide for nameplates on hot and/or insulated surfaces.

.3 Protection:

.1 Do not paint, insulate or cover.

3.5 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

.1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.

.2 Adjacent to each change in direction.

.3 At least once in each small room through which piping or ductwork passes.

.4 On both sides of visual obstruction or where run is difficult to follow.

.5 On both sides of separations such as walls, floors, partitions.

.6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.

.7 At beginning and end points of each run and at each piece of equipment in run.

.8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.

.9 Identification easily and accurately readable from usual operating areas and from access points.

.1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

3.6 FIELD QUALITY CONTROL

.1 Verification requirements in accordance with Division 1.

3.7 CLEANING

.1 Proceed in accordance with Division 1.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

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

1.2 QUALIFICATIONS OF TAB PERSONNEL

.1 Submit names of personnel to perform TAB to Commissioning Agent and Engineer within 90 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:

.1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1-2002.

.2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems - 1998.

.3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing - 2002

.4 Recommendations and suggested practices contained in the TAB Standard: mandatory.

.5 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.

.6 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.

.7 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.

.8 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.

.1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.

.2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

.1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads

.2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.

.3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

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

1.5 CO-ORDINATION

.1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule 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.

.3 Coordinate with Controls Contractor for Control Set Point Requirements.

1.6 PRE-TAB REVIEW

.1 Review contract documents before project construction is started and confirm in writing to Departmental Representative and Engineer adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.

.2 Review specified standards and report to Departmental Representative and Engineer in writing proposed procedures which vary from standard.

.3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

.1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

.2 Follow special start-up procedures specified elsewhere in Division 23.

1.8 OPERATION OF SYSTEMS DURING TAB

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

1.9 START OF TAB

.1 Notify Engineer 7 days prior to start of TAB.

.2 Start TAB when building is essentially completed, including:

.3 Installation of ceilings, doors, windows, other construction affecting TAB.

.4 Application of weather stripping, sealing, and caulking.

.5 Pressure, leakage, other tests specified elsewhere Division 23.

.6 Provisions for TAB installed and operational.

.7 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:

.1 Proper thermal overload protection in place for electrical equipment.

.2 Air systems:

.1 Filters in place, clean.

.2 Duct systems clean.

.3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.

.4 Correct fan rotation.

.5 Fire, smoke, volume control dampers installed and open.

.6 Coil fins combed, clean.

.7 Access doors, installed, closed.

.8 Outlets installed, volume control dampers open.

1.10 APPLICATION TOLERANCES

.1 Do TAB to following tolerances of design values:

.1 HVAC systems: plus 10%, minus 10%.

1.11 ACCURACY TOLERANCES

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

1.12 INSTRUMENTS

.1 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

.2 Calibrate within 3 months of TAB. Provide certificate of calibration to Engineer.

1.13 SUBMITTALS

.1 Submit, prior to commencement of TAB:

.2 Proposed methodology and procedures for performing TAB if different from referenced standard.

1.14 PRELIMINARY TAB REPORT

.1 Submit for checking and approval of Departmental Representative and Engineer, prior to submission of formal TAB report, sample of rough TAB sheets. Include:

.1 Details of instruments used.

.2 Details of TAB procedures employed.

.3 Calculations procedures.

.4 Summaries.

1.15 TAB REPORT

.1 Format in accordance with referenced standard.

.2 TAB report to show results in SI units and to include:

.1 Project record drawings.

.2 System schematics.

.3 Submit required copies of TAB Report to Departmental Representative and Engineer for verification and approval, in English in D-ring binders, complete with index tabs.

1.16 VERIFICATION

.1 Reported results subject to verification by Engineer.

.2 Provide personnel and instrumentation to verify up to 30% of reported results.

.3 Number and location of verified results as directed by Engineer.

.4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative and Engineer.

1.17 SETTINGS

.1 After TAB is completed to satisfaction of Departmental Representative and Engineer, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.

.2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

1.18 COMPLETION OF TAB

.1 TAB considered complete when final TAB Report received and approved by Departmental Representative and Engineer.

1.19 AIR SYSTEMS

.1 Standard: TAB to most stringent of this section or TAB standards of AABC, NEBB, SMACNA and ASHRAE.

.2 Do TAB of following systems, equipment, components, controls:

.1 AC-1, AC-2 & AC-3 Heat Pumps

.2 VAV Boxes

.3 Diffusers

.3 Qualifications: personnel performing TAB current member in good standing of AABC or NEBB

.4 Quality assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB

.5 Measurements: to include as appropriate for systems, equipment, components, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dewpoint), duct cross-sectional area, RPM, electrical power, voltage, noise, vibration.

.6 Locations of equipment measurements: to include as appropriate:

.1 Inlet and outlet of dampers, filter, coil, humidifier, fan, other equipment causing changes in conditions.

.2 At controllers, controlled device.

.7 Locations of systems measurements to include as appropriate: main ducts, main branch, sub-branch, run-out (or grille, register or diffuser).

1.20 OTHER TAB REQUIREMENTS

.1 General requirements applicable to work specified this paragraph:

.1 Qualifications of TAB personnel: as for air systems specified this section.

.2 Quality assurance: as for air systems specified this section.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation of low-pressure metallic ductwork, joints and accessories.

.2 Related Sections:

.1 Division 1- General Requirements.

.2 Section 07 84 00 - Firestopping.

.3 Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.

1.2 REFERENCES

.1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.2 American Society for Testing and Materials International, (ASTM).

.1 ASTM A480/A480M-11, Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.

.2 ASTM A635/A635M-09b, Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.

.3 ASTM A653/A653M-10, Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

.3 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33 .

.4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association (NFPA).

.1 NFPA 90A-09, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-09, Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.

.3 NFPA 96-11, Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.

.6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition 1995 and Addendum No. 1, 1997.

.2 SMACNA HVAC Air Duct Leakage Test Manual, 1985, 1st Edition.

.3 IAQ Guideline for Occupied Buildings Under Construction 1995, 1st Edition.

.7 Transport Canada (TC).

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 SUBMITTALS

.1 Submit shop drawings and product data in accordance with Division 1 – General Requirements.

.2 Product Data: submit WHMIS MSDS - Material Safety Data Sheets in accordance with Division 1 – General Requirements for the following:

.1 Sealants.

.2 Tape.

.3 Proprietary Joints.

.3 Co-ordinate submittal requirements and provide submittals required in accordance with Division 1 – General Requirements.

.4 Submit Indoor Air Quality (IAQ) Management Plan in accordance with Division 1 – General Requirements.

.5 Indicate VOC's for adhesives and solvents during application and curing.

1.4 QUALITY ASSURANCE

.1 Certification of Ratings:

.1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.2 Health and Safety:

.1 Do construction occupational health and safety in accordance with Division 1 – General Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Store and manage hazardous materials in accordance with Division 20 – Common Work Results for Mechanical and Manufacturer's Written Instructions.

.3 Waste Management and Disposal:

.1 Separate waste materials for reuse and recycling in accordance with Division 1 – General Requirements.

Part 2 Products

2.1 SEAL CLASSIFICATION

.1 Classification as follows:

Maximum Pressure Pa	SMACNA Seal Class
500	C

.2 Seal classification:

.1 Class C: transverse joints and connections made air tight with gaskets, sealant or combination thereof. Longitudinal seams unsealed.

2.2 SEALANT

.1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30°C to plus 93°C.

.2 Indicate VOC's during application and curing.

.3 Acceptable material:

.1 Fosters 30-02
.2 Duro Dyne DSW
.3 Hardcast DS-321
.4 Bakor 530-09
.5 or approved alternate.

2.3 TAPE

.1 Tape: polyvinyl treated, open weave fiberglass tape, 50 mm wide.

.1 Acceptable material:
.1 Duro Dyne FT-2
.2 Bakor 990-06
.3 or approved alternate.

2.4 DUCT LEAKAGE

.1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

2.5 FITTINGS

.1 Fabrication: to SMACNA.

.2 Radius elbows.

.1 Rectangular: standard radius.
.2 Round: five piece.

.3 Mitred elbows, rectangular:

.1 To 400 mm: with double thickness turning vanes.
.2 Over 400 mm: with double thickness turning vanes.

.4 Branches:

.1 Rectangular main and branch: 45 degrees entry on branch.
.2 Round main and branch: enter main duct at 45 degrees with conical connection.
.3 Provide volume control damper in branch duct near connection to main duct.
.4 Main duct branches: with splitter damper.

.5 Transitions:

.1 Diverging: 20 degrees maximum included angle.
.2 Converging: 30 degrees maximum included angle.

.6 Offsets:

.1 Full radius elbows or as indicated.

.7 Obstruction deflectors: maintain full cross-sectional area.

.1 Maximum included angles: as for transitions.

2.6 FIRE STOPPING

.1 Retaining angles around duct, on both sides of fire separation in accordance with Section 07 84 00 – Firestopping, Fire Damper Manufacturer's written instructions and local authority having jurisdiction.

.2 Fire stopping material and installation must not distort duct.

2.7 GALVANIZED STEEL

.1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.

.2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.

.3 Joints: to ASHRAE and SMACNA.

.4 All ductwork within 10 m of air handlers is to be 1 gauge heavier.

2.8 HANGERS AND SUPPORTS

.1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment and Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment.

.1 Hanger configuration: to ASHRAE and SMACNA.
.2 Hangers: galvanized steel angle with galvanized steel rods to ASHRAE and SMACNA:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

.3 Upper hanger attachments:

.1 For concrete: manufactured concrete inserts.

.2 For steel joist: manufactured joist clamp.

.3 For steel beams: manufactured beam clamps.

2.9 VOC LIMITS

.1 Refer to Division 20 – Common Work Results for HVAc

Part 3 Execution

3.1 GENERAL

.1 Do not break continuity of insulation vapour barrier with hangers or rods.

.1 Insulate strap hangers 100 mm beyond insulated duct and Ensure diffuser is fully seated.

.2 Support risers in accordance with ASHRAE and SMACNA.

.3 Install breakaway joints in ductwork on sides of fire separation.

.4 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.

.5 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining (clear inside dimensions shown on drawings).

3.2 HANGERS

.1 Strap hangers: install in accordance with SMACNA.

.2 Angle hangers: complete with locking nuts and washers.

.3 Hanger spacing: in accordance with SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

3.3 SEALING AND TAPING

.1 Apply sealant to outside of joint to manufacturer's recommendations.

.2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

3.4 FIELD QUALITY CONTROL

.1 Verification requirements in accordance with Division 1 – General Requirements.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Materials and installation for duct accessories including flexible connections, access doors, vanes, collars, balance dampers, motorized dampers, and flexible ductwork.

.2 Related Sections:

.1 Division 1- General Requirements.

.2 Division 20- Common Work Results for HVAC

1.2 REFERENCES

.1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).

.1 Material Safety Data Sheets (MSDS).

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, 95.

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).

.4 National Fire Protection Association (NFPA).

.1 NFPA 90A-09, Standard for the Installation of Air-Conditioning and Ventilating Systems.

.2 NFPA 90B-09, Standard for Installation of Warm Air Heating and Air-Conditioning Systems.

.5 Underwriters’ Laboratories Inc. (UL).

.1 UL 181-96, Standard for Factory-Made Air Ducts and Air Connectors.

.6 Underwriters’ Laboratories of Canada (ULC).

.1 CAN/ULC-S110-07, Fire Tests for Air Ducts.

1.3 SUBMITTALS

.1 Submittals in accordance with Division 1-General Requirements.

.2 Product Data:

.1 Submit manufacturer's printed shop drawings, product literature, specifications and data sheet. Indicate the following:

.1 Flexible connections.

.2 Duct access doors.

.3 Turning vanes.

.4 Instrument test ports.
.5 Balance Dampers.
.6 Motorized Dampers.
.7 Flexible Ductwork.

.2 Indicate Following:
.1 Thermal properties.
.2 Friction loss.
.3 Acoustical loss.
.4 Leakage.
.5 Fire rating.

.3 Submit WHMIS MSDS in accordance with Division 1-General Requirements. Indicate VOC's for adhesive and solvents during application and curing.

.4 Certification of ratings: catalogue or published ratings to be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to codes and standards.

.5 Closeout submittals: submit maintenance and engineering data for incorporation into manual in accordance with Division 1- General Requirements.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Division 1- General Requirements.

.2 Construction requirements: in accordance Division 1- General Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Division 20- Common Work Results Mechanical.

.2 Deliver, store and handle materials in accordance with manufacturer’s written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 1- General Requirements.

1.6 INDOOR AIR QUALITY (IAQ) MANAGEMENT

.1 Develop and implement an Indoor Air Quality (IAQ) Management Plan in accordance with Division 1 – General Requirements.

.2 During construction meet or exceed the requirements of SMACNA IAQ Guidelines for Occupied Building under Construction in accordance with Division 1 – General Requirements.

Part 2 Products

2.1 MATERIALS

.1 Materials and resources in accordance with Division 1- General Requirements.

2.2 GENERAL

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

2.3 FLEXIBLE CONNECTIONS

.1 Frame: galvanized sheet metal frame match duct thickness with fabric clenched by means of double locked seams.

.2 Material:

.1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40°C to plus 90°C, density of 1.3 kg/m^2.

.3 Acceptable manufacturer: Duro-Dyne.

2.4 ACCESS DOORS IN DUCTS

.1 Non-Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.

.2 Insulated Ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.

.3 Gaskets: neoprene.

.4 Hardware:

.1 Up to 300 x 300 mm: two sash locks.

.2 301 to 450 mm: four sash locks.

.3 451 to 1000 mm: piano hinge and minimum two sash locks.

.4 Doors over 1000 mm: piano hinge and two handles operable from both sides.

.5 Hold open devices.

.5 Acceptable manufacturers: Nailor, E.H. Price, Duro-Dyne.

2.5 TURNING VANES

.1 Factory or shop fabricated double thickness with trailing edge, to recommendations of SMACNA and as indicated.

2.6 INSTRUMENT TEST PORTS

.1 1.6 mm thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 28 mm minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

2.7 SPIN-IN COLLARS

.1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.

.2 Sheet metal thickness to co-responding round duct standards.

2.8 BLANCE DAMPERS

.1 Single Blade Dampers

.1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.

.2 Size and configuration to recommendations of SMACNA, except maximum height 250mm.

.3 Locking quadrant.

.4 Inside and outside end bearings.

.5 Acceptable Material: Duro-Dyne.

.2 Multi-Bladed Dampers

.1 Factory manufactured of material compatible with duct.

.2 Opposed blade: configuration to recommendations of SMACNA.

.3 Maximum blade height: 100mm.

.4 Bearings: pin in bronze bushings.

.5 Linkage: shaft extension with locking quadrant.

.6 Channel frame of same material as adjacent duct, complete with angle stop.

2.9 FLEXIBLE DUCT

.1 General

.1 Factory fabricated to CAN/ULC-S110

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

.2 Non-Metallic – Uninsulated

.1 Non-collapsible, coated type, mechanically boned to, as indicated.

.2 Performance:

.1 Factory tested to 2.5 kPa without leakage.

.3 Acceptable material:

.1 Thermaflex MKE

.2 Flexmaster

.3 or approved alternate.

2.10 VOC LIMITS

.1 Refer to Division 20- Common Work Results for Mechanical.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Flexible Connections:

.1 Install in following locations:

.1 Inlets and outlets to supply air units and fans.

.2 Inlets and outlets of exhaust and return air fans.

.3 As indicated.

.2 Length of connection: 100 mm.

.3 Minimum distance between metal parts when system in operation: 75 mm.

.4 Install in accordance with recommendations of SMACNA.

.5 When fan is running:

.1 Ducting on sides of flexible connection to be in alignment.

.2 Ensure slack material in flexible connection.

.2 Access Doors and Viewing Panels:

.1 Size:

.1 As required.

.2 Locations:

.1 Fire and smoke dampers.

.2 Control dampers.

.3 Devices requiring maintenance.
.4 Required by code.
.5 Reheat coils.
.6 Elsewhere as indicated.

.3 Instrument Test Ports:

.1 General:
.1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
.2 Locate to permit easy manipulation of instruments.
.3 Install insulation port extensions as required.
.4 Locations:
.1 For traverse readings:
.1 Ducted inlets to roof and wall exhausters.
.2 Inlets and outlets of other fan systems.
.3 Main and sub-main ducts.
.4 And as indicated.
.2 For temperature readings:
.1 At outside air intakes.
.2 In mixed air applications in locations as approved by Engineer.
.3 Downstream of junctions of two converging air streams of different temperatures.
.4 And as indicated.

.4 Turning vanes:

.1 Install in accordance with recommendations of SMACNA and as indicated.

.5 Balance Dampers:

.1 Install where indicated.
.2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer’s instructions.
.3 Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
.4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
.5 Dampers: vibration free.
.6 Ensure damper operators are observable and accessible.

.6 Flexible Ductwork

.1 Install in accordance with: CAN/ULC-S110, UL-181, NFPA 90A, NFPA 90B, SMACNA.
.2 Maximum allowable length 1,500mm.

3.3 FIELD QUALITY CONTROL

.1 Verification requirements in accordance with Division 1- General Requirements:

3.4 CLEANING

.1 Perform cleaning operations in accordance with manufacturer's recommendations.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

.1 The Contractor shall be responsible to carry out all the Work set out or referred to in this Section 23 36 00.

1.2 SUMMARY

.1 Section Includes:

.1 Electronic variable air volume boxes.

1.3 REFERENCES

.1 American National Standards Institute (ANSI):

.1 ANSI/AMCA 210-1999, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.

.2 ANSI/NFPA 90A-2002, Standard for the Installation of Air Conditioning and Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

.3 International Organization of Standardization (ISO):

.1 ISO 3741-2001, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure - Precision Methods for Reverberation Rooms.

.4 Underwriter's Laboratories (UL):

.1 UL 181-2003, Factory-Made Air Ducts and Air Connectors.

1.4 SYSTEM DESCRIPTION

.1 Performance Requirements:

.1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from certified ADC (Air Diffusion Council) testing agency signifying adherence to codes and standards.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures:

.1 Construction/Demolition Waste Management:

.1 Construction waste management submittals in accordance with 01 74 19 Waste Management and Disposal.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 01 33 00 - Submittal Procedures. Include product characteristics, performance criteria, and limitations.

.2 Test data: in accordance with ANSI/AMCA 210:

.1 Submit published test data on DIN (Direct Internal Noise), in accordance with ISO 3741 made by independent testing agency for 0, 2.5 and 6 m/s branch velocity or inlet velocity.

.2 Pressure loss through silencer shall not exceed 60% of inlet velocity pressure maximum.

.3 Shop Drawings:

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

.2 Indicate the following:

.1 Capacity.

.2 Pressure drop.

.3 Noise rating.

.4 Leakage.

.5 Reheat Coils.

.4 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Section 01 61 00 - Common Product Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 19 – Construction/Demolition Waste Management and Disposal.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MANUFACTURED UNITS

.1 Terminal units of the same type to be product of one manufacturer.

2.2 VARIABLE AIR VOLUME (VAV) TERMINAL UNITS

.1 Provide and install new VAV terminal units with the supply air ductwork as outlined on drawings.

.2 Single Duct Terminal Unit:

.1 22 gauge zinc-coated steel housing.

.2 20 gauge zinc-coated steel damper rigidly fastened to a ½ in. round zinc plated solid shaft which rotates in durable polyethylene bearings. Damper position is identified by a mark on the end of the damper shaft.

.3 20 gauge zinc-coated steel control panel fastens to 20 gauge zinc-coated steel mounting angles which are used to secure the unit to the rectangular duct.

.4 The edges of the measuring station are to be gasketted to provide a tight seal.

.5 Multipoint flow sensor averages and amplifies velocity for accurate control.

.6 Gauge taps for flow measurement and balancing.

.7 Pressure independent operation.

.8 Electronic controls by others.

.9 900 mm factory alternator.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with manufacturers recommendations.

.2 Support independently of ductwork.

.3 Install with at least 1000 mm of flexible inlet ducting and minimum of four duct diameters of straight inlet duct, same size as inlet.

.4 Locate controls, dampers and access panels for easy access.

3.3 CLEANING

.1 Proceed in accordance with Section 01 74 11 - Cleaning.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Supply, return and exhaust grilles and registers, diffusers and linear grilles, for commercial and residential use.

1.2 SYSTEM DESCRIPTION

.1 Performance Requirements:

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

1.3 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Division 1 – General Requirements. Include product characteristics, performance criteria, and limitations.

.1 Submit required copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Division 1 – General Requirements. Indicate VOC's for all adhesives and solvents during application and curing.

.2 Indicate following:

.1 Capacity.

.2 Throw and terminal velocity.

.3 Noise criteria.

.4 Pressure drop.

.5 Neck velocity.

.2 Quality assurance submittals: submit following in accordance with Division 1 – General Requirements.

1.4 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 1 – General Requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, shipping, handling and unloading:

.1 Deliver, store and handle in accordance with Division 1 – General Requirements.

.2 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Waste Management and Disposal:

.1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Division 1 – General Requirements.

1.6 MAINTENANCE

.1 Extra Materials:

.1 Provide maintenance materials in accordance with Division 1 – General Requirements.

.2 Include:

.1 Keys for volume control adjustment.

.2 Keys for air flow pattern adjustment.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Division 1 – General Requirements.

2.2 GENERAL

.1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as specified.

.2 Frames:

.1 Full perimeter gaskets.

.2 Plaster frames where set into plaster or gypsum board.

.3 Concealed fasteners.

.3 Concealed manual volume control damper operators.

.4 Colour: as specified.

.5 Acceptable Manufacturers: E. H. Price, Nailor, Tuttle & Bailey, Titus or approved alternate.

.6 All grille and diffuser selections are based on one Manufacturer. Listed equal Manufacturers shall comply with technical specifications of listed Manufacturer.

2.3 MANUFACTURED UNITS

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

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install in accordance with manufacturers instructions.

.2 Install with screws in countersunk holes where fastenings are visible.

3.3 FIELD QUALITY CONTROL

.1 Verification requirements in accordance with Division 1 – General Requirements.

3.4 CLEANING

.1 Proceed in accordance with Division 1 – General Requirements.

.2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Division 01 – General Requirements.

.2 Division 20 – Common Work Results for Mechanical.

.3 Related Sections:

.1 Section 01 33 00 - Submittal Procedures.
.2 Section 01 45 00 - Quality Control.
.3 Section 01 47 17 - Sustainable Requirements: Contractor's Verification.
.4 Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
.5 Section 01 78 00 - Closeout Submittals.
.6 Section 01 91 13 - General Commissioning (Cx) Requirements.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/Air Conditioning and Refrigeration Institute (ARI)

.1 ANSI/ARI 210/240-03, Unitary Air-Conditioning and Air-Source Heat Pump Equipment.
.2 ARI 270-95, Sound Rating of Outdoor Unitary Equipment.

.2 ANSI/UL 1995 B-1998, Standard for Heating and Cooling Equipment.

.3 Canadian Standards Association (CSA International)

.1 CSA B52-99, Mechanical Refrigeration Code.
.2 CSA C22.1 HB-02, Canadian Electrical Code Handbook.

.4 Health Canada / Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.5 National Fire Protection Association

.1 NFPA 90A-02, Standard for the Installation of Air Conditioning and Ventilating Systems.

1.3 SUBMITTALS

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet for packaged rooftop HVAC units.

.3 Shop Drawings:

.1 Submit shop drawings to indicate project layout and dimensions; indicate:

.1 Control equipment shipped loose, showing final location in assembly.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.

.3 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices of ancillaries, accessories, controllers.

.4 Fan performance curves.

.5 Details of vibration isolation.

.6 Estimate of sound levels to be expected across individual octave bands in dB referred to A rating.

.7 Type of refrigerant used.

.4 Test Reports: submit certified test reports from approved independent testing laboratories indicating compliance with specifications for specified performance characteristics and physical properties.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Instructions: submit manufacturer's installation instructions.

.7 Manufacturer's Field Reports: manufacturer's field reports specified.

.8 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals include data as follows:

.1 Indicate: brief description of unit, indexed, with details of function, operation, control, and service for components.

.2 Provide for units, manufacturer's name, type, year, number of units, and capacity.

1.4 QUALITY ASSURANCE

.1 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

.1 Waste Management and Disposal:

.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.

1.6 WARRANTY

.1 For Work of this Section 23 74 00 Packaged Outdoor HVAC Equipment, 12 months parts and labour warranty period for all components, compressors to be extended to 5 years.

Part 2 Products

2.1 GENERAL

.1 General Description

.1 Configuration: Fabricate as detailed on prints and drawings:

.1 Return plenum/economizer section

.2 Filter section

.3 Cooling coil section

.4 Supply fan section

.5 Condensing unit section

.2 The complete unit shall be cETLus listed.

.3 The unit shall be ASHRAE 90.1-2016 compliant and labeled.

.4 Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Each unit shall be completely factory assembled and shipped in one piece. Packaged units shall be shipped fully charged with R-410 Refrigerant and oil.

.5 The unit shall undergo a complete factory run test prior to shipment. The factory test shall include a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.

.6 All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.

.7 Performance: All scheduled EER, IEER, capacities and face areas are minimum accepted values. All scheduled amps, kW, and HP are maximum accepted values that allow scheduled capacity to be met.

.8 Warranty: The manufacturer shall provide 12-month parts and labour warranty. Defective parts shall be repaired or replaced during the warranty period at no charge. Compressor warranty to be 5 years parts and labour. The warranty period shall commence at substantial completion.

2.2 CABINET, CASING, AND FRAME

.1 Panel construction shall be double-wall construction for all panels. All floor panels shall have a solid galvanized steel inner liner on the air stream side of the unit to protect insulation during service and maintenance. Insulation shall be a minimum of 1" thick with an R-value of 7.0, and shall be 2 part injected foam. Panel design shall include no exposed insulation edges. Unit cabinet shall be designed to operate at total static pressures up to 5.0 inches w.g.

.2 Exterior surfaces shall be constructed of painted galvanized steel, for aesthetics and long-term durability. Paint finish will include a base primer with a high-quality polyester resin topcoat. Finished, unabraded panel surfaces shall be exposed to an ASTM B117 salt spray environment and exhibit no visible red rust at a minimum of 3,000 hours exposure. Finished, abraded surfaces shall be tested per ASTM D1654, having a mean scribe creepage not exceeding 1/16" at 1,000 hours minimum exposure to an ASTM B117 salt spray environment. Measurements of results shall be quantified using ASTM D1654 in conjunction with ASTM D610 and ASTM D714 to evaluate blister and rust ratings.

.3 Service doors shall be provided on the fan section, filter section, control panel section, and heating vestibule in order to provide user access to unit components. All service access doors shall be mounted on multiple, stainless steel hinges and shall be secured by a latch system. Removable service panels secured by multiple mechanical fasteners are not acceptable.

.4 The unit base shall overhang the roof curb for positive water runoff and shall seat on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base to accept cable or chain hooks for rigging the equipment.

2.3 OUTDOOR/RETURN AIR SECTION

.1 Unit shall be provided with an outdoor air economizer section. The economizer section shall include outdoor, return, and exhaust air dampers. The economizer operation shall be fully integral to the mechanical cooling and allow up to 100% of mechanical cooling if needed to maintain the cooling discharge air temperature. The outdoor air hood shall be factory installed and constructed from galvanized steel finished with the same durable paint finish as the main unit. The hood shall include moisture eliminator filters to drain water away from the entering air stream. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be parallel blade design. Damper blades shall be gasketed with side seals to provide an air leakage rate of 1.5 cfm / square foot of damper area at 1" differential pressure in according with testing defined in AMCA 500. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. A bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with vinyl gasketing on contact edges. Control of the dampers shall be by a factory installed direct coupled actuator. Damper actuator shall be of the modulating, spring return type. A comparative enthalpy control shall be provided to sense and compare enthalpy in both the outdoor and return air streams to determine if outdoor air is suitable for "free" cooling. If outdoor air is suitable for "free" cooling, the outdoor air dampers shall modulate in response to the unit's temperature control system.

.2 Economizer assembly Fault Detection and Diagnostics (FDD) shall be 90.1, IECC, and California Title 24 compliant. MicroTech III controls shall display a warning, and write a warning to the BAS, if the economizer malfunctions in accordance with 90.1, IECC, and Title 24 specifications.

2.4 EXHAUST FAN

.1 Exhaust fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with aluminum fan blades that are continuously welded to the hub plate and end rim. The exhaust fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

.2 The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

.3 The unit DDC controller shall provide building static pressure control. The unit controller shall provide proportional control of the exhaust fans from 25% to 100% of the supply air fan designed airflow to maintain the adjustable building pressure setpoint. The field shall mount the required sensing tubing from the building to the factory mounted building static pressure sensor.

2.5 FILTERS

.1 Unit shall be provided with a draw-through filter section. The filter rack shall be designed to accept a 2” prefilter and a 4” final filter. The unit design shall have a hinged access door for the filter section. The manufacturer shall ship the rooftop unit with 2” MERV 8 and 4" MERV 14 filters. Provide three (3) sets of each type of filter with unit.

2.6 COOLING COIL

.1 The indoor coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with a factory piped cooling coil and an ASHRAE 62.1 compliant double sloped drain pan.

.2 The direct expansion (DX) cooling coils shall be fabricated of seamless high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design with a minimum of 3 rows. All cooling coils shall have an interlaced coil circuiting that keeps the full coil face active at all load conditions. All coils shall be factory leak tested with high pressure air under water.

.3 The cooling coil shall have an electronic controlled expansion valve. The unit controller shall control the expansion valve to maintain liquid subcooling and the superheat of the refrigerant system.

.4 The refrigerant suction lines shall be fully insulated from the expansion valve to the compressors.

.5 The drain pan shall be stainless steel and positively sloped. The slope of the drain pan shall be in two directions and comply with ASHRAE Standard 62.1. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall extend beyond the leaving side of the coil. The drain pan shall have a threaded drain connection extending through the unit base.

2.7 SUPPLY FAN

.1 Supply fan shall be a single width, single inlet (SWSI) airfoil centrifugal fan. The fan wheel shall be Class II construction with fan blades that are continuously welded to the hub plate and end rim. The supply fan shall be a direct drive fan mounted to the motor shaft. Belts and sheaves are not acceptable due to the additional maintenance.

.2 All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment.

.3 Supply fan and motor assembly combinations larger than 8 hp or 22” diameter shall be internally isolated on 1” deflection, spring isolators and include removable shipping tie downs.

.4 The fan motor shall be a totally enclosed EC motor that is speed controlled by the rooftop unit controller. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase. Motors shall be premium efficiency.

.5 The supply fan shall be capable of airflow modulation from 30% to 100% of the scheduled designed airflow. The fan shall not operate in a state of surge at any point within the modulation range.

2.8 HEATING SECTION

.1 The rooftop unit shall include an electrical resistance heating coil section. Staged electric heating coil modules shall be factory installed downstream of the supply air fan in the heating section of the rooftop unit. Heating coils shall be constructed of a low watt density, nickel - chromium alloy resistance wire with intermediate supports that include ceramic bushings. The electrical contactors shall be of the full line-breaking type with all the electrical power legs being disconnected when the contactors are not energized. All electrical circuit wiring shall be designed with copper conductors, aluminum wires are not acceptable. Heating element branch circuits shall be individually fused to a maximum of 48 Amps per NEC requirements. The power supply for the electric heater shall be factory wired into the units main power block or disconnect switch.

.2 The heating modules shall have an automatic reset, high temperature limit safety protection. A secondary high limit protection shall also be provided that requires a manual reset. An airflow switch shall be provided with the heating module to prevent the electric heater from operating in the event of no airflow.

.3 The electric heat elements shall be controlled by the factory installed DDC unit control system. The heater shall have proportional SCR control. The unit controller shall modulate the electric heater to maintain the discharge air temperature setpoint.

.4 Field installed heating modules shall require a field ETL certification. Duct heaters mounted within the rooftop unit in the field shall not be acceptable. The manufacturer's rooftop unit ETL certification shall cover the complete unit including the electric heating modules

2.9 HEAT PUMP HEATING

.1 The evaporator coil, condenser coil, compressors and refrigerant circuit shall be designed for heat pump operation. The refrigerant circuit shall contain a 4 way reversing valve for the heat pump operation. The outdoor coil shall have an electronic expansion valve to control the refrigerant flow. The unit controller shall modulate the expansion valve to maintain compressor operation within the compressor operational envelope.

.2 The refrigerant system shall have a pump-down cycle.

.3 The unit shall have an electric resistance heating coil for auxiliary heating. When the heatpump operation cannot maintain the discharge air temperature setpoint the electric heating coil shall temper the airstream to the discharge air temperature setpoint.

2.10 CONDENSING SECTION

.1 Outdoor coils shall have seamless copper tubes, mechanically bonded into aluminum plate-type fins. The fins shall have full drawn collars to completely cover the tubes. A sub-cooling coil shall be an integral part of the main outdoor air coil. Each outdoor air coil shall be factory leak tested with high-pressure air under water.

.2 Fan motors shall be an ECM type motor for proportional control. The unit controller shall proportionally control the speed of the condenser fan motors to maintain the head pressure of the refrigerant circuit from ambient condition of 25~120°F. Mechanical cooling shall be provided to 25º F. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

.3 The condenser fan shall be low noise blade design. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be of a composite materiaI.

.4 The unit shall have scroll compressors. One of the compressors shall be an inverter compressor providing proportional control. The unit controller shall control the speed of the compressor to maintain the discharge air temperature. The inverter compressor shall have a separate oil pump and an oil separator for each compressor that routes oil back to the compressor instead of through the discharge line.

.5 Pressure transducers shall be provided for the suction pressure and head pressure. Temperature sensor shall be provided for the suction temperature and the refrigerant discharge temperature of the compressors. All of the above devices shall be an input to the unit controller and the values be displayed at the unit controller.

.6 Refrigerant circuit shall have a bypass valve between the suction and discharge refrigerant lines for low head pressure compressor starting and increased compressor reliability. When there is a call for mechanical cooling the bypass valve shall open to equalizing the suction and discharge pressures. When pressures are equalized the bypass valve shall close and the compressor shall be allowed to start.

.7 Each circuit shall be dehydrated and factory charged with R-410A Refrigerant and oil.

2.11 ELECTRICAL

.1 Unit wiring shall comply with CNEC requirements and with all applicable ULC standards. All electrical components shall be ULC recognized where applicable. All wiring and electrical components provided with the unit shall be number and color-coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch short circuit protection, 115-volt control circuit transformer and fuse, system switches, and a high temperature sensor shall also be provided with the unit. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. Supply fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance.

2.12 CONTROLS

.1 Provide a complete integrated microprocessor based Direct Digital Control (DDC) system to control all unit functions including temperature control, scheduling, monitoring, unit safety protection, including compressor minimum run and minimum off times, and diagnostics. This system shall consist of all required temperature sensors, pressure sensors, controller and keypad/display operator interface. All MCBs and sensors shall be factory mounted, wired and tested.

.2 The stand-alone DDC controllers shall not be dependent on communications with any on-site or remote PC or master control panel for proper unit operation. The microprocessor shall maintain existing set points and operate standalone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.

.3 The DDC control system shall permit starting and stopping of the unit locally or remotely. The control system shall be capable of providing a remote alarm indication. The unit control system shall provide for outside air damper actuation, emergency shutdown, remote heat enable/disable, remote cool enable/disable, heat indication, cool indication, and fan operation.

.4 All digital inputs and outputs shall be protected against damage from transients or incorrect voltages. All field wiring shall be terminated at a separate, clearly marked terminal strip.

.5 The DDC controller shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

.6 The keypad interface shall allow convenient navigation and access to all control functions. The unit keypad/display character format shall be 4 lines x 20 characters. All control settings shall be password protected against unauthorized changes. For ease of service, the display format shall be English language readout. Coded formats with look-up tables will not be accepted. The user interaction with the display shall provide the following information as a minimum:

.1 Return air temperature.
.2 Discharge air temperature.
.3 Outdoor air temperature.
.4 Space air temperature.
.5 Outdoor enthalpy, high/low.
.6 Compressor suction temperature and pressure
.7 Compressor head pressure and temperature
.8 Expansion valve position
.9 Condenser fan speed
.10 Inverter compressor speed
.11 Dirty filter indication.
.12 Airflow verification.
.13 Cooling status.
.14 Control temperature (Changeover).
.15 VAV box output status.
.16 Cooling status/capacity.
.17 Unit status.
.18 All time schedules.
.19 Active alarms with time and date.
.20 Previous alarms with time and date.
.21 Optimal start
.22 Supply fan and exhaust fan speed.

.23 System operating hours.
- .1 Fan
- .2 Exhaust fan
- .3 Cooling
- .4 Individual compressor
- .5 Heating
- .6 Economizer
- .7 Tenant override

.7 The user interaction with the keypad shall provide the following:

- .1 Controls mode
  - .1 Off manual
  - .2 Auto
  - .3 Heat/Cool
  - .4 Cool only
  - .5 Heat only
  - .6 Fan only
- .2 Occupancy mode
  - .1 Auto
  - .2 Occupied
  - .3 Unoccupied
  - .4 Tenant override
- .3 Unit operation changeover control
  - .1 Return air temperature
  - .2 Space temperature
  - .3 Network signal
- .4 Cooling and heating change-over temperature with deadband
- .5 Cooling discharge air temperature (DAT)
- .6 Supply reset options
  - .1 Return air temperature
  - .2 Outdoor air temperature
  - .3 Space temperature
  - .4 Airflow (VAV)
  - .5 Network signal
  - .6 External (0-10 vdc)
  - .7 External (0-20 mA)
- .7 Temperature alarm limits
  - .1 High supply air temperature
  - .2 Low supply air temperature
  - .3 High return air temperature
- .8 Lockout control for compressors.
- .9 Compressor interstage timers

.10 Night setback and setup space temperature.
.11 Building static pressure.
.12 Economizer changeover
  .1 Enthalpy
  .2 Drybulb temperature
.13 Currently time and date
.14 Tenant override time
.15 Occupied/unoccupied time schedule
.16 One event schedule
.17 Holiday dates and duration
.18 Adjustable set points
.19 Service mode
  .1 Timers normal (all time delays normal)
  .2 Timers fast (all time delays 20 sec)

.8 To increase the efficiency of the cooling system the DDC controller shall include a discharge air temperature reset program for part load operating conditions. The discharge air temperature shall be controlled between a minimum and a maximum discharge air temperature (DAT) based on one of the following inputs:

.1 Airflow
.2 Outside air temperature
.3 Space temperature
.4 Return air temperature
.5 External signal of 1-5 vdc
.6 External signal of 0-20 mA
.7 Network signal

2.13 ROOF CURB

.1 A prefabricated heavy gauge galvanized steel, mounting transition curb shall be provided for field assembly on the existing curb. The roof curb shall be a full perimeter type with complete perimeter support of the air handling section and condensing section. The curb shall be a minimum of 14" high and include a nominal 2" x 4" wood nailing strip. Gasket shall be provided for field mounting between the unit base and roof curb.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install as per manufacturers' instructions on roof curbs provided by manufacturer.

.2 Manufacturer to certify installation, supervise start-up and commission unit.

.3 Run drain line from cooling coil condensate drain pan to discharge over roof drain.

3.3 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services:

.1 Have manufacturer of products supplied under this Section review work involved in handling, installation/application, protection and cleaning of its product[s], and submit written reports, in acceptable format, to verify compliance of work with Contract.

.2 Provide manufacturer's field services, consisting of product use recommendations and periodic site visits for inspection of product installation, in accordance with manufacturer's instructions.

.2 Verify accessibility, serviceability of components including motorized dampers, filters coils, fans, motors, operators, humidifiers, sensors, electrical disconnects.

.3 Verify accessibility, cleanability, drainage of drain pans for coils, humidifiers.

3.4 DEMONSTRATION

.1 Training: in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O&M Personnel, supplemented as specified.

3.5 CLEANING

.1 Perform cleaning operations as specified in Section 01 74 11 and in accordance with manufacturer's recommendations.

.2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:

.1 Start-up testing and verification of systems.

.2 Check out demonstration or proper operation of components.

.3 On-site operational tests.

.2 Related Sections:

.1 Section 01 00 01 – Project Specific General Requirements.

.2 Section 01 78 00 – Closeout Submittals.

.3 Section 01 79 00 – Demonstration and Training.

.4 Section 01 91 13 – Commissioning and Training.

.5 Section 25 05 01 – EMCS: General Requirements.

.6 Appendix IX – Preliminary Commissioning Plan.

1.2 DEFINITIONS

.1 Design Criteria: All pertinent information for the design, including key assumptions and limitations including such as temperature, occupancy, codes, references and indoor air quality.

.2 Design Intent: a detailed explanation of the ideas, concepts and criteria that are defined by the Owner to be important.

.3 PID – Proportional, Integral and Derivative.

1.3 CONTROLS VERIFICATION

.1 EMCS contractor shall test each point system, and sequence, and submit verification reports to satisfaction of Owner Site Representative.

.2 Reports required:

.1 Point Verification Report. – See Appendix IV.

.2 Above noted reports shall be submitted prior to interim inspection, or substantial performance.

1.4 DESIGN REQUIREMENTS

.1 Confirm with Owner Site Representative that Design Criteria and Design Intents are still applicable.

.2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 00 01 – Project Specific General Requirements.

.2 Final Report: submit report to Owner Site Representative:

.1 Include measurements, final settings and certified test results.

.2 Bear signature of commissioning technician and supervisor

.3 Report format to be approved by Owner Site Representative before commissioning is started.

.4 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Owner Site Representative in accordance with Section 01 78 00 - Closeout Submittals.

.5 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

1.6 CLOSEOUT SUBMITTALS

.1 Provide documentation, O&M Manuals, and training of O&M personnel for review by Owner Site Representative before interim acceptance in accordance with Section 01 78 00 – Closeout Submittals.

1.7 CONTROL SYSTEM CHECKOUT AND TESTING

.1 Start-up Testing: All testing listed in this article shall be performed by the Contractor and shall make up part of the necessary verification of an operating control system. This testing shall be completed before the Owner's Representative is notified of system demonstration.

.1 The Contractor shall furnish all labour and test apparatus required to calibrate and prepare for service of all instruments, controls, and accessory equipment furnished under this specification.

.2 The mechanical design engineer shall reserve the right to use any piece of electrical equipment, device, or material for such reasonable lengths of time and at such times as he may require to make complete and thorough tests of same before the final completion and acceptance.

.3 Verify that all control wiring is properly connected and free of all shorts and ground faults. Verify that terminations are tight.

.4 Enable the control systems and verify calibration of all input devices individually. Perform calibration procedures per manufacturers' recommendations.

.5 Verify that all binary output devices (relays, solenoid valves, two-position actuators and control valves, magnetic starters, etc.) operate properly and that the normal positions are correct.

.6 Verify that all analog output devices (I/Ps, actuators, etc.) are functional, that start and span are correct, and that direction and normal positions are correct. The Contractor shall check all control valves and automatic dampers to ensure proper action and closure. The Contractor shall make any necessary adjustments to valve stem and damper blade travel.

.7 Verify that the system operation adheres to the Sequences of Operation.

.8 Alarms and Interlocks:

.1 Check each alarm separately by including an appropriate signal at a value that will trip the alarm.

.2 Interlocks shall be tripped using field contacts to check the logic, as well as to ensure that the fail-safe condition for all actuators is in the proper direction.

.3 Interlock actions shall be tested by simulating alarm conditions to check the initiating value of the variable and interlock action.

.9 Mechanical deficiencies which may inhibit operation/control of the mechanical systems shall be brought to the attention of Owner Site Representative.

1.8 CONTROL SYSTEM DEMONSTRATION AND ACCEPTANCE

.1 Demonstration:

.1 Prior to acceptance, the control system shall undergo a series of performance tests to verify operation and compliance with this specification. These tests shall occur after the Contractor has completed the installation, started up the system, and performed its own tests.

.2 The tests described in this section are to be performed in addition to the tests that the contractor performs as a necessary part of the installation, start-up, and debugging process and as specified in the “Control System Checkout and Testing” in this specification. The Owner Site Representative will be present to observe and review these tests. The Owner Site Representative shall be notified at least 10 days in advance of the start of the testing procedures.

.3 The demonstration process shall follow that approved in “Submittals”. The approved checklists and forms shall be completed for all systems throughout the demonstration.

.4 The contractor shall provide at least two persons equipped with two-way communication, and shall demonstrate actual field operation of each control and sensing point for all modes of operation including day, night, occupied, unoccupied, fire/smoke alarm, seasonal changeover, and power failure modes.

.5 The purpose is to demonstrate the calibration, response, and action of every point/object and system. Any test equipment required to prove the proper operation shall be provided by and operated by the contractor.

.6 For educational facilities and buildings over 20,000 square feet, the contractor shall provide a controls representative on site for two days to assist Owner testing and to be available to respond to telephone inquiries during the testing period. For other buildings, the controls representative is to be available to respond to telephone inquiries by Owner during the test period.

.7 As each control input and output is checked, a log shall be completed showing the date, technician's initials, and any corrective action taken or needed. This will form part of the **"Point Verification Report" Appendix IV**. Verification of all input/output points with regards to proper operation. Owner Site Representative will inspect 100% of all points for physical installation, including conduit, wire, labels, connections, etc. Owner Site Representative commissioning agent may choose to randomly inspect 50% of each point type for input/output response.

.8 Any failure will result in termination of inspection and future 100% inspections will be at the contractor's cost.

.2 Optimization:

.1 For each 100 control points, or portion thereof, this Contractor shall provide 1 additional day (8 hr) of optimization programming as required by the Engineer.

.3 Final Acceptance:

.1 This phase shall consist of verifying to Owner Site Representative that the deficiencies as identified during "Demonstration" have been rectified. If deficiencies are still found, the Contractor will have one week to correct them and costs for additional inspection shall be billed to the contractor.

.2 Demonstrate compliance with "System Performance".

.3 Demonstrate and simulate compliance with Sequences of Operation through all modes of operation.

.4 Demonstrate complete operation of Operator Interface.

.5 Additionally, the following items shall be demonstrated:

.1 DDC Loop Response. The contractor shall supply trend data output in a graphical form showing the step response of each DDC loop. The test shall show the loop's response to a change in setpoint, which represents a change of actuator position of at least 25% of its full range. The sampling rate of the trend shall be from 10 seconds to 3 minutes, depending on the speed of the loop. The trend data shall show for each sample the setpoint, actuator position, and controlled variable values. Any loop that yields unreasonably under-damped or over-damped control shall require further tuning by the contractor.

.2 Optimum Start/Stop. The contractor shall supply a trend data output showing the capability of the algorithm. The hour-by-hour trends shall include the output status of all optimally started and stopped equipment, as well as temperature sensor inputs of affected areas.

.3 Operational logs for each system that indicate all setpoints, operating points, valve positions, mode, and equipment status shall be submitted to the Owner Site Representative. These logs shall cover three 48-hour periods and have a sample frequency of not more than 10 minutes. The logs shall be provided in both printed and disk formats.

.4 A power failure for the building will be simulated and proper system operation and recovery observed.

.4 Any tests that fail to demonstrate the proper operation of the system shall be repeated at a later date. The Contractor shall be responsible for any necessary repairs or revisions to the hardware or software to successfully complete all tests.

.5 Point **Verification Reports Appendix IV –** To be completed by the contractor and forwarded to the Owner Site Representative prior to completing Demonstration. Owner Site Representative will provide blank forms in Microsoft Excel format to the contractor as requested.

.6 The Owner Representative will require testing, verification, of all commissioning for all points, and full simulation of all sequences. This contractor is to commit the necessary resources, manpower, and devices (example - radios) to allow Owner Site Representative to complete commissioning.

.7 All software, database files, modem, phone number and instruction must be provided to Owner Site Representative 10 days in advance of inspections.

.8 All repeat testing and commissioning due to noncompliance to specification will be at the contractor's expense.

.9 All tests described in this specification shall have been performed to the satisfaction of both the Owner Site Representative prior to the acceptance of the control system as meeting the requirements of completion. Any tests that cannot be performed due to circumstances beyond the control of the contractor may be exempt from the completion requirements if stated as such in writing by the Owner Site Representative. Such tests shall then be performed as part of the warranty.

.10 The system shall not be accepted until all forms and checklists completed as part of the demonstration are submitted and approved.

1.9 CLEANING

.1 The contractor shall clean up all debris resulting from its activities daily. The contractor shall remove all cartons, containers, crates, etc., under its control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.

.2 At the completion of work in any area, the contractor shall clean all of its work, equipment, etc., keeping it free from dust, dirt, and debris, etc.

.3 At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be repaired to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

1.10 THIRD PARTY COMMISSIONING

.1 Contractors are required to complete the commissioning, field quality assurance, testing and/or performance verification as outlined in this and subsequent sections.

.2 The Commissioning Authority will conduct third party commissioning verification. The following specification sections will also apply to the work to be performed under this and subsequent sections:

.1 01 91 13 General Commissioning Requirements.

.2 Preliminary Commissioning Plan.

Part 2 Products

2.1 EQUIPMENT

.1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

.2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.

.3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than 2 months prior to tests.

.4 Locations to be approved, readily accessible and readable.

.5 Application: to conform to ASHRAE Guideline 0-2005 – The Commissioning Process and Guideline 1.1 – 2007 – The HVAC Commissioning Process.

Part 3 Execution

3.1 PROCEDURES

.1 General: test installation of each system part after completion of mechanical and electrical hook-ups, to verify correct installation and function.

.1 Test each system independently and then in unison with other related systems.

.2 Commission each system using procedures prescribed by the Owner Site Representative.

.3 Commission integrated systems using procedures prescribed by Owner Site Representative.

.4 Debug Programming.

.5 Optimize operation and performance of systems by fine-tuning PID values and modifying programming as required.

.6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

.2 Include following activities:

.1 Test and calibrate field hardware including stand-alone capability of each controller.

.2 Verify each analog to digital convertor.

.3 Test and calibrate each analog input using calibrated digital instruments.

.4 Test each binary input to ensure proper settings and switching contacts.

.5 Test each binary output to ensure proper operation and lag time.

.6 Test each analog output to ensure proper operation of controlled devices. Verify tight closure and signals.

.7 Test operating software.

.8 Test application software and provide samples of logs and commands.

.9 Debug software.

.10 Provide point verification list in table format including point identifier, point commissioning technician and Owner Site Representative comments. This document will be used in final start-up testing.

.3 Demonstration: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Owner Site Representative and 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 Owner Site Representative Acceptance signature to be on executive and applications programs.

.4 Demonstration testing is to be in accordance with the following conditions:

.1 Commissioning to commence during final start-up testing.

.2 O&M personnel may assist in commissioning procedures as part of training.

.3 Commissioning to be supervised by qualified supervisory personnel and Owner Site Representative.

.4 Commission systems considered as life safety systems before affected parts of the facility are occupied.

.5 Operate systems as long as necessary to commission entire project.

.6 Monitor progress and keep detailed records of activities and results.

3.2 ADJUSTING

.1 Final adjusting: upon completion of commissioning as reviewed by Owner Site Representative, set and lock devices in final position and permanently mark settings.

3.3 DEMONSTRATION

.1 Demonstrate to Owner Site Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.

.2 Related Sections:

.1 Division 01 – Standard General Requirements.

.2 Section 21 05 01 – Common Work Results - Mechanical.

1.2 SUBMITTALS

.1 Submittals in accordance with Division 01 – Standard General Requirements, supplemented and modified by requirements of this Section.

.2 Submit training plan complete with hour-by-hour schedule including brief overview of content of each segment to Owner Site Representative 30 days prior to anticipated date of beginning of training.

.1 List name of trainer, and type of visual and audio aids to be used.

.2 Show co-ordinated interface with other EMCS mechanical and electrical training programs.

.3 Submit training plan within one week following completion of controls testing and demonstration.

1.3 QUALITY ASSURANCE

.1 Provide competent trainers thoroughly familiar with aspects of EMCS installed in facility.

.2 Owner Site Representative reserves the right to approve instructors.

1.4 INSTRUCTIONS

.1 Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.

.2 Training is to be project specific.

1.5 TRAINING

.1 Contractor shall instruct Owner’s designated representatives on proper system use and maintenance, including set point changes, trending and simple program changes.

.2 Instructions shall be provided. Minimum of two – 4 hour (2 separate days), over a 12 month period, at Owner’s request.

1.6 TRAINING MATERIALS

.1 Provide equipment, visual and audio aids, and materials for classroom training.

.2 Supply manual for each trainee, describing in detail data included in each training program.

.1 Review contents of manual in detail to explain aspects of operation and maintenance.

1.7 ADDITIONAL TRAINING

.1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

1.8 MONITORING OF TRAINING

.1 Owner Site Representative to monitor training program and may modify schedule and content.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 TRAINING

.1 Provide a minimum of one onsite training class 8 hours in length during the construction period for personnel designated by the Owner Site Representative.

.2 Train the designated staff of Owner Site Representative and Owner to enable them to:

.1 Day-to-day Operators:

.1 Proficiently operate the system.

.2 Understand control system architecture and configuration.

.3 Understand DDC system components.

.4 Understand system operation including DDC system control and optimizing routines (algorithms).

.5 Operate the workstation and peripherals.

.6 Log on and off the system.

.7 Access graphics, point/object reports, and logs.

.8 Adjust and change system setpoints, time schedules, and holiday schedules.

.9 Recognize malfunctions of the system by observation of the printed copy and graphical visual signals.

.10 Understand system drawings included in the Operation and Maintenance Manual.

.11 Understand the job layout and location of control components.

.12 Access data from DDC controllers.

.13 Operate portable operator's terminals.

.2 Advance Operators:

.1 Make and change graphics on the workstation.

.2 Create, delete, and modify alarms, including annunciation and routing of these.

.3 Create, delete, and modify point/object trend logs, and graph or print these.

.4 Create, delete, and modify reports.

.5 Add, remove, and modify system's physical points/objects.

.6 Create, modify, and delete programming.

.7 Add panels when required.

.8 Add operator interface stations.

.9 Create, delete, and modify system displays – both graphical and otherwise.

.10 Perform DDC system field checkout procedures.

.11 Perform DDC controller unit operation and maintenance procedures.

.12 Perform workstation and peripheral operation and maintenance procedures.

.13 Perform DDC system diagnostic procedures.

.14 Configure hardware including PC boards, switches, communication, and I/O points/objects.

.15 Maintain, calibrate, troubleshoot, diagnose, and repair hardware.

.16 Adjust, calibrate, and replace system components.

.3 System Managers/Administrators:

.1 Maintain software and prepare backups.

.2 Interface with job-specific, third-party operator software.

.3 Add new users and understand password security procedures.

.4 Provide course outline and materials as per Section 01 00 02 – Standard General Requirements. The trainer (s) shall provide one copy of training material per student.

.5 The trainer (s) shall be factory-trained instructors experienced in presenting this material.

.6 Classroom training shall be done using a network of controllers representative of the installed hardware.

.7 All Operation and Maintenance Manuals must be made available prior to training. Manuals will be a training tool, used during training sessions.

.8 List the name of the person conducting each session and the visual and audio aids employed.

.9 Owner Site Representative may monitor the training program and reserves the right to modify the schedule, content, as well as replace instructors deemed unqualified.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

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

.2 Related Sections:

.1 Section 25 05 54 - EMCS: Identification.

1.2 REFERENCES

.1 American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA):

.1 ANSI/ISA 5.5-1985, Graphic Symbols for Process Displays.

.2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics (IEEE):

.1 ANSI/IEEE 260.1-2004, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).

.3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE):

.1 ASHRAE STD 135-R2008, BACNET - Data Communication Protocol for Building Automation and Control Network.

.4 Canadian Standards Association (CSA International):

.1 CAN/CSA-Z234.1-(R2006), Canadian Metric Practice Guide.

.5 Consumer Electronics Association (CEA):

.1 CEA-709.1-C-2010, Control Network Protocol Specification.

.6 Department of Justice Canada (Jus):

.1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.7 Electrical and Electronic Manufacturers Association (EEMAC):

.1 EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.

.8 Health Canada/Workplace Hazardous Materials Information System (WHMIS):

.1 Material Safety Data Sheets (MSDS).

.9 Transport Canada (TC):

.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.10 Standard Construction Contract Documents – Version 2008.

1.3 ACRONYMS AND ABBREVIATIONS

.1 Acronyms used in EMCS: See Appendix II.

1.4 SUMMARY

.1 This Section includes the EMCS (Energy Management Control System) equipment for HVAC systems and components, including open protocol control components for HVAC functions.

.2 The control system shall be as shown and consist of a high-speed, peer-to-peer network of Direct Digital Control (DDC) controllers residing and communicating on a **BACnet/IP Network**. The graphics shall be generated on the existing Owner server (under a separate contract). Each mechanical system, building floor plan, and control device will be depicted by point-and-click graphics. Systems using gateways to route proprietary devices and object to BACnet are not acceptable.

.3 All further references within this section to the term “network”, unless specifically excepted, refers to the BACnet network between the DDC panels referenced within these specifications.

.4 Provide EMCS for all HVAC functions. Refer to schematics, floor plans, point list and sequence of operation.

.5 Coordinate to ensure user server is equipped and configured to provide Trend History of a minimum 24 month capacity.

.6 Remove existing controls not re-used or not required. Place in approved storage for disposal as directed.

1.5 CODES AND STANDARDS

.1 All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications. As a minimum, the installation shall comply with the current editions in effect 30 days prior to receipt of bids of the following codes:

.1 Canadian Electrical Code (latest version).

.2 National Building Code (latest addition).

.3 ASHRAE 135-2001.

.4 FCC Regulation, Part 15- Governing Frequency Electromagnetic Interference.

.5 Underwriters Laboratories UL916.

1.6 SYSTEM PERFORMANCE

.1 Performance Standards. The system shall conform to the following:

.1 Graphic Display. The system shall display a graphic with 20 dynamic points/objects with all current data within 10 seconds.

.2 Graphic Refresh. The system shall update a graphic with 20 dynamic points/objects with all current data within 10 seconds.

.3 Object Command. The maximum time between the command of a binary object by the operator and the reaction by the device shall be less than 2 seconds. Analog objects should start to adjust within 2 seconds.

.4 Object Scan. All changes of state and change of analog values will be transmitted over the high-speed Ethernet network such that any data used or displayed at a controller or workstation will have been current within the previous 2 seconds.

.5 Alarm Response Time. The maximum time from when an object goes into alarm to when it is annunciated at the workstation shall not exceed 45 seconds.

.6 Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 1 second. The Contractor shall be responsible for selecting execution times consistent with the mechanical process under control.

.7 Performance. Programmable controllers shall be able to execute DDC PID control loops at a frequency of at least once per second. The controller shall scan and update the process value and output generated by this calculation at this same frequency.

.8 Multiple Alarm Annunciation. All workstations on the network must receive alarms within 5 seconds of each other.

.9 Reporting Accuracy. The system shall report all values with an end-to-end accuracy equal to or better than those listed in Table 1.

.10 Stability of Control. Control loops shall maintain measured variable at setpoint within the tolerances listed in Table 2.

.2 TABLE 1: Reporting Accuracy

Measured Variable	**Reported Accuracy**
Space Temperature	±0.5ºC
Ducted Air	±0.5ºC
Outside Air	±1.0ºC
Dewpoint	±1.5ºC
Water Temperature	±0.5ºC
Delta-T	±0.15ºC
Relative Humidity	±5% RH
Water Flow	±5% of full scale
Airflow (terminal)	±10% of full scale *(see Note 1)*
Airflow (measuring stations)	±5% of full scale
Air Pressure (ducts)	±25 Pa
Air Pressure (space)	±3 Pa
Water Pressure	±2% of full scale *(see Note 2)*
Electrical (A, V, W, Power factor)	5% of reading
Carbon Monoxide (CO)	±5% of reading
Carbon Dioxide (CO_2)	±50 ppm
Note 1: 10%-100% of scale	
Note 2: For both absolute and differential pressure	

Note 3: Not including utility-supplied meters	

.3 TABLE 2: Control Stability and Accuracy

Controlled Variable	Control Accuracy	Range of Medium
Air Pressure	±50 Pa ±3 Pa	0-1.5 kPa -25 to 25 Pa
Airflow	±10% of full scale	
Temperature	±0.5ºC	
Humidity	±5% RH	
Fluid Pressure	±10 kPa	0-1 kPa
" " differential	±250 Pa	0-12.5 kPa

1.7 SUBMITTALS

.1 Make submittals in accordance with Section 01 00 01 – Project Specific General Requirements and 25 05 01 – Common Work Results for Mechanical.

.2 Submit for review:

.1 Equipment list and systems manufacturers within 10 days after award of contract.

.2 List existing field control devices to be re-used included in tender, along with unit price.

.3 Quality Control:

.1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.

.2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.

.3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 - EMCS: Submittals and Review Process. Label or listing of specified organization is acceptable evidence.

.4 In lieu of such evidence, submit certificate from testing organization, approved by Owner Site Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.

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

.6 Permits and fees: in accordance with general conditions of contract.

.7 Submit certificate of acceptance from authority having jurisdiction to Owner Site Representative.

.8 Existing devices intended for re-use: submit test report.

1.8 COORDINATION

.1 Coordinate location of thermostats, 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,” “Panelboards,” and “Fire Alarm” to achieve compatibility with equipment that interfaces with those systems.

.3 Coordinate supply of conditioned electrical circuits for control units.

.4 Coordinate with the Owner's IT department on locations for UNC's, Ethernet communication cabling and TCP/IP addresses

1.9 OWNERSHIP OF PROPRIETARY MATERIAL

.1 The owner shall sign a copy of the manufacturer’s standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to owner as defined by the manufacturer’s license agreement, but shall protect manufacturer’s rights to disclosure of trade secrets contained within such software. All project developed software and documentation shall become the property of the owner. These include, but are not limited to project graphic images, record drawings, project database, project specific application programming code, and all other associated documentation.

Part 2 Products

2.1 APPROVED MANUFACTURERS

.1 Manufacturers Agent/Product: Subject to compliance with requirements, provide products by one of the following pre-qualified manufacturers:

.1 Delta – Controls & Equipment Ltd.

.2 Reliable/Alerton – Advanced Energy Management.

.3 Automated Logic Controls – Memco.

.4 Distech Controls - PMC

Part 3 Execution

3.1 INSTALLATION

.1 Installation: to manufacturer’s recommendations.

.2 Installation by a manufacturers authorized product dealer and supplier.

3.2 MISCELLANEOUS REQUIREMENTS

.1 Remove existing devices where indicated. Turn over to Owner.

.2 Relocate existing devices where indicated or required for access.

.3 Air Handler devices shall be accessible.

3.3 WIRING AND RACEWAYS

.1 General: Provide copper wiring, plenum cable, and raceways as specified.

.2 All insulated wire to be copper conductors. UL labelled for 90C minimum service.

.3 Electrical work shall be in accordance with Canadian Electrical Code, latest edition, Electrical wiring, terminal blocks and other high voltage contacts shall be fully enclosed or properly guarded and marked to prevent accidental injury to personnel.

.4 All wiring in mechanical rooms and ceiling spaces shall be in accordance with the latest edition electrical code. Conformance with this code will be the responsibility of the Contractor.

.5 Low voltage wiring must be run in conduit unless Owner Site Representative approves it to be run above suspended ceilings. All wiring under this section shall be by this contractor and shall include furnishing labour and miscellaneous material to make connections for all wiring related to the programmable controller:

.1 All wiring shall be concealed in cable tray or conduit from the stand-alone control panel to the ceiling space (as high as possible). Conduit is required in all areas.

.2 Low voltage wiring shall not be run in conduit containing high voltage wiring.

.3 Communication or shielded control wiring shall be installed away from high voltage wiring where possible.

.4 Provide all power wiring in EMT conduit.

.5 Identify each wire and cable in a permanent manner with wire numbers referenced to EMCS hardware address.

.6 Network (communication) wiring shall be run separately from other wiring.

.7 All control wiring to comply with manufacturers recommendations.

.8 Controls contractor to provide and install relays in motor starter’s control circuit wiring as required to allow EMCS control.

.9 All new control wiring to be yellow in color.

.10 120V receptacles to be placed within 10 feet of new DDC panels.

.11 When the Subcontractor is interfacing into existing starters with hand-off-auto switches, it is the responsibility of the Subcontractor to ensure that the piece of equipment which they are controlling from the starter, the Owner can override the S.A.C.P. signal and operate the equipment in the hand position.

.12 Where there is a start/stop switch in place of a starter, the Contractor shall provide for manual override capability. S.A.C.P. (Stand Alone Control Panel) LED modules with HOA switch are acceptable providing the manual starter label reads “Manual Override within S.A.C.P. #”. (Lamacoid Label Required).

.13 All heating circulation pumps and AHU heating coil valves shall be wired for fail safe operation. (i.e. Heating controls to normally open position, cooling and outside air dampers fail to normally closed position).

.14 Provide 120V, 15A power to each control panel from distribution panel and provide new locking circuit breakers. If emergency power exists, control panel shall be connected to the emergency power circuit.

.15 All networking and control device wiring to be continuous wire runs only, no splicing is permitted.

.16 All I/O wiring passing near or within the enclosure of a VFD will be shielded, with the shield terminated at the controller end.

.17 All I/O wiring will be suitably identified using adhesive wire-marker or equivalent at the controller end.

.18 All I/O wiring within controller enclosure shall be neat and tidy and suitably bundled and strapped or contained in wire duct or equivalent.

.19 All I/O wiring that requires a transition to a different conductor to meet electrical code requirement shall be executed using a terminal strip. Marret connections are not acceptable for any connection other than to connect low-voltage pigtails at the device end (e.g. Thermistors, 24 VAC/VDC transducers, actuators, etc.).

.20 Low voltage I/O wiring may be mixed together within a conduit.

.21 Power Wiring:

.1 Provide power wiring and transformers and ground to each controller and transducer as per the manufacturer’s specifications.

.2 Each Building Controller will have its own dedicated power supply. No other controller or I/O device will be powered from this supply.

.3 Custom Application Controllers may share a common power supply, but this supply will not be used for any other device (e.g. I/O devices).

.4 Power wiring shall not be mixed with I/O wiring in a conduit.

.22 All control wiring to have a one (1) year warranty.

.23 Wiring in plenum spaces to be FT6 or in conduit.

3.4 EXAMINATION

.1 The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the Owner Site Representative for resolution before rough-in work is started.

.2 The Contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the Owner Site Representative for resolution before rough-in work is started.

.3 The Contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate or if any

discrepancies occur between the plans and the Contractor's work, and the plans and the work of others – the Contractor shall report these discrepancies to the Owner Site Representative and shall obtain written instructions for any changes necessary to accommodate the Contractor's work with the work of others.

Any changes in the work covered by this specification made necessary by the failure or neglect of the Contractor to report such discrepancies shall be made by and at the expense of this Contractor.

3.5 PROTECTION

.1 The Contractor shall protect all work and material from damage by its work or employees, and shall be liable for all damage thus caused.

.2 The Contractor shall be responsible for its work and equipment until finally inspected, tested, and accepted. The Contractor shall protect any material that is not immediately installed. The Contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

3.6 COORDINATION

.1 Site:

.1 Where the mechanical work will be installed in close proximity to, or will interfere with work of other trades, the Contractor shall assist in working out space conditions to make a satisfactory adjustment. If the Contractor installs its work before coordinating with other trades, so as to cause any interference with work of other trades, the Contractor shall make the necessary changes in its work to correct the condition without extra charge.

.2 Coordinate and schedule work with all other work in the same area, or with work which is dependent upon other work, to facilitate mutual progress.

.2 The Contractor shall furnish all tools necessary to interface to the control system for test and balance purposes.

.3 Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the Contractor as follows:

.1 Each supplier of controls product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.

.2 This Contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this Section and those provided under other sections or divisions.

3.7 GENERAL WORKMANSHIP

.1 Install equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.

.2 Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.

.3 Install all equipment in readily accessible locations as defined by Canadian Electrical Code (latest version).

.4 All wiring shall be verified for its integrity to ensure continuity and freedom from shorts and grounds.

.5 All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices.

3.8 FIELD QUALITY CONTROL

.1 All work, materials, and equipment shall comply with the rules and regulations of applicable local, state, and federal codes and ordinances as identified in Part 1 of this specification.

.2 Contractor shall continually monitor the field installation for code compliance and quality of workmanship.

.3 Contractor shall have work inspected by local and provincial authorities having jurisdiction over the work.

3.9 EXISTING EQUIPMENT

.1 Wiring: The Contractor may not reuse any abandoned wires. .

.2 Local Control Panels: The Contractor may reuse any existing local control panel to locate new equipment. All redundant equipment within these panels must be removed. Panel face cover must be patched to fill all holes caused by removal of unused equipment, or replaced with new.

.3 Unless otherwise directed, the Contractor is not responsible for the repairs or replacement of existing energy equipment and systems, valves, dampers, or actuators. Should the Contractor find existing equipment that requires maintenance, the Owner Site Representative is to be notified immediately.

.4 Temperature Sensor Wells: The Contractor may reuse any existing wells in piping for temperature sensors. These wells shall be modified as required for proper fit of new sensors.

.5 Indicator Gauges: Where these devices remain and are not removed, they must be made operational and recalibrated to ensure reasonable accuracy. Maintain the operation of existing pneumatic transmitters and gauges.

.6 Room Thermostats: Shall be removed and turned over to the Owner, unless otherwise noted.

.7 Electronic Sensors and Transmitters: Unless specifically noted otherwise, remove and deliver to the Owner.

.8 Controllers and Auxiliary Electronic Devices: Deliver to the Owner upon removal.

.9 Pneumatic Controllers, Relays and Gauges: Deliver to Owner upon removal.

.10 Damper Actuators, Linkages and Appurtenances: Deliver to Owner upon removal.

.11 Control Valves: Salvage, recondition, and reuse.

.12 The mechanical system must remain in operation between the hours of 6 a.m. and 6 p.m., Monday through Friday. No modifications to the system shall cause the mechanical system to be shut down for more than 15 minutes or to fail to maintain space comfort condition during any such period. Perform cutover of controls that cannot meet these conditions outside of those hours.

.13 The scheduling of fans through existing or temporary time-clocks or control system shall be maintained throughout the DDC system installation.

.14 Install control panels where shown.

.15 Modify existing starter control circuits, if necessary, to provide Hand/Off/Auto control of each starter controlled.

.16 Patch holes and finish to match existing.

3.10 WIRING INSTALLATION

.1 All control and interlock wiring shall comply with national and local electrical codes.

.2 All NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway per NEC.

.3 All low-voltage wiring shall meet NEC Class 2 requirements. (Low-voltage power circuits shall be sub-fused when required to meet Class 2 current-limit).

.4 Where NEC Class 2 (current-limited) wires are in concealed and accessible locations including ceiling return air plenum, approved cables not in raceway may be used, provided that cables are UL listed for the intended application. For example, cables used in ceiling plenum shall e UL listed specifically for that purpose.

.5 All wiring in mechanical, electrical, or service rooms or where subject to mechanical damage shall be installed in raceway at levels below 3m.

.6 Do not install Class 2 wiring in raceway containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).

.7 Do not install wiring in raceway containing tubing.

.8 Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it, and *neatly* tied at 2m intervals.

.9 Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.

.10 All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.

.11 All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.

.12 Maximum allowable voltage for control wiring shall be 120V. If only higher voltages are available, the Contractor shall provide step-down transformers.

.13 All wiring shall be installed as continuous lengths, with no splices permitted between termination points/objects.

.14 Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.

.15 Size of raceway and size and type of wire shall be the responsibility of the Contractor, in keeping with the manufacturer's recommendation and Canadian Electrical Code requirements, except as noted elsewhere.

.16 Include one pull string in each raceway 2.5 cm or larger.

.17 Use coded conductors throughout with different coloured conductors.

.18 Control and status relays are to be located in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.

.19 Conceal all raceways, except within mechanical, electrical, or service rooms. Install raceway to maintain a minimum clearance of 15 cm from high-temperature equipment (e.g., steam pipes or flues).

.20 Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.

.21 Adhere to Electrical Code requirements where raceway crosses building expansion joints.

.22 Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of all vertical raceways.

.23 The Contractor shall terminate all control and/or interlock wiring, and shall maintain updated (as-built) wiring diagrams with termination identified at the job site.

.24 Flexible metal raceways and liquid-tight, flexible metal raceways shall not exceed 1 m in length and shall be supported at each end. Flexible metal raceway less than ½" electrical trade size shall not be used. In areas exposed to moisture including chiller and boiler rooms liquid-tight, flexible metal raceways shall be used.

.25 Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (per code). Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.

.26 FT6 wiring must be used where wires are run through a space used as a plenum. Controls wiring to meet manufacturers recommend installation guidelines.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

.2 Related Sections:

.1 Section 25 05 01 - EMCS: General Requirements.

.2 Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

1.2 SUBMITTALS

.1 Make submittals in accordance with Section 01 00 01 – Project Specific General Requirements and 21 05 01 – Common Work Results.

.1 Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and start-up instructions for each type of product indicated.

.2 Each control device labelled with setting or adjustable range of control.

.2 Mock-Ups / Samples:

.1 Graphics Interface:

.1 Prior to upload to server, submit to Engineer, detailed graphics screens for each floor plan and each individual system, indicating comprehensively; all components, sensor inputs, standard setpoints, user setpoints, modes, schedules, trend graphs, PI graphs, resets, overrides, status points, positions, overrides, pushbuttons, timers, alarms, etc; in accordance with the intent of work stipulated in drawings, specifications, sequences, and points list.

.3 Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, and method of field assembly, components, and location and size of each field connection.

.1 Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.

.2 Wiring Diagrams: Power, signal, and control wiring. Differentiate between manufacturer-installed and field-installed wiring.

.3 Details of control panel faces, including controls, instruments, and labeling.

.4 Written description of sequence of operation.

.5 Schedule of dampers including size, leakage, and flow characteristics.

.6 Schedule of valves including close-off and flow characteristics.

.7 Trunk cable schematic showing programmable control unit locations and trunk data conductors.

.8 Listing of connected data points, including connected control unit and input device.

.9 System graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations.

.10 System configuration showing peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

.4 Protocol Implementation Conformance/BACnet Interoperability Building Blocks Statements clarifying which BACnet objects and services are supported by each controller.

.5 ANSI / ASHRAE™ Standard 135-2001, BACnet PIC/BIBB Statement: Proof of Compliance Level 3 or higher is required to protect building owner by reducing future maintenance and expansion costs.

.6 Samples: For each color required, of each type of thermostat cover.

.7 Software and Firmware Operational Documentation: Include the following:

.1 Engineering, Installation, Operation and Maintenance manuals.

.2 Program Software Backup: On a magnetic media or compact disc, complete with data files.

.3 Device address list.

.4 Printout of software application and graphic screens.

.5 Licenses, guarantee, and warranty documents for all equipment and systems.

.8 Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

.9 Schedules:

.1 Within two weeks of contract award, provide a schedule of the work indicating the following:

.1 Intended sequence of work items.

.2 Start dates of individual work items.

.3 Duration of individual work items.

.4 Planned delivery dates for major material and equipment, and expected lead times.

.5 Milestones indicating possible restraints on work by other trades or situations.

.2 Provide monthly written status reports indicating work completed, revisions to expected deliver dates, etc. an updated project schedule shall be included.

.10 Qualification Data: For firms and persons specified in “Quality Assurance” Article.

.11 Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors. Revise Shop Drawings to reflect actual installation and operating sequences.

1.3 QUALITY ASSURANCE

.1 Bids by wholesalers, distributors, mechanical contractors and non-franchised contractors shall not be acceptable.

.2 The contractor shall have an established working relationship with the control system manufacturer, and be an authorized representative of the manufacturer at bid time.

.3 The contractor shall have successfully completed control system manufacturers classes on the control system. Owner reserves the right to request proof of training.

.4 The system manufacturer shall, as a minimum, manufacture and supply the Variable Air Volume Direct Digital Controller, Unitary Equipment Controller, Advanced Application Controller and Graphical User Interface.

.5 All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this.

.6 The EMCS contractor shall have a full service facility within 200 km of the project that is staffed with engineers trained in Integrating Interoperable Systems and technicians fully capable of providing routine emergency maintenance service on all system components.

.7 Mechanical equipment manufacturers that are listed as approved to provide DDC type controls may submit a bid with factory mounted controls, and shall also provide a separate bid for their products less all controls, actuators, valve assemblies and sensors, which are specified to be provided by the EMCS contractor.

.8 Electrical Components, Devices, and Accessories: Listed and labelled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

.9 Comply with NFPA 90A, "Installation of Air Conditioning and Ventilation Systems."

.10 Comply with Canadian Electric Code, UL-916 Energy Management Systems, ULC, FCC Part 15, subpart J, Class B Computing Devices.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers Steel, Metal, Plastic waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with Regional and Municipal, regulations.

.7 Label location of salvaged material's storage areas and provide barriers and security devices.

.8 Ensure emptied containers are sealed and stored safely.

.9 Divert unused metal materials from landfill to metal recycling facility as approved by Owner Site Representative.

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

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Requirements and procedures for identification of Building Energy Monitoring and Control System (EMCS) devices such as: sensors; wiring; tubing; conduit; and equipment. This section covers requirements for nameplate materials, colours and lettering sizes.

.2 Related Sections:

.1 Section 01 00 02 – Standard General Requirements.

.2 Section 25 05 01 - EMCS: General Requirements.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International):

.1 CSA C22.1- The Canadian Electrical Code, Part I (latest edition), Safety Standard for Electrical Installations.

1.3 DEFINITIONS

.1 For acronyms reference Appendix II – Programming/Graphic Standards and Conventions Descriptor Acronyms and Appendix III – Object Tagging.

1.4 SYSTEM DESCRIPTION

.1 Language Operating Requirements: provide identification for control items in English.

1.5 SUBMITTALS

.1 Submittals in accordance with Section 01 00 02 – Standard General Requirements supplemented and modified by requirements of this Section.

.2 Submit samples to Owner Site Representative for pre-approval. Include samples of nameplates, identification tags and list of proposed wording.

Part 2 Products

2.1 WARNING LABELS

.1 Permanent warning labels shall be affixed to all equipment which can be automatically started by the EMCS system.

.1 Labels shall use white lettering (12-point type or larger) on a red background.

.2 Warning labels shall read as follows:

C A U T I O N

This equipment is operating under automatic control and may start or stop at any time without warning. Switch disconnect to "Off" position before servicing.

.2 Permanent warning labels shall be affixed to all motor starters and all control panels which are connected to multiple power sources utilizing separate disconnects.

.1 Labels shall use white lettering (12-point type or larger) on a red background.

.2 Warning labels shall read as follows:

C A U T I O N

This equipment is fed from more than one power source with separate disconnects. Disconnect all power sources before servicing.

2.2 IDENTIFICATION OF HARDWARE AND WIRING

.1 All wiring and cabling, including that within factory-fabricated panels, shall be labelled at each end within 5 cm of termination with the information provided as sample. See Appendix III – Object Tagging.

Field Equipment Identification: To be as per laminated sample.

1. To include the following:
   a. Scale/set-up range
   b. Panel (controller) address
   c. Point address
   d. Device Descriptor/Manufacturer
   e. Controls Company.

.2 All pneumatic tubing shall be labelled at each end within 5 cm of termination with a descriptive identifier.

.3 Permanently label or code each point/object of field terminal strips to show the instrument or item served.

.4 Identify control panels with minimum 1 cm letters on laminated plastic nameplates.

.5 Identify all other control components with permanent labels. All plug-in components shall be labelled such that removal of the component does not remove the label.

.6 Identify room sensors relating to terminal box or valves with nameplates.

.7 Identifiers shall match record documents.

.8 Conduit:

.1 Colour code EMCS conduit. Confirm colour coding with Owner Site Representative during project start-up meeting.

.2 Pre-paint box covers and conduit fittings as per Owner Standards.

2.3 MANUFACTURERS NAMEPLATES

.1 Each piece of equipment shall have a metal nameplate mechanically fastened to equipment, with raised or recessed letters. Nameplates to be located so that they are easily read. Do not insulate or paint over plates.

.2 Include registration plates (e.g. pressure vessel, Underwriters' Laboratories and CSA approval) as required by respective agency and as specified. The supplier shall indicate size, equipment model, manufacturer's name, serial number, voltage, cycle, phase and power of motors.

2.4 SYSTEM NAMEPLATES

.1 Major equipment to be identified with laminated plastic plates with black face and white center (lettering) of minimum size 3 ½" x 1 ½" x 3/32" nominal thickness, engraved with ½" high lettering.

.2 Nameplates to be fastened securely with pop rivets or screws in conspicuous place. Where nameplates cannot be mounted, such as on cool surfaces, provide standoffs.

.3 Unique mechanical identification tag shall follow naming system laid out on drawings and in specifications. Equipment type, number and service or areas or zone of building it serves to be identified.

2.5 EQUIPMENT CONCEALED BY CEILING

.1 At valves, balancing dampers air vents and drains, and other similar pieces of mechanical equipment located above T-bar ceilings or access doors, install circular ¾" diameter self-adhesive identification discs on the underside of the ceiling, as close as possible to the location of the equipment.

.2 Discs shall be coloured as scheduled in this section (see pipe primary and secondary colours table).

.3 Where the item has a primary and secondary colour, provide a ¾" diameter primary colour disc with a 3/8" diameter secondary colour disc centered on the primary disc.

.4 For backflow preventers, fire dampers, air terminal units, exhaust fans, reheat coils and other similar pieces of equipment located above T-bar ceilings or access doors, provide laminated plastic plates as noted for System nameplates above (with plates for fire dampers to have red face and white lettering). A second identical plate shall be installed on the underside of the ceiling grid or access door opening frame, as close as possible to the location of the equipment.

2.6 ELECTRICAL AND CONTROLS EQUIPMENT IDENTIFICATION

.1 Electrically fed equipment supplied by Division 21 – 28 (excluding that noted in .2 and .3, below) shall be identified as per Division 26 identification requirements.

.2 Intermediate and end control devices including sensor, controllers, monitoring devices, etc. shall be identified with laminated plastic plates or white polyolefin tags as noted for system nameplates above. The plates shall be fastened securely with pop rivets or screws.

Where rivets or screws are not feasible, provide heavy duty plastic tie wraps. As a minimum, control device identification shall correspond to descriptors provided in the approved shop drawings with respect to panel designation or DDC point name.

.3 Control devices located concealed by ceilings shall also be provided with a second identical plate installed on the underside of the ceiling grid or access door opening frame, as close as possible to the location of the device.

Part 3 Execution

3.1 NAMEPLATES AND LABELS

.1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

3.2 EXISTING PANELS

.1 Correct existing nameplates and legends to reflect changes made during Work.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Requirements and procedures for warranty and activities during warranty period for building Energy Monitoring and Control System (EMCS).

.2 Related Sections:

.1 Section 01 00 01 – Project Specific General Requirements.
.2 Section 25 05 01 – EMCS: General Requirements.

1.2 WARRANTY

.1 Provide standard warranty twelve (12) months from approval date of substantial completion.

.2 EMCS Contractor shall perform all maintenance on installed equipment and software during the warranty period. Provide all personnel, vehicles, materials, and labour necessary.

.3 Warrant all work as follows:

.1 Labour and materials for the control system specified shall be warranted free from defects for a period of 12 months after the substantial completion date is accepted. Control system failures during the warranty period shall be adjusted, repaired, or replaced at no additional cost or reduction in service to the Owner. The contractor shall respond to the Owner's request for warranty service within 24 hours during normal business hours.

.2 All work shall have a single warranty date, even when the Owner has received beneficial use due to an early system start-up. If the work specified is split into multiple contracts or a multi-phase contract, then each contract or phase shall have a separate warranty start date and period. In this case, each building will have separate warranty dates.

.3 At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the Owner Site Representative, the Owner Site Representative shall sign certificates certifying that the control system operation has been tested and accepted in accordance with the terms of this specification. The date of substantial completion shall be the start of warranty.

.4 Touch Screen Interface software, graphic software, database software, and firmware updates which resolve known software deficiencies as identified by the contractor shall be provided at no charge during the warranty period.

.5 All firmware updates or functional enhancements associated with the above mentioned items must be provided during the warranty period. Written authorization by the Owner must, however, be granted prior to the installation of any of the above mentioned items.

.6 Exception: The contractor shall be required to warrant reused devices. Contractor to bear necessary cost. The contractor shall warrant all installation labour and materials.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 NOT USED

.1 Not used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 System requirements for Local Network for Building Energy Monitoring and Control System (EMCS).

1.2 RELATED SECTIONS

.1 Section 01 – General Requirements.

.2 Section 25 – EMCS.

1.3 REFERENCES

.1 C22.1-15, Canadian Electrical Code, Safety Standard for Electrical Installations.

.2 CSA-C22.2 No. 214-08, Communications Cables.

.3 IEEE Standard 802.3, Local Area Network (LAN) protocols.

.4 ANSI/TIA/EIA-568-C.1 Commercial Building Telecommunications Cabling Standard, Ed. C, Amd. 2, 05-2012.

.5 ANSI/TIA/EIA-568-C.2 Balanced Twisted-Pair Telecommunication Cabling and Components Standard, Ed. C, Err. 04-2014.

.6 ANSI/TIA/EIA-568-C.3 Optical Fiber Cabling Components Standard, Ed. C, Amd. 1, 10-2011.

.7 ANSI/BICSI-568-2006, Standard for Installing Commercial Building Telecommunications Cabling.

.8 ANSI/ASHRA Standard 135-2012 BACnet – A Data Communications Protocol for Building Automation and Control Networks.

1.4 SYSTEM DESCRIPTION

.1 Data communication network to link Operator Interface Software and EMCS Control Panels:

- .1 Provide reliable and secure connectivity of adequate performance between different sections (segments) of network.
- .2 Allow for future expansion of network, with selection of networking technology and communication protocols.

.2 Data communication network to include, but not limited to:

- .1 EMCS-LAN.
- .2 EMCS-MS/TP serial cabling DataBus.
- .3 Network interface hardware.
- .4 Network management hardware and software.

.5 Network components necessary for complete network.

1.5 DESIGN REQUIREMENTS

.1 All control products provided for this project shall comprise a BACnet internetwork. Communication involving control components (i.e., all types of controllers and Operator Workstations) shall conform to ANSI/ASHRAE Standard 135-2012, BACnet.

.2 Each BACnet device shall operate on the BACnet Data Link/Physical layer protocol specified for that device class.

.3 The Contractor shall provide all communication media, connectors, repeaters, bridges, hubs, switches, and routers necessary for the internetwork.

.4 All controllers shall have a communication port for connections with the Operator Workstations using the BACnet Data Link/ Physical layer protocol.

.5 Connection of an Operator Interface device to any one controller on the internetwork will allow the operator to interface with all other controllers as if that interface were directly connected to the other controllers. Data, status information, reports, system software, custom programs, etc., for all controllers shall be available for viewing and editing from any one controller on the internetwork.

.6 All database values (e.g., objects, software variables, custom program variables) of any one controller shall be readable by any other controller on the internetwork. This value passing shall be automatically performed by a controller when a reference to an object name not located in that controller is entered into the controller's database. An operator/installer shall not be required to set up any communication services to perform internetwork value passing.

.7 The time clocks in all controllers shall be automatically synchronized daily. An operator change to the time clock in any controller shall be automatically broadcast to all controllers on the network.

Part 2 Products

2.1 ETHERNET SWITCHES

.1 Device shall conform with:

.1 IEEE Standard 802.3.

.2 ANSI/TIA/EIA-568-C.

.2 The following Ethernet physical media standards shall be supported:

.1 100Base-TX copper.

.2 100Base-FX fiber (multi-mode and single mode).

.3 1000Base-SX fiber (multi-mode).

.4 1000Base-LX fiber (single mode).

.3 Provide sufficient ports to support the specified network devices plus 20% (minimum 2 extra ports).

2.2 CONTROL WIRING NETWORK

.1 General:

.1 For wiring under 70 volts, use FT6 (Plenum rated) wiring, minimum #22AWG, where wiring is not run in conduit (free-air installation).

.2 For wiring under 70 volts, use FT4 (Non-Plenum rated), minimum #24AWG, where wiring is run in conduit.

.3 All HVAC/EMCS cabling shall be color coded 'Green'. Confirm cable coding color with Owner's representative prior to order.

.2 Network / LAN Cabling:

.1 Minimum ETHERNET/IP Cabling Requirements:

.1 IEEE Standard 802.3.

.2 ANSI/TIA/EIA-568-C.1, C.3.

.3 Category 6A (CAT6A), UTP-8, Shielded. Alternate medium: Optical Fiber Cable.

.4 100BASE-TX thru 1000BASE-TX; minimum throughput 100Mbps – 1000Mbps).

.5 Maximum permissible length for CAT6 shall be 70 meters (230 ft). Optical Fiber length unlimited.

.6 Standard of Acceptance: Belden 10GX.

.2 MS/TP Field Controller / Device Serial Cabling (Data Bus) Network:

.1 IEEE Standard 802.3.

.2 ANSI/ASHRA Standard 135-2012.

.3 ANSI/TIA/EIA-485.

.4 ANSI/TIA/EIA-568-C.2.

.5 Multi-Conductor Data Cable shall have Stranded, Twisted Copper conductors; minimum three (3) insulated, shielded pairs. Overall cable to be complete with Shield plus tinned copper braid, drain wire, and PVC jacket rated FT4 or FT6 for conduit rated or open plenum rated respectively. Standard of Acceptance: Belden 3108A and 7202A respectively.

.6 Maximum cable Impedance shall be 120ohms (+/- 10%).

.7 Maximum permissible length is 1220 meters (4000ft).

.1 Establish system Baud rate at maximum of 38400k,

Or

.2 76800k maximum Baud rate using BACnet COV (change of value) protocol.

.8 Strands shall remain twisted at termination(s).

.9 Utilize 3rd conductor as the common ground reference for all devices. Do not use other ground reference, except where specifically required to do so as per device manufacturer's installation instructions for 3-wire cable. Cable shield is not permitted for use as ground reference.

.10 Shield Drain wire to be earth grounded on one end of cable run only. Ground through a 100 ohm current-limiting resistor.

.11 Physical configurations: Maintain serial network topology. Minimize serial drop legs. Star configurations not permitted. Refer to network schematic, where provided.

.12 Install 100 ohm end of line resistors for each serial trunk/leg.

.13 Cable conductors shall have low capacitance ('Low Cap') of less than 100pF (picofarad) per meter (<30pF per foot) distributed capacitance between conductors and shield.

Part 3 Execution

3.1 COMMUNICATIONS CABLE INSTALLATION

.1 All cabling shall be installed in accordance with:

.1 C22.1-15.

.2 CSA-C22.2 No. 214-08.

.3 IEEE Standard 802.3.

.4 ANSI/TIA/EIA-568-C.1, C.2, C.3.

.5 ANSI/BICSI-568-2006.

.2 Coordinate Network tie-ins & terminations with Owner's Facility Manager or Owner's Representative.

.3 Coordinate installation with all affected trades and parties.

.4 Point-to-point wiring must be continuous, without splices or junctions, to the extent where that length is available (typically 1000ft maximum spool) and/or where specifically indicated by Engineer.

.5 All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.

.6 Do not install communication wiring in raceway and enclosures containing Class 1 or other Class 2 wiring.

.7 Cabling shall not be coiled or twisted around other cabling.

.8 Cable shall not be crushed, pinched, knotted, crimped, punctured, or adhered.

.9 Plenum Cable shall be supported at intervals not more than 1.5m (5ft) with appropriately plenum rated 'J' hooks, Cable Trays, or Velcro-Wraps. Cable-Ties (Ty-Rap) is not permitted. All supports/fasteners shall secure cable but permit reasonable pull/removal/access to individual cable.

.10 Cable shall not be installed on, in contact with, or adjacent to equipment/devices/conditions or devices that generate heat, moisture, abrasion, chemical reaction, ultra-violet exposure, or any otherwise damaging effects. Where conditions are unavoidable, advise Engineer as appropriate, and provide appropriate contact separation and enclosure in rated conduit.

.11 Maximum pulling tension and bend radius for cable installation as specified by the cable manufacturer shall not be exceeded during installation.

.12 Cable shall be terminated in accordance with manufacturer's guidelines and in conformance with maintaining cable and enclosure rating, isolation, and capacitance.

.13 Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.

.14 When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.

.15 Refer to Part 2 for specific Product installation/configuration/termination requirements.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 All DDC building controllers.

.2 Install minimum of one BACnet Testing Laboratories (BTL) listed BACnet Building Controller (B-BC) per floor, and per penthouse or mechanical room.

.3 Related Sections:

.1 Section 25 05 01 – EMCS: General Requirements.

.2 Section 25 30 02 – EMCS: Field Control Devices.

.3 Section 25 10 01 – EMCS: Network.

1.2 REFERENCES

.1 **http://www.bacnetinternational.net/btl/**

1.3 DEFINITIONS

.1 Acronyms and definitions: refer to Appendix II.

1.4 SYSTEM DESCRIPTION

.1 General. Provide an adequate number of Building Controllers to achieve the performance specified in the Part 1 Article on “System Performance.” Each of these panels shall meet the following requirements.

.1 The Energy Management and Control System shall be comprised of one or more independent, standalone, microprocessor-based Building Controllers to manage the global strategies described in the System Software section. Failure of one panel shall not affect the remaining panels. Last known global valves shall be used in the event of a panel failure.

.2 The Building Controller shall have sufficient memory to support its operating system, database, and programming requirements.

.3 Data shall be shared between networked Building Controllers.

.4 The operating system of the Building Controller 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 Controllers that perform scheduling shall have a real-time clock.

.6 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

1.5 DESIGN REQUIREMENTS

.1 To include:

.1 Scanning of Analog Input and Binary Output connected inputs for detection of change of value and processing detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.

.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

.4 Control of systems as described in sequence of operations.

.5 Execution of optimization routines as listed in this section.

.2 Field Termination and Interface Devices:

.1 To: CSA C22.2 No.205.

.2 Electronically interface sensors and control devices to processor unit.

.3 Include, but not be limited to, following:

.1 Programmed firmware or logic circuits to meet functional and technical requirements.

.2 Power supplies for operation of logics devices and associated field equipment.

.3 Lockable wall cabinet.

.4 Required communications equipment and wiring (if remote units).

.5 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.

.6 Input Output interface to accept as minimum Analog Input, Analog Output, Digital Input, Digital Output functions as specified.

.7 Wiring terminations: use conveniently located screw type or spade lug terminals.

.4 Analog Input interface equipment to:

.1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges:

.1 4 - 20 mA;

.2 0 – 10 V DC;

.3 100/1000 ohm RTD input;

.3 Meet IEEE C37.90.1 surge withstand capability.

.4 Have common mode signal rejection greater than 60 dB to 60 Hz.

.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

.5 Analog Outputs interface equipment:

.1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.

.2 Provide for following output signal types and ranges:

.1 4 - 20 mA.

.2 0 – 10V DC.

.3 Meet IEEE C37.90.1 surge withstand capability.

.6 Binary Input interface equipment:

.1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.

.2 Meet IEEE C37.90.1 surge withstand capability.

.3 Accept pulsed inputs up to 2 kHz.

.7 Binary Output interface equipment:

.1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5 amps at 24V AC.

.2 Switch up to 5 amps at 220V AC using optional interface relay.

.3 Controllers and associated hardware and software: operate in conditions of 0°C to 44 °C and 20 % to 90 % non-condensing RH.

.4 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door:

.1 Provide for conduit entrance from top, bottom or sides of panel.

.2 ECUs and TCUs to be mounted in equipment enclosures or separate enclosures.

.3 Mounting details as approved by Engineer for ceiling mounting.

.5 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.

.6 Provide surge and low voltage protection for interconnecting wiring connections.

1.6 SUBMITTALS

.1 Make submittals in accordance with Section 01 00 01 – Project Specific General Requirements and Section 25 05 01 – Common Work Results for Mechanical:

.1 Submit product data sheets for each product item proposed for this project.

1.7 MAINTENANCE PROCEDURES

.1 Provide manufacturers recommended maintenance procedures in Operations and Maintenance Manuals.

Part 2 Products

2.1 BUILDING CONTROLLER

.1 General Requirements:

.1 BACnet Conformance:

.2 Building Controller shall be approved by the BTL as meeting the BACnet Building Controller requirements.

.3 Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

.1 Building controller shall be of modular construction such that various modules may be selected to fit specific requirements of a given project. All modules shall be panel-mounted on DIN rail for ease of addition and shall be interconnected using a simple plug-in cable. A module in the middle shall be replaceable without removing other modules.

.4 Communication:

.1 Each Building Controller shall support direct Ethernet or a communications card. The Building Controller shall be connected to the BACnet network using the ISO 8802-3 (Ethernet) Data Link/ Physical layer protocol.

.2 Each Building Controller with a communications card shall perform BACnet routing if connected to a network of Custom Application and Application Specific Controllers.

.3 The controller shall 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.

.4 The Building Controller secondary communication network shall support BACnet MS/TP.

.5 Environment. Controller hardware shall be suitable for the anticipated ambient conditions:

.1 Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 32°F to 100°F and 10 to 90% RH.

.2 Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 32°F to 120°F.

.6 Building Controllers shall be fully peer to peer.

.7 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.

.8 Memory. The Building Controller shall 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 shall be user extendible through RAM chip sockets and SIMMs for future memory expansion.

.9 Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage.

.10 The Building Controller shall 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.

.11 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.

2.2 ADVANCED APPLICATION CONTROLLERS

.1 General: Provide an adequate number of Advanced Application Controllers to achieve the performance specified in the Part 1 Article on "System Performance." Each of these panels shall meet the following requirements:

.1 The Advanced Application Controller shall have sufficient memory to support its operating system, database, and programming requirements.

.2 Advanced Application Controllers shall be fully peer to peer.

.3 The operating system of the Controller 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.

.4 All equipment that requires scheduling shall be scheduled in that equipment's controller.

.5 Both firmware and controller database shall be loadable over the network.

.2 Communication:

.1 Each Advanced Application Controller shall reside on a BACnet network using the MS/TP or Ethernet Data Link/ Physical layer protocol.

.2 The controller shall provide a service communication port using BACnet Data Link/ Physical layer protocol for connection to portable operator's workstation and allow access to the entire network.

.3 Environment. Controller hardware shall be suitable for the anticipated ambient conditions:

.1 Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 0°C to 40°C.

.2 Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 0°C to 50°C.

.4 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.

.5 Memory. The Advanced Application Controller shall be non-volatile FLASH memory.

.6 Immunity to power and noise. Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to120 Hz and from keyed radios up to 5 W at 1 m.

2.3 APPLICATION SPECIFIC CONTROLLERS

.1 General: Provide an adequate number of Advanced Application Controllers to achieve the performance specified in the Part 1 Article on “System Performance.” Each of these panels shall meet the following requirements:

.1 The Application Specific Controller shall have sufficient memory to support its operating system, database, and programming requirements.

.2 Application Specific Controllers shall be fully peer to peer.

.3 The operating system of the Controller 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.

.4 Both firmware and controller database shall be loadable over the network.

.5 Advanced Application Controllers shall be BTL listed as a B-ASC device.

.2 Communication:

.1 Each Application Specific Controller shall reside on a BACnet network using the MS/TP or Ethernet Data Link/ Physical layer protocol.

.2 The controller shall provide a service communication port using BACnet Data Link/ Physical layer protocol for connection to portable operator’s workstation and allow access to the entire network.

.3 Environment: Controller hardware shall be suitable for the anticipated ambient conditions:

.1 Controllers used outdoors and/or in wet ambient conditions shall be mounted within waterproof enclosures, and shall be rated for operation at 0°C to 40°C.

.2 Controllers used in conditioned space shall be mounted in dust-proof enclosures, and shall be rated for operation at 0°C to 50°C.

.4 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.

.5 Memory: The Application Specific Controller shall be non-volatile FLASH memory.

.6 Immunity to power and noise: Controller shall be able to operate at 90% to 110% of nominal voltage rating and shall perform an orderly shutdown below 80% nominal voltage. Operation shall be protected against electrical noise of 5 to120 Hz and from keyed radios up to 5 W at 1 m.

2.4 INPUT/OUTPUT INTERFERENCE

.1 Hardwired inputs and output points/objects may be wired into the system through building, Custom Application.

.2 All input and output points shall be protected such that shorting of the point to itself, to another point, or to ground, will cause no damage to the controller. All input and output points shall be protected from voltage up to 24 volts of any duration, such that contact with this voltage will cause no damage to the controller.

.3 Digital inputs shall allow the monitoring of ON/OFF signals from remote devices. The digital inputs shall provide a current of at least 12 mA to be compatible with commonly available control devices, and shall be protected against the effects of contact bounce and noise. Digital inputs shall sense “dry contact” closure without external power (other than that provided by the controller) being applied.

.4 Analog inputs shall allow the monitoring of 0-5 VDC, 0-10 VDC-voltage, 4-20 mA-current, or thermistors. Analog inputs shall be compatible, and be field configurable to commonly available sensing devices.

.5 Digital outputs shall provide for ON/OFF operation. Digital outputs on Building and Advanced Application Controllers shall have three-position override switches, Hand-Off-Auto with status lights. Outputs shall be selectable for either normally open or normally closed operation.

.6 Analog outputs shall provide a modulating signal for the control of end devices. Outputs shall provide a 0 to 10 VDC signal as required to provide proper control of the output device. Analog outputs on Building or Advanced Application Controllers shall have status lights and a two-position (AUTO/MANUAL) switch and manually adjustable potentiometer for manual override. Analog outputs shall not exhibit a drift of greater than 0.4% of range per year.

.7 Tri-State Outputs: Provide tri-state outputs (two coordinated binary outputs) for control of three-point floating type electronic actuators without feedback. Use of three-point floating devices shall be limited to zone control and terminal unit control applications (VAV terminal units, duct mounted heating coils, zone dampers, radiation, etc.)

.8 Input/Output points/objects shall be universal type, i.e., controller input or output may be designated (in software) as either a binary or analog type point/object with appropriate properties. Application Specific Controllers are exempted from this requirement.

.9 System Object Capacity. The system size shall be expandable to at least twice the number of input/output objects required for this project. Additional controllers (along with associated devices and wiring) shall be all that is necessary to achieve this capacity requirement. The Operator Workstations installed for this project shall not require any hardware additions or software revisions in order to expand the system.

2.5 CONTROL PANELS

.1 Local Control Panels: Unitized NEMA 1 cabinet with suitable brackets for wall or floor mounting, located adjacent to each system under automatic control. Provide common keying for all panels.

.1 Fabricate panels of 0.06-inch thick, furniture-quality steel, or extruded-aluminum alloy, totally enclosed, with hinged doors and keyed lock and with manufacturer's standard shop-painted finish.

.2 Interconnections between internal and face-mounted devices pre-wired with color-coded stranded conductors neatly installed in plastic troughs and/or tie-wrapped. Terminals for field connections shall be UL Listed for 600 volt service, individually identified per control/interlock drawings, with adequate clearance for field wiring. Control terminations for field connection shall be individually identified per control drawings.

.3 Door-Mounted Equipment: Flush-mount (on hinged door) manual switches, including damper-positioning switches, changeover switches, thermometers, and gages.

.4 Provide ON/OFF power switch with over-current protection for control power sources to each local panel.

.5 Provide engraved plastic nameplates indicating panel identification and all instruments and controls inside the cabinet and on the cabinet face.

2.6 TREND LOGS

.1 The operator shall be able to define a custom trend log for any data object in the system. This definition shall include change-of-value digital, change-of-value analog, time interval, start time, and stop time. Trend data shall be sampled and stored on the Building Controller panel, and be archiveable on the hard disk and be retrievable for use in spreadsheets and standard database programs. Contractor to set up all trend logging requested by Owner Site Representative.

As a minimum, Contractor to set up trend logging as outlined below:

Data logging to be set up by Contractor, format to be pre-approved by the Owner Site Representative. The following points must be logged hourly for typical systems. Logs must be continuously updated.

.1 D/N Points:

- D/N point switch over
- Space setpoint used as a D/N reference point
- Space actual temperature used as a D/N reference point
- Building override status, if used

If there are multiple zones, with separate D/N control, provide a trend log for each, containing the above information.

.2 Scheduled Water:

- OAT temperature
- Scheduled water actual temperature
- Valve position (EMCS output signal) or boiler control input from EMCS

- Scheduled water setpoint
- Scheduled water actual temperature

.3 Pump Control:

- OAT temperature
- Lowest space value
- Pump control output value from EMCS (pump status value preferred if available)
- Pump status value if available

.4 AHU Systems:

The trend logs required are dependent on the type of systems controlled. It may be necessary to modify these slightly to suit the system.

- AHU fan start/stop output value from EMCS
- AHU fan status
- AHU run time, using fan status point
- AHU override status, if used
- SAT setpoint as dictated by lowest percent space error signal
- SAT actual temperature
- Mixed air damper output signal from EMCS
- H/C valve output signal from EMCS (if electric coil, use SCR input)
- Space temperature setpoint served by AHU system
- Lowest space temperature value served by AHU system
- Minimum percent fresh air setpoint
- Percent fresh air actual value
- MAT setpoint (as calculated by percent fresh air equation)
- MAT actual
- Cooling control valve output signal from EMCS (if DX, log enable point)
- Static pressure setpoint
- Static pressure actual valve
- Inlet vane/speed drive output signal from EMCS
- Percentage of boxes requiring cooling

.5 Space Temperature Sensors:

As required (1 for every space sensor):

- All space setpoints
- All space actual valves
- All percent error valves with associated space sensors
- Heating output valve if applicable
- Lowest percent space error
- Highest percent space error
- Lowest space temperature
- Highest space temperature

.6 Morning Warm-up:

- OAT valve
- Optimized start value
- Space temperature setpoint used by morning warm-up reference
- Space temperature value used by morning warm-up reference

.7 Other Systems:

- Various exhaust fans
- Outdoor lights
- CO/NOX status (OK, Alarm)

2.7 POWER SUPPLIES AND LINE FILTERING

.1 Control transformers shall be UL listed. Furnish Class 2 current-limiting type, or furnish over-current protection in both primary and secondary circuits for Class 2 service per NEC requirements. Limit connected loads to 80% of rated capacity.

.1 DC power supply output shall match output current and voltage requirements. Unit shall be full-wave rectifier type with output ripple of 5.0 mV maximum peak-to-peak. Regulation shall be 1.0% line and load combined, with 100 microsecond response time for 50% load changes. Unit shall have built-in over-voltage and over-current protection, and shall be able to withstand a 150% current overload for at least 3 seconds without trip-out or failure.

.1 Unit shall operate between 0°C and 50°C. EM/RF shall meet FCC Class B and VDE 0871 for Class B, and MIL-STD 810C for shock and vibration.

.2 Line voltage units shall be UL recognized and CSA approved.

.2 Power line filtering:

.1 Provide transient voltage and surge suppression for all workstations and controllers either internally or as an external component. Surge protection shall have the following at a minimum:

.1 Dielectric strength of 1,000 volts minimum.

.2 Response time of 10 nanoseconds or less.

.3 Transverse mode noise attenuation of 65 dB or greater.

.4 Common mode noise attenuation of 150 dB or better at 40 Hz to 100 Hz.

.3 Each panel shall have its own power supply/transformer.

Part 3 Execution

3.1 LOCATION

.1 Location of Controllers to be approved by Owner Site Representative.

3.2 INSTALLATION

.1 Install Controllers in secure locking enclosures. Provide 120 V duplex receptacles on outside of each main control cabinet.

.2 Provide necessary power from local 120 E.P.S. V branch circuit panel for equipment.

.3 Install tamper locks on breakers of circuit breaker panel.

.4 Use uninterruptible Power Supply (UPS) and emergency power when equipment must operate in emergency and co-ordinating mode.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Control devices integral to the Building Energy Monitoring and Control System (EMCS): transmitters, sensors, controls, switches, transducers, dampers, damper operators, valves, valve actuators, low voltage current transformers, variable frequency drives.

1.2 RELATED SECTIONS

.1 Section 01 73 00 - Execution Requirements.

.2 Section 25 05 01 - EMCS: General Requirements.

1.3 REFERENCES

.1 American National Standards Institute (ANSI):

.1 ANSI C12.7-2014 (R1999), Requirements for Watthour Meter Sockets.

.2 ANSI/IEEE C57.13-2008, Standard Requirements for Instrument Transformers.

.2 American Society for Testing and Materials International, (ASTM):

.1 ASTM B148-14, Standard Specification for Aluminum-Bronze Sand Castings.

.3 National Electrical Manufacturer's Association (NEMA).

.1 NEMA 250-2014, Enclosures for Electrical Equipment (1000 Volts Maximum).

.4 Air Movement and Control Association, Inc. (AMCA):

.1 AMCA Standard 500-D-12, Laboratory Method of Testing Dampers For Rating.

.5 Canadian Standards Association (CSA):

.1 CSA-C22.1-15, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

1.4 DEFINITIONS

.1 Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

1.5 SUBMITTALS

.1 Submit shop drawings and manufacturer's installation instructions in accordance with:

.1 Section 01 00 01 – Project Specific General Requirements.

.2 Section 01 00 02 – Standard General Requirements.

.3 Section 21 05 01 – Common Work Results for Mechanical.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions for specified equipment and devices.

1.6 EXISTING CONDITIONS

.1 Cutting and Patching: in accordance with Section 01 73 00 - Execution Requirements supplemented as specified herein.

.2 Repair surfaces damaged during execution of Work.

.3 Turn over to Owner existing materials removed from Work not identified for re-use.

Part 2 Products

2.1 GENERAL

.1 Control devices of each category to be of same type and manufacturer.

.2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant, assembly.

.3 Operating conditions: 0 – 32°C with 10 - 90% RH (non-condensing) unless otherwise specified.

.4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.

.5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.

.6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

.7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.

.8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

2.2 TEMPERATURE SENSORS

.1 General: to be resistance or thermocouple type to following requirements:

The following sensors shall apply to thermistor and resistance temperature sensors as applicable:

.1 Sensing element to be hermetically sealed.

.2 Stem and tip construction to be copper.

.3 Sensors to have a time constant response of less than 3 seconds to a temperature chance of 10ºC.

.4 Sensors shall operate over the following ranges with the accuracies over the noted range of the sensor.

-50ºC to +50ºC, plus or minus 0.5ºC.

0ºC to +50ºC, plus or minus 0.25ºC.

0ºC to 25ºC, plus or minus 0.1ºC.

0ºC to 100ºC, plus or minus 1ºC.

.5 Immersion wells shall be of (stainless steel) materials. Heat transfer compound to be compatible with sensor. Unless noted otherwise, where an existing sensor or well is not available, a strap-on sensor will be acceptable.

.6 Immersion sensors shall be provided with a separable brass well. Pressure rating of well is to be consistent with the system pressure in which it is to be installed.

.7 Provide matched temperature sensors for differential temperature measurement.

.2 Temperature sensors shall be of the following types:

.1 General Purpose Duct Type: Suitable for insertion into air ducts at any angle, insertion length of 457 mm and 760 mm as noted on schedule or drawings.

.2 Spring-Loaded Thermowell Type: Spring-loaded construction with compression fitting for 20 mm NPT well-mounting. Lengths of 100 mm or 150 mm as noted.

.3 Averaging Duct Type: Continuous filament with Immersion length of 6000 mm minimum. Probe to be bent, at field installation time, to a minimum radius of 100 mm at any point along the probe length without degradation in performance. Averaging duct type to be used for all sensors between mixed air plenum and fan without exception and on downstream side of heat recovery coils.

.4 Space Temperature Sensors:

(Type 1) – Surface Space Temperature Sensor: to be acceptable product – Greystone TSRC, Delta, Alerton, or approved equal.

(Type 2) – Surface-Mounted Space Temperature Sensor complete with setpoint adjustment and override pushbutton: Acceptable Products – Greystone, TSRC-PS, Delta, Alerton or approved equal.

(Type 3) – Network Type Surface Space Temperature Sensor complete with Temperature display, Setpoint Adjustment, Occupancy Sensor, override pushbutton, Programmable Pushbutton: Acceptable Products – Delta eZNT-T100, Alerton, Greystone or approved equivalent. To be c/w protective open wire guard where indicated.

(Type 4) – Stainless Steel Plate Sensor install in insulated box complete with insulation gasket.

.5 Outdoor Air Type: Complete with non-corroding shield designed to minimize solar and wind effects, threaded fittings for mating to 13 mm conduit, probe length of 100-150 mm.

2.3 HUMIDITY SENSORS

.1 Sensor to be polymer type, with a 4 to 20 mA output. Accuracy to be ± 2% RH through the 5 to 95% RH span.

.2 Sensor to be duct-mounted or wall-mounted as indicated.

.3 Duct and room sensors shall have a sensing range of 20% to 80%.

.4 Duct sensors shall be provided with a sampling chamber.

.5 Outdoor air humidity sensors shall have a sensing range of 20% to 95% RH. They shall be suitable for ambient conditions of -40°C to 75°C.

.6 Humidity sensor's drift shall not exceed 3% of full scale per year.

.7 Approved Equal: Greystone, Delta, or approved equal.

2.4 PRESSURE TRANSDUCERS

.1 Requirements:

.1 Transducer shall have linear output signal. Zero and span shall be field-adjustable.

.2 Transducer sensing elements shall withstand continuous operating conditions of positive or negative pressure 50% greater than calibrated span without damage.

.3 Water pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi. minimum. Transducer shall be complete with 1 – 5 vdc or 4 to 20 mA output, required mounting brackets and block and bleed valves.

.4 Water differential pressure transducer shall have stainless steel diaphragm construction, proof pressure of 150 psi minimum. Over-range limit (differential pressure) and maximum static pressure shall be 300 psi. Transducer shall be complete with 1 – 5 Vdc or 4 to 20 mA output, required mounting brackets, and five-valve manifold.

Acceptable Products: Greystone, ACI, BAPI.

2.5 DIFFERENTIAL PRESSURE TRANSMITTERS

.1 Requirements:

.1 Air System Differential Pressure Transducer:

.1 Provide proportional electrical output for unidirectional pressure range.

.2 Pressure Media: Typically air or similar non-conducting gases.

.3 Maximum Line Pressure: 62 Pa H_20 Gage.

.4 Accuracy: < ± 1.0% full scale

Resolution: Infinite

Repeatability: < 0.3% F.S.

.5 Environmental & Mechanical Data:

.1 Temperature: 0 to 175ºF

.2 Case: Fire-retardant glass filled polyester

.3 Pressure Connections: 4.76 mm barbed brass pressure fitting for 6.35 mm push-on tubing.

.6 Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as shown.

Acceptable Products – Greystone, ACI, BAPI

2.6 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES

.1 Requirements:

.1 Internal materials: suitable for continuous contact with compressed air, water, steam, etc., as applicable.

.2 Adjustable setpoint and differential.

.3 Differential pressure type switches (air or water service) shall be UL listed, SPDT snap-acting, pilot duty rated (125 VA minimum), NEMA 1 enclosure, with scale range and differential suitable for intended application, or as shown.

.4 Switch assembly: to operate automatically and reset automatically when conditions return to normal. Over-pressure input protection to at least twice rated input pressure.

.5 Accuracy: within 1% repetitive switching.

.6 Provide switches with isolation valve and snubber, where code allows, between sensor and pressure source.

.7 Switches on steam and high temperature hot water service: provide pigtail syphon.

Acceptable Products – Greystone, ACI, BAPI

2.7 CURRENT / PNEUMATIC (I/P) TRANSDUCERS

.1 Requirements: Current-to-Pneumatic transducer shall have the following minimum specifications:

.1 Input range of 4-20 mA as suitable for interfacing with the FID digital-to-analog converter output sub-system.

.2 Directly proportioned output range of 20-104 kPa or 20-186 kPa as applicable.

.3 Dustproof housing or panel-mounted.

.4 Internal materials of the converter suitable for continuous contact with industrial standard instrument air.

.5 Combined non-linearity, repeatability and hysteresis effects not to exceed +2% of full scale over the entire range.

.6 Internal zero and span adjustment.

.7 Temperature effect of +2.0% full scale/50% or less.

.8 Maximum regulated supply pressure of 206 kPa or less.

.9 Integral gauge manifold c/w gauge (0-206 kPa).

Acceptable Products: Greystone, ACI, BAPI, or approved equal.

2.8 AIR PRESSURE GAUGES

.1 Diameter: 38 mm minimum.

.2 Range: zero to two times operating pressure of measured pressure media or nearest standard range.

2.9 ELECTROMECHANICAL RELAYS

.1 Requirements: Double pole double throw (DPDT) relays control and status indication of alarms and/or electrical starters and equipment where shown on point schedule.

.1 Relay coils shall be rated for 120V or 24V. Where other voltages occur, provide transformer.

.2 Contacts rated at 5 amps at 130V AC.

.3 Relays to be plug-in type with termination base.

.4 Relay to have visual status indication

2.10 SOLID STATE RELAYS

.1 General:

.1 Input and output Barrier Strips to accept 14 to 28 AWG wire.

.2 Operating temperature range to be -20°C to 70°C.

.3 Relays to be CSA Certified.

.4 Input/output Isolation Voltage to be 4000 VAC at 25°C for 1 second maximum duration.

.5 Operational frequency range, 45 to 65 HZ.

.2 Input:

.1 Control voltage, 3 to 32 VDC.

.2 Drop out voltage, 1.2 VDC.

.3 Maximum input current to match AO (Analog Output) board.

.3 Output.

.1 AC or DC Output Model to suit application.

2.11 CURRENT TRANSDUCERS

.1 Requirements: Supply and install where status points on equipment are required, unless otherwise noted.

.1 AC current transducers will be self-powered combination split-core current transformer type with built-in rectifier and high-gain servo amplifier with 0-5vdc two-wire output. Unit ranges shall be 10A, 20A, 50A, 100A, 150A, and 200A full scale, internal zero and span adjustment, and ± 1% full scale accuracy at 500 ohm maximum burden.

.2 Transducer shall meet or exceed ANSI/ISA S50.1 requirements and shall be UL/CSA recognized.

.3 Unit shall be split-core type for clamp-on installation.

2.12 CO2 SENSORS

.1 Power Supply: Nominal 24VDC/AC.

.2 Output Signal: 4-20mA or 0-10V.

.3 Sensor:

.1	Range:	0 to 2000 PPM CO2
.2	Repeatability:	< ± 20 PPM
.3	Response Time:	< 60 seconds
.4	Long-term stability:	< ± 100 PPMM/5 years

.5 Acceptable Products: Greystone, Model CDD Series, (duct mount) VASILA, Critical Environment Technologies or approved equal.

2.13 PANELS

.1 Wall mounted enamelled steel cabinets with hinged and key-locked front door.

.2 Multiple panels as required to handle requirements with additional space to accommodate 25% additional capacity as required by Owner's Representative without adding additional cabinets.

.3 Panels to be lockable with same key.

2.14 OCCUPANCY SENSORS

.1 Occupancy Sensors:

.1 Occupancy controls from the following manufactures are acceptable. The listing of any manufacturer as "acceptable" does not imply automatic approval. It is the sole responsibility of the contractor to ensure that any price quotations received and submittals made are for sensors which meet or exceed the specifications included herein:

.1 Wattstopper.

.2 Sensor Switch.

.3 Hubbell.

.4 Leviton.

.5 Lutron.

.2 Dual technology sensors shall:

.1 Be either corner mounted or ceiling mounted in such a way as to minimize coverage in unwanted areas.

.3 Use passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound shall not be considered.

.4 The contractor shall install one or more sensors with PIR coverage areas that cover the entire space and all entrance points. Exact placement and quantity required shall be per manufacturer's best practice recommendations.

.5 Ceiling and wall-mounted, dual technology sensors shall utilize a digital PIR detector (dual element pyro-electric detector) component, so as to provide a high degree of RF immunity.

.6 Sensors shall operate on 12 to 24 VAC or VDC.

.7 Sensors shall have test mode that temporarily shortens/disable all time delays (e.g., minimum on, occupancy, photocell transition, dimming rates) such that an installer can quickly test operation of sensor. Test mode shall time out and return sensor to normal operation should the installer forget to disable test mode after installation.

Part 3 Execution

3.1 INSTALLATION

.1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.

.2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.

.3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.

.4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.

.5 Fire stopping: provide space for fire stopping. Maintain fire rating integrity.

3.2 INSTALLATION OF SENSORS

.1 Install all sensors in accordance with the manufacturer’s recommendations.

.2 Mount sensors rigidly and adequately for the environment within which the sensor operates.

.3 Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

.4 All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

.5 Sensors used in mixing plenums, and hot and cold decks shall be of the averaging type. Averaging sensors shall be installed in a serpentine manner vertically across duct. Each bend shall be supported with a capillary clip.

.6 Low limit sensors used in mixing plenums shall be installed in a serpentine manner horizontally across duct. Each bend shall be supported with a capillary clip. Provide 3 m of sensing element for each 1 m^2 of coil area.

.7 All pipe-mounted temperature sensors shall be installed in wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

.8 Install outdoor air temperature sensors on north wall complete with sun shield at designated location.

.9 Differential air static pressure:

.1 Supply Duct Static Pressure: Pipe the high-pressure tap to the duct using a pitot tube. Pipe the low-pressure port to a tee in the high-pressure tap tubing of the corresponding building static pressure sensor (if applicable), or to the location of the duct high-pressure tap and leave open to the plenum.

.2 The piping to the pressure ports on all pressure transducers shall contain a capped test port located adjacent to the transducer.

.3 All pressure transducers, other than those controlling VAV boxes, shall be located in field device panels, not on the equipment monitored or on ductwork. Mount transducers in a location accessible for service without use of ladders or special equipment.

.4 All air and water differential pressure sensors shall have gauge tees mounted adjacent to the taps. Water gauges shall also have shutoff valves installed before the tee.

.10 Provide all room temperature and humidity sensors located in the Gymnasium, Swimming Pools and Shop/Storage areas with tamper-proof protection guard. If plate mounted space sensors are used, the Subcontractor shall provide tamper proof screws.

.11 Strap-on sensor installation shall be as follows:

.1 Scrape and sand the top portion of the bare pipe, where the sensor is installed.

.2 Install heat conductive compound.

.3 Submerse sensor in compound.

.4 Completely cover the top of the sensor with additional compound.

.5 Cover compound with a reflective heat shield. Install tightly over complete installation.

.6 Install pipe bracket. (Gear clamp).

.7 Install insulation over complete installation.

.12 Stainless steel plate sensors to utilize a foam gasket to isolate sensor perimeter from direct contact with wall surface. Foam fill cavity directly behind space sensor then installation is recessed into wall.

3.3 PANELS

.1 Arrange for conduit and tubing entry from top, bottom or either side.

.2 Wiring and tubing within panels: locate in trays or individually clipped to back of panel.

.3 Identify wiring and conduit clearly.

3.4 I/P TRANSDUCERS

.1 Install air pressure gauge on outlet.

3.5 AIR PRESSURE GAUGES

.1 Install pressure gauges on pneumatic devices, I/P, pilot positioners, motor operators, switches, relays, valves, damper operators, valve actuators.

.2 Install pressure gauge on output of auxiliary cabinet pneumatic devices.

3.6 IDENTIFICATION

.1 Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

3.7 ACTUATORS

.1 Mount and link control damper actuators per manufacturer's instructions.

.1 To compress seals when spring-return actuators are used on normally closed dampers, power actuator to approximately 5°C open position, manually close the damper, and then tighten the linkage.

.2 Check operation of damper/actuator combination to confirm that actuator modulates damper smoothly throughout stroke to both open and closed positions.

.3 Provide all mounting hardware and linkages for actuator installation.

.2 Electric/Electronic:

.1 Dampers: Actuators shall be direct-mounted on damper shaft or jackshaft unless shown as a linkage installation. For low-leakage dampers with seals, the actuator shall be mounted with a minimum 5° available for tightening the damper seals. Actuators shall be mounted following manufacturer's recommendations.

.2 Valves: Actuators shall be connected to valves with adapters approved by the actuator manufacturer. Actuators and adapters shall be mounted following the actuator manufacturer's recommendations.

3.8 TESTING AND COMMISSIONING

.1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

.2 Factory Commissioning of Occupancy Sensors:

.1 Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based control system.

.2 The Trade Contractor shall provide both the manufacturer and the Consultant with ten working days written notice of the scheduled commissioning date. Upon completion of the system fine tuning the factory authorized technician shall provide the proper training to the owner's personnel in the adjustment and maintenance of the sensors.

.3 A signed letter from the factory authorized technician must be provided, stating the date of the training, and the names of the personnel who were present and received training.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Other Trades Sections:

.1 Section 25 01 12 – EMCS: Training.
.2 Section 25 05 01 – EMCS: General Requirements.
.3 Section 25 05 02 – EMCS: Submittals and Review Process.
.4 Section 25 05 03 – EMCS: Project Record Documents.
.5 Section 25 05 54 – EMCS: Identification.
.6 Section 25 05 20 – EMCS: Warranty and Maintenance.
.7 Section 25 30 01 – EMCS: Building Controllers.

1.2 BAS COORDINATION

.1 This Contractor shall meet with Boiler Manufacturer's representative who supplied the equipment to coordinate Work for this BACnet Interface Device and integration into the new DDC network.

.2 This Contractor shall discuss and confirm the BACnet integration and details of the proposed interface, including:

.1 PICS for BACnet equipment
.2 Hardware and software object list using the object list in this section as a guide.
.3 Networking requirements including any network address range restrictions, bus communication speeds and any required network accessories.
.4 Communications and power wiring requirements for the gateway and ancillary equipment to be terminated into the BACnet Interface Device (valves, dampers, sensors, etc.).
.5 Equipment installation and mounting requirements if the device is not integral to the supplier's equipment.
.6 AutoCAD/PDF files to be used to create the BAS graphics.
.7 The purpose of this meeting shall be to insure there are no unresolved issues regarding the integration of these products into the BAS Device Network.

.3 Once this information is reviewed and approved, provide a formal submittal via the Shop Drawing process.

.4 Submittals for these products shall not be approved prior to the completion of this meeting.

.5 If the equipment supplier is providing a BACnet gateway device from an OEM supplier, both suppliers shall jointly warrant in writing that the gateway can successfully parse the proprietary protocol used by the packaged controls that come with the equipment.

.6 The BACnet Interface Device shall permit this Contractor to plot the BACnet objects into a graphic his non- UL Front End. This Contractor shall be able to monitor alarms and events and will be able to have control over objects as permitted by the supplier of the BACnet Interface Device(s).

1.3 SHOP DRAWINGS

.1 Provide product data sheets illustrating the equipment packaged controls interface(s) to be integrated with the BAS system device network. The Contractor/Equipment Supplier shall provide the following information in their Shop Drawing Submittals.

.1 Show the following BACnet interface wiring system components:

Networking terminations: for example, indicate on the wiring diagram where the equipment supplier is terminating at an equipment outlet sometimes referred to as a “jack-in-the box”.

Field server/gateway devices: indicate wiring connection to Modbus equipment/controller interface. Indicate on the drawing wiring and termination responsibilities.

.2 Show how the Field Server/Gateway devices are to be installed and mounted if they are not integral to the supplier’s equipment.

.3 Show how power wiring for the Field Server/Gateway and ancillary equipment is to be terminated into the BACnet Interface Device such as sensors, etc.

.4 Networking Diagrams should include the following:

.1 BACnet device address range restrictions.

.2 Bus communication speeds.

.3 Required network accessories.

.5 Product cut sheets for Local Control Panels (LCP), Field servers/Gateways devices and native BACnet devices to interface a piece of equipment to the network should include the following:

.1 Device BACnet Conformance Statements.

.2 Device BACnet BIBBS.

.3 Device BACnet PICS.

.4 Communications speeds.

.5 Communications protocols such as BACnet/IP, BACnet MS/TP etc.

.6 The BACnet Objects associated with equipment, are provided in the Specification. This list is provided as a minimum list of requirements however we understand that there are variations in Modbus listings depending on equipment options as required by the specification. Highlight the objects to be provided and if additional objects are available list these on a separate attachment. If some objects cannot be provided indicate the reason why they are not available.

.7 If using gateways provide details on the proprietary protocol used in the supplier’s equipment and the BACnet protocol to which the proprietary points are being mapped.

.8 Hardware and Software object list table: use the object list in the specification as a guide. Show the object names for BACnet, Modbus register mapping numbers and names, SNVT's for LonMark or other identifiers.

The reason this is required is that we provide this list to the BAS contractor so that they know how many objects are required for programming and what to expect when they discover the objects.

.9 Include shop drawings of the mechanical/electrical controller boards of the equipment to be integrated.

.10 Review the sequence of operation in the specification/drawings of the equipment to be provided. Some systems such as chillers, boilers and AHU's have interaction with external devices controlled by BAS and these external devices may need to be referenced in the shop drawing.

1.4 BACNET INTERFACE DEVICE TYPE

.1 This BACnet Interface Device shall be provided as:

.1 Single On-board BACnet Interface Device Type:

.1 This device is a single onboard BACnet interface device. Contractor is responsible for providing, installing, powering and networking this device.

Part 2 Products, Materials and Equipment

2.1 INTEGRATED AUTOMATION, GENERAL

.1 Each supplier of a controls product is responsible for the configuration, programming, start-up, and testing of that product to comply with the Control Sequences Standard.

2.2 GENERAL BACNET INTERFACE REQUIREMENTS

.1 If the equipment interface is a native BACnet device, all data shall be represented externally on the network as BACnet objects and services. The Controls Contractor shall also parse the alarms that are represented as AV and BV objects by the equipment interface.

.2 If the equipment interface is a Modbus, LonWorks, or proprietary device requiring a BACnet Gateway, the Division supplying the equipment shall provide a gateway to support mapping all the points from the device to BACnet AV and BV objects.

.3 Device data may be represented internally in the interface as SNVTs or proprietary points, but the data shall be represented externally on the network as BACnet objects and services. Device interfaces using LonWorks or Modbus are acceptable only on this basis.

.4 The interface shall support the following BACnet Interoperability Building Blocks (BIBBs):

.1 Data Sharing – Read Property - B (DS-RP-B).

.2 Data Sharing – Read Property Multiple - B (DS-RPM-B).
.3 Data Sharing – Write Property - B (DS-WP-B).
.4 Data Sharing – Write Property Multiple - B (DS-WPM-B).
.5 Alarm and Event - Notification Internal - B (AE-N-I-B).
.6 Alarm and Event - ACK - B (AE-ACK-B).
.7 Alarm and Event - Information - B (AE-INFO-B).
.8 Device Management - Dynamic Device Binding - B (DM-DDB-B).
.9 Device Management - Dynamic Object Binding - B (DM-DOB-B).
.10 Device Management – Device Communication Control - B (DM-DCC-B).
.11 Device Management – Time Synchronization - B (DM-TS-B).
.12 Device Management – UTC Time Synchronization - B (DM-UTC-B).
.13 Device Management – Re-initialize Device - B (DM-RD-B).
.14 Device Management - Restart - B (DM-R-B).

.5 The interface shall support the following Object types:

.1 Analog Input.
.2 Analog Output.
.3 Analog Value.
.4 Binary Input.
.5 Binary Output.
.6 Binary Value.
.7 Device.
.8 Multi-state Input.
.9 Multi-state Output.
.10 Multi-state Value.
.11 Trend Log.

.6 Support the required optional properties to comply with the Specification requirements and Control Sequences.

.7 All sensors and transmitters provided in the Work by the supplier shall meet the accuracy requirements outlined in Specification Sections 25 05 01 and 25 30 02.

2.3 BACNET INTERFACE DEVICE GENERAL REQUIREMENTS

.1 The BACnet Interface Device supplier shall provide a BACnet/IP BACnet Interface Device complete with an Annex J router to support BACnet/IP to act as a client and/or server for all BACnet information from this system to the BAS System.

.2 The device shall have an open Ethernet port for connection to the DDC network infrastructure.

.3 The BACnet Interface Device shall be a product that is manufactured directly by the equipment supplier or may be an OEM product that is compatible with the equipment supplier.

.1 If the BACnet Interface Device supplier is providing a device from an OEM supplier, both suppliers shall jointly warrant in writing that the gateway can successfully parse the equipment protocol. Provide this information as a Shop Drawing.

.4 If the equipment interface is a native BACnet Interface Device, all objects must be represented externally on the network using BACnet objects and services.

.1 The exception is objects that are used by the supplier to configure the device or to assign administrative passwords or for use by qualified service personnel.

.5 If the equipment interface is a Modbus, LonWorks, or proprietary device requiring a BACnet gateway device, the Division supplying the equipment shall provide a gateway to support mapping all proprietary device points and their present values residing in the gateway device to BACnet AV and BV objects.

.6 The following shall apply to BACnet Interface Devices that are exposing objects in Life Safety devices (e.g., the Fire Alarm Panel).

.1 The BACnet Interface Device shall be a non-UUKL 864 listed device. The device shall present the BACnet objects in a non UUKL 864 manner. The device shall permit unidirectional communications only. The device shall permit this Contractor to plot the BACnet objects in his non-UL Front End, but this Contractor shall not be able to shut down or modify any values to any objects located in the BACnet Interface Device.

2.4 BACNET/IP INTERFACE REQUIREMENTS

.1 All equipment with packaged controls that provide a BACnet/IP interface shall include an Annex J router to support BACnet/IP to act as a client and/or server for all BACnet information from the supplied equipment to the BAS control device network.

.2 The interface shall have an open Ethernet 8P8C port for connection to the BAS system device network infrastructure using communications cabling that complies with the TIA/EIA 568-B standard.

.3 The interface shall operate at a minimum of 10 Mbps, full duplex.

2.5 BACNET MS/TP INTERFACE REQUIREMENTS

.1 All BACnet MS/TP interfaces shall operate as master devices on the BACnet MS/TP network.

.2 All equipment with packaged controls that provide a BACnet MS/TP interface shall have an opto-isolated EIA-485 termination block for connection of the communications cabling. All communications cabling shall only require a two-pair, twisted shielded pair, low capacitance cable following standard MS/TP wiring methods. Each MS/TP network segment shall support a total maximum cable length of 1,220 m (4,000 ft).

.3 The BACnet MS/TP interface address shall be settable via DIP switch or software, with an address range of at least 0 to 31 per network segment. It shall be possible to connect up to 32 BACnet interfaces on any BACnet MS/TP network segment without requiring the use of repeaters.

.4 The BACnet MS/TP interface shall support network data rates of 9,600 bps, 19,200 bps, 38,400 bps, or 76,800 bps.

Part 3 Installation, Fabrication and Construction

3.1 BACNET INTERFACE DEVICE INSTALLATION AND COMMISSIONING: BACNET/IP REQUIREMENTS

.1 The BACnet Interface Devices described in this Section shall reside on the DCC Representative's network as a BACnet/IP device. Reference Appendix I for list of Interface Devices.

.2 A BACnet/IP device provided in the Work shall meet the following requirements:

.1 BACnet/IP device shall include an Annex J B/IP router to support BACnet/IP to act as a client and/or server for all BACnet information from the supplied equipment to the BAS Device Network, which is considered a "directly connected network".

.2 The BAS Device Network is treated as a "remote network" that is reachable by communicating using BACnet/IP with a router supplied by others that serves the remote network.

.3 The BACnet/IP device shall come c/w a BBMD that will be configured to traverse IP subnets.

.4 The interface shall have an open Ethernet RJ-45 port for connection to the BAS system device network infrastructure using communications cabling that complies with the TIA/EIA 568-B standard.

.5 The interface shall operate at a minimum of 10 Mbps, full duplex.

.3 The supplier of the BACnet Interface Device shall provide the following:

.1 Configuration of the device with the assigned IP address.

.2 Connection of the network cable to the BACnet Interface Device.

.3 Providing details of the required alarms, schedules and trends as outlined in the Sequence of Operation.

.4 Creation and assignment of passwords and access levels within the device.

.5 Commissioning of the BACnet Interface Device with MCW CES to the satisfaction of the Owner Representative. The Work includes the following:

.1 Use the commissioning forms and procedures outlined in this Division.

.2 All network visible objects shall be commissioned.

.3 The process shall be overseen by Controls Engineers Representative.

.4 Allow 4 hours of on-site time for this Work.

.4 Creation of the Front End graphics based on information from the supplier of the BACnet Interface Device. The following minimums apply to this Section:

.1 Provide main graphical screen showing all objects. Graphical screen to be as per the heat flow schematic.

.2 Provide one master alarm graphic showing the Critical Alarms and all equipment fault alarms.

3.2 BACNET INTERFACE DEVICE INSTALLATION AND COMMISSIONING: BACNET/MS-TP REQUIREMENTS

.1 The BACnet Interface Devices described in this Section shall reside on the DCC Representative's network as a BACnet/MS-TP device. Reference Appendix I for list of Interface Devices.

.2 A BACnet MS/TP device provided in the Work shall meet the following requirements:

.1 The device shall:

.1 Operate as a master device on the BACnet MS/TP network.

.2 All equipment with packaged controls that provide a BACnet MS/TP interface shall have an opto- isolated EIA-485 termination block for connection of the communications cabling. All communications cabling shall only require a two-pair, twisted shielded pair, low capacitance cable following standard MS/TP wiring methods. Each MS/TP network segment shall support a total maximum cable length of 1,220 m [4,000 ft].

.3 The BACnet MS/TP device address shall be settable via DIP switch or software, with an address range of at least 0 to 31 per network segment. It shall be possible to connect up to 32 BACnet interfaces on any BACnet MS/TP network segment without requiring the use of repeaters.

.4 The BACnet MS/TP device shall support network data rates of 9,600 bps, 19,200 bps, 38,400 bps, or 76,800 bps.

.3 The supplier of the BACnet Interface Device shall provide the following:

.1 Configuration of the device with the BACnet Interface Device ID that is unique to the BAS Device Network.

.2 Connection of the network cable to the BACnet Interface Device.

.3 Information on the baud rate used. Each BACnet MS/TP device shall be set to a fixed bit rate. Auto- bauding BACnet MS/TP device configuration will not be allowed.

.4 Providing details of the required alarms, schedules and trends as outlined in the Sequence of Operation.

.5 Creation and assignment of passwords and access levels within the device.

.6 Joint commissioning of the BACnet Interface Device with MCW CES to the satisfaction of the Owner Representative or the designated Commissioning Authority. The Work includes the following:

.1 Use the commissioning forms and procedures outlined in this Division.

.2 All network visible objects shall be commissioned.

.3 The process shall be overseen by Controls Engineer.

.4 Allow 4 hours of on-site time for this Work.

.4 This Contractor shall provide the following:

.1 Connect a shield wire to earth or device chassis at one point along the MS/TP bus prevent ground potential differences on the BAS Device Network.

.2 Each network segment shall be configured as a peer-to-peer token passing BACnet MS/TP network.

.3 A network drop from the Contractor's BACnet/IP Level 1/1A panel's MS/TP network to within 1 m (3 ft) of the BACnet Interface Device location. Install and test this MS/TP connection per this Division.

.4 Joint commissioning the network connection to this Contractor's MS/TP network.

.5 Creating of the required alarms, schedules and trends as outlined in the Sequence of Operation. The following minimums apply to this Section:

.1 A minimum of 10 alarms or an alarm for each equipment fault. Two of which are considered critical.

.2 A minimum of 1 schedule.

.3 A minimum of 10 trends and 1 extended trend.

.5 Creation of the Front End graphics based on information from the supplier of the BACnet Interface Device. The following minimums apply to this Section:

.1 Provide main graphical screen showing all objects. Graphical screen to be as per the heat flow schematic.

.2 Provide one master alarm graphic showing the Critical Alarms and all equipment fault alarms.

3.3 BACNET INTERFACE SUPPLIER RESPONSIBILITY

.1 Supply a panel enclosure (tub) that is suitably sized for the BACnet interface and the required power supply, if supplied separately from the supplied equipment. Supply a separate low voltage power supply for the BACnet interface (if required).

.2 Supply any additional remote panels/equipment required to provide connectivity between the BACnet interface and the supplied equipment packaged controls.

.3 Each supplier of equipment with a BACnet interface is responsible for the configuration, programming, start- up, and testing of that product to comply with the requirements set out in the Specifications and Drawings for the Work. Create and assign passwords and access levels within the interface.

.4 If the equipment packaged controls has a native Modbus, LonWorks, or proprietary interface requiring a BACnet gateway, the equipment supplier shall verify that all proprietary equipment and interface data has been mapped to BACnet AV and BV Objects.

.5 The Controls Contractor shall produce graphics on the BAS system Front End that are visually similar to and emulate the functionality of the equipment local interface. The equipment supplier shall review the related Front End graphic(s) with the Controls Contractor to ensure that all local interface capabilities of the supplied equipment have been accurately reproduced on the Front End.

3.4 CONTROLS CONTRACTOR RESPONSIBILITY

.1 Install the panel enclosure for the BACnet interface and the required power supply as directed by the equipment supplier, if supplied separately from the supplied equipment.

.2 Mount the BACnet Interface Device in the panel enclosure as recommended by the Manufacturer.

.3 Supply and install line or low voltage power for the BACnet interface.

.4 Supply and install all communications lines between the BACnet interface and the supplied equipment packaged controls.

.5 Wire any additional remote panels/equipment required to provide connectivity between the BACnet interface and the supplied equipment packaged controls.

.6 Provide a Project Work Plan as a Shop Drawing that is specific to the networking requirements for connecting the BACnet device(s).

.7 Provide cost of equipment. Supplier/Representative to provide any required addressing modifications for a fully functional system.

.8 Provide all conduit, cabling, repeaters, switches, and termination of all communication cables to the supplied BACnet interfaces.

.9 Create all required Alarms, Schedules and Trends as outlined in the Specifications and Drawings for the Work.

.10 Create Front End graphics based on information from the supplier of the BACnet Interface Device.

.1 The Controls Contractor shall emulate the functionality of the supplied equipment local interface (e.g., annunciator panel, LCD display, GUI interface) at the BAS system Front End.

.2 The Front End graphics shall closely resemble the layout of the controls and display information available via the equipment local interface.

.11 Document password and access levels within the device using information provided by the Owner Representative.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 General requirements that are common to Sections of Division 26 – Electrical.

1.2 RELATED SECTIONS

.1 Division 01 – General Requirements.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International):

.1 CSA C22.1-18, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.

.2 CSA C22.2 No. 0-M91 (R2006), General Requirements.

.3 CAN3-C235-83 (R2006) Preferred Voltage Levels for AC Systems, 0 to 50,000 V.

.2 National Building Code of Canada, (2015).

1.4 DEFINITIONS

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

1.5 SCOPE OF WORK

.1 It is the requirement of this work to provide all systems completely functioning in intended system operation, notwithstanding that every item necessarily required may not be specifically mentioned.

.1 The description of the work shall include but not be limited to:

.1 Supply and install new breakers in existing panel boards for mechanical equipment, as indicated.

.2 Supply and install new cabling to connect the new mechanical equipment.

.3 Supply and install new 120 volt circuits for maintenance receptacles, as indicated.

.4 Obtain permit as required to perform work.

.5 Provide Owner training on all new equipment.

.6 Provide O & M Manuals and As-Built Drawings.

.2 It is the requirement of this work to provide all systems completely functioning in intended system operation, notwithstanding that every item necessarily required may not be specifically mentioned.

1.6 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235.

.2 Motors, distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.

.1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.7 SUBMITTALS

.1 Submittals: in accordance with Division 01 – General Requirements.

.2 Product Data: submit WHMIS MSDS in accordance with Division 01 – General Requirements.

.3 Shop drawings:

.1 Refer to individual specification sections for shop drawing requirements.

.2 Submit shop drawings in accordance with Division 01 – General Requirements.

.3 Identify applicable specification section and paragraph number on each shop drawing.

.4 Submit installation details of proposed location, layout and arrangement of conduit and boxes, and other items that must be shown to ensure co-ordinated installation.

.5 Faxes are not acceptable for shop drawings. If sent by fax, they will not be reviewed.

.6 Do not begin fabrication until shop drawings have been reviewed by Consultant. Allow ten (10) working days for Consultant review.

.7 Consultant review of shop drawings does not relieve the contractor of the responsibility for co-ordination of field measurements required to complete the work.

.8 Contractor shall approve all shop drawings by signing and dating them prior to submitting to Consultant.

.4 Quality Control: in accordance with Division 01 – General Requirements.

.1 Provide CSA or other certification agency certified material, recognized by the Authority Having Jurisdiction.

.2 Where certified material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.

.3 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to Engineer.

.5 Submit test results for installed electrical systems.

.6 Manufacturer's Field Reports: submit to Engineer written report, within 3 days of review, verifying compliance of Work, as described in PART 3 - FIELD QUALITY CONTROL.

.7 Submit for review revised single line electrical diagrams showing the altered electrical equipment as As-Built.

1.8 AS-BUILT DRAWINGS

.1 On a set of opaque drawings, record all changes as work progresses. Incorporate all information issued in Addenda, Site Instructions and Change Orders and all changes in actual installation as a result of site conditions and coordination. All changes shall be recorded neatly and legibility in red ink.

.2 Identify each drawing in lower right hand corner in letters at least 13 mm high as follows:

.1 AS-BUILT DRAWING (This drawing has been revised to show electrical systems as installed),

.2 (Name of Contractor),

.3 (Signature of Contractor) and

.4 (Date).

.3 Submit to the General Contractor for approval and make all corrections as directed.

1.9 ALTERNATE PRODUCTS

.1 Requests for alternate product approval shall be in accordance with Division 01 – General Requirements.

.2 It is the intent of these specifications to establish the required quality of materials. Where manufacturer's name and catalogue number are used, it is done in order to establish the required quality, style, size or function. The decision as to suitability shall rest with the Engineer.

.3 All materials not meeting the standards as set down by these specifications shall not be allowed on the job site.

.4 Substitutions affecting the design will not be permitted.

.5 Additional costs to any other trade as a result of a change or substitution by this Contractor shall be borne by this Contractor.

.6 The listing of a manufacturer as acceptable does not imply acceptance of all products of that manufacturer and only products of that manufacturer meeting the standards as set out in the specifications will be accepted.

.7 All requests for alternates must be submitted no later than five (5) working days prior to tender close.

.8 Faxes are not acceptable for request for alternates. If sent by fax, they will not be reviewed.

1.10 SAMPLES

.1 Submit samples in accordance with Division 01 – General Requirements.

.2 After review and acceptance, samples will be returned for incorporation into work.

1.11 TEST REPORTS

.1 Submit certified test reports and certificates to Engineer from approved independent testing laboratories.

.2 Indicate compliance with specifications for specified performance characteristics and physical properties.

.3 Manufacturer's Field Services: submit copies of manufacturer's field inspection reports.

1.12 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into operation and maintenance manual as per Division 01 – General Requirements.

.2 Include in Operation and Maintenance Data:

.1 Table of Contents.
.2 Name and address of Electrical Contractor.
.3 Names, addresses and telephone numbers of local suppliers for items included in Operation and Maintenance Manuals.
.4 Letter of Warranty.
.5 Product related warranties.
.6 Copy of reviewed Shop Drawings.
.7 Copy of all test certificates.
.8 Copy of all final panelboard schedules.
.9 Copy of signed transmittal verifying all maintenance materials turned over to the owner/user.
.10 One (1) paper copy of As Built drawings and specifications including all addenda and change orders.
.11 Include details of design elements, component function and maintenance requirements to effectively operate, maintain or repair.
.12 Include technical data, product data, component illustrations, technical descriptions and parts list, wiring and schematic diagrams not considered proprietary, test and verification reports. Advertising or sales literature is not acceptable.

1.13 MAINTENANCE MATERIALS

.1 Provide maintenance materials in accordance with Division 01 – General Requirements and as indicated in respective specification sections.

1.14 EXISTING CONDITIONS

.1 Tie into existing systems at times coordinated with Owner.

.2 Submit written request for approval 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing construction by this work.

.4 Ensure daily clean-up of existing areas.

1.15 FIRESTOPPING

.1 All firestopping work is to be performed by the Electrical Contractor.

1.16 INTERPRETATION OF PLANS AND SPECIFICATIONS

.1 These specifications are to be considered as an integral part of the plans which accompany them and neither the plans nor the specifications shall be used alone. Any item which is omitted in one but which is reasonably implied in the other shall be considered properly and sufficiently specified and must, therefore, be provided by this Contractor.

.2 Drawings are diagrammatic. Building dimensions shall not be scaled from the Electrical plans.

.3 Any discrepancy between the drawings and the building shall be questioned before proceeding with any installation.

1.17 CO-OPERATION OF CONTRACTORS

.1 This Contractor shall become familiar with the work of other contractors and in laying out and installing the work shall co-operate with the other Contractors, so as to facilitate the progress of the work as a whole and avoid interference or delays. Where interference exists, this Contractor shall notify the project manager and the engineer before installing the work. Any changes in the work or alterations of the Electrical Contractor's schedule required for such co-operation will not be considered as a claim for extra compensation.

.2 Due to the complexities of many sub-trades, and the restrictive space available in this project, it is required that all trades co-operate closely so as to install all systems in their allotted locations as indicated on the drawings, or as coordinated on site.

1.18 ERRORS AND OMISSIONS

.1 The drawings are not intended to show every item of accessory equipment, but the Contractor shall tender on and install all essential details to provide for efficiency of operation and ease of maintenance.

.2 Should this Contractor discover errors or discrepancies in the plans or specification, he shall refer the matter to the Engineer for change or clarification

and shall not proceed with that portion of the work until advised by the Engineer to do so.

1.19 DELIVERY, STORAGE, AND HANDLING

.1 Material Delivery Schedule: Provide Engineer with schedule within 14 days after award of contract.

.2 Construction/Demolition Waste Management and Disposal: in accordance with Division 01 – General Requirements.

.3 Store and handle materials in accordance with Division 01 – General Requirements and manufacturer's written instructions.

1.20 SYSTEM STARTUP

.1 Instruct operating personnel in operation, care and maintenance of systems, system equipment and components.

.2 Arrange and pay for services of manufacture's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.

1.21 PERMITS, FEES AND INSPECTION

.1 Submit to Electrical Inspection Department necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Obtain an electrical work permit and pay associated fees.

.3 Notify Engineer of changes required by the Electrical Inspection Department.

1.22 WARRANTY

.1 Warranty duration: 12 calendar months following Substantial Completion.

.2 Coverage: warrant against failure to perform to characteristics as specified.

.3 Manufacturer's warranty: submit manufacturer's warranty, for Engineer's acceptance.

Part 2 Products

2.1 MATERIALS AND EQUIPMENT

.1 Provide material and equipment in accordance with Division 01– General Requirements.

.2 Material and equipment to be CSA or ULC certified. Where CSA or ULC certified material and equipment are not available, obtain special approval from authority having jurisdiction, before delivery to site.

.3 Ensure labels are visible and readable after equipment is installed.

.4 Factory assemble electrical panels and component assemblies.

2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

.2 Division 26 responsibility is as follows:

.1 Supply and installation of new breakers for new mechanical equipment.

.2 Supply and installation of power feeder from existing panel to new mechanical equipment.

.3 Supply and installation of disconnect switches at motors unless noted otherwise.

.4 Supply and installation of 120V branch wiring to maintenance receptacles as indicated on drawings.

.3 Control wiring and conduit is by Division 25 unless noted otherwise on electrical drawings.

2.3 WARNING SIGNS

.1 Warning Signs: in accordance with requirements of authority having jurisdiction, inspection authorities and Engineer.

.2 Signs, minimum size 178 x 254 mm.

2.4 WIRING TERMINATIONS

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

2.5 FINISHES

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two (2) coats of finish enamel.

.1 Paint outdoor electrical equipment "equipment" green finish to EEMAC Y1-1.

.2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify electrical equipment with nameplates and labels as follows:

.1 Nameplates: 3 mm thick plastic engraving sheet, matt white finish face, black core, lettering accurately aligned and engraved into core, self-adhesive type.

.2 Sizes as follows:

NAMEPLATE SIZES

Size 1	*10 x 50 mm*	*1 line*	*3 mm high letters*
Size 2	*12 x 70 mm*	*1 line*	*5 mm high letters*
Size 3	*12 x 70 mm*	*2 lines*	*3 mm high letters*
Size 4	*20 x 90 mm*	*1 line*	*8 mm high letters*
Size 5	*20 x 90 mm*	*2 lines*	*5 mm high letters*
Size 6	*25 x 100 mm*	*1 line*	*12 mm high letters*
Size 7	*25 x 100 mm*	*2 lines*	*6 mm high letters*

.3 Labels:

.1 Embossed plastic labels with 6 mm high letters unless specified otherwise.

.4 Wording on nameplates to be approved by Engineer prior to manufacture.

.5 Allow for minimum of twenty-five (25) letters per nameplate.

.6 Identification to be in English.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour coding: to CSA C22.1–12.

Part 3 Execution

3.1 FIELD QUALITY CONTROL

.1 Confirm other related work is complete to receive work of this and related electrical sections.

.2 Commission electrical systems.

.3 Qualifications:

.1 Electricians: qualified, licensed electricians or apprentices in accordance with Provincial Act respecting manpower vocational training and qualifications.

.2 Apprentices: employees registered in provincial apprentices program permitted, under direct supervision of qualified licensed electrician, to perform specific tasks. Permitted activities determined based on level of training attained and demonstration of ability to perform specific duties.

.4 Contractor holding valid Master Electrical contractor licensed as issued by Province that work is being constructed.

3.2 INSTALLATION

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, MSDS, and product datasheets.

.2 Protect electrical equipment from dust and dirt. Plug or cap openings in conduit, fixtures and equipment during construction with Consultant approved materials.

.3 Conceal conduit in finished areas, unless otherwise authorized. Run exposed conduit parallel to building lines, and maintain maximum headroom.

.4 Install outlets, plates and other visible items parallel to building lines. Line up exposed raceways, parallel and at right angles to building walls, partitions, and ceilings.

.5 Set equipment and components plumb and level, accurate to position intended, and position hanger rods plumb.

3.3 NAMEPLATES AND LABELS

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

3.4 FIELD QUALITY CONTROL

.1 Conduct and pay for following tests in accordance with Division 01 – General Requirements.

- .1 Circuits originating from branch and distribution panels.
- .2 Insulation resistance testing:
  - .1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
  - .2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.
  - .3 Check resistance to ground before energizing.
  - .4 Replace conductors as required.

.2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.3 Manufacturer's Field Services:

- .1 Obtain written certificates from manufacturers verifying compliance of Work, in handling, installing, applying, protecting and cleaning of products for inclusion in operation and maintenance manuals.
- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions as indicated in respective specification sections.

3.5 VERIFICATION

.1 Measure phase current to panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit report, at completion of measurements, listing phase and neutral currents on panelboards, dry-type transformers and motor control centres, operating under normal load. Include hour and date on which load was measured, and voltage at time of test.

3.6 FIELD TESTS

.1 Provide advance notice Consultant of proposed testing schedule.

.2 Perform tests at time of acceptance of work.

.3 Conduct and pay for field tests:

- .1 Power distribution, including phase voltage, grounding and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Motors, including sequenced operation.
- .4 Lighting and lighting control.

.4 Perform tests in presence of Consultant.

- .1 Provide instruments, meters, equipment and personnel required to conduct required tests.
- .2 Test systems to verify operation as specified.

.5 Conduct di-electric tests, hi-pot tests, insulation resistance tests and ground continuity tests as required by nature of various systems and equipment.

.6 Perform following tests on completed power systems:

- .1 Control and switching: test circuits for correct operation of devices, switches and controls.
- .2 Polarity tests: test circuits for correct operation of devices, switches and controls.
- .3 Voltage tests: test voltage at last outlet of each circuit; maximum potential drop 2% on 120 V, and 208 V branch circuits, 2% on feeder circuits. Correct deficiencies.
- .4 Phase balance: measure load on each phase at switchboards, splitter, distribution panel board and lighting and power panel board.
  - .1 Submit results to Consultant in writing.
  - .2 Re-arrange phase connections as necessary to balance load on each phase as instructed by Consultant.
  - .3 After marking such changes, submit revised drawings showing modified connections to Consultant.

.5 Supply voltage: measure line voltage of each phase at load terminals of main breakers and report results in writing to Engineer Consultant. Perform test with majority of electrical equipment in use.

.6 Motor loading: measure line current of each phase of motors with motor operating under load, and report results in writing to Consultant.

.1 Upon indications of imbalances or overloads, thoroughly examine electrical connections and rectify defective parts or wiring.

.2 If electrical connections are correct, report overloads due to defects in driven machines in writing to Consultant.

.7 Insulation resistance tests:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument. Minimum insulation resistance shall be 0.5mΩ.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument. Minimum insulation resistance shall be 1.0mΩ.

.3 Check resistance to ground before energizing.

.8 Co-ordinate and carry out motor testing at same time as driven equipment is being tested. In addition to motor loading tests, provide labour and instruments to read and record motor load readings required to supplement tests on driven equipment through various load sequences, as required by driven equipment tests.

.7 General operations: energize and operate electrical circuit and item. Repair, alter, replace, test and adjust as necessary for a complete and operating electrical system.

.8 Provide labour, instruments, apparatus and pay expenses required for testing. Consultant reserves right to demand proof of accuracy of instruments used.

.9 Immediately prior to occupancy, test entire electrical system by performing loss and return of utility power test. Demonstrate operation of:

.1 High and low voltage service equipment and metering.

.2 EMCS system shut down and auto restart, including re-stabilization of systems after power return. Attach report printouts as evidence of expected operation on systems.

.3 User equipment shut-down and auto-restart.

3.7 TEST RESULTS

.1 Submit test results to Consultant for review.

.2 Testing methods and test results: to CSA, CEC and authorities having jurisdiction.

.3 Remove and replace conductors found damaged, with new materials.

.4 Provide required labour and tools, if during testing Consultant requests equipment be opened and removed from their housings to examine equipment, terminations and connections.

3.8 TRAINING

.1 Train operating personnel in operation, care and maintenance of electrical equipment.

.2 Arrange and pay for manufacturer's factory service engineer to provide training. Ensure operating personnel are conversant with its care and operation.

.3 Obtain and submit written confirmation from operating personnel that satisfactory training has been received.

3.9 CLEANING

.1 Perform final cleaning of electrical equipment, systems and components.

3.10 DEMONSTRATION

.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, and audio visual aids as part of instruction materials.

.3 Owner’s Representative may record these demonstrations on video tape for future reference.

3.11 PROTECTION

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

3.12 CONTROL OF HAZARDOUS ENERGY

.1 Lock out and tag out all electrical and other equipment before performing work as per CAN/CSA-Z460-05.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials and installation for wire and box connectors.

1.2 RELATED SECTIONS

.1 Division 01 – General Requirements.

.2 Section 26 05 00 – Common Work Results – Electrical.

.3 Section 26 05 21 – Wires and Cables 0-1000V.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International) Latest Edition of the following:

.1 CSA C22.2 No.65 (R2008) Wire Connectors.

.2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC) Latest Edition of the following:

.1 EEMAC 1Y-2, 1961 Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).

Part 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: CSA C22.2 No. 65-03, with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors to: CSA C22.2 No. 65-03, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

.3 Bushing stud connectors to: EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded, copper conductors.
.2 Clamp for stranded copper conductors.
.3 Stud clamp bolts.
.4 Bolts for copper conductors.
.5 Bolts for aluminum conductors.
.6 Sized for conductors as indicated.

.4 Clamps or connectors for armoured cable, flexible conduit, as required to: CAN/CSA-22.2 No. 18.1.

.5 Joints required in connecting all wiring up to and including # 8 are to be made using twist-on connectors.

.6 Joints for all other wiring shall be made using colour-keyed compression type connectors followed by a layer of CSA approved vinyl plastic tape.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Division 01 – General Requirements.

.2 Section 26 05 00 – Common Work Results – Electrical.

.3 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.

1.2 REFERENCES

.1 CSA C22.2 No .0.3-09 (R2005), Test Methods for Electrical Wires and Cables Latest Edition.

.2 CAN/CSA-C22.2 No. 131-M89 (R2004), Type TECK 90 Cable Latest Edition.

Part 2 Products

2.1 BUILDING WIRES

.1 Conductors: solid for #10 AWG and smaller; stranded for #8 AWG and larger. Minimum size: #12 AWG.

.2 Conductors: size as indicated, with 600V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

.3 Conductors: all wiring shall be copper.

.4 Neutral conductor insulated for 600V shall be continuous with no fuses, switches, or breaks of any kind.

.5 The voltage drop shall in no case exceed 3% of the line volts for branch circuits.

.6 Voltage drop shall be calculated based on 80% of the circuit breaker current rating for all branch circuits unless noted otherwise.

.7 Voltage drop for motor branch circuits shall be calculated based on current equal to 80% of the ampacity of the branch circuit conductors.

.8 Branch circuit conductor sizes specified on drawings are the minimum required. Upsize branch circuit conductor sizes as required so that the voltage drop is less than the maximum value permitted.

2.2 TECK CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.3 Insulation:

.1 Type: ethylene propylene rubber.

.2 Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: interlocking.

.6 Overall covering: thermoplastic polyvinyl chloride material.

.7 Fastenings:

.1 Channel type supports for two or more cables at 1.5 m centers.

.2 Threaded rods: 13 mm dia. to support suspended channels.

.8 Connectors:

.1 Watertight, approved for TECK cable.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION OF TECK CABLE 0-1000 V

.1 Group cables wherever possible on channels.

.2 Terminate cables in accordance with Section 26 05 20- Wire and Box Connectors - 0 - 1000 V.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 26 05 32 – Outlet Boxes, Conduit Boxes and Fittings.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International):

.1 CSA C22.2 No.41-07, Grounding and Bonding Equipment.

Part 2 Products

2.1 CONNECTORS AND TERMINATIONS

.1 Copper compression connectors to CSA C22.2 as required sized for conductors.

Part 3 Execution

3.1 INSTALLATION

.1 Install, terminations, and splices in accordance with manufacturer's instructions.

.2 Bond and ground as required to CSA C22.2 No.41.

.3 Do not install more than three (3) connections per junction box unless specifically permitted by Engineer (in writing).

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Division 01 – General Requirements.

.2 Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 SUPPORT CHANNELS

.1 U shape, size 41 x 41 x 2.5 mm thick, surface mounted or suspended.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with nylon shields.

.2 Secure equipment to poured concrete with expandable inserts.

.3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.4 Support cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.5 Fasten cables to building construction or support system using straps:

.1 One-hole steel straps to secure surface cables 51mm and smaller.

.2 Two-hole steel straps for cables larger than 51mm.

.6 Suspended support systems:

.1 Support individual cable runs with 6 mm dia. threaded rods and spring clips.

.2 Support 2 or more cables on channels supported by 10 mm dia threaded rod hangers where direct fastening to building construction is impractical.

.7 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support cable runs.

.8 Ensure adequate support for cables dropped vertically to equipment where there is no wall support.

.9 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.10 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

.11 Install fastenings and supports as required for cabling in accordance with manufacturer's installation recommendations.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Division 01 – General Requirements.

.2 Section 26 05 00 – Common Work Results – Electrical.

1.2 SECTION INCLUDES

.1 Receptacles and cover plates and their installation.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International) Latest Edition of the following:

.1 CSA-C22.2 No.42.1-00 (R2004), Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

1.4 SUBMITTALS

.1 Submit shop drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 COVER PLATES

.1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.

.2 Cover plates from one manufacturer throughout project.

.3 Weather-proof while-in-use covers for wiring devices installed outdoors and as indicated: 1-gang, heavy cast aluminium construction, complete with gaskets, accepts padlock. Acceptable Materials: Pass & Seymour #WIUCASTI or approved equal from Hubbell, Leviton or Cooper.

2.2 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results – Electrical.

.2 Label size: 1.

.3 Provide one label for each wiring device indicating circuit number that the wiring device is connected to. Example: “A-23”.

2.3 RECEPTACLES

.1 Commercial specification grade GFCI U-ground duplex receptacles, CSA type 5-20R 125V to CSA-C22.2 No.144 with following features:

.1 Impact resistant nylon face.
.2 Thermoplastic back body.
.3 White urea moulded housing.
.4 Suitable for No. 10 AWG for back and side wiring.
.5 Weather and tamper resistant.
.6 Triple wipe contacts and riveted grounding contacts.
.7 Plated steel mounting strap with integral ground contacts.
.8 Solid state ground sensing device.
.9 Facility for Testing and Resetting.

.2 Standard of Acceptance:

.1 Hubbell #GFTR20W.

.3 Approved alternate manufacturers: Eaton, Leviton, Pass & Seymour.

.4 Receptacles of one manufacturer throughout project.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Cover plates:

.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.
.2 Install suitable common cover plates where wiring devices are grouped.
.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

.2 General:

.1 All surface mounted wiring devices shall be installed in FS-type outlet boxes, c/w FS-type coverplates.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Materials for moulded-case circuit breakers.

1.2 RELATED SECTIONS

.1 Division 01 – General Requirements.

.2 Section 26 05 00 – Common Work Results – Electrical.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International) Latest Edition of the following:

.1 CSA-C22.2 No. 5-2 (R2007), Moulded-Case Circuit Breakers, Moulded-Case Switches and Circuit-Breaker Enclosures (Tri-national standard with UL 489, tenth edition, and the second edition of NMX-J-266-ANCE).

.2 CAN/CSA-C22.2 No. 144-M91 (R2001), Ground Fault Circuit Interrupters.

1.4 SUBMITTALS

.1 Submit Shop Drawings in accordance with Section 26 05 00 – Common Work Results – Electrical.

Part 2 Products

2.1 BREAKERS GENERAL

.1 Moulded-case circuit breakers: to CSA C22.2 No. 5

.2 Bolt-on moulded case circuit breaker: quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.

.3 Common-trip breakers: with single handle for multi-pole applications.

.4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches setting.

.1 Trip settings on breakers with adjustable trips to range from 3-8 times current rating.

.5 Circuit breakers to have minimum symmetrical rms interrupting capacity rating to match panel.

2.2 THERMAL MAGNETIC BREAKERS

.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

2.3 ACCEPTABLE MATERIALS

.1 Breakers shall be compatible with panelboards specified in Section 26 24 17 – Panelboards Breaker Type and shall meet the short circuit interrupting ratings as indicated.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

.1 Install circuit breakers as indicated.

3.3 TESTS

.1 Demonstrate and record results of simulated ground fault tests for all GFCI breakers.

END OF SECTION

City of Saint John

CONTRACT SPECIFICATIONS

DIVISION 4

FORM OF TENDER

AUGUST 2021

City of Saint John

TABLE OF CONTENTS

DIVISION 4 – FORM OF TENDER

4.1 TENDER IDENTIFICATION

Tender No: 2021-085303T

Title of Work: HVAC and Control System Upgrades – Municipal Operations Building

4.2 TENDERER'S RESPONSIBILITIES AND AGREEMENT

TO THE CITY OF SAINT JOHN, NEW BRUNSWICK:

The undersigned hereby agrees that failure to complete all required parts of the Form of Tender shall be subject to the reserved rights of the City and shall be grounds for rejection of the Tender in accordance with Section 2.11.

The undersigned Tenderer has carefully examined the site of the Work described herein, has become familiar with local conditions and the character and extent of the Work, has carefully examined every part of the proposed Contract, and thoroughly understands its stipulations, requirements and provisions and has carefully examined all of the following documents which together comprise the Tender Documents:

1. Project Description (Division 1)
2. Instructions to Tenderers and Tendering Procedures (Division 2)
3. The Particular Specifications (Division 3)
4. The Form of Tender (Division 4)
5. The Form of Agreement (Division 5)
6. The General Specifications (Divisions 6 through 31)
7. The Plans and Drawings
8. Addenda Issued

together, the "Tender Documents".

The undersigned Tenderer has determined the quality and quantity of materials required, has investigated the location and determined the source of supply of materials required, has investigated labour conditions, and has arranged for the continuous execution of the Work herein described.

The undersigned Tenderer hereby agrees to be bound by the award of the contract, and if awarded the Contract, to sign the Form of Agreement (Division 5) within five (5) working days following the City's Notice of Selection.

In the event the City accepts its Tender, the undersigned Tenderer hereby agrees to Substantially Complete the Work no later than March 31, 2022.

The undersigned Tenderer agrees that he has received all Addenda and the Tender Price includes the provisions set out in the Addenda.

4.2 TENDERER'S RESPONSIBILITIES AND AGREEMENT (Cont'd)

The undersigned Tenderer further agrees to provide all necessary permits, approvals, labour, material, plant, equipment, tools, incidentals, products, water, light, heat, power, transportation, facilities, services and other means of the specified requirements which are necessary to complete the work in accordance with the contract and agrees to accept, therefore, in payment in full, the total sum of

_____
_____
_____

in Canadian Funds, which price includes HST (the "Tender Price").

By submitting a Tender, the Tenderer absolutely waives any right, cause of action or claim for any compensation of any kind whatsoever as a result of participating in this Request for Tender Call or by reason of the City's failure to accept the Tender submitted by the Tenderer, and the Tenderer shall be deemed to have agreed to waive such right, cause of action or claim.

Place of Signing: Signed, sealed and delivered at _____

Date of Signing: This _____ day of _____, in the year _____

Name and Title: By_____

Legal Name of Tenderer: _____ *PLACE*

Signature of Tenderer or Authorized Agent: _____ *SEAL*

Signature of Witness: _____ *HERE*

Address of Tenderer: _____

_____

4.3 BONDING AND INSURANCE COMMITMENTS

Failure of the Tenderer to complete Sections 4.3.01, 4.3.02 and 4.3.03 may be grounds for rejection of the Tender.

4.3.01 Tender (Bid) Bond or Certified Cheque

A certified cheque or Tender (Bid) Bond accompanies this Tender, as indicated below:

(a) Certified Cheque

Provided is a certified cheque payable to The City of Saint John in the amount of

_____

Signature of Tenderer or Authorized Agent: _____

(b) Tender (Bid) Bond

Provided is a Tender (Bid) Bond payable to The City of Saint John in the amount of

_____

The Tender (Bid) Bond has been negotiated for, procured from and the premium paid to a New Brunswick resident agent of an insurance company licensed to do business in New Brunswick.

Signature of Tenderer or Authorized Agent: _____

4.3.02 Performance Guarantees

One of the following acceptable forms of Performance Guarantees will accompany the Contract, as indicated below:

(a) Performance Bond

The Performance Bond and the Labour and Material Payment Bond, each at fifty percent (50%) of the Tender Price covering the faithful performance of the full Contract, will be negotiated for, procured from and the premium paid to an insurance company licensed to do business in the Province of New Brunswick.

A surety consent letter or Agreement to Bond must accompany the Tender submission.

Signature of Tenderer or Authorized Agent: _____

4.3.02 Performance Guarantees (Cont'd)

(b) Certified Cheque

In lieu of the performance bond and the labour and material payment bond, we shall supply a certified cheque in the amount of twenty percent (20%) of the Tender Price.

Signature of Tenderer or Authorized Agent: _____

4.3.03 Insurance

The undersigned Tenderer has reviewed the insurance requirements in the Contract. The following provision for contract insurances will be utilized, as indicated below:

The insurance required in the contract will be negotiated for, procured from and the premium paid to an insurance company licensed to do business in the Province of New Brunswick.

Signature of Tenderer or Authorized Agent: _____

4.4 STATEMENTS

A Tender which does not include completed statements at Sections 4.4.01 to 4.4.07 hereunder and the duly completed Schedule of Quantities and Unit Prices at Appendix 4A may be Disqualified.

4.4.01 Reference Regarding Tenderer's Financial Status

Name of Reference: _____

Address of Reference: _____

_____

4.4.02 Particulars of Tenderer's Recent Contracts

The Tenderer shall provide hereunder particulars of at least three (3), and if possible, five (5) contracts which the Tenderer has successfully carried to completion within the last three (3) years, or is now carrying to completion.

Tenderers shall be actually engaged in performing the type and standard of work specified, and the projects referenced below shall be work of a similar character to the Work now being tendered and shall be of comparable or greater size.

Tenderers who have not performed work for The City of Saint John within the last three (3) years shall submit additional information with the Form of Tender that would demonstrate the Tenderer's ability to perform the type and standard of work specified and the Tenderer's financial, technical and project management reliability.

4.4.02 Particulars of Tenderer's Recent Contracts (Cont'd)

Contract 1: Brief description of contract: _____

_____

_____

Owner, contact name and telephone number: _____

_____

Contractor's supervisor: _____

Year completed: _____ Contract Value: _____

Contract 2: Brief description of contract: _____

_____

_____

Owner, contact name and telephone number: _____

_____

Contractor's supervisor: _____

Year completed: _____ Contract Value: _____

Contract 3: Brief description of contract: _____

_____

_____

Owner, contact name and telephone number: _____

_____

Contractor's supervisor: _____

Year completed: _____ Contract Value: _____

4.4.02 Particulars of Tenderer's Recent Contracts (Cont'd)

Contract 4: Brief description of contract: _____

_____

_____

Owner, contact name and telephone number: _____

_____

Contractor's supervisor: _____

Year completed: _____ Contract Value: _____

Contract 5: Brief description of contract: _____

_____

_____

Owner, contact name and telephone number: _____

_____

Contractor's supervisor: _____

Year completed: _____ Contract Value: _____

Contract 6: Brief description of contract: _____

_____

_____

Owner, contact name and telephone number: _____

_____

Contractor's supervisor: _____

Year completed: _____ Contract Value: _____

4.4.03 Particulars of Current Construction Work by Tenderer

If none of the projects described in 4.4.02 were in progress in Canada during the twelve (12) months immediately preceding this Tender, the Tenderer shall provide below particulars of a contract which the Tenderer satisfactorily carried out in Canada during that period.

Brief description of contract: _____

_____

_____

Owner, contact name
and telephone number: _____

_____

Date of commencement: _____

Date of (anticipated) completion: _____

Contract value: _____

Contractor's supervisor: _____

4.4.04 Tenderer's Senior Supervisory Staff

The Tenderer shall identify their senior supervisory staff in the spaces below.

Tenderers who have not performed work for the City within the last three (3) years shall submit with their Form of Tender a completed resume for each staff member listed hereunder outlining their experience, education, designations/certificates and continued training/education.)

Name	Position	Qualifications	# Years Experience

4.4.05 Tenderer's Plant

The Tenderer shall list below the construction plant (type of machinery, equipment, trucks, etc.) the Tenderer proposes to use, other plant under the Tenderers control, and the plant the Tenderer proposes to hire, to complete the work within the time allowed.

Type	Make	Model # & Year	Gas/ Diesel	Net Engine Horsepower	Bucket Size Excavator GVW

4.4.06 Tenderer's Other Resources

The Tenderer shall list below the batch plant, gravel pits or quarries, and the like that the Tenderer proposes to use to complete the work within the time allowed.

4.4.07 Sub-Contractors and Suppliers

Tenderers shall state the name and address of each proposed sub-contractor or supplier.

The listing of more than one sub-contractor or supplier for any one sub-trade or failure to submit a complete list of sub-contractors and suppliers may be grounds for rejection of the Tender. After the City has provided the selected Tenderer with written notification of the City's acceptance of its Tender, the selected Tenderer shall not substitute other sub-contractors or suppliers in place of those named below without the written approval of the Engineer.

Sub-Trade or Supplier	Name of Sub-Contractor/Supplier	Address

4.5 SCHEDULE OF QUANTITIES AND UNIT PRICES

The tenderer shall complete and attach as Appendix 4A the required *Schedule of Quantities and Unit Prices* for the Work tendered, in the format specified by the Engineer.

4.6 CERTIFICATE OF INDEPENDENT TENDER DETERMINATION

I, the undersigned, in submitting the accompanying Tender to The City of Saint John for:

Tender No.: 2021-085303T

Title of Work: HVAC and Control System Upgrades – Municipal Operations Building

do hereby make the following statements that I certify to be true and complete in every respect:

I certify, on behalf of _____ that:

(Corporate Name of Tenderer)

4.6 CERTIFICATE OF INDEPENDENT TENDER DETERMINATION (Cont'd)

1. I have read and I understand the contents of this Certificate;

2. I understand that the accompanying Tender will be disqualified if this Certificate is found not to be true and complete in every respect;

3. I am authorized by the Tenderer to sign this Certificate, and to submit the accompanying Tender, on behalf of the Tenderer;

4. Each person whose signature appears on the accompanying Tender has been authorized by the Tenderer to determine the terms of, and to sign, the Tender, on behalf of the Tenderer;

5. For the purposes of this Certificate and the accompanying Tender, I understand that the word "competitor" shall include any individual or organization, other than the Tenderer, whether or not affiliated with the Tenderer, who:

(a) may submit a Tender in response to this Request for Tender;

(b) could potentially submit a Tender in response to this Request for Tender, based on their qualifications, abilities or experience;

6. The Tenderer discloses that (check one of the following only, as applicable):

☐ the Tenderer has arrived at the accompanying Tender independently from, and without consultation, communication, agreement or arrangement with, any competitor; or

☐ the Tenderer has entered into consultations, communications, agreements or arrangements with one or more competitors regarding this Request for Tender, and the Tenderer discloses, in the attached document(s), complete details thereof, including the names of the competitors and the nature of, and reasons for, such consultations, communications, agreements or arrangements.

7. In particular, without limiting the generality of paragraphs (6)(a) or (6)(b) above, there has been no consultation, communication, agreement or arrangement with any competitor regarding:

(a) prices;

(b) methods, factors or formulas used to calculate prices;

(c) the intention or decision to submit, or not to submit, a Tender; or

(d) the submission of a Tender which does not meet the specifications of the Request for Tender;

except as specifically disclosed pursuant to paragraph (6)(b) above;

4.6 CERTIFICATE OF INDEPENDENT TENDER DETERMINATION (Cont'd)

8. In addition, there has been no consultation, communication, agreement or arrangement with any competitor regarding the quality, quantity, specifications or delivery particulars of the products or services to which this Request for Tender relates, except as specifically authorized by The City of Saint John or as specifically disclosed pursuant to paragraph (6)(b) above;

9. The terms of the accompanying Tender have not been, and will not be, knowingly disclosed by the Tenderer, directly or indirectly, to any competitor, prior to the date and time of the official Tender Opening, or of the awarding of the Contract, whichever comes first, unless otherwise required by law or as specifically disclosed pursuant to paragraph (6)(b) above.

Name of Tenderer or Authorized Agent: _____

Signature of Tenderer or Authorized Agent: _____

Position Title: _____

Date: _____

Address of Tenderer: _____

_____

ATTACHMENT: TENDERER'S CHECKLIST

(The onus is entirely on the Tenderer to understand all the requirements of the tendering process and the Tender Documents. This checklist is provided for information only and is not required to be submitted with the Form of Tender.)

BEFORE SUBMITTING YOUR TENDER, CHECK THE FOLLOWING POINTS:

- ☐ Has your Tender been signed and witnessed?
- ☐ Have you sealed the *Form of Tender* with your corporate seal?
- ☐ Have you enclosed your Tender (Bid) Bond or certified cheque?
- ☐ Have you enclosed the surety consent letter?
- ☐ Have you completed all sections of the *Form of Tender*?
- ☐ Have you completed all schedules and prices in the *Form of Tender*?
- ☐ Have you written each unit price or lump sum price out in words, including the words "dollars" and "cents"?
- ☐ Have you included signed copies of all addenda signature pages?
- ☐ Have you listed your Subcontractors and suppliers?
- ☐ Have you listed your experience in similar work?
- ☐ Have you listed your senior staff?
- ☐ Have you listed the Tenderer's plant?
- ☐ Have you attached required appendices and required supplemental information?
- ☐ Are the documents complete?
- ☐ Is everything legible?

DIVISION 4.5

SCHEDULE OF QUANTITIES AND UNIT PRICES

CONTRACT NUMBER 2021-085303T

TITLE: HVAC AND CONTROL SYSTEM UPGRADES - MUNICIPAL OPERATIONS BUILDING

Item	Description	Price
1	All material and labour cost (less controls) for the removal and replacement of AC-1 including installation of all Level 1 VAV boxes, ductwork modifications, cutting and patching, air balancing, start-up commissioning, electrical, roofing, etc.	
2	All material and labour cost (less controls) for the removal and replacement of AC-2 including installation of Level 2 VAV boxes 2-1 to 2-27, ductwork modifications, cutting and patching, air balancing, start-up commissioning, electrical, roofing, etc.	
3	All material and labour cost (less controls) for the removal and replacement of AC-3 including installation of Level 2 VAV boxes 2-1 to 2-27, ductwork modifications, cutting and patching, air balancing, start-up commissioning, electrical, roofing, etc.	
4	All material and labour cost to remove existing BMCS and install new BMCS including all wiring, sensors, control panels, programming, etc.	
5	All other costs not covered in breakdowns #1 to #4 , including but not limited to start up. permits, construction administration, close out documents, overhead and profit, etc.	
6	Contingency	$ 40,000.00
7	Subtotal	
8	HST (15%)	
9	Total (Copy to Division 4, Item 4.2)	

City of Saint John

CONTRACT SPECIFICATIONS

DIVISION 5

FORM OF AGREEMENT

AUGUST 2021

City of Saint John

TABLE OF CONTENTS

DIVISION 5 – FORM OF AGREEMENT

5.1 AGREEMENT BETWEEN OWNER AND CONTRACTOR

THIS AGREEMENT made in triplicate between **THE CITY OF SAINT JOHN** herein (and in the Specifications) called the "Owner" or the “City”

AND

_____

herein (and in the Specifications) called the "Contractor".

WITNESSETH: That the Owner and the Contractor agree as follows:

a) The Contractor shall provide all the materials and perform all the work shown on the drawings and described in the Contract Specifications titled:

Contract No: 2021-085303T

Title: HVAC and Control System Upgrades – Municipal Operations Building

b) The Contractor shall do and fulfill everything indicated by this Agreement; and

c) The Contractor shall Substantially Complete the Work no later than March 31, 2022.

5.2 CONTRACT DOCUMENTS

5.2.01 General Specifications

General Specifications, City of Saint John, New Brunswick,
with all applicable divisions, as updated and as listed in the Table of Contents of the Contract Specifications.

5.2.02 Contract Specifications

Contract specifications for

Contract No: 2021-085303T

Title: HVAC and Control System Upgrades – Municipal Operations Building

City of Saint John, New Brunswick,

5.2.02 Drawings

Sheet No.	Title
MD-1	Level 1 Demolition
MD-2	Level 2 Plan – Demolition
M-1	Level 1 HVAC Plan
M-2	Level 2 HVAC Plan
M-3	Roof Plan & Details
M-4	Controls
E-1	Electrical Plans & Electrical Notes

5.3 ADDENDA

The Contractor agrees that he has received addenda ___ to ___ inclusive, and that the tender price includes the provisions set out in the addenda.

5.4 CONTRACT PRICE

The Owner shall pay to the Contractor, in lawful money of Canada for the performance of the Contract, the amounts determined for each of the items of work completed at the unit prices as listed in the Schedule of Quantities and Unit Prices, submitted with the tender, which is to be attached with this Agreement, for the total tender price of:

_____

_____

_____ (Including Taxes) _____

If the Engineer orders in writing the performance of any work not covered by the drawings or included in the specifications that cannot be classified as coming under any of the contract units and for which a unit price can be agreed upon, then such additional work shall be paid for as described under the General Administration of Contract, Division 6.

5.5 PAYMENT

The Owner shall pay on account of thereof upon the Engineer's Certificate, as invoiced by the Contractor and approved by the Engineer, in the manner described in the Specifications.

5.6 AGREEMENT DOCUMENTS

The General Administration of Contract, Division 6 and the aforesaid Specifications and Drawings are all to be read into and form part of this Agreement and the whole shall constitute the Contract between the parties and it shall inure to the benefit of and be binding upon them and their successors, executors, administrators, and subject to the General Administration of Contract, their assigns.

5.7 EXECUTION OF AGREEMENT

In Witness Whereof the parties hereto have executed this Agreement.

	) SIGNED, SEALED AND DELIVERED
	)
	) this _____ day of _____, _____
	)
	) by _____
	) (Contractor)
	)
_____	) _____
(Witness)	) (Signature)
	)
_____	) _____
(Name and Title)	) (Name and Title)
	)
	) _____
	) (Signature)
	)
	) _____
	) (Name and Title)
	)
	)
	) *PLACE SEAL HERE*

	)
	)
	) SIGNED, SEALED AND DELIVERED
	)
	) this _____ day of _____, _____
	)
	) by THE CITY OF SAINT JOHN.
	)
	)
	) _____
	) MAYOR
	)
	) _____
	) COMMON CLERK
	)
	)
	)
	) *PLACE SEAL HERE*

5.8 AFFIDAVIT OF CORPORATE EXECUTION

CANADA
PROVINCE OF NEW BRUNSWICK
CITY OF SAINT JOHN

I, _____, of the _____
in the County of _____, and Province of New Brunswick
MAKE OATH AND SAY:

(1) THAT I am the _____ of _____, and _____ is the _____ of the said Company, as such I am/we are duly authorized officer(s) of the said Company to execute the foregoing instrument.

(2) THAT the signature _____ subscribed to the within instrument is my signature and in my own proper handwriting and that the signature _____ so subscribed is his signature made thereto by him in my presence.

(3) THAT the Seal affixed to the said instrument purporting to be the Corporate Seal of the said _____ is the Corporate Seal of the said Company and was affixed to the said instrument by me and by order of the Board of Directors of the Company.

SWORN TO BEFORE ME at the_____)
)
of _____)
)
in the Province of _____)
)
this _____ day of _____ A.D., _____.)
)
_____) _____
COMMISSIONER OF OATHS) CONTRACTOR
)

Note: The blank spaces are to be filled in with the name or names of the signing officer(s).

5.9 CHECKLIST FOR INSURANCE REQUIREMENTS

The insurance coverage required by the City is set out in General Administration of Contract, Division 6, of the General Specifications. An Insurance Certificate is to be deposited with the City.

The certificate of insurance should contain at least the following information:

- ❑ Be addressed to the City of Saint John.
- ❑ Be signed by an authorized representative on behalf of the insurance company.
- ❑ Contain a Wrap-up (Project Specific) Liability policy with inclusive limits of at least five million dollars ($5,000,000.00).
- ❑ Show that the City of Saint John, the Contractor and Sub-Contractors, the Engineer and the Architect, are added as Additional Insured with respect to the operations of the Contractor.
- ❑ Confirm coverage for bodily injury and property damage and set forth the amount.
- ❑ Confirm that there is coverage for Contractual Liability with respect to this Contract.
- ❑ Confirm that the policy contains a cross liability clause.
- ❑ Confirm that there is Contingent Employer's Liability Coverage.
- ❑ Confirm that there is coverage for Broad Form Property Damage.
- ❑ Confirm that there is Completed Operations coverage with respect to this contract and that such coverage shall continue to be in force for the duration of the guarantee period (maintenance period) which is a period of twelve (12) months from the date of issuance of the Certificate of Final Completion.
- ❑ Confirm that there is coverage for Non-Owned Automobiles or licensed vehicles.
- ❑ Confirm that there is coverage for Owned Automobiles or licensed vehicles.
- ❑ Confirm that the indicated policies will not be cancelled, substantially amended, or allowed to lapse without the City first being given a thirty (30) day written notice.