**CITY OF HAMILTON**

# REQUEST FOR TENDERS

**Contract Number: C13-04-20**

**Building Automation System (BAS) & Mechanical (HVAC) Upgrades at Wentworth Lodge**

**Closes: 3:00 pm, Hamilton time**
**Monday February 24th, 2020**

***** ELECTRONIC BID SUBMISSIONS ONLY *****

**Procurement Section**
**Corporate Services Department**

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**Online documents:**

Drawings

Schedule of Prices

Specifications

- Bidder's Business Structure

Bonding

Form of Tender

# COMMUNICATIONS

## Contract Number: C13-04-20

## Building Automation System (BAS) & Mechanical (HVAC) Upgrades at Wentworth Lodge

All questions related to this Request for Tenders (RFT) or for clarification on completing the Form of Tender shall be submitted through the Bidding System by clicking on the "Submit a Question" button for the specified Request for Tenders document and shall be directed to:

Marusia Douglas
Procurement Specialist

All questions related to this Request for Tenders (RFT) or any clarification with respect to this RFT must be made no later than **3 Business Days prior** to the closing date of this RFT in order that City staff may have sufficient time to respond. The City reserves the right to extend the deadline for questions if required regarding this RFT.

Written answers or clarifications to issues of substance shall be shared with all bidders and issued as part of the RFT in the form of an Addendum. **All bidders are advised that any Addenda issued will only be posted on the following website:**

**https://hamilton.bidsandtenders.ca**

**It is the sole responsibility of each bidder to check the website for any and all Addenda that have been issued for this Request for Tenders.**

City of Hamilton
Corporate Services Department
Procurement Section
Phone: 905 546 2773
Fax: 905 546 2327
Email: procurement@hamilton.ca

Marusia Douglas
Procurement Specialist
Telephone: (905) 546-2424, extension 3707
Email: Marusia.Douglas@hamilton.ca

# REQUEST FOR TENDERS NOTICE

## Contract Number: C13-04-20

## Building Automation System (BAS) & Mechanical (HVAC) Upgrades at Wentworth Lodge

## Closes: 3:00 pm, Hamilton time
## Monday, February 24th, 2020

**Only electronic bid submissions shall be accepted and received through the Bidding System by the closing date and time stated above.**

**There is no public opening for this Request for Tenders.**

## 1.0 SCOPE OF WORK

The City if Hamilton is planning an upgrade to the Building Automation Systems (BAS) and Mechanical (HVAC) Systems at Wentworth Lodge Long Term Care Facility. The upgrades are described at length in the Specifications section 01 00 00 and drawing number G01 provided in the document.

## 2.0 CONTRACT REQUIREMENTS

Bidders are advised of the following contract requirements for this Request for Tenders:

### 2.1 Bid Security

Bid security: **$35,000.000**

**The City will only accept a digital bid bond in an electronically verifiable and enforceable (e-Bond) format.**

### 2.2 Performance and/or Labour and Material Payment Security

Successful Bidder to provide:

Performance security (bond only accepted): **50%** of the Base Bid Price.

Labour and Material Payment security (bond only accepted): **50%** of the Base Bid Price.

## 3.0 SITE MEETINGS

### 3.1 Mandatory Site Meeting

There is a mandatory site meeting scheduled. Failure of a Bidder to attend this site meeting will result in the rejection of any Bid submission by that Bidder.

**Location:** **Wentworth Lodge Long Term Care Facility,**
**41 South Street, Dundas, ON,**
**L9H 4C4 (see location map attached)**
**Date:** **Thursday, February 6th, 2020**
**Time:** **1:30pm, Hamilton time**

**All attendees are required to wear CSA approved hard hats and safety boots. If an attendee does not have the required personal protection equipment they may not be allowed to attend the site meeting.**

## 4.0 TO OBTAIN DOCUMENTS

### 4.1 Free Preview of Request for Tenders Documents

A complete set of Request for Tenders documents may be viewed for free on the City of Hamilton's bid opportunities website **hamilton.bidsandtenders.ca.**

### 4.2 Purchase of Request for Tenders Documents

The Request for Tenders documents are available for online purchase only.

Online: **hamilton.bidsandtenders.ca**

Fee: $53.00 non-refundable, tax included + applicable bids&tenders™ fees

## 4.3 Accommodations for Bidders with Disabilities

In accordance with the Ontario Human Rights Code, Ontarians with Disabilities Act, 2001 (ODA) and Accessibility for Ontarians with Disabilities Act, 2005 (AODA), the City of Hamilton will accommodate for a disability, ensuring full and equitable participation throughout the bid process.

If a bidder requires this Request for Tenders in a different format to accommodate a disability, the bidder must contact the Tender Coordinator as soon as possible and in any event prior to the closing date. The Request for Tenders in the different format will be issued only to the requesting bidder and all Addenda will be issued in such different format only to the requesting bidder.

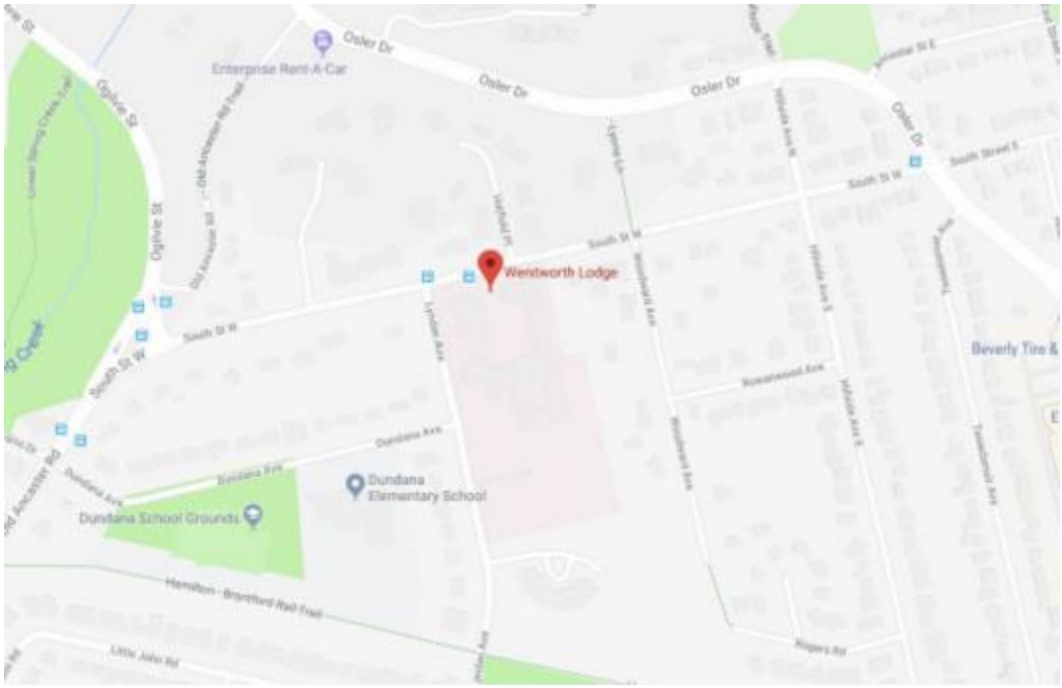
Procurement Manager
City of Hamilton

## MAP LOCATION OF Wentworth Lodge Long Term Care Facility

**DISCLAIMER:**
The following URL address and map have been provided for illustration purposes only and every effort has been made to ensure accuracy. The City of Hamilton cannot accept any responsibility for errors, omissions, or positional inaccuracy for this information.

**Bidders must copy and paste the following URL address into a new web browser:**

**https://www.google.com/maps/place/Wentworth+Lodge/@43.259848,-79.9488211,17z/data=!4m5!3m4!1s0x882c84917371b1a9:0xbc412d95d3b92fe9!8m2!3d43.259973!4d-79.9494541**



**CITY OF HAMILTON**
**REQUEST FOR TENDERS**

# INSTRUCTIONS TO BIDDERS

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## INSTRUCTIONS TO BIDDERS

**Notice to prospective bidders: The Instructions set out herein define your obligations and limit your rights. Read carefully.**

### 1 Interpretation

In these Instructions to Bidders,

1.1 the provisions shall be read with changes of gender, number or corporate status as the context may require;

1.2 a reference to any Act, by-law, rule, procedure or regulation shall be deemed to include a reference to any substitution or amendment thereof;

1.3 the headings to each section are inserted for convenience of reference only and do not form part of the Request for Tenders;

1.4 any reference to an officer of the City shall be construed to mean the person holding that office from time to time, the designate or deputy of that person, and shall be deemed to include a reference to any person holding a successor office or the designate or deputy of that person.

1.5 unless expressly stated to the contrary, the number of days shall be calculated by,

1.5.1 counting all days including Saturdays, Sundays and public holidays, provided, however, that if the final day of any period shall fall on a Saturday, Sunday or public holiday, then the final day shall be deemed to be the next day which is not a Saturday, Sunday or public holiday;

1.5.2 where “month” is referred to, it shall be a calendar month.

### 2 Definitions

Capitalized words and phrases used in these Instructions to Bidders, Supplementary Instructions to Bidders, and the Form of Tender shall have the following meanings, unless expressly stated otherwise.

“Addendum” means a written change issued to the Request for Tenders.

“Alternative” means anything for which bidders provide a price in a manner that gives the City options in determining the actual Work of the Contract and may include such items as an optional product, system, installation, method, design and requirement. The City shall not be obliged to purchase an Alternative when accepting a Bid, but may, at its discretion elect to purchase all, some or none of the Alternatives offered.

“Alternative Price” means the amount stipulated by the bidder for an Alternative, which can be stated as an addition, a deduction, or no change to the Base Bid Price. The Successful Bidder shall be obliged to adhere to the Alternative Price quoted in its Bid.

“Base Bid Price” means the amount stated in the Form of Tender by the bidder, for the Work without considering any Alternative or Alternative Price and includes all Provisional Items and Provisional Prices (if any).

“Bid” means a submission made by a bidder in response to the Request for Tenders.

“Bid Security” means the security submitted by a bidder with its Bid which provides financial protection to the City should the Successful Bidder not enter into the Contract or commence the Work following the issuance of a purchase order, and/or not provide the specified security required under the Contract.

“Bidding System” means the electronic system used by the City for the advertisement of public bid opportunities at the following website: https://hamilton.bidsandtenders.ca, and which is required to be used for all dissemination of information by or on behalf of the City and submissions from bidders for this Request for Tenders.

“Business Day” means a day which is not a Saturday, Sunday, public holiday or day when the administrative offices of the City are closed.

“City” means the City of Hamilton, and where an authority or discretion is conferred upon the City under the Request for Tenders, means the appropriate official of the City as designated or appointed under its governing by-laws, resolutions or policies from time to time.

“Contract” means the agreement by formal contract executed by both the City and the Successful Bidder, or by purchase order issued by the City, to perform the Work, including the supply and delivery of all labour, Goods, Services, equipment and incidentals necessary for the proper and satisfactory execution of the Work, and the fulfillment of all other contractual obligations and undertakings, all in accordance with the Request for Tenders, and any written supplementary agreements which form part of the Contract.

“Electronic Bidding” means a method of issuing this Request for Tenders and/or receiving Bids where the process of using and/or receiving Bids by internet is considered appropriate, and in particular includes the Bidding System operated by bids&tenders™ system operated by eSolutions Group, 455 Philip Street, Waterloo, Ontario N2L 3X2.

“Form of Tender” means the City’s forms entitled Form of Tender and Schedule of Prices and any other documents that are supplied as part of the Request for Tenders and which are to be completed and confirmed by the bidder and submitted back to the City in their entirety through the Bidding System.

“Good” means any product of any description required to be installed, supplied or consumed in order to complete the Work.

“Lump Sum Price” means an all inclusive one price that applies to a single item, or specific Service as set out on the Form of Tender.

“Procurement Manager” means the City’s Procurement Manager or his or her delegate or designate.

“Procurement Policy” includes those City procurement policies found at: hamilton.ca/buying-selling-city/bids-tenders/procurement-policy-by-law.

“Procurement Section Office” means 120 King Street West, 9th Floor, Suite 900, Hamilton, Ontario L8P 4V2.

“Project Manager” means the person designated by the City to administer and oversee the Work.

“Provisional Item” means work or a portion of work the City may wish to have performed but which may be removed, at no additional cost to the City from the scope of the Work at any time. Where such item is removed, the City will deduct the relevant Provisional Price from the Base Bid Price after the award of the Contract.

“Provisional Price” means the amount stipulated by the bidder for a Provisional Item which is to be included in the Base Bid Price.

“Request for Tenders” means all of the following documents, and in the event of a conflict between them, each shall enjoy priority against the others (subject to any express term or condition to the contrary) in accordance with the following successive order:

(a) any Addendum;

(b) any Supplementary General Conditions or Supplementary Conditions;

(c) the General Conditions;

(d) the Specifications, with any Supplementary Specifications (if any) taking priority over the standard Specifications;

(e) any contract drawings;

(f) the Supplementary Instructions to Bidders

(g) these Instructions to Bidders;

(h) the standard form text of the Form of Tender as prescribed by the City;

(i) the sample Contract;

(j) any other documents that form a part of the Request for Tenders.

“Service” means a service of any description required in order to complete the Work, whether commercial, industrial, trade or otherwise, and includes all professional, technical and artistic service, and the transporting, acquiring, supplying, storing and otherwise dealing in a Good.

**"**Specifications**"** means all written or printed requirements and standards forming part of the Request for Tenders and pertaining to the method and the manner of performing the Work or Service, to the scope of Work and to the quality of a Good to be furnished under the Contract.

"Stipulated Price" means a single, all inclusive, one price that applies to all of the Work.

"Successful Bidder" means the bidder to whom the City has awarded the Contract.

"Tender Coordinator" means the single point of contact for the Request for Tenders and will be the person named on the Communications page of the Request for Tenders.

"Tender Notice" means the public notification of the Request for Tenders.

"Total Contract Price" has the same meaning as Base Bid Price.

"Unit Price" means any component price as set out on the Form of Tender.

"Value Added Taxes" means such sum as shall be levied upon the Base Bid Price by the Federal or Provincial or Territorial Government and is computed as a percentage of the Base Bid Price and includes the Goods and Services Tax, the Quebec Sales Tax, the Harmonized Sales Tax, and any similar tax, the collection and payment of which have been imposed on the bidder by the tax legislation.

"Work" means the whole of the work, the supply and delivery of a Good, the delivery and performance of any Services, the total construction and related services, material, matters and things required to be completed, supplied, mentioned or referred to in performing or executing the work in full in accordance with the requirements set out in the Request for Tenders.

## 3 Guidelines Regarding Bid Irregularities

As a guide to the bidder, but without qualifying any rights and privileges reserved to the City, the bidders guidelines set out below is indicative of the manner in which discretion reserved by the City is to be exercised with respect to non-compliant Bids. However, the City shall not be liable to any bidder or other person where it elects to exercise a discretion, reserved privilege or right in a manner different from that indicated below. An irregularity that goes beyond the scope of the bidders Guidelines set out below shall be considered by the Procurement Manager.

| **BIDDERS GUIDELINES** | | |
|---|---|---|
| **IRREGULARITY** | | **RESPONSE** |
| 1. | Qualified or conditional Bid (A Bid restricted by a statement added to the Form of Tender or a covering letter or alterations to the Form of Tender). | Automatic rejection unless the Request for Tenders specifically permit such qualification or condition. |

| BIDDERS GUIDELINES | | |
|---|---|---|
| **IRREGULARITY** | | **RESPONSE** |
| 2. | A Bid received in a format not specified in the Request for Tenders such as hardcopy submission, fax, email, etc. | Automatic rejection. |
| 3. | A Bid received on documents other than those original documents supplied by the Bidding System. | Automatic rejection. |
| 4. | Bid Security:<br><br>Amount of Bid Security provided by bidder is insufficient, does not name correct Municipality as obligee, or no Bid Security is provided or is not otherwise in compliance with the Request for Tenders requirements. | Automatic rejection. |
| 5. | Execution of Bid bond:<br>Corporate seal or electronic signature of bidder, or both, are missing.<br>Corporate seal or electronic signature of bonding company, or both, are missing. | Automatic rejection.<br><br>Automatic rejection. |
| 6. | Digital bid bond not provided or not an electronically verifiable and enforceable e-Bond. | Automatic rejection. |
| 7. | Other irregularities. | An irregularity that goes beyond the scope of the Bidders Guidelines may be considered by the Procurement Manager. |

## 4 Bid Submission and Form of Tender

4.1 Every Bid **shall**

4.1.1 be submitted on the City's prescribed Form of Tender in its entirety;

4.1.2 be completed in English;

4.1.3 have all of the required blank spaces provided on the Form of Tender completed by the bidder;

4.1.4 include all material, Goods, Services, equipment and labour, required to complete the Work; and

4.1.5 state all prices in Canadian funds, unless otherwise stipulated.

4.2 Electronic Bid submissions only, shall be accepted and received by the Bidding System, on or before the closing date and time stated in the Request for Tenders. A

Bid submitted by mail, in person, fax, e-mail or other electronic means, other than through the Bidding System, will not be accepted.

4.3 Bidders shall have a Bidding System vendor account and must be registered as a plan taker for this Request for Tenders. Only plan takers will have access to download this Request for Tenders document, receive Addendum email notifications, download Addendum and to submit their Bid electronically through the Bidding System.

If a bidder has obtained the Request for Tenders document from a third party, the onus is on the bidder to create a Bidding System vendor account and register as a plan taker for the bid opportunity.

4.4 Time is of the essence with respect to the submission of a Bid. It is the **sole** responsibility of each bidder to ensure that its Bid is received by the Bidding System on or before the closing date and time stated in the Request for Tenders document. The closing time shall be determined by the Bidding System web clock.

Bidders are advised that the timing of their Bid submission is based on when the Bid is RECEIVED by the Bidding System, not when a Bid is submitted by a bidder, as Bid transmission can be delayed in an "internet traffic jam" due to file transfer size, transmission speed, etc.

Bidders shall allow sufficient time to upload their Bid submission, including any attachments. Late Bid submission shall not be accepted by the Bidding System.

4.5 The Bidding System will send a confirmation email to the bidder advising that their Bid was submitted successfully. If an email confirmation is not received, contact technical support at bids&tenders™ via email: support@bidsandtenders.ca or by telephone 1-800-594-4798.

4.6 It is the exclusive responsibility of each bidder to submit a complete Bid in accordance with the Request for Tenders.

4.7 All documents prepared and work carried out by a bidder in preparing a Bid, and all oral presentations to the City in connection with a Bid, shall be without cost to the City, and neither the City's publication of a Request for Tenders nor the submission of a Bid shall be construed to oblige the City to award a Contract.

4.8 All words and phrases forming part of a Bid should be written out in full, and abbreviations should not be used.

4.9 No amendment may be made to a Bid after it has been submitted, except in the circumstances set out in Article 6.4 of these Instructions to Bidders.

## 5 Bid Security

5.1 Each bidder shall submit with its Bid a Bid Security in the form of a digital bid bond in an electronically verifiable and enforceable (e-Bond) format in the amount set out in the Supplementary Instructions to Bidders.

For additional information regarding e-Bonds, bidders should contact their surety company or visit the Surety Association of Canada website: https://www.surety-canada.com/en/ebonding/index.html

5.2 A scanned PDF copy of bonds, original certified cheque, bank draft, money order or any other format other than a digital bid bond is not acceptable and shall be rejected.

5.3 Bidders shall upload their Bid Security to the Bidding System, in the bid submission file labelled “Bid Bond”. All instructions and details for assessing authentication shall be included with the digital bond uploaded in the Bidding System.

5.4 A Bid Security shall, include such terms, be in a form, be executed appropriately and be provided by an issuer authorized to do business in the Province of Ontario, satisfactory to the City in its reasonable discretion.

5.5 When a Bid is accepted by the City, the Successful Bidder will enter into a Contract for the performance of the Work. The Successful Bidder will commence the Work, following the issuance of a purchase order or notice to proceed, and will give the specified security required under the Request for Tenders and the Contract within 10 Business Days of request by the City.

5.6 The digital bid bond will not be returned to the bidder.

5.7 The term of the Bid Security shall be for a minimum period of 90 days after the closing date of the Request for Tenders. Where the irrevocability period for a Bid is extended in accordance with Article 10.2 of these Instructions to Bidder, the bidder shall also ensure that the term of the Bid Security is extended for the same period of time as the irrevocability period.

5.8 A Bid submitted without the required Bid Security will be rejected by the City.

5.9 Each bidder that submits a Bid will be deemed to have acknowledged and agreed that the amount of the Bid Security required with respect to a Bid constitutes a genuine pre-estimate on the part of the City of the damages that will be suffered by the City as a result of a failure or refusal on the part of the Successful Bidder to enter into a Contract, to commence the Work following the issue of a purchase order or notice to proceed, and/or to give the specified security required under the Request for Tenders and the Contract.

5.10 In the event of a failure or refusal on the part of the Successful Bidder to enter into the Contract, to commence the Work following the issue of a purchase order or notice to proceed, and/or to give the specified security required under the Request for Tenders and the Contract, the City shall declare the Bid Security forfeited and the Successful Bidder may be held responsible at the City’s discretion for any increased costs or damages incurred by the City over and above the amount of that Bid Security.

5.11 In addition to the Reserved Privileges of the City set out at Article 16 of the Instructions to Bidders, the City may at its discretion, in the event of a failure, refusal

or default on the part of the Bidder to enter into the Contract, to commence the Work following the issue of a purchase order or notice to proceed, and/or to give the specified security required under the Request for Tenders and the Contract, annul the award or terminate the Contract, accept the next lowest compliant Bid, advertise for new tenders, or carry out the Work in any manner deemed in the best interests of the City. In such a case, if required by the City, the bidder shall pay the City the difference between the Base Bid Price and any greater sum that the City may be obligated to pay by reason of the failure, refusal or default of that bidder, including the cost of any advertisement for new tenders.

## 6 Addenda and Clarification of the Request for Tenders

6.1 The City reserves the right at any time prior to the award of the Contract,

6.1.1 to withdraw or cancel the Request for Tenders;

6.1.2 to extend the time for the submission of Bids; or

6.1.3 to modify the Request for Tenders,

by the publication of an Addendum, which shall become part of the Request for Tenders, and the City shall not be liable for any expense, cost, loss or damage incurred or suffered by any bidder (or any other person) as a result of its so doing.

6.2 Without limiting the City's right, Article 6.1 may apply to situations where no Bid is compliant or an insufficient number of bids have been received.

6.3 Any Addendum shall be posted on the following website and is sufficiently served upon any prospective bidder if so posted.

https://hamilton.bidsandtenders.ca

6.3.1 In addition to the above method of posting, the City may also notify prospective bidders of any Addendum by any other method it deems appropriate, including email, telephone, fax, courier, hand-delivery or by personal delivery. The need for additional notification and the method(s) to be used shall be in the absolute discretion of the City and notification shall be to the co-ordinates provided by the bidder to the City at the time it obtained the Request for Tenders from the City.

6.3.2 It is the sole responsibility of each bidder to check the website and ensure that it has received any and all Addenda issued by the City. Bidders shall confirm in the Form of Tender that they have received, examined and provided for all Addenda issued under the Request for Tenders. Bidders may in writing, seek confirmation of the number of Addenda issued under the Request for Tenders from the Tender Coordinator.

6.4 Where a bidder submits their Bid prior to the Request for Tenders closing date and time and an Addendum has been issued by the City, the Bidding System automatically **WITHDRAWS** the bidder's Bid submission and changes the Bid

submission to an **INCOMPLETE STATUS** (**NOT accepted by the City**). The withdrawn Bid can be viewed by the bidder in the "**MY BIDS**" section of the Bidding System. The bidder is solely responsible to:

6.4.1 make any required adjustments to their Bid;

6.4.2 acknowledge all Addenda that have been issued for this Request for Tenders; and

6.4.3 ensure the re-submitted Bid is **RECEIVED** by the Bidding System before the closing date and time stated in the Request for Tenders.

6.5 All communication between a bidder and the City (including requests for information or clarification) **shall** be set down in writing and directed to the Tender Coordinator named in the Communications page.

6.6 Any request directed to the City with respect to Article 6.5 prior to the closing date of the Request for Tenders must allow sufficient time for a written response or clarification to be issued by the City prior to the closing date, should the City consider it necessary to issue such response or clarification.

6.7 A written response or clarification of substance shall be shared with each bidder and issued in the form of an Addendum.

6.8 The City shall not be bound by any oral:

6.8.1 instruction;

6.8.2 amendment or clarification of the Request for Tenders;

6.8.3 information; or

6.8.4 advice or suggestion,

provided by any member of the City's staff or consultant to the City concerning the Request for Tenders or the manner in which the Work is to be carried out and the bidder bears any and all risk in relying on such representation.

6.9 Bidders shall acknowledge receipt of any Addenda when submitting their Bid through the Bidding System. Bidders shall check a box for all Addenda and any applicable attachments that have been issued before a bidder can re-submit their Bid submission online.

## 7 Bidder Responsibilities

7.1 The Contract shall only be between the City and the Successful Bidder. Neither the City nor its consultant shall be construed to have any contractual relationship with the Successful Bidder's employees, subcontractors or material suppliers, or their respective employees or suppliers.

7.2 Each bidder shall be responsible for:

7.2.1 ensuring that it has conducted a thorough inspection of the site, has investigated and examined the Request for Tenders and any other document made available to the bidder by the City and has delivered to the City any request for information in respect of all questions arising out of the foregoing inspections, investigations and examinations in respect to the site;

7.2.2 reviewing all drawings, reports, tests and other documents with respect to site, subsurface or otherwise concealed physical conditions which have been provided or made available to the bidder by the City in relation to the Request for Tenders and shall be responsible for any site, subsurface or otherwise concealed physical condition set out in or inferable from any such report; and

7.2.3 ensuring that they have conducted a sufficient and appropriate scope of inquiry into the manner, method(s) and magnitude of the work that is proposed in the Request for Tenders such that they have established a clear and full understanding of the work being undertaken and are able to fully appreciate the consequences of that work in preparing their Bid.

7.3 The cost of any Work which results from encountering any condition that is described in or properly inferable from the information referred to in Article 7.2 above shall be included in the bidder's Base Bid Price.

## 8 Opening of Bids

There is no public opening for this Request for Tenders. All Bids shall be electronically opened and posted on the Bidding System, https://hamilton.bidsandtenders.ca, following the closing date and time of the Request for Tenders. The name of the bidder and the Base Bid Price shall be posted for each Bid received.

## 9 Review of Bids & Bid Verification

9.1 Following the electronic opening, each apparently eligible Bid will be examined by the Procurement Manager to confirm that they are compliant and otherwise complete.

9.2 Unless expressly stated otherwise, the City shall apply a standard of substantial compliance against each Bid.

9.3 The City is not obliged to seek verification of any aspect of a Bid, however, the City may, if it determines that it is appropriate to do so under the circumstances, verify any aspect of any Bid received, at any time, in order to resolve an ambiguity in either the language used or any other vague or uncertain aspect of the Bid.

9.4 Such verification shall not alter the Bid, constitute negotiation or re-negotiation of the price or any other aspect of the Bid, and all correspondence with a bidder for the purposes of such verification shall be conducted through the Procurement Manager.

9.5 The review or verification of a Bid with a bidder shall not oblige the City to enter into a Contract with a particular bidder, nor shall it constitute an acceptance of a Bid.

9.6 All verification under this section shall form part of the Bid, be in writing, and be in a form satisfactory to the City.

## 10 Acceptance & Irrevocability of Bid

10.1 A Bid shall be irrevocable and open for acceptance by the City of Hamilton for a period of 90 days following the closing date and time of the Request for Tenders.

10.2 Where the City is unable to award a Contract prior to the expiry of the irrevocability period, the City may, on or prior to that expiry date, make a request to each of the compliant bidders to confirm, in writing, their willingness to hold their Bid prices, extend the term of their Bid Security and extend the irrevocability period for the specific period of time requested by the City.

## 11 Award of Contract

11.1 The City shall notify the Successful Bidder as soon as practicable after the award of the Contract. Despite any requirement for the formal execution of a Contract, the Contract shall be deemed to arise upon the award of the Contract to the Successful Bidder.

11.2 Where a Request for Tenders is awarded to a bidder in respect of the Work and in accordance with the provisions of the Request for Tenders and Bid, the bidder shall be required to either:

11.2.1 execute a Contract on the form set out in the Request for Tenders and approved by the City's Legal Services Division; or

11.2.2 where the form of Contract in Article 11.2.1 is not required they shall be assigned a contract number and the Request for Tenders and the Bid shall become the Contract in respect of the Work.

11.3 The award letter will identify documents required by the City prior to being able to issue a purchase order, the timeline for providing those documents to the City and the name of the Project Manager who will coordinate the start date for the Work.

11.4 The Base Bid Price for each compliant Bid received as well as the Contract award information may be obtained from the following website:

https://hamilton.bidsandtenders.ca

## 12 Conflict of Interest, Lobbying and Collusion

12.1 The City may reject any Bid submitted where a bidder is in contravention of the City's Procurement Policy with respect to conflict of interest.

12.2 Other than as expressly permitted or required in the Request for Tenders a bidder and their representative shall not, with respect to the Request for Tenders or the Work, make any public comment, respond to questions in a public forum, or carry out any activities to publicly promote or advertise their qualifications, their Bid, or their interest in this competitive procurement process.

12.3 For greater certainty, a bidder shall not communicate with the City regarding this procurement except through the Tender Coordinator identified on the Communications page of the Request for Tenders who shall be the City's single point of contact for the bidder during this process.

12.4 The bidder acknowledges that this Bid is made without any connection, comparison of figures or arrangements with, or knowledge of, any other person making a Bid for the same work and is in all respects fair and without collusion or fraud.

## 13 Confidentiality

13.1 A bidder should be aware that all information submitted is being collected under authority of the Municipal Act, 2001, and may be used in the City's review of Bids and in the Contract that is entered into with the Successful Bidder. In this regard, the bidder should be aware that:

13.1.1 the bidder's name and Base Bid Price at a minimum will be made public. In addition, certain contractual information must be disclosed to Council and accordingly may become part of the public record; and

13.1.2 all correspondence, documentation and information provided by a bidder to the City as part of a Bid may be reproduced for the purposes of reviewing the bidder's Bid and/or for the purposes of an audit of the procurement process.

13.2 All such information is also subject to collection in accordance with the Municipal Freedom of Information and Protection of Privacy Act ("MFIPPA") and Personal Health Information Protection Act ("PHIPA") and City policies and procedures related to the collection and administration of such records. For greater particularity and direction regarding how such issues of confidentiality will be handled and may affect a bidder's rights, the bidder should reference the City's policies related to Freedom of Information on the City's website under the Office of the City Clerk at hamilton.ca. In preparing the Bid, the bidder should note the following:

13.2.1 a bidder may mark as confidential any scientific, technical, commercial, proprietary or similar confidential information contained in its Bid, the disclosure of which could cause it injury, excluding the Base Bid Price and its name. A bidder shall not identify the whole of a Bid as confidential. A watermark or rubber stamp imprint is suitable to identify confidential parts of a Bid.

13.3 All correspondence, documentation and information provided by the City, its employees, agents or representatives to any bidder in connection with, or arising out of the Request for Tenders remains the property of the City and must not be used

for any purpose other than for replying to the Request for Tenders. Confidentiality of records and information of the City relating to the Work described in the Request for Tenders must be maintained at all times. If any proprietary or confidential information belonging to, or in the care of, the City is disclosed to any bidder by the City's employees, agents, representatives and independent contractors, or any other person at the request of the City in connection with the Request for Tenders, the bidder shall:

13.3.1 safeguard all such information;

13.3.2 maintain in strict confidence and not reproduce or disclose any such information to any person except as required by law or as expressly permitted in advance by the City in writing;

13.3.3 return forthwith all such information as may be in documentary form or recorded electronically by the closing date and time; and

13.3.4 not use any such information for any purpose other than the purpose for which it was provided by the City or by any other person at the request of the City.

## 14 Withdrawal of Bids by Bidder

14.1 Withdrawal of a Bid after it has been submitted and received by the Bidding System, is permitted only prior to the closing date and time of the Request for Tenders.

14.2 Requests made after the closing date and time of the Request for Tenders to withdraw a Bid received by the Bidding System will be disregarded.

14.3 A Bid withdrawn prior to the closing date and time of the Request for Tenders may be revised and re-submitted at any time prior to that closing date and time. Bidders are solely responsible to ensure:

14.3.1 any required revisions are made to their Bid;

14.3.2 acknowledge all Addenda that have been issued for this Request for Tenders; and

14.3.3 ensure the re-submitted Bid is received by the Bidding System prior to the closing date and time of the Request for Tenders.

## 15 Price

15.1 No variation in Bid price(s) shall be permitted after the closing date and time of the Request for Tenders except where the City corrects an obvious computational or other mathematical error evident on the face of the Bid. Only extensions, subtotals and totals shall be corrected. No modification to individual prices, either Unit Price or Lump Sum Price, shall be made by the City.

15.2 Where the bidder is instructed to price the Work on a Stipulated Price basis only, no corrections to the Base Bid Price shall be made by the City.

15.3 The Base Bid Price must be quoted on an all-in basis and include the provision and delivery of all necessary labour, Goods, materials, warranty and maintenance requirements, Services, tools, equipment, supplies, utilities, levies and duties and other incidentals, and for performing all the Work and providing all Services contemplated under the Contract.

15.4 The Base Bid Price and all other prices quoted on the Form of Tender shall be exclusive of Value Added Taxes. All other taxes shall be included in the prices submitted for this Request for Tenders.

Where there is a variation due solely to an increase or decrease in the rate of applicable Value Added Tax from a Canadian taxing authority, beyond the control of the Successful Bidder, occurring after the time and date of submission of its Bid, the variation shall alter the price of the Bid only to the extent of the Value Added Tax increase or decrease. The Successful Bidder must prove to the satisfaction of the City that the Successful Bidder will not benefit in any way by reason of any increase to the Base Bid Price.

15.5 As various parts of the Work may or may not be exempt from Value Added Taxes, the bidder is required to refer to the Supplementary Instructions to Bidders for details, if any, respecting payment exemptions, rebates and Value Added Taxes.

## 16 Reserved Privileges of the City

The City shall have the following reserved privileges, which may be exercised or waived in its absolute discretion.

16.1 The City may reject a Bid on the following basis:

16.1.1 the City may reject any Bid, the lowest Bid or all Bids, may cancel the Request for Tenders or may cancel the Request for Tenders and require the submission of new Bids;

16.1.2 any extraordinary or unjustified disparity between the lowest Bid and the other Bids received by the City;

16.1.3 the need to avoid the use of unproven technology and methodologies;

16.1.4 the prior record of the bidder as a contractor to the City;

16.1.5 a Bid submitted by a person which in the opinion of the City or its professional advisors, does not possess the experience, or financial, technical, personnel or other resources that may reasonably be expected to be necessary in order to carry out the obligations that the bidder proposes to assume under the terms of its Bid.

16.2 Where the Contract is awarded to the lowest compliant bidder, the City may negotiate amendments to the Contract or to the Work to be done or Services or materials to be supplied under the Contract.

16.3 Where none of the Bids are compliant and in the opinion of the City it is impractical to reissue a new Request for Tenders, the City will reject all of the Bids and may permit Bids to be submitted without issuing a new Request for Tenders.

16.4 Where the Base Bid Price for the lowest compliant Bid received substantially exceeds the estimated procurement cost of the Work, the City may negotiate with the lowest compliant bidder for a reduction to the Base Bid Price.

16.5 The City maintains the right to verify any information provided or contained in any Bid.

16.6 The City reserves the ability to exercise the rights, privileges and authority contained in the Procurement Policy and procedures thereunder with respect to the Request for Tenders.

## 17 Notice to Proceed and Start Date

17.1 The City may issue a written notice to proceed to the Successful Bidder prior to the execution of any required Contract.

17.2 Work shall commence on the start date specified in the notice to proceed, unless otherwise agreed by the Successful Bidder and the City.

## 18 Applicable Law and Limit on Liability

18.1 The City shall not be liable, in any way, to the bidder for any delays, or costs associated with delays, in the Request for Tenders process.

18.2 The bidder agrees that,

18.2.1 any action or proceeding relating to the Request for Tenders process shall be brought in an Ontario court of competent jurisdiction and any such action or proceeding shall be issued at the Hamilton, Ontario office of that Court and for that purpose each party irrevocably and unconditionally attorns and submits to the jurisdiction of that Ontario court at Hamilton, Ontario;

18.2.2 it irrevocably waives any right to and will not oppose any Ontario action or proceeding relating to the Request for Tenders process on any jurisdictional basis, including forum non conveniens; and

18.2.3 it will not oppose, in any other jurisdiction, the enforcement against it of any judgment or order duly obtained from an Ontario court in Hamilton, Ontario as set out above.

18.3 If a bidder is required by applicable law to hold or obtain a licence, permit, consent or authorization to carry on an activity contemplated in its Bid, neither acceptance of

the Bid nor execution of the Contract shall be considered to be approval by the City of carrying on such activity without the requisite licence, permit, consent or authorization.

18.4 The bidder agrees that if the City commits a material breach of the Request for Tenders (that is, a material breach of Contract A), the City's liability to the bidder and the aggregate amount of damages recoverable against the City for any matter relating to or arising from that material breach, whether based upon an action or claim in contract, warranty, equity, negligence, intended conduct or otherwise, including any action or claim arising from the acts or omissions, negligent or otherwise, of the City, shall be no greater than the Bid preparation costs that the bidder seeking damages from the City can demonstrate.

## 19 Accommodations for Bidders with Disabilities

19.1 In accordance with the Ontario Human Rights Code, Ontarians with Disabilities Act, 2001 (ODA) and Accessibility for Ontarians with Disabilities Act, 2005 (AODA), the City of Hamilton will accommodate for a disability, ensuring full and equitable participation throughout the bid process.

19.2 If a bidder requires this Request for Tenders in a different format to accommodate a disability, the bidder must contact the Tender Coordinator as soon as possible and in any event prior to the closing date. The Request for Tenders in the different format will be issued only to the requesting bidder and all Addenda will be issued in such different format only to the requesting bidder.

# SUPPLEMENTARY INSTRUCTIONS TO BIDDERS

## 1. Mandatory Site Meeting

There is a mandatory site meeting scheduled. Failure of a Bidder to attend this site meeting will result in the rejection of any Bid submission by that Bidder.

**Location:** **Wentworth Lodge Long Term Care Facility,**
**41 South Street, Dundas, ON,**
**L9H 4C4 (see location map attached)**
**Date:** **Thursday, February 6th, 2020**
**Time:** **1:30pm, Hamilton time**

**All attendees are required to wear CSA approved hard hats and safety boots. If an attendee does not have the required personal protection equipment they may not be allowed to attend the site meeting.**

## 2. TAXES

There are no supplementary instructions regarding Value Added Taxes.

## 3. BID SECURITY

Bidders shall submit Bid Security in accordance with Article 5 Bid Security of the Instructions to Bidders in the amount of not less than **$35,000.00.**

## 4. JOINT VENTURES

For greater certainty, a Bid must be submitted by a single entity as the bidder. The City will not accept a Bid from a collection of entities jointly submitting as the bidder. The single entity submitting the Bid must not be a special purpose company incorporated solely for the purpose of entering into a Contract with the City regarding the Work. The bidder shall be expected to perform the Work either through itself, or through itself and any subcontractors.

## 5. RECORD AND REPUTATION

See the City of Hamilton Procurement Policy for specific requirements and obligations at:

hamilton.ca/buying-selling-city/bid-tenders/procurement-policy-by-law

## 6. AWARD OF CONTRACT

Subject to the Reserved Privileges of the City set out in Article 16 of the Instructions to Bidders, the Contract shall be awarded to the compliant Bid with the lowest Base Bid Price.

## 7. BID SUBMISSION

Electronic Bid submissions only, shall be accepted and received by the Bidding System, **on or before 3:00:59 p.m., Hamilton time, Monday February 24th, 2020**.

## 8. SPECIFIED PRODUCTS OR SERVICES

Specified product or service by name, trade or company is regarded as the standard of quality required by the Specifications. **No alternates or substitutes will be considered prior to the award of the Contract**. After the award of the Contract, should the Successful Bidder want the City to approve an alternate or substitute for a specified product or service, the Successful Bidder shall make such request in writing to the City, which the City may consider, in its sole discretion. No alternate nor substitution for a specified product or service required by the Specifications shall be made by the Successful Bidder without the prior written approval of the City.

## 9. PROPOSED TIMELINE

| **Event** | **Date** |
|---|---|
| Proposal closing date | Monday February 24. 2020 |
| Anticipated award date | March 31, 2020 |
| Commencement of Work | **4 weeks from award date (End of April 2020)** |

## 10. POLICIES, REGULATIONS AND GUIDELINES

The Successful Bidder shall be aware of and adhere to all of the applicable City Policies and Legislation set out on the City of Hamilton website at:

hamilton.ca

## 11. DECLARATION OF BIDDER COMPLIANCE WITH CITY BY-LAWS

Should the bidder's declaration in its Form of Tender that it is in compliance with all City of Hamilton by-laws be untrue or incorrect, the City shall be entitled at its sole discretion to reject the bidder's Bid.

# LUMP SUM BREAKDOWN OF BASE BID PRICE

## Contract Number: C13-04-20

**Section "1" – Base Bid Price Breakdown Excluding Provisional Items**

**LOCATION: Wentworth Lodge**

For information purposes, after opening of the Bids, the two apparent low bidders are required to submit to the City, within two Business Days of the closing date of the Request for Tenders, the breakdown of their Base Bid Price. The breakdown shall be given according to the following Lump Sum Breakdown. The City may refuse to accept any breakdown, which contains prices considered to be unbalanced and request the bidder to adjust the breakdown to correct such unbalancing, and by submitting its Bid, the bidder agrees to do so upon such request by the City.

| ITEM NO. | DESCRIPTION | UNITS | TOTAL PRICE |
|---|---|---|---|
| 1.1 | Mechanical - Equipment and Installation | LUMP SUM | $ |
| 1.2 | Electrical - Equipment and Installation | LUMP SUM | $ |
| 1.3 | Proprietary BAS Controls - Equipment and Programming including controllers, control devices, configuration, programming, graphics, commissioning. | LUMP SUM | $ |
| 1.4 | Non-Proprietary BAS Controls - Devices and Installation | LUMP SUM | $ |
| 1.5 | Air and Hydronic Testing and Balancing | LUMP SUM | $ |
| | **Total of Item No. 1.1, 1.2, 1.3, 1.4 & 1.5** | **$** | _____ |

l.m. - linear metre
sq. m. - square metre
ea. - each

**SECTION "2" - Provisional Items**

**LOCATION: Wentworth Lodge**

| ITEM NO. | DESCRIPTION | UNITS | TOTAL PRICES |
|---|---|---|---|
| 2.1 | Provide Administration area upgrades including VAV box, ductwork modifications, controls upgrades. | LUMP SUM | $ |
| 2.2 | Provide 9 1st floor radiant panel control valves including piping, controls, wiring, control devices. | LUMP SUM | $ |
| 2.3 | Provide 13 2nd floor radiant panel control valves including piping, controls, wiring, control devices. | LUMP SUM | $ |
| 2.4 | Provide air handler controls as indicated on G. Air Handlers AHU-1,2,3,4. | LUMP SUM | $ |
| | | **Total of Item No. 2.1, 2.2, 2.3 & 2.4** | **$** _____ |

Notes:

If this Contract or Form of Tender contains a Provisional Item, the Contractor is not entitled to payment thereof except for the extra or additional work carried out by him, as directed by the City and in accordance with the Contract and only to the extent of such extra or additional work and payment approved by the City.

The City reserves the right to delete from the Base Bid Price one or more of the items identified in the Form of Tender as Provisional Items, for credit at the price shown in the table. All prices are inclusive of all duties and taxes applicable, except for Value Added Taxes.

**CCDC 2 - 2008**
**STIPULATED PRICE CONTRACT**

A copy of the CCDC 2 – 2008 Stipulated Price Contract is not being reproduced for this RFT and the English version can be purchased at:

http://www.ccdc.org/documents/ccdcoutlets.pdf

## SUPPLEMENTARY CONDITIONS TO CONTRACT CCDC 2-2008

### SC 1. GENERAL

These Supplementary Conditions presuppose the use of the Standard Construction Document CCDC 2-2008 Stipulated Price Contract, English version. These "Supplementary Conditions" void, supersede or amend the "Agreement", "Definitions" and "General Conditions" as hereinafter provided, as the case may be.

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

### SC 2. AGREEMENT

1. Add new paragraph 1.4 to Article A-1 THE WORK, as follows:

    1.4 Provide all the labour, material, equipment, machinery, *Products* and work including, without limitation, all *Commissioning* services required by the *Contract Documents* in order to fully complete and construct the *Work* and in accordance with, and satisfaction of all *Applicable Laws* including, without limitation, those relating to occupational health and safety and any and all obligations, responsibilities and duties required by or set in any site plan agreement or approval, attributable to the *Place of the Work* and/or the proposed development therein, and furnish efficient business and construction administration and superintendence consistent with the interests of the *Owner*.

2. Add documents to the existing list of *Contract Documents* in paragraph 3.1 of Article A-3 CONTRACT DOCUMENTS as follows:

    - Addenda, as issued
    - the Special Provisions
    - *Project* specific Supplementary Conditions to Contract CCDC 2-2008
    - Supplementary Conditions to Contract CCDC 2-2008
    - the *Form of Tender* as approved and accepted by the *Owner*
    - detailed *Contract Price* Breakdown or Lump Sum Breakdown of Base Bid Price
    - the *Specifications*
    - *Drawings*

3. In paragraph 5.1, insert "ten" between "of" and "percent", and "10" before "%".

4. Delete paragraphs 5.2 and 5.3 from Article A-5 PAYMENT in their entirety and replace with the following:

5.2 As such payments become due, the *Contractor* shall, in accordance with the terms of its agreements with any *Subcontractors*, *Suppliers* and workers, pay all of its *Subcontractors*, *Suppliers* and workers in full on account of work properly performed or *Products* properly supplied, as applicable, less any holdback monies retained in compliance with the *Construction Act* (Ontario).

5.3 In the event of loss or damage occurring where payment becomes due under the property and boiler insurance policies, payments shall be made to the *Contractor* in accordance with the provisions of GC 11.1 - INSURANCE.

5.4 Interest

.1 Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by arbitration or court, interest at the rate prescribed by the *Construction Act* (Ontario) on such unpaid amounts shall also become due and payable until payment. Such interest shall be compounded on a monthly basis.

.2 Interest shall apply at the rate and in the manner prescribed by paragraph 5.4.1 of this Article on the settlement amount of any claim in dispute that is resolved either pursuant to Part 8 of the General Conditions - DISPUTE RESOLUTION or otherwise, from the date the amount would have been due and payable under the *Contract*, had it not been in dispute, until the date it is paid.

5. Amend Article A-6 RECEIPT OF AND ADRESSES FOR NOTICES IN WRITING as follows:

(a) Delete “or other form of electronic communication during the transmission of which no indication of failure of receipt is communicated to the sender” from the second sentence of paragraph 6.1 and replace with the following: “or, in the case of the *Notices in Writing* specified below, other form of electronic communication during the transmission of which no indication of failure of receipt is communicated to the sender”.

(b) Add the following after the fifth sentence of paragraph 6.1 and before the signing lines: “The only *Notices in Writing* which will be delivered by electronic communication are applications for progress payment, applications for final payment, and notices of non-payment. All other *Notices in Writing* will be delivered by hand, by courier, by prepaid first class mail or by facsimile.”

6. Delete Article A-7 LANGUAGE OF THE CONTRACT in its entirety.

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

**ARTICLE A-9 CONFLICT OF INTEREST**

9.1 The *Contractor*, all of the *Subcontractors*, and any of their respective advisors, partners, directors, officers, employees, and agents shall not engage in any activity or provide any services where such activity or the provision of such services creates a conflict of interest (actually or potentially, in the sole opinion of the *Owner*) with the provision of the *Work* pursuant to

the *Contract*. The *Contractor* acknowledges and agrees that a conflict of interest includes the use of *Confidential Information* where the *Owner* has not specifically authorized such use.

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

9.3 The *Contractor* covenants and agrees that it will not hire or retain the services of any employee or previous employee of the City of Hamilton where to do so constitutes a breach by such employee or previous employee of the *Owner*'s conflict of interest policy, as it may be amended from time to time.

9.4 A breach of this Article by the *Contractor*, any of the *Subcontractors*, or any of their respective advisors, partners, directors, officers, employees, agents, and volunteers shall entitle the *Owner* to terminate the *Contract*, in addition to any other rights and remedies that the *Owner* has in the *Contract*, in law, or in equity.

8. Add new Article A-10 CONFIDENTIALITY as follows:

**ARTICLE A-10 CONFIDENTIALITY**

10.1 The *Contractor* agrees to ensure that it shall, both during or following the term of the *Contract*, maintain the confidentiality and security of all *Confidential Information* and *Personal Information*, and that it shall not directly or indirectly disclose, destroy, exploit, or use any *Confidential Information* or *Personal Information*, except where required by law, without first obtaining the written consent of the *Owner*. The *Contractor* may disclose any portion of the *Contract Documents* or any other information provided to the *Contractor* by the *Owner* to any *Subcontractor* or *Supplier* if the *Contractor* discloses only such information as is necessary to fulfill the purposes of the *Contract* and the *Contractor* has included a commensurate confidentiality provision in its contract with the *Subcontractor* or *Supplier*. The *Contractor* acknowledges that it will comply with all requirements of the *Personal Information Protection and Electronic Documents Act*. The *Contractor* acknowledges that the *Owner* is bound by the provisions of the *Municipal Freedom of Information and Protection of Privacy Act ("MFIPPA")*. The *Contractor* further acknowledges that the *Owner* may be required to disclose any or all of the *Confidential Information* and *Personal Information* in the event that it is compelled to do so by law, through a request under *MFIPPA*, or by the rules of any applicable regulatory authority.

## SC 3. DEFINITIONS

1. Add before "*Substantial Performance of the Work*" in Definition 8. Contract Time, the following:

"the date of"

2. Add to the end of Definition 16. Provide, the following:

"or supply, install or connect as applicable, complete and in place, including accessories, finishes, tests, services required to render each item so specified complete and ready for use."

3. Add after "The *Work* means the total construction" in Definition 25. Work, the following:

", *Products*, installation, C*ommissioning*, checkout, start-up testing"

4. Delete Definition 26. Working Day in its entirety and replace with the following:

*Working Day* means a day when the *Owner*'s administrative offices are open, and does not include weekends or statutory holidays.

5. Add new Definitions as follows:

27. **Applicable Laws**
*Applicable Laws* and applicable laws means all public laws, statutes, regulations, transactions, codes, acts, orders, by-laws, rules, judgements, decrees, treaties, *Governmental Consents*, notices, protocols, binding policies and guidelines, and requirements of all *Governmental Authorities*, which now or hereafter, may be applicable to and enforceable against the *Work* or any part thereof, including those relating to employment, zoning, building, life/safety, environment and health, and includes, where appropriate, any interpretation of a rule, statute, regulation, order, decree, treaty or other requirement having the force of law by any person having jurisdiction over it, or charged with its administration or interpretation.

28. **As-Built Drawings**
*As-Built Drawings* means the *Drawings* and *Specifications* revised by the *Contractor* during the *Work*, showing any and all changes or variations to the *Work* from the requirements of the *Drawings* and *Specifications***.**

29. **Authorities Having Jurisdiction**
The phrase *Authorities Having Jurisdiction* or the term *Authorities* means those authorities having jurisdiction under *Applicable Laws* over the *Work* or parts thereof.

30. **Commission**
*Commission* means and *Commissioning* refers to the procedure which includes checking, balancing, testing, adjusting and measuring *Work*

performed by the *Contractor* to demonstrate and verify to the *Owner* and *Consultant*, the satisfactory installation, operation and performance of all components of the *Work* and that the *Project* is ready for use.

31. **Confidential Information**

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

(1) is or becomes generally available to the public without fault or breach on the part of the *Contractor*, including without limitation breach of any duty of confidentiality owed by the *Contractor* to the *Owner* or to any third party, but only after that information becomes generally available to the public;

(2) the *Contractor* can demonstrate to have been rightfully obtained by the *Contractor* from a third party who had the right to transfer or disclose it to the *Contractor* free of any obligation of confidence;

(3) the *Contractor* can demonstrate to have been rightfully known to or in the possession of the *Contractor* at the time of disclosure, free of any obligation of confidence; or

(4) is independently developed by the *Contractor* without use of any *Confidential Information*.

32. **Construction Costs**

*Construction Costs* means the direct costs of all the elements of the *Work* or a change in the *Work* as the case may be. A cost that can be applied wholly to a particular item of the *Work*, or a change in the *Work*, should be considered part of the *Construction Costs*, excluding all *Value Added Taxes*, *Overhead Costs*, and profit.

33. **Contemplated Change Order**

*Contemplated Change Order* means a standard document issued to the *Contractor* by the *Consultant* on behalf of the *Owner*, requesting that the *Contractor* provide pricing for a change to the scope of the *Work*. Authorization of the *Contemplated Change Order* is formalized by a *Change Order* prior to the *Work* proceeding.

34. **Fair Wage Policy**

*Fair Wage Policy* means the City of Hamilton's Fair Wage Policy and Fair Wage Schedule available on the City of Hamilton's website at: hamilton.ca/buying-selling-city/bids-tenders/fair-wage-policy-and-fair-wage-schedule

35. **Final Completion of the Work**

*Final Completion of the Work* shall have been reached when the *Work* has previously been deemed substantially performed as defined in these *Contract*

*Documents*, and all deficiencies and incomplete *Work* have been completed and certified by the *Consultant*, prior to the release of final holdback monies on the *Project*.

36. **Force Majeure**

*Force Majeure* means a delay in the performance of the services occurring other than as a result of the deliberate act or negligence of either party respectively, and which:

(1) could not have been reasonably foreseen, and

(2) was caused by an event beyond the reasonable control of each party respectively, and

(3) for the sake of greater certainty, shall include any one or more of the following:

(i) acts of God, the Queen or Her enemies;
(ii) civil war, insurrections or riots;
(iii) fires, floods, explosions, earthquakes, or serious accidents;
(iv) unusually severe weather, epidemics, or quarantine restrictions;
(v) governmental priorities or allocation regulations or orders affecting materials, labour, equipment and facilities;
(vi) fuel shortages or freight embargoes;
(vii) strikes or labour troubles causing cessation, slowdown, interruption of work or other similar events relating to a person other than the *Contractor* (or any *Subcontractor*) or to the *Owner*.

Financial difficulties experienced by the *Contractor* will not be considered an occurrence of a *Force Majeure* under the *Contract*.

37. **Form of Tender**

*Form of Tender* means the City's forms entitled Form of Tender and Schedule of Prices and any other documents that were supplied as part of the request for tenders/request for proposals for the *Contract*, and were completed and submitted by the *Contractor* back to the *Owner*.

38. **Governmental Authority**

*Governmental Authority* means any federal, provincial, or municipal government and any agency, authority, body, board or commission established by any of them. It includes the police and fire departments.

39. **Governmental Consent**

*Governmental Consent* means any license, right, permit, franchise, privilege, registration, direction, decree, consent, order, permission, approval, or authority to be issued or provided by, or written contract between the *Owner* and a *Governmental Authority*.

40. **Overhead Costs**

*Overhead Costs* means those costs that cannot be attributed to a single task of *Work* and are exclusive of *Construction Costs*, *Value Added Taxes*, and profit. *Overhead Costs* include both general and administrative costs of the *Contractor* or *Subcontractor* together with any and all *Project* specific or office

costs of the *Contractor* or *Subcontractor*. Without limiting the generality of the foregoing, *Overhead Costs* include costs associated with general conditions, administration, head office, field office, management, supervision, coordination, scheduling, purchasing, security, health and safety, general labour, accommodation, subsistence, travel, storage, inventory, loading and unloading, computers and electronics, software, printing, general tools and equipment, standby costs and charges, vehicles, engineering, drafting, shop drawings, submittals, surveying, temporary facilities, traffic control, fire safety, sanitation, site clean-up, utilities and services, controls, insurance, bonding, heating, winterization, permits, inspection, regulatory fees, mobilization, demobilization, and other costs of a similar reasonable nature.

41. **Personal Information**
*Personal Information* has the same definition as in subsection 2(1) of *MFIPPA* and includes an individual's name, address, telephone number, and date of birth, whether recorded in printed form, on film, by electronic means, or otherwise and disclosed to the *Contractor*.

42. **Request for Information (RFI)**
*Request for Information* ("RFI") means a standard document typically issued by the *Contractor* to the *Consultant*, requesting a clarification of the scope of *Work* provided in the *Contract Documents*. The response to the RFI typically results in a formal *Supplemental Instruction* where there is no modification of the original scope of the *Work*, or a *Contemplated Change Order* from which the *Contractor* may provide pricing for the revision to the original scope of the *Work*.

43. **Substantial Performance Date**
*Substantial Performance Date* means the date by which the *Contractor* shall attain *Substantial Performance of the Work* as specified in Article A-1 – THE WORK.

44. **Statutory Declaration**
*Statutory Declaration* means the form of the statutory declaration to be delivered by the *Contractor* upon applications for progress payment, release of holdback and final payment, being CCDC 9A – 2001 Statutory Declaration (latest edition available).

## SC 4. GC 1.1 CONTRACT DOCUMENTS

1. Delete subparagraph 1.1.7.1 in its entirety and replace with the following:

.1 the order of priority of documents, from highest to lowest, shall be

- *Change Orders* and/or *Change Directives*
- the executed Agreement between the *Owner* and the *Contractor*
- detailed *Contract Price* breakdown or Lump Sum Schedule Breakdown
- the *Form of Tender* as approved and accepted by the *Owner*

- Addenda, as issued
- Special Provisions
- *Project* specific Supplementary Conditions
- Supplementary Conditions to Contract CCDC 2-2008
- Definitions
- the General Conditions of the Stipulated Price Contract
- the *Specifications*
- *Drawings*

2. Add new subparagraph 1.1.7.5 as follows:

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

3. Delete paragraph 1.1.8 in its entirety and replace with the following:

   1.1.8 The *Owner* shall provide the *Contractor,* without charge, a maximum of six (6) copies of the *Contract Documents* to perform the *Work.* The *Contractor* is responsible for the provision of any additional sets required in order to complete the *Work*, at no cost to the *Owner*.

4. Delete "and shall remain the *Consultant's* property" from the first sentence of paragraph 1.1.9 and replace with the following:

   "not the *Contractor's* property"

## SC 5. GC 1.2 LAW OF THE CONTRACT

1. Add new paragraphs 1.2.2 and 1.2.3 as follows:

   1.2.2 The *Contractor* agrees that:
   - .1 any action or proceeding relating to the *Contract* shall be brought in a court of competent jurisdiction in the City of Hamilton and for that purpose each party irrevocably and unconditionally attorns and submits to the jurisdiction of that court;
   - .2 it irrevocably waives any right to and will not oppose any action or proceeding relating to the *Contract* on any jurisdictional basis, including forum non conveniens; and
   - .3 it will not oppose in any other jurisdiction, the enforcement against it, of any judgment or order duly obtained from a Hamilton court as set out above.

   1.2.3 The *Contractor* shall comply with all municipal by-laws as they pertain to the City of Hamilton in respect of the operation of the *Contractor's* business and the *Work*. Further, the *Contractor* shall, at all times that the Contract is in effect and upon request of the *Owner*, provide proof of compliance satisfactory to the *Owner*, at the *Contractor's* own cost. If the Contractor fails to do any of the foregoing, the *Contractor* shall be considered to be in default

of the *Contract* in accordance with GC7.1.2 and the *Owner* shall be entitled at its sole discretion to terminate the *Contract* and to pursue any other legal recourse the *Owner* deems appropriate.

## SC 6. GC 1.3 RIGHTS AND REMEDIES

1. Add to the beginning of paragraph 1.3.2, the following:

"Except with respect to the notice requirements set out in paragraphs 6.4.1, 6.5.4, and 6.6.1,"

2. Add new paragraph 1.3.3 as follows:

1.3.3 All rights and remedies of the parties for any breach by the other party of its obligations under the *Contract* shall be cumulative and not exclusive or mutually exclusive alternatives, may be exercised singularly, jointly or in combination and shall not be deemed to be in exclusion of any other rights or remedies available to the non-breaching party under the *Contract* or otherwise at law or in equity or by statute.

## SC 7. GC 1.4 ASSIGNMENT

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

1.4.1 The *Contractor* shall not assign the *Contract*, or any portion thereof, without the prior written consent of the *Owner*, which consent may not be unreasonably withheld. The *Owner* shall be entitled to assign the *Contract* to any person or other entity (the "Assignee"). Upon the assumption by the Assignee of the *Owner*'s obligations under the *Contract*, the *Owner* shall be released from its obligations arising under the *Contract*.

2. Add new paragraph 1.4.2 as follows:

1.4.2 Neither the use of one or more *Subcontractors* to carry out part of the *Work*, nor the assignment of the whole or of any part of the *Contract* or the *Work* to be done under it shall relieve the *Contractor* of its obligations and liability to the *Owner*.

## SC 8. MUNICIPAL CONFLICT OF INTEREST

1. Add new general condition GC 1.5 MUNICIPAL CONFLICT OF INTEREST as follows:

### GC 1.5 MUNICPAL CONFLICT OF INTEREST

1.5.1 The *Owner* may terminate the *Contract* where the *Contractor* is in contravention with the *Owner*'s Procurement Policy with respect to conflict of interest.

## SC 9. ENTIRE CONTRACT, AMENDMENTS TO BE IN WRITING

1. Add new general condition GC 1.6 ENTIRE CONTRACT, AMENDMENTS TO BE IN WRITING as follows:

### GC 1.6 ENTIRE CONTRACT, AMENDMENTS TO BE IN WRITING

1.6.1 The *Contract Documents* (including all properly authorized *Change Directives* and *Change Orders*) constitute the entire *Contract* between the parties. Each of the parties,

.1 acknowledges that it is not relying upon any representation, warranty, promise, instruction, advice or information received from the other party or from any employee or agent of the other party, except as set out in the *Contract Documents*;

.2 shall not rely at any time in the future on any representations, warranty, instruction, advice or information purportedly received from the other party or any employee or agent of the other party, except as set out in a properly authorized *Change Order*, *Change Directive* or in an amendment as provided under this section.

1.6.2 The *Contract* shall not be deemed to be or construed as having been amended as a result of any oral communication between the parties or as a result of any practice of the parties, but all amendments to the *Contract* shall be in writing and shall be signed by both parties, provided that any such amendment may be executed in counterpart form.

## SC 10. NON-DISCLOSURE AND NO COMMENT

1. Add new general condition GC 1.7 NON DISCLOSURE AND NO COMMENT as follows:

### GC 1.7 NON-DISCLOSURE AND NO COMMENT

1.7.1 The *Contractor* shall not disclose details relating to the *Contract*, *Work* or *Project* to any outside person not engaged in activities relating to the *Contract*, *Work* or *Project*, and shall restrain its employees from giving unauthorized information with respect thereto.

1.7.2 The *Contractor* shall refer all inquiries from whatever source relating to the works to be undertaken within the scope of the *Contract* to the *Consultant*.

## SC 11. OWNER'S ACCESS TO SITE

1. Add new general condition GC 1.8 OWNER'S ACCESS TO SITE as follows:

### GC 1.8 OWNER'S ACCESS TO SITE

1.8.1 The *Owner* shall have the right to enter and occupy the *Place of the Work* in whole or in part, for the purpose of placing fittings and equipment or for other uses before the issuance of the certificate of the *Substantial Performance of the Work*, where in the opinion of the *Consultant*, such entry and occupancy will not interfere unreasonably with the *Contractor*'s delivery of the *Work*.

1.8.2 Notwithstanding paragraph 1.8.1, the parties agree that during the term of the *Contract*, the *Owner* may inspect any and all aspects of the *Project*, at all reasonable times, for the purpose of ensuring that the *Contractor* is carrying out the *Work* and other obligations in accordance with the *Contract*.

## SC 12. PATENTS AND OTHER INTELLECTUAL PROPERTY

1. Add new general condition GC 1.9 PATENTS AND OTHER INTELLECTUAL PROPERTY as follows:

### GC 1.9 PATENTS AND OTHER INTELLECTUAL PROPERTY

1.9.1 Where the *Work* or *Project* to be carried out requires the installation or use of any patented or other protected intellectual property,

.1 belonging to the *Contractor*, the *Contract Price* shall be deemed to include the grant of a perpetual license from the *Contractor* to the *Owner* to make use of that intellectual property;

.2 belonging to any other person, the *Contractor* shall obtain and assign to the *Owner* a perpetual license from the owner thereof entitling the *Owner* to make use of that intellectual property, and the cost thereof shall be deemed to be included in the *Contract Price*.

## SC 13. GC 2.1 AUTHORITY OF THE CONSULTANT

1. Delete from the end of paragraph 2.1.2, the following:

", the *Contractor* and the *Consultant*"

2. Delete from paragraph 2.1.3, the following:

"against whom the *Contractor* makes no reasonable objection and"

## SC 14. GC 2.2 ROLE OF THE CONSULTANT

1. Add after "promptly inform the *Owner*" in paragraph 2.2.4, the following

"within twenty-four (24) hours"

2. Delete from the beginning of paragraph 2.2.7, the following:

"Except with respect to GC5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER,"

3. Add to the end of paragraph 2.2.10, the following:

"and not more than forty-eight (48) hours after receipt of the written query unless otherwise agreed to by the parties."

4. Add after "with reasonable promptness" in paragraph 2.2.13, the following:

"but not more than five (5) *Working Days* after receipt of a written Request for Information from the *Contractor*"

5. Add after ", the *Consultant* does not guarantee" in the second sentence of paragraph 2.2.17, the following:

"to the *Contractor*"

6. Add to the end of paragraph 2.2.18, the following:

"The *Consultant* shall ensure that all such warranties and documents submitted for approval and for the *Owner's* records are in accordance with the *Contract Documents* prior to the documents being forwarded."

7. Add new paragraph 2.2.19 as follows:

2.2.19 The *Consultant* will provide the *Contractor* in writing with bench marks and points of reference to be used by the *Contractor* in setting out the *Work*. The *Owner* will be responsible only for the correctness of the information so supplied. From these bench marks and points of reference the *Contractor* will do its own setting out. The setting out by the *Contractor* shall include but shall not be limited to the preparation of grade sheets, the installation of centre lines stakes, grades stakes, offsets and site rails.

## SC 15. GC 2.3 REVIEW AND INSPECTION OF THE WORK

1. Add to end of paragraph 2.3.2, the following:
"Reasonable notice shall not be less than twenty-four (24) hours prior to the testing and inspection"

2. Add after "inspection reports relating to the Work" in paragraph 2.3.3, the following:

", and in any event no later than two (2) *Working Days* from the date of the inspection"

## SC 16. GC 2.4 DEFECTIVE WORK

1. Add after "failing to conform to the *Contract Documents*" in paragraph 2.4.1, the following:

"at the *Contractor's* expense"

2. Add new paragraphs 2.4.1.1, 2.4.1.2 as follows:

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

2.4.1.2 The *Contractor* shall prioritize and schedule the correction of any defective *Work* which, in the sole discretion of the *Owner*, adversely affects the day to day operation of the *Owner*.

## SC 17. GC 3.1 CONTROL OF THE WORK

1. Add after "construction means, methods, techniques," in paragraph 3.1.2, the following:

"schedule,"

2. Add new paragraph 3.1.3, as follows:

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

## SC 18. GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS

1. Delete subparagraphs 3.2.2.1 and 3.2.2.2 in their entirety.

2. Add to the end of subparagraph 3.2.2.3, the following:

"; the *Contractor* acknowledges that, if the *Owner* does not enter into any other contracts for the *Project*, the *Contractor* is the "constructor" and the "employer" within the meaning of the Occupational Health and Safety Act (Ontario) and the *Contractor* undertakes to carry out the duties, obligations and responsibilities of the constructor and the employer with respect to the *Project*. In the event that the *Owner* enters into more than one contract for the *Project*, or when work is performed by the *Owner's* own forces, the *Owner* agrees to fulfill all of the duties, obligations and responsibilities required under the *Occupational Health and Safety Act* (Ontario). Without restricting the generality of any other term or condition in the Contract, the *Contractor* shall indemnify and hold harmless the *Owner* from any liability for claims, damages or penalties, including reasonable legal fees to defend any offences, arising from the *Contractor's* failure to comply with the duties, responsibility and obligations of the constructor and the employer under the *Occupational Health and Safety Act* (Ontario)."

3. Add new subparagraph 3.2.3.4 as follows:

3.2.3.4 Subject to General Condition 6.1.1 Owners Right to Make Changes and GC 9.4 - CONSTRUCTION SAFETY, where paragraph 3.2.4 of GC 3.2 - CONSTRUCTION BY OWNER OR OTHER CONTRACTORS applies, for the *Owner's* own forces and for other contractors performing work within the construction site limits identified in the *Contract Documents*, assume overall responsibility for compliance with all aspects of the applicable health and safety legislation in the *Place of the Work*, including all of the responsibilities of the constructor as that term is defined in the *Occupational Health and Safety Act*.

**SC 19. GC 3.4 DOCUMENT REVIEW**

1. Delete paragraph 3.4.1 in its entirety and replace with the following:

3.4.1. The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency or omission the *Contractor* may discover. Such review by the *Contractor* shall comply with the standard of care described in paragraph 3.14.1 of the *Contract*. Except for its obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or to the *Consultant* for the accuracy of the *Contract Documents*. The *Contractor* shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Contract Documents*, which the *Contractor* could not reasonably have discovered. If the *Contractor* does discover any error, inconsistency or omission in the *Contract Documents,* the *Contractor* shall not proceed with the work affected until the *Contractor* has received corrected or missing information from the *Consultant*.

2. Add new paragraphs 3.4.2 and 3.4.3 as follows:

3.4.2 The *Contractor* shall follow the procedures as set forth in the *Contract Documents*. All requests are to be formal, written, and tracked, beginning with a *Request for Information* from the *Contractor*. If the *Request for Information* results in a change to the *Work* as specified in the *Contract Documents*, the *Consultant* will then issue a written request for *Change Order*, as set forth in GC 6 - CHANGES IN THE WORK.

3.4.3 If, at any time, the *Contractor* finds errors, inconsistencies, or omissions in the *Contract Documents* or has any doubt as to the meaning or intent of any part thereof, the *Contractor* shall immediately notify the *Consultant*, through a *Request for Information*. The *Contractor* shall not proceed with the work until the *Consultant* has responded to the *Request for Information*, and in dealing with such error, inconsistency or omission the *Contractor* shall co-operate with the *Owner* and the *Consultant* in good faith to resolve such errors, inconsistency or omission so as to avoid any increase in the *Contract Price* or delay in the progress of the *Work*. Neither the *Owner* nor the *Consultant* will

be responsible for the consequences of any action of the *Contractor* based on oral instructions.

## SC 20. GC 3.5 CONSTRUCTION SCHEDULE

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

3.5.1 The *Contractor* shall:

.1 prior to the first application for payment, prepare and submit to the *Owner* and the *Consultant* for their review and acceptance, a construction schedule that indicates the timing of the activities of the *Work* and provides sufficient detail of the critical events and their inter-relationship to demonstrate the *Work* will be performed in conformity with the *Contract Time* and in accordance with the *Contract Documents.* The *Contractor* shall employ construction scheduling software, where required by the *Specifications,* that permits the progress of the *Work* to be monitored in relation to the critical path established in the schedule. The *Contractor* shall provide the schedule and any successor or revised schedules in both electronic format and paper copy. Once accepted by the *Owner* and the *Consultant*, the construction schedule submitted by the *Contractor* shall become the baseline construction schedule;

.2 provide the expertise and resources, such resources including manpower and equipment, as are necessary to maintain progress under the accepted baseline construction schedule or any successor or revised schedule accepted by the *Owner* pursuant to GC 3.5 - CONSTRUCTION SCHEDULE;

.3 monitor the progress of the *Work* on a weekly basis relative to the baseline construction schedule, or any successor or revised schedule accepted by the *Owner* pursuant to GC 3.5 - CONSTRUCTION SCHEDULE, update the schedule on a monthly basis and advise the *Consultant* and the *Owner* in writing of any variation from the baseline or slippage in the schedule; and

.4 if, after applying the expertise and resources required under subparagraph 3.5.1.2, the *Contractor* forms the opinion that the variation or slippage in schedule reported pursuant to subparagraph 3.5.1.3 cannot be recovered by the *Contractor*, it shall, in the same notice, indicate to the *Consultant* and the *Owner* if the *Contractor* intends to apply for an extension of *Contract Time* as provided in PART 6 of the General Conditions - CHANGES IN THE WORK.

2. Add new paragraphs 3.5.2, 3.5.3, 3.5.4, 3.5.5, 3.5.6., 3.5.7, 3.5.8, 3.5.9 and 3.5.10 as follows:

3.5.2 If, at any time, it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to become behind schedule, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant* pursuant to subparagraph 3.5.1.3, the *Contractor* shall take appropriate steps to cause the actual progress of the *Work* to conform to the

schedule or minimize the resulting delay and shall produce and present to the *Owner* and the *Consultant* a recovery plan demonstrating how the *Contractor* will achieve the recovery of the schedule. If the *Contractor* intends to apply for a change in the *Contract Price* in relation to a schedule recovery plan, then the *Contractor* shall proceed in accordance with GC 6.5 – DELAYS.

3.5.3 Where a *Force Majeure* occurs, the *Consultant* shall determine the number of days (if any) to be allowed by reason thereof for the *Substantial Performance of the Work*.

3.5.4 An extension of time may be granted under this section by the *Consultant* where in the *Consultant's* reasonable opinion it is appropriate in all of the circumstances to do so;

.1 by reason of the occurrence of a *Force Majeure*;

.2 by reason of a *Change Directive* or *Change Order*;

.3 where the *Owner*, for any reason, directs that *Work* be discontinued; provided that,

(1) an extension under subparagraph 3.5.4.1 shall not entitle the *Contractor* to any additional payment; and

(2) any other extension shall entitle the *Contractor* to additional overhead costs only to the extent that the *Consultant* is satisfied that such costs will increase by reason of the extension.

3.5.5 Any extension of time so granted shall not exceed the amount that is reasonably required. Requests for extension will be evaluated collectively, rather than on an individual *Change Directive* or *Change Order* basis, provided that the collective evaluation shall not be less frequently than at least once per quarter. There is no presumption that the time required to carry out a *Change Directive* or *Change Order* will necessarily extend the date of the *Substantial Performance of the Work* by the same length of time. Instead, the *Consultant* shall make an independent determination of whether an extension is required.

3.5.6 An extension of time under this section shall be for such time as the *Consultant* may prescribe as being fair and reasonable and the *Consultant* shall fix the terms on which the said extension may be granted.

3.5.7 An application for an extension of time as herein provided shall be made in writing by the *Contractor* to the *Consultant* through the *Change Order* process.

3.5.8 Any additional time granted for the completion of the *Contract* will be conditional upon the *Contractor* providing the *Owner* with evidence that all insurance, bonds or other securities, furnished to the *Owner* by the *Contractor*, have been increased and, if necessary, extended beyond the limit of the time extension.

3.5.9 Any extension of time that may be granted to the *Contractor* shall be so granted and accepted without prejudice to any rights of the *Owner*

whatsoever under the *Contract* and all of such rights shall continue in full force and effect after the time limited in the *Contract* for the completion of the *Work*, and whenever in the *Contract* power and authority is given to the *Owner* or the *Consultant* or any person to take any action consequent upon the act, default, breach, neglect, delay, non-observance or non-performance by the *Contractor* in respect of the *Work* or *Contract*, or any portion thereof, such powers or authorities may be exercised from time to time and not only in the event of the happening of such contingencies before the time limited in the *Contract* for the completion of the *Work* but also in the event of the same happening after the time so limited in the case of the *Contractor* being permitted to proceed with the execution of the *Work* under an extension of time granted by the *Consultant*. In the event of the *Consultant* granting an extension of time, time shall continue to be deemed of the essence with respect to that extension.

3.5.10 Due to the time constraints regarding the *Project*, the *Contractor* shall maintain rigorous control of all elements of the *Work* for which the deadlines are indicated in the *Contract Documents*.

## SC 21. GC 3.6 SUPERVISION

1. Delete paragraph 3.6.1 in its entirety and replace with the following:

3.6.1 The *Contractor* shall furnish a competent and adequate staff, who shall be in attendance at the *Place of the Work* at all times, as necessary, for the proper administration, co-ordination, supervision and superintendence of the *Work*; organize the procurement of all materials and equipment so that they will be available at the time they are needed for the *Work*, and keep an adequate force of skilled workmen on the job to complete the *Work* in accordance with all requirements of the *Contract Documents.* The appointed representatives shall not be changed except for valid reasons, at no additional cost to the *Owner*, and upon the *Contractor* obtaining the *Owner's* written consent, which consent will not be unreasonably withheld. Further, the Contractor shall not employ or continue to employ on the *Work* anyone to whom the *Owner* may reasonably object.

2. Add new paragraphs 3.6.3, 3.6.4, 3.6.5, 3.6.6, 3.6.7, 3.6.8 and 3.6.9 as follows:

3.6.3 The *Contractor* shall at all times have at the *Place of Work*, a full-time and competent construction superintendent who shall be capable of reading and thoroughly understanding plans and specifications and of adequately communicating with the *Consultant* and its representatives and who also must be thoroughly experienced in the type of *Work* being performed, and who shall be the recipient of all instructions from the *Consultant* or its authorized representatives. No work of any kind shall be carried out by the *Contractor* or its *Subcontractors* during prolonged absence of the construction superintendent.

3.6.4 The construction superintendent shall have full authority to execute the orders or directions of the *Consultant* without delay, and to promptly provide such materials, equipment, tools, labour and incidentals as may be required. The *Contractor* shall provide a superintendent regardless of the amount of *Work* subcontracted.

3.6.5 The *Contractor* shall provide the *Consultant* with the telephone and the address of its appointed representative(s), who could be contacted on matters relating to the *Contract*, (e.g. urgent messages or emergencies), and who shall be available within reasonable notice, twenty-four (24) hours a day, seven (7) days a week, on matters relating to the *Contract*.

3.6.6 The *Owner* may, at any time during the course of the *Work*, request the replacement of the appointed representative(s), where the grounds for the request involve incompetent or disorderly conduct or conduct which jeopardizes the safety and security of the site or the *Owner's* operations. Immediately upon receipt of the request, the *Contractor* shall make arrangements to appoint an acceptable replacement at no additional cost to the *Owner*.

3.6.7 The *Contractor* shall cause each *Subcontractor* at all times while the *Work* is being carried out, to have a fully competent supervisor at the *Place of the Work*, who is thoroughly familiar with all aspects of the *Project* for which that *Subcontractor* is responsible.

3.6.8 The superintendent shall not be employed in any other capacity at the *Place of Work*. Where it is necessary to employ a superintendent in some other capacity, the *Consultant* shall approve the extent to which a labour time charge may be claimed by the *Contractor* or a *Subcontractor* in respect of that superintendent.

3.6.9 The *Contractor* acknowledges that the replacement of the construction superintendent or project team members will have significant impacts on the *Project* schedule and quality of the *Work*; therefore, all measures will be taken by the *Contractor* in order to maintain the original team assigned to the *Project*. Replacement of any team members will result in a possible delay to the *Project* and will be the responsibility of the *Contractor* to make-up any such delays.

## SC 22. GC 3.7 SUBCONTRACTORS AND SUPPLIERS

1. Add to the end of paragraph 3.7.2, the following:

"Failure on the part of the *Contractor* to indicate in writing such *Subcontractors* and *Suppliers* to the *Owner*, shall be deemed to be a failure or refusal to enter into the *Contract*."

2. Add to the end of paragraph 3.7.4, the following:

"at the discretion of the *Consultant.*"

3. Add new paragraph 3.7.7 as follows:

3.7.7 The *Contractor* shall not change any of the *Subcontractors* or *Suppliers* proposed by the *Contractor* in writing and accepted by the *Owner* at the signing of the *Contract* without the *Owner's* written consent or execute any subcontracts for the performance of the *Work* without the *Owner's* prior written consent.

## SC 23. GC 3.8 LABOUR AND PRODUCTS

1. Add new paragraphs 3.8.4, 3.8.5, 3.8.6, 3.8.7, 3.8.8, 3.8.9, 3.8.10, 3.8.11, 3.8.12, 3.8.13, 3.8.14 and 3.8.15 as follows:

3.8.4 The cost for overtime required beyond the normal *Working Day* to complete individual construction operations of a continuous nature, such as pouring or finishing of concrete or similar work, or work that the *Contractor* elects to perform at overtime rates without the *Owner* or the *Consultant* requesting it shall not be chargeable to the *Owner* and shall be at the sole cost and expense of the *Contractor*.

3.8.5 The *Contractor* shall comply with all requirements set out in the *Fair Wage Policy*. The *Owner* has adopted the *Fair Wage Policy*, respecting contractors and subcontractors that must be adhered to on this *Project*.

3.8.6 The *Contractor* shall comply in all respects with the *Fair Wage Policy* and is fully responsible for ensuring that all of its *Subcontractors* also comply in all respects with the *Fair Wage Policy*.

3.8.7 All workers employed by the *Contractor* and its *Subcontractors* in connection with the *Work* or *Project* shall be paid or provided with wages, benefits and hours of work in accordance with the *Fair Wage Policy* which were in effect on the date of the closing of the request for tenders/request for proposals for the *Contract*.

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

3.8.9 The *Contractor* shall neither permit nor allow underaged persons contrary to *Applicable Laws*, the introduction or use of alcoholic beverages or illegal narcotics on or about the *Place of the Work*.

3.8.10 At the request of the *Owner* or *Consultant*, the *Contractor* shall remove from the *Place of the Work*, any person (whether employed on the *Work* or not) who, in the opinion of the *Owner* or *Consultant*, is incompetent, intoxicated or otherwise impaired, or who is conducting himself (or herself) improperly, and the *Contractor* shall not permit any such person to remain on the *Place of the Work*, nor to return to the *Place of the Work* without the written approval of the *Owner* or *Consultant* as the case may be.

3.8.11 Where required by the *Consultant*, the *Contractor* shall furnish a complete written statement of the origin, composition and manufacture of all materials to be supplied by them, and shall furnish samples thereof for testing purposes, if so instructed by the *Consultant*.

3.8.12 The *Consultant*'s approval of changed materials shall not be considered as waiver of objection to the *Work* or materials at any subsequent time due to their failure to conform to the *Specifications*.

3.8.13 The *Contractor* shall furnish for the *Consultant*'s approval, such material tests, mock-ups, mix designs and tests of items and/or materials manufactured or fabricated off the *Place of the Work* as the *Consultant* may reasonably request.

3.8.14 Specified product by name, trade or company is regarded as the standard of quality required by the *Specifications*. No substitution shall be made by the *Contractor* without the prior written approval of the *Owner*.

3.8.15 By-law 07-170 (City of Hamilton Licensing Code) regulates the trade licensing process in Hamilton. The By-law regulates all businesses of plumbing, heating, ventilation and air-conditioning, drain laying and building repair. The City of Hamilton's Standards & Licensing Section is responsible for the licensing of contractors and masters. Licenses are issued to contractors and masters working in the above noted trades.

**SC 24. GC 3.11 USE OF THE WORK**

1. Add new paragraph 3.11.3 as follows:

3.11.3 The *Contractor* shall abide by and enforce directives and policies regarding signs, advertisements, safety procedures, fires and smoking at the *Place of the Wor*k as directed by the *Owner*.

**SC 25. GC 3.13 CLEANUP**

1. Add new paragraphs 3.13.4, 3.13.5 and 3.13.6 as follows:

3.13.4 The *Owner* shall have the right to set-off the cost of cleaning to the *Contractor* if it is not done within twenty-four (24) hours of written notice to clean and the *Owner* shall have the right to set-off the cost of damage to the *Place of the Work* caused by the *Contractor's, the Subcontractor's* or the *Supplier's*

transportation in and out of the *Place of the Work* if not repaired within five (5) *Working Days* of written notice to repair or before final payment, whichever is earlier.

3.13.5 All material delivered to the *Place of the Work* shall be neatly stored or contained upon delivery only in areas as approved by the *Owner* or the *Consultant* and shall be secured and remain in the *Contractor's* control until installed.

3.13.6 The *Contractor* shall legally dispose forthwith of any debris and surplus material accumulated at the *Place of the Work*, and where requested, the *Contractor* shall provide to the *Consultant* a true copy of the original certificate approval from a waste management system and a true copy of the original certificate of approval from the place of disposal for all debris and surplus material disposed of by the *Contractor* under the *Contract*.

## SC 26. PERFORMANCE BY CONTRACTOR

1. Add new general condition GC 3.14 PERFORMANCE BY CONTRACTOR as follows:

### GC 3.14 PERFORMANCE BY CONTRACTOR

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

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

.1 the personnel it assigns to the *Project* are appropriately experienced;

.2 it has a sufficient staff of qualified and competent personnel to replace any vacancy, subject to the *Owner's* approval, resulting from death, incapacity, removal or resignation; and

.3 there are no pending, threatened or anticipated claims that would have a material effect on the financial ability of the *Contractor* to perform its work under the *Contract*.

## SC 27. SECURITY

1. Add new general condition GC 3.15 SECURITY as follows:

## GC 3.15 SECURITY

3.15.1 The *Contractor* is responsible to provide and maintain the *Place of the Work* in a secure manner, free from public access, trespassing, or vandalism. This provision is to be maintained on a twenty-four (24) hours per day, seven (7) days per week basis and may require such items as fencing, hoarding, lighting, security guards or systems, and security cameras.

## SC 28. GC 4.1 CASH ALLOWANCES

1. Delete paragraph 4.1.4 in its entirety and replace with the following:

    4.1.4 Where the actual cost of the *Work* under any cash allowance exceeds the amount of the allowance, any unexpended amounts from other cash allowances shall be reallocated, at the *Consultant's* direction, to cover the shortfall, and, in that case, there shall be no additional amount added to the *Contract Price* for overhead and profit. Only where the actual cost of the *Work* under all cash allowances exceeds the total amount of all cash allowances shall the *Contractor* be compensated for the excess incurred and substantiated, plus an amount for overhead and profit on the excess only, as set out in the *Contract Documents*.

2. Delete paragraph 4.1.5 in its entirety and replace with the following:

    4.1.5 The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the *Contract Price* by *Change Order* without any adjustment for the *Contractor's* overhead and profit on such amount.

3. Add new paragraph 4.1.8 as follows:

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

## SC 29. GC 4.2 CONTINGENCY ALLOWANCES

1. Add new paragraph 4.2.5:

    4.2.5 Any contingency allowance specified in the *Contract Documents*, the *Owner*'s Council resolution with respect to the *Contract*, or elsewhere, shall be deemed to be solely a budgetary authorization by the *Owner*. The *Contractor* shall have no right to draw upon any such contingency allowance for payment unless specifically authorized to do so by way of *Change Order*.

2. Add new paragraph 4.2.6:

    4.2.6 In the absence of a contingency allowance being shown on the *Contract Documents*, the *Contractor* is not to assume that there is one in place. The disclosure of any contingency allowances is at the discretion of the *Owner*.

## SC 30. GC 4.3 PROVISIONAL AMOUNTS

1. Add new general condition GC 4.3 PROVISIONAL AMOUNTS as follows:

### GC 4.3 PROVISIONAL AMOUNTS

4.3.1 The *Contract Price* includes provisional items, if any, as stated in the *Contract Documents*.

4.3.2 The *Contractor* is not entitled to payment of any provisional items except for the extra or additional work carried out by the *Contractor*, as directed by the *Owner* and in accordance with the *Contract* and only to the extent of such extra or additional work and payment approved by the *Owner*.

4.3.3 The *Owner* reserves the right to delete from the *Contract Price* any of the provisional items identified in the *Form of Tender*, for credit at the price shown. All prices are inclusive of all duties and taxes applicable, except *Value Added Taxes*.

## SC 31. GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

1. Delete GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER in its entirety.

## SC 32. GC 5.2 APPLICATIONS FOR PROGRESS PAYMENT

1. Add to the end of paragraph 5.2.1, the following:

Applications for payment shall be made by way of *Notice in Writing* and shall be delivered by electronic communication to both the *Consultant* and the *Owner*.

2. Add to the end of paragraph 5.2.3, the following:

The *Contractor* shall review with the *Consultant* and the *Owner*, at a scheduled time, the percentage of work completed for each item indicated in the schedule of values. This procedure shall be complied with for each application for payment prior to submitting the formal application for payment.

3. Delete paragraph 5.2.6 in its entirety and replace with the following:

Each application for payment shall meet the requirements of a “proper invoice” as defined in the *Construction Act* (Ontario) if the *Contractor* includes the following:

- a statement based on the schedule of values, which statement shall include the *Contract* number, *Project* name and purchase order number;
- breakdown of approved *Change Orders* and percentage completed of each;.
- a *Statutory Declaration* as required by paragraph 5.2.8; and
- any other requirement that the *Construction Act* (Ontario) prescribes for a proper invoice.

4. Add to the end of paragraph 5.2.7, the following:

Any *Products* delivered to the *Place of the Work* but not yet incorporated into the *Work* shall remain at the risk of the *Contractor* notwithstanding that title has passed to the *Owner* pursuant to General Condition 13.1 - OWNERSHIP OF MATERIALS.

5. Add new paragraphs 5.2.8, 5.2.9, 5.2.10, 5.2.11, 5.2.12, 5.2.13 and 5.2.14, as follows:

5.2.8 The *Contractor* must provide with each application after the first, a *Statutory Declaration*, certifying that all accounts for all subcontract, construction machinery and equipment, materials, *Products*, labour and other indebtedness which may have been incurred by the *Contractor* and for which the *Owner* might in any way be held responsible have been paid in full or will be paid with the proceeds from such application for payment, except for amounts properly retained as holdback or as an identified amount in dispute.

5.2.9 After the first application for payment and with each subsequent application for payment the *Contractor* shall submit evidence of compliance with the applicable worker's compensation legislation at the *Place of the Work,* including payments due thereunder.

5.2.10 Subject to the *Construction Act* and all other *Applicable Laws*, the *Owner* will pay to the *Contractor* ninety percent (90%) of the amount shown on such certificates, less previous payments, less the amount of any liens or any written notice of a lien of which the *Owner* has notice, plus 25% for security for costs, less the maintenance security referred to in GC 12.3 – WARRANTY, and less any amounts that the *Owner* deems necessary to retain for its protection against claims or liabilities or for any claim or claims the *Owner* may have against the *Contractor* under the *Contract*, other contracts, or otherwise, and such payments shall not in any way be construed as, nor shall it constitute, an acceptance of all or any part of the *Work* or material under the *Contract*. Once the reason for the *Owner* being entitled to withhold payment of any amount has been rectified, the amount withheld due to that reason will be paid by the *Owner* to the *Contractor.*

5.2.11 Deviation or incomplete submissions with respect to the breakdown of approved *Change Orders* and percentage completed of each will require resubmission of the application for payment.

5.2.12 If any Work or item under the *Contract* is included by the *Contractor* in its progress claims as partially or fully completed, but it is not completed in accordance with *Drawings* or *Specifications*, or is not completed to the *Consultant*'s satisfaction, the *Consultant* shall omit the partial or total cost of such items from the certificates of payment and shall notify the *Contractor* in writing of its action and the reason for same, and shall withhold payments for such items, over, above and distinct from applicable construction lien holdbacks, until they are completed or corrected to its full satisfaction.

5.2.13 The *Consultant* and/or the *Owner* shall not be held responsible for any delays in payment due to a disagreement in the amounts shown by the *Contractor* on their payment application as submitted to the *Consultant* for review.

5.2.14 The *Contractor* shall not submit an application for payment between the period of December 14 to January 4, inclusive, in any year. The *Contractor* shall not submit an application for payment during any other reasonable period which the *Owner* advises the *Contractor* in writing due to downtime for payment system upgrades.

**SC 33. GC 5.3 PROGRESS PAYMENT**

1. Add after "the *Consultant* will promptly inform the *Owner*" in subparagraph 5.3.1.1, the following:

"within twenty-four (24) hours"

2. Delete "10 calendar days" in subparagraph 5.3.1.2 and replace with "5 calendar days".

3. Delete subparagraph 5.3.1.3 in its entirety and replace with the following:

.3 the *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement - PAYMENT on or before the deadline prescribed by the *Construction Act* (Ontario).

4. Add new paragraph 5.3.2 as follows:

5.3.2 If the *Contractor* fails to comply with GC 5.2 – APPLICATIONS FOR PROGRESS PAYMENT or GC 10.4 – WORKERS' COMPENSATION, the *Owner* shall not be required to make payments to the *Contractor* until the obligation has been complied with, subject to the *Construction Act* (Ontario).

5. Add new paragraph 5.3.3 as follows:

5.3.3 All progress payments are not conclusive as to the value or quality of *Work* performed, and are subject to reopening and readjustment, until and including the date that the *Owner* releases the holdback for finishing work under the *Construction Act*.

**SC 34. GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK**

1. Add new subparagraph 5.5.1.3 as follows:

5.5.1.3 submit a statement that no written notices of lien have been received by it.

2. Delete “statement” from paragraph 5.5.2 and replace with the following: “documents”

3. Delete paragraphs 5.5.3, 5.5.4 and 5.5.5 in their entirety.

## SC 35. GC 5.6 PROGRESSIVE RELEASE OF HOLDBACK

1. Delete GC 5.6 - PROGRESSIVE RELEASE OF HOLDBACK in its entirety.

## SC 36. GC 5.7 FINAL PAYMENT

1. Delete paragraph 5.7.1 in its entirety and replace with the following:

    5.7.1 When the *Contractor* considers that the *Work* is completed, the *Contractor* shall submit an application for final payment. The *Contractor's* application for final payment shall be accompanied by any documents or materials not yet delivered pursuant to paragraph 5.4.5 and, for purposes of the Construction Act, the remaining Work is valued at more than $5,000. The *Work* shall be deemed not to be performed until all of the aforementioned documents have been delivered. Application for final payment shall be made by way of *Notice in Writing* and shall be delivered by electronic communication to both the *Consultant* and the *Owner*. Application for final payment shall meet the requirements of a “proper invoice” as set out in paragraph 5.2.6.

2. Delete “10 calendar days” in paragraph 5.7.2 and replace with “5 calendar days”.

3. Delete “5 calendar days after the issuance of a final certificate for payment” in paragraph 5.7.4 and replace with “the deadline prescribed by the *Construction Act* (Ontario)”.

4. Add new paragraph 5.7.5 as follows:

    5.7.5 Prior to the release of the holdback for finishing work under the *Construction Act*, the *Contractor* shall submit:
    .1 *Contractor's* written request for release of the holdback, including a statement that no written notices of lien have been received by it;
    .2 a *Statutory Declaration*; and
    .3 a final Workplace Safety & Insurance Board Clearance Certificate.

## SC 37. LIENS

1. Add new general condition GC 5.10 LIENS as follows:

    **GC 5.10 LIENS**

    5.10.1 In the event that a construction lien arising from the performance of the *Work* is claimed, the *Contractor* shall, if requested, undertake the *Owner's* defence of any subsequent lawsuit commenced in respect of the lien at the

*Contractor's* sole expense.

5.10.2 Without limiting any of the foregoing, the *Contractor* shall indemnify the *Owner* for all costs (including, without limitation, legal fees on a solicitor and client basis) it may incur in connection with the claim for lien or subsequent lawsuit brought in connection with the lien, or in connection with any other claim or lawsuit brought against the *Owner* by any person that provided services or materials to the *Project* lands which constituted a part of the *Work*.

5.10.3 This GC 5.10 does not apply to construction liens claimed by the *Contractor*.

## SC 38. PAYMENT BY ELECTRONIC FUNDS TRANSFER

1. Add new general condition GC 5.11 PAYMENT BY ELECTRONIC FUNDS TRANSFER as follows:

### GC 5.11 PAYMENT BY ELECTRONIC FUNDS TRANSFER

5.11.1 The term "EFT" refers to electronic funds transfer and may also include the payment information transfer.

5.11.2 All payments by the *Owner* under the *Contract* shall be made by EFT as a direct deposit to a Canadian chartered bank, save and except where:

.1 the funds payable under the terms of the *Contract* are only payable in a single lump sum and not payable by installments or progress payments or otherwise than a single lump sum payment; or

.2 the Owner is unable to release one or more payments by EFT, in which case the *Contractor* agrees to either:

(1) accept payment by cheque or some other mutually agreeable method of payment; or

(2) request the *Owner* to extend payment due dates until such time as the *Owner* makes payment by EFT, subject to paragraph 5.11.4.

5.11.3 Mandatory Submission of the *Contractor*'s EFT Information

.1 The *Contractor* is required to provide the *Owner* with the information required for the *Owner* to make payment by EFT. A purchase order may not be issued to the *Contractor* without this requisite information.

.2 In the event that the EFT information changes, the *Contractor* shall be responsible for providing forthwith the updated information to the *Owner*.

.3 Where the *Contractor* provides changes to the EFT information more than once in a calendar year, the *Contractor* shall also pay any fee approved by the Council of the City of Hamilton for each additional change.

5.11.4 Suspension of Payment

.1 The *Owner* is not required to make any payment under the *Contract* until its designated officer has received the correct EFT payment

information from the *Contractor*. Until receipt of the correct EFT information, any invoice or contract payment request shall be deemed not to be a proper invoice or valid request for the purpose of payment under the *Contract*. No interest or any other manner of claim whatsoever for delayed or non-payment shall be permitted as a result of incorrect EFT information or improper delivery of EFT payment information.

.2 If the EFT information changes after submission of correct EFT information, the *Owner* shall have thirty (30) calendar days within which to update the changed EFT information after its receipt by the designated officer to the extent payment is made by EFT. However, the *Contractor* may request that no further payments be made until the updated EFT information is implemented by the *Owner*'s payment office. If such suspension would result in a late payment under any payment terms of the *Contract*, the *Contractor*'s request for suspension shall extend the due date for payment by the number of days of the suspension.

5.11.5 Liability for Uncompleted or Erroneous Transfers

.1 If an uncompleted or erroneous transfer occurs because the *Owner* used the *Contractor*'s EFT information incorrectly, the *Owner* remains responsible for making a correct payment.

.2 If an uncompleted or erroneous transfer occurs because the *Contractor*'s EFT information was incorrect, or was revised within thirty (30) calendar days of the *Owner*'s release of the EFT payment transaction instruction, and

.3 Funds are no longer under the control of the *Owner*'s payment office, the *Owner* is deemed to have made payment and the *Contractor* is responsible for recovery of any erroneously directed funds; or

.4 If the funds remain under the control of the *Owner*'s payment office, the *Owner* shall not make payment and the provisions of paragraph 5.11.4 shall apply.

5.11.6 EFT and Timely Payment

A payment shall be deemed to have been made in a timely manner in accordance with the payment terms of the *Contract* if, in the *Owner*'s EFT payment transaction instruction released to its bank, the date specified for settlement of the payment is on or before the last date for due payment under the terms of the *Contract*, provided the specified payment date is a valid date when the Owner's bank is open for business.

5.11.7 Liability for Change of EFT Information by Financial Agent

The *Owner* is not liable for errors resulting from changes to EFT information provided by the *Contractor*'s financial agent.

## SC 39. GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

1. Add new paragraph 6.1.3 as follows:

   6.1.3 The *Contractor* is not entitled to any compensation for loss or loss of anticipated profit as a result of the deletion of any major item or major part of an item.

## SC 40. GC 6.3 CHANGE DIRECTIVE

1. Delete subparagraph 6.3.6.3 in its entirety and replace with the following:

   .3 The *Contractor's* fee shall be as specified in GC 6.7 - EXTRA WORK, CLAIMS PAYMENT FROM CONTINGENCY or as otherwise agreed by the parties.

2. Delete subparagraph 6.3.7.1 in its entirety and replace with the following:

   .1 salaries, wages and benefits paid to personnel in the direct employ of the *Contractor* while directly engaged in the *Work* attributable to the change under a salary or wage schedule agreed upon by the *Owner* and the *Contractor,* or in the absence of such a schedule, actual salaries, wages and benefits paid under applicable bargaining agreement, and in the absence of a salary or wage schedule and bargaining agreement, actual salaries, wages and benefits paid by the *Contractor* while directly engaged in the *Work* attributable to the change*,* for personnel
   (1) stationed at the *Contractor's* field office, in whatever capacity employed;
   (2) engaged in the preparation or review of *Shop Drawings,* fabrication drawings, and coordination drawings; or
   (3) engaged in the processing of changes in the *Work.*

3. Delete "and hand tools not owned by the workers" from subparagraph 6.3.7.5 and replace with the following:
   "exclusive of hand tools"

4. Add to the end of subparagraph 6.3.7.9, the following:

   ", provided however that the cost included in such amounts shall be limited to the actual costs of the items described in this paragraph 6.3.7 changing "*Contractor"* to "*Subcontractor"* as necessary"

5. Add to the end of subparagraph 6.3.7.17, the following:

   "not caused by the *Contractor* or anyone for whom it is responsible"

6. Delete "thereof when requested" from paragraph 6.3.9 and replace with the following:

   "upon submission of any claim for costs related to the *Change Directive*"

7. Add to the end of paragraph 6.3.10, the following:
"The *Contractor* shall include all pertinent documentation as back-up with any claims for additional *Contract Time* and/or increase in *Contract Price* to the *Consultant* for review and approval."

8. Add after "proposed adjustment in the Contract Time from paragraph 6.3.12, the following:

"and/or *Contract Price*"

## SC 41. GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

1. Add new paragraph 6.4.5 as follows:

6.4.5 If the *Contractor* was given access to the *Place of the Work* prior to the submission of the bid on which the *Contract* was awarded, then the *Contractor* confirms that it carefully investigated the *Place of the Work* and, in doing so, applied to that investigation the degree of care and skill required by paragraph 3.14.1. In those circumstances, notwithstanding the provisions of paragraph 6.4.1, the *Contractor* is not entitled to an adjustment to the *Contract Price* or to an extension of the *Contract Time* for conditions which could reasonably have been ascertained by the *Contractor* by such careful investigation, or which could have been reasonably inferred from the material provided with the *Contract Documents*. In those circumstances, should a claim arise, the *Contractor* will have the burden of establishing that it could not have discovered the materially different conditions from a careful investigation, because of restrictions placed on its access or inferred the existence of the conditions from the material provided with the *Contract Documents*.

## SC 42. GC 6.5 DELAYS

1. Delete paragraph 6.5.1 in its entirety and replace with the following:

6.5.1 If the *Contractor* is delayed in the performance of the *Work* by an action or omission of the *Owner, Consultant* or anyone employed or engaged by the *Owner* directly, contrary to the provisions of the *Contract Documents,* then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor.* The *Contractor* shall be reimbursed by the *Owner* for reasonable costs incurred by the *Contractor* as the result of such delay, provided that the *Owner* shall not be liable for any other costs or damages whatsoever including, without limitation, any indirect, consequential, or special damages, such as loss of profits, loss of opportunity or loss of productivity resulting from such delay.

2. Add to the end of paragraph 6.5.2, the following:

", provided that the *Owner* shall not be liable for any other costs or damages whatsoever including, without limitation, any indirect, consequential, or special damages, such as loss of profits, loss of opportunity or loss of productivity resulting from such delay."

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

6.5.3 If the *Contractor* is delayed in the performance of *Work* by *Force Majeure* then the *Contract Time* shall be extended for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor.* The extension of time shall not be less than the time lost as the result of the event causing the delay, unless the *Contractor* agrees to a shorter extension. The *Contractor* shall not be entitled to payment for costs incurred by such delays unless such delays result from actions by the *Owner, Consultant* or anyone employed or engaged by them directly, provided that the *Owner* shall in such instance, only be liable for reasonable costs incurred by the *Contractor* and shall not be liable for any other costs or damages whatsoever including, without limitation, any indirect, consequential, or special damages, such as loss of profits, loss of opportunity or loss of productivity resulting from such delay. Notwithstanding the foregoing, the *Contractor* shall use its best efforts to minimize the impact of such event upon the performance of the *Work* and *Contract Time.*

1. Subject to the foregoing, each party shall be excused from performance so long as the *Force Majeure* persists, and shall not be considered to be in default under this section, if and to the extent that its failure of, or delay in performance is due to that *Force Majeure*.
2. Where a *Force Majeure* remains in effect for more than ninety (90) calendar days, either party may terminate the *Contract* upon thirty (30) calendar days written notice to the other party, provided at the time when that notice is given the *Force Majeure* is then continuing.
3. While a *Force Majeure* subsists which prevents the *Contractor* from proceeding with the *Work* under the *Contract*, the *Owner* may engage an alternate contractor on an interim basis, and the *Work* and the *Contract Price* will be adjusted accordingly.

4. Add new paragraph 6.5.6 as follows:

6.5.6 Where the *Project* is not totally completed within twenty (20) *Working Days* of the *Substantial Performance Date*, or at a time mutually agreed to by the parties, the *Owner* has the right to complete any remaining deficiencies or outstanding work and deduct the amount from monies that may be due or payable to the *Contractor.*

## SC 43. GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

1. Add new paragraph 6.6.7 as follows:

6.6.7 The *Owner* may make claims against the *Contractor* arising out of the costs incurred for additional services provided by the *Consultant* resulting from the

*Contractor's* failure to reasonably perform the *Work* in accordance with the terms and conditions of the *Contract*.

## SC 44. EXTRA WORK, CLAIMS, PAYMENT FROM CONTINGENCY.

1. Add new general condition GC 6.7 EXTRA WORK, CLAIMS, PAYMENT FROM CONTINGENCY, as follows:

### GC 6.7 EXTRA WORK, CLAIMS, PAYMENT FROM CONTINGENCY.

6.7.1 When a change in the *Work* is proposed or required, the *Consultant* may, on behalf of the *Owner*, issue a *Contemplated Change Order* to the *Contractor*. The Contractor shall upon receipt of a *Contemplated Change Order* promptly present to the *Consultant* a method of adjustment or, pursuant to paragraph 6.7.2, an amount of adjustment for the *Contract Price*, if any, and the adjustment in the *Contract Time*, if any, for the proposed change in the *Work*.

6.7.2 When the *Contractor* submits an amount of adjustment in response to a *Contemplated Change Order* or a *Change Directive*, the following provisions shall apply:

.1 Where the scope of *Work* identified by the *Contemplated Change Order* or *Change Directive* involves an adjustment in the *Contract Price*, the *Contractor* shall express and calculate the adjustment in the form of a written quotation with supporting documentation, acceptable to the *Consultant*, and to include an amount:

(1) representing the net change in *Construction Costs* of the *Work*, taking into account all credits and scope reductions resulting from the change;

(2) for *Overhead Costs* and profit calculated in accordance with paragraph 6.7.3; and,

(3) for *Value Added Taxes*.

.2 Where the scope of *Work* identified by the *Contemplated Change Order* or *Change Directive* involves an adjustment in the *Contract Time*, the *Contractor* shall express the number of *Working Days*, the reason and logic for the adjustment, and all the supporting documentation inclusive of a *Project* schedule identifying the impacted activities, their inter-relationship, and changes to the critical path.

.3 Notwithstanding any other provisions in the General Conditions or Supplementary Conditions of the *Contract*, it is the intention and agreement of the parties that the *Contractor's* submitted adjustment in *Contract Price*, if any, and the adjustment in *Contract Time*, if any, in response to a *Contemplated Change Order* or *Change Directive* shall be all-inclusive of any costs, claims, impacts, and liabilities of the *Contractor* and *Subcontractor*(s) whether known or unknown, direct or indirect, collective or cumulative.

.4 The Consultant and Owner are entitled to rely on the accuracy, completeness, and all-inclusive nature of the Contractor's submitted adjustment(s), if any, in response to a *Contemplated Change Order* or *Change Directive*. Once a *Change Order* has been issued for the

submitted adjustment(s) the *Contractor* shall not be entitled to any further claim or adjustment in the *Contract Price* or *Contract Time* associated, in part or whole, with the respective change.

6.7.3 Where an adjustment to the *Contract Price* and/or *Contract Time* is made for a change carried out by *Change Order* or *Change Directive*, the amount of *Overhead Costs* and profit for the *Contractor* and *Subcontractor* shall be calculated in accordance with the following provisions:

.1 Where a change in the *Work* is performed by the *Contractor's* own forces, *Overhead Costs* and profit shall not exceed an amount equal to 15% of the first $50,000.00 in additional *Construction Costs* and 5% thereafter;

.2 Where a change in the *Work* is performed by a *Subcontractor's* forces:

(1) The *Subcontractor's Construction Costs* for the change in the *Work* shall be all-inclusive to perform the change and be identified separate and apart from any *Value Added Taxes*, *Overhead Costs*, or profit of the *Subcontractor* or *Contractor*.

(2) The *Subcontractor's Overhead Costs* and profit shall not exceed an amount equal to 15% of the first $50,000.00 in additional *Construction Costs* and 5% thereafter; and

(3) The *Contractor's Overhead Costs* and profit shall not exceed an amount equal to 10% of the first $50,000 in additional *Subcontractor Construction Costs* and 5% thereafter;

.3 Where a change in the *Work* is performed both by the *Contractor's* own forces and a *Subcontractor's* forces the *Overhead Costs* and profit shall be calculated separately in accordance with paragraph 6.7.3.1 and 6.7.3.2 as the case may be, as applied proportionately to the total amount of change in *Construction Costs* being done by the *Contractor* and *Subcontractor*.

## SC 45. GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

1. Add before "OR TERMINATE THE CONTRACT" in the title of GC 7.1, the following:

   "SUSPEND THE WORK"

2. Delete "however, if such cost of finishing the *Work* is less than the unpaid balance of the *Contract Price*, the *Owner* shall pay the *Contractor* the difference" from subparagraph 7.1.5.3.

3. Delete paragraph 7.1.6 in its entirety.

4. Add new paragraphs 7.1.6, 7.1.7, 7.1.8, 7.1.9 and 7.1.10 as follows:

   7.1.6 In addition to its right to terminate the *Contract* set out herein, the *Owner* may terminate the *Contract* at any time for any other reason and without cause upon giving the *Contractor Notice in Writing* to that effect. In such event, the

*Contractor* shall be entitled to be paid for all *Work* performed including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Contract*, but in no event shall the *Contractor* be entitled to be compensated for any loss of profit on unperformed portions of the *Work*, or indirect, special, or consequential damages incurred.

7.1.7 The *Owner* may suspend *Work* under the *Contract* at any time for any reason and without cause upon giving the *Contractor Notice in Writing* to that effect. In such event, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of suspension and be compensated for all actual costs incurred arising from the suspension, including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the suspension of the *Work*, but in no event shall the *Contractor* be entitled to be compensated for any indirect, special, or consequential damages incurred. In the event that the suspension continues for more than one hundred and eighty (180) calendar days, the *Contract* shall be deemed to be terminated and the provisions of paragraph 7.1.6 shall apply.

7.1.8 In the case of either a termination of the *Contract* or a suspension of the *Work* under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* shall use its best commercial efforts to mitigate the financial consequences to the *Owner* arising out of the termination or suspension, as the case may be.

7.1.9 Upon the resumption of the *Work* following a suspension under GC 7.1 - OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK, SUSPEND THE WORK OR TERMINATE THE CONTRACT or GC 7.2 - CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT, the *Contractor* will endeavour to minimize the delay and financial consequences arising out of the suspension.

7.1.10 The *Contractor's* obligation under the *Contract* as to quality, correction, and warranty of the *Work* performed by the *Contractor* up to the time of termination or suspension shall continue after such termination of the *Contract* or suspension of the *Work*.

## SC 46. GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

1. Delete "20 *Working Days*" in paragraph 7.2.2 and replace with the following:

"ninety (90) *Working Days*"

2. Delete paragraph 7.2.3 in its entirety and replace with the following:

7.2.3 The *Contractor* may give *Notice in Writing* to the *Owner,* with a copy to the *Consultant,* that the *Owner* is in default of the *Owner's* contractual obligations if:

.1 subject to the other terms and conditions of the *Contract* the *Owner* fails to pay the *Contractor* when due the amounts certified by the *Consultant* or awarded by arbitration or court, except where the *Owner* has a bona fide claim for set-off, or

.2 the *Owner* violates the requirements of the *Contract* to a substantial degree and the *Consultant*, confirms by written statement to the *Contractor* and the *Owner,* that sufficient cause exists.

3. Delete paragraph 7.2.4 in its entirety and replace with the following:

7.2.4 The *Contractor's Notice in Writing* to the *Owner* provided under paragraph 7.2.3 shall advise that if the default is not corrected within twenty (20) *Working Days* following the receipt of the *Notice in Writing,* the *Contractor* may, without prejudice to any other right or remedy the *Contractor* may have, suspend the *Work* until the default is corrected*,* provided, however, that in the event of such suspension, the provisions of paragraph 7.1.10 shall apply. If the *Contractor's Notice in Writing* to the *Owner* was given pursuant to paragraph 7.2.3, then, ninety (90) *Working Days* after the delivery of the *Notice in Writing*, the *Contractor* may terminate the *Contract,* provided, however, that in the event of such termination, the provisions of paragraph 7.1.10 shall apply.

4. Delete paragraph 7.2.5 in its entirety and replace with the following:

7.2.5 If the *Contractor* terminates the *Contract* under the conditions set out above, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of termination and be compensated for all actual costs incurred arising from the suspension, including reasonable profit, for loss sustained upon *Products* and *Construction Equipment*, and such other damages as the *Contractor* may have sustained as a result of the termination of the *Work*, but in no event shall the *Contractor* be entitled to be compensated for any indirect, special or consequential damages incurred.

## SC 47. GC 8.2 NEGOTIATION, MEDIATION AND ARBITRATION

1. Delete paragraphs 8.2.6, 8.2.7 and 8.2.8 in their entirety.

2. Add new paragraphs 8.2.6 and 8.2.7 as follows:

8.2.6 When a dispute has not been resolved through negotiation or mediation, within ten (10) *Working Days* after the date of termination of the mediated negotiations under paragraph 8.2.5, either party may give a *Notice in Writing* to the other party and to the *Consultant* inviting the other party to agree to

submit the dispute to be finally resolved by arbitration, pursuant to provisions of the *Arbitration Act, 1991*. If the other party wishes to accept the invitation to submit the dispute to arbitration, it shall so indicate by the delivery of a responding *Notice in Writing* within ten (10) *Working Days* of receipt of the invitation. If, within the required times, no invitation is made or, if made, is not accepted, either party may refer the dispute to the courts or to any other form of dispute resolution, including arbitration, which the parties may agree to use.

8.2.7 The determination of a matter by an adjudicator under the *Construction Act* (Ontario) may be submitted to arbitration or the courts or other form of dispute resolution as provided in section 8.2.6 at any time.

## SC 48. GC 9.1 PROTECTION OF WORK AND PROPERTY

1. Delete "property adjacent to the *Place of the Work*" in paragraphs 9.1.1 and 9.1.3 and replace with the following:

"property adjacent, in the vicinity of or proximate to the *Place of the Work*"

2. Delete subparagraph 9.1.1.1 in its entirety and replace with the following:

.1 errors in the *Contract Documents* which the *Contractor* could not have reasonably discovered applying the standard of care described in paragraph 3.14.1;

3. Delete paragraph 9.1.2 in its entirety and replace with the following:

9.1.2 Before commencing any work, the *Contractor* shall determine the locations of all underground utilities and structures indicated in the *Contract Documents* or reasonably apparent from the *Contract Documents*, or that are reasonably apparent from an inspection of the *Place of the Work* exercising the degree of care and skill described in paragraph 3.14.1.

4. Add new paragraph 9.1.5 as follows:

9.1.5 With respect to any damage to which paragraph 9.1.4 applies, the *Contractor* shall neither undertake to repair or replace any damage whatsoever to the work of other contractors, or to property adjacent, in the vicinity of or proximate to the *Place of the Work*, nor acknowledge that the same was caused or occasioned by the *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*. Where, however, there is danger to life, the environment, or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger.

## SC 49. GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

1. Delete paragraph 9.2.6 in its entirety and replace with the following:

9.2.6 If the *Owner* and *Contractor* do not agree on the existence, significance of, or whether the toxic or hazardous substances were brought onto the *Place of the Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, or whether any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the *Owner* or others, the *Owner* shall retain and pay for an independent qualified expert to investigate and determine such matters. The expert's report shall be delivered to the *Owner* and the *Contractor.*

2. Delete subparagraph 9.2.7.4 in its entirety and replace with the following:

9.2.7.4 indemnify the *Contractor* from and against claims, demands, losses, costs, damages, actions, suits or proceedings made, suffered or brought by third parties arising out of or resulting from exposure to, or the presence of, toxic or hazardous substances for which the *Contractor* is not responsible under GC 9.2 – TOXIC AND HAZARDOUS SUBSTANCES at the Place of Work. This obligation shall not be construed to negate, abridge or reduce other rights or obligations of indemnity set out in GC 12.1 – INDEMNIFICATION or that otherwise exist respecting a person or party described in this paragraph.

3. Delete paragraph 9.2.8 in its entirety and replace with the following:

9.2.8 If the *Owner* and *Contractor* agree or if the expert referred to in paragraph 9.2.6 determines that the toxic or hazardous substances were brought onto the place of the *Work* by the *Contractor* or anyone for whom the *Contractor* is responsible, that any toxic or hazardous substances or materials already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the *Owner* or others, the *Contractor* shall promptly at the *Contractor's* own expense:

.1 take all necessary steps, in accordance with applicable legislation in force at the *Place of the Work,* to safely remove and dispose the toxic or hazardous substances;

.2 make good any damage to the *Work,* the *Owner's* property or property adjacent to the place of the *Work* as provided in paragraph 9.1.3 of GC 9.1- PROTECTION OF WORK AND PROPERTY;

.3 reimburse the *Owner* for reasonable costs incurred under paragraph 9.2.6; and as a result of the delay

.4 indemnify the Owner as required by GC 12.1 - INDEMNIFICATION.

## SC 50. GC 9.4 CONSTRUCTION SAFETY

1. Delete paragraph 9.4.1 in its entirety and replace with the following:

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

2. Add new paragraphs 9.4.2, 9.4.3, 9.4.4, 9.4.5, 9.4.6, 9.4.7, 9.4.8, 9.4.9, 9.4.10 and 9.4.11 as follows:

   9.4.2 Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner*:
   .1 documentation setting out the *Contractor's* in-house safety programs; and
   .2 a copy of the Notice of Project filed with the Ministry of Labour naming the *Contractor* as "constructor" under the *Occupational Health and Safety Act*.

   9.4.3 The *Contractor* shall indemnify, defend and save harmless the *Owner*, its agents, officers, directors, employees, consultants, successors, appointees, and assigns from and against the consequences of any and all safety infractions committed by the *Contractor* under the *Occupational Health and Safety Act*, including the payment of legal fees and disbursements on a solicitor and client basis. Such indemnity shall apply to the extent to which the *Owner* is not covered by insurance, provided that the indemnity contained in this paragraph shall be limited to costs and damages resulting directly from such infractions and shall not extend to any consequential, indirect or special damages.

   9.4.4 The *Owner* undertakes to include in its contracts with other contractors and in its instructions to its own forces the requirement that the other contractor or its own forces, as the case may be, comply with the policies and procedures of and the directions and instructions from the *Contractor* with respect to occupational health and safety and related matters. Prior to admission to the *Place of the Work*, the *Contractor* may, as a condition of admission, require any other contractor or the *Owner's* own forces to sign a written acknowledgement in the following form:

   **Acknowledgement**

   The undersigned acknowledges that the *Work* it will perform on behalf of the *Owner* requires it to enter a *Place of the Work* which is under the total control of a *Contractor* that has a contract with the *Owner*, pursuant to which the *Contractor* has assumed overall responsibility for compliance with all aspects of the applicable health and safety legislation, including all the responsibilities of the "constructor" under the *Occupational Health and Safety Act*, as well as

responsibility to co-ordinate and schedule the activities of our *Work* with the *Work* of the *Contractor* under its contract. The undersigned agrees to comply with the *Contractor*'s directions and instructions with respect to health, safety, co-ordination, and scheduling and acknowledges that its failure to do so will be cause for termination of employment or of the undersigned's contract with the *Owner,* as the case may be. The undersigned also agrees to have the *Contractor* named as an additional insured on any commercial general liability insurance policy, where such insurance is required.

9.4.5 Without limiting any of the foregoing, prior to commencement of the *Work*, the *Contractor* shall have both a written occupational health and safety policy and program to implement that policy, and that all of its employees, *Subcontractors* and any other persons performing the *Work* shall be appropriately trained, licensed and certified, as required to perform the *Work*.

9.4.6 The *Contractor* and *Subcontractors* shall comply with the safety by-laws of the *Owner*, the *Employment Standards Act, Occupational Health and Safety Act* and all regulations thereunder, any other legislation governing construction or workplace safety, and all instructions issued by the *Consultant* or any inspector appointed by the Province of Ontario or City of Hamilton.

9.4.7 The *Contractor* shall be responsible for keeping the work free from trespassers and for protection of the work and the public from any loss or injury from commencement of the work to *Substantial Performance of the Work*.

9.4.8 The *Contractor* shall comply with all applicable occupational health and safety requirements in force during the time when *Work* is being carried out, and shall provide at the *Place of the Work*, such equipment and medical facilities as are necessary to furnish first aid to anyone who may be injured in connection with the *Work*.

9.4.9 Before commencing with any *Work*, the *Contractor*, the *Consultant* and the *Owner's* representative shall meet at the *Place of the Work*, and establish safe routes and routines for material deliveries, material storage locations, construction office location, and all other aspects of the execution of all *Work*.

9.4.10 The *Contractor* shall erect and maintain during construction, a dependable temporary fence, barricades, warning lights, and signage around the perimeter of the *Place of the Work*, all hazardous areas and excavations, and the *Consultant* may give reasonable directions to the *Contractor* as to the type and extent of the fence, barriers, warning lights, and signage needed.

9.4.11 The *Contractor* shall, at its own expense, shore up or otherwise securely support or protect any buildings, walls, fences, pavement, boulevards or other structures at the *Place of the Work*, and on the adjoining properties which may be endangered or which may cause injury during the *Work*, and in case of damage, disturbance or injuries to any such structures during and attributable, whether directly or indirectly, to any work under the *Contract*, or

to any extra work entering into the *Contract*, the *Contractor* shall at its own expense, repair, rebuild or other wise make good all damage, injuries or disturbance to said structures and put all such structures in a condition the same as, or equal to, that existing previous to its beginning that work.

## SC 51. GC 9.5 MOULD

1. Add to the end of subparagraph 9.5.2.3, the following:

   "and incurred as a result of the delay"

2. Delete subparagraph 9.5.3.4 in its entirety and replace with the following:

   9.5.3.4 indemnify the *Contractor* from and against claims, demands, losses, costs, damages, actions, suits or proceedings made, suffered or brought by third parties arising out of or resulting from exposure to, or the presence of, mould for which the *Contractor* is not responsible under GC 9.5 – MOULD at the Place of Work. This obligation shall not be construed to negate, abridge or reduce other rights or obligations of indemnity set out in GC 12.1 – INDEMNIFICATION or that otherwise exist respecting a person or party described in this paragraph.

## SC 52. GC 10.1 TAXES AND DUTIES

1. Add to the end of paragraph GC 10.1.2 the following:

   "The *Contractor* must prove to the satisfaction of the *Owner* that the *Contractor* will not benefit in any way by reason of any increase to the *Contract Price*."

2. Add new paragraph 10.1.3 as follows:

   10.1.3 Where the *Owner* is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or *Value Added Taxes* applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner*, assist with application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over to the *Owner* any cheques received from the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph.

## SC 53. GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

1. Add to the beginning of paragraph 10.2.5, the following:

   "Subject to paragraph 3.4.1,"

## SC 54. GC 10.3 PATENT FEES

1. Add before “hold the *Owner* harmless” in the second sentence of paragraph 10.3.1, the following:

“indemnify and”

2. Add after “which was supplied to the Contractor” in paragraph 10.3.2, the following:

“by the *Owner*”

## SC 55. GC 10.4 WORKERS' COMPENSATION

1. Add after the words “Prior to commencing the *Work*,” in the first line of paragraph 10.4.1, the following:

“and upon execution of the Agreement, again with each application for progress payment,”

2. Add to the beginning of paragraph 10.4.2, the following

“The *Contractor* shall ensure that each *Subcontractor* complies with the workers' compensation legislation at the *Place of the Work.”*

## SC 56. GC 11.1 INSURANCE

1. Delete GC 11.1 INSURANCE in its entirety and replace with the following:

**GC 11.1 INSURANCE**

11.1.1 The *Contractor* shall obtain and maintain at its own expense, including the cost of any applicable deductible, the following policies of insurance.

.1 Commercial General Liability Insurance, written on IBC Form 2100 or its equivalent, including but not limited to bodily and personal injury liability, property damage, products liability, completed operations liability, owners & contractors protective liability, blanket contractual liability, premises liability, and contingent employer’s liability coverage, having an inclusive limit of not less than $2,000,000 per occurrence and $4,000,000 in the aggregate. To achieve the desired limit, Umbrella or Excess liability insurance may be used. Coverage shall be subject to the following:

(1) where the Work involves one or more of the following activities:

(i) the use of explosives for blasting;

(ii) vibration from pile driving or caisson work;

(iii) the removal or weakening of support of any property, building or land whether such support be natural or otherwise,

explosion, collapse and underground ("XCU") coverages shall be added by endorsement to the policy and noted on the certificate of insurance;

(2) where the Work provides for or contemplates the handling of asbestos, coverage shall not contain an asbestos exclusion and same shall be noted on the certificate of insurance. Alternatively, coverage may be provided under Contractors Pollution Liability Insurance providing coverage in an amount of not less than $1,000,000 per claim. Such Contractors Pollution Liability Insurance coverage shall remain in effect for 12 months following the completion of the Work.

(3) the policy shall include coverage for pollution from "hostile fires";

(4) unless otherwise approved by the *Owner*, the *Contractor's* deductible on the Commercial General Liability policy and, if applicable, Contractors Pollution Liability Insurance shall be not more than $100,000; and

(5) the insurance coverage shall remain in effect throughout the time that the *Contract* is in effect, including the warranty period.

.2 Standard Form Automobile Liability Insurance that complies with all requirements of the current legislation of the Province of Ontario, having an inclusive limit of not less than $5,000,000 per occurrence for third party liability, in respect of the use or operation of vehicles owned, operated or leased by the *Contractor* for the performance of the *Work* under the *Contract*. The insurance coverage shall remain in effect throughout the time that the *Contract* is in effect, including the warranty period. To achieve the desired limit, Umbrella or Excess liability insurance may be used;

.3 Non-Owned Automobile Liability Insurance in standard form having an inclusive limit of not less than $1,000,000 per occurrence, in respect of vehicles not owned by the *Contractor*, that are used or operated on its behalf for the performance of the *Work* under the *Contract.* The insurance coverage shall remain in effect throughout the time that the *Contract* is in effect, including the warranty period. To achieve the desired limit, Umbrella or Excess liability insurance may be used;

.4 Builders Risk Insurance which covers the *Place of Work* for the full amount of the *Contract Price* plus the full value of any optional features or other options that the *Owner* elects to order (but the *Owner* may require insurance up to the amount of the replacement cost of any

building or structure in, on, or upon which any *Work* is to be done under the *Contract*, where in the reasonable opinion of the *Owner* there is a sufficient risk of damage to the same). Such policy shall:

(1) apply to all risks of direct loss or damage (including theft and sinkhole) subject to the actual policy form;

(2) unless otherwise directed in writing by the *Owner*, or stipulated elsewhere herein, be in force and be maintained from the commencement date of the *Contract* until the day of issue of the certificate of *Substantial Performance of the Work;*

(3) apply to all *Products*, labour, equipment and supplies of every nature, the property of the *Owner* or *Contractor* or for which the *Owner* or *Contractor* may have assumed responsibility (whether on site or in transit), that is to be used in or pertaining to site preparation, and the erection, fabrication, construction, reconstruction, re-modeling or repair of any building, structure, other fixture or thing;

(4) include the installation, testing and any subsequent use of machinery and equipment, including boilers, pressure vessels or vessels under vacuum;

(5) include damage to the *Work* caused by an accident to or the explosion of any boiler or other pressure vessel or equipment forming part of the *Work*;

(6) include off-site storage, transit and installation risks;

(7) include flood and earthquake insurance;

(8) include coverage for loss of income, extra expense and/or expediting expense if such exposures exist;

(9) be subject to a waiver of coinsurance;

(10) permit use and occupancy of the *Project*, or any part thereof, where such use and occupancy is for the purposes for which the *Project* is intended upon completion;

(11) be endorsed to cover the interest of the *Owner* ;

(12) unless otherwise approved by the *Owner*, provide for a deductible of not more than $25,000; and

(13) provide that in the case of a loss or damage, payment shall be made to the *Owner* as their interest may appear. The *Contractor* shall act on behalf of the *Owner* for the purpose of adjusting the amount of such loss or damage payment with the

insurer. When the extent of the loss or damage is determined, the *Contractor* shall proceed to restore the *Work*. Loss or damage shall not affect the rights and obligations of either party under the *Contract* except that the *Contractor* shall be entitled to a reasonable extension of *Contract Time.*

.5 Property Insurance with respect to loss or damage (including fire, theft, burglary, etc.) of the *Contractor's* own property and property in its care, custody and control, including its equipment, tools and stock, used in connection with the *Contract*.

11.1.2 All polices of insurance required under paragraph 11.1.1 shall,

.1 be recorded as being a primary policy and shall be in a form and issued by an insurance company satisfactory to the *Owner*, that is licensed to carry on business in Ontario;

.2 be maintained continuously during the course of carrying out the *Work*, or for such period of time as may be required after completion of the *Work* as deemed necessary by the *Owner*;

.3 except in the case of standard form automobile liability insurance and non-owned automobile liability insurance, include the *Owner* named as an additional insured, to the extent of the *Contractor's* obligations to the *Owner* under the *Contract Documents*;

.4 contain cross liability and severability of interest provisions, as may be applicable;

.5 preclude subrogation claims against the *Owner* and any other person insured under the policy; and

.6 provide that at least 30 days prior written notice (15 days in the case of standard form automobile liability insurance, and 10 days in the event of non-payment of premiums) shall be given to the *Owner* by the insurer before the insurer or *Contractor* takes any steps to cancel, terminate, fail to renew, amend or otherwise change or modify the insurance or any part thereof.

11.1.3 The *Contractor* shall be responsible for deductible amounts under all of the policies of insurance required under paragraph 11.1.1.

11.1.4 The *Owner* reserves the right to require the *Contractor* to purchase such additional insurance coverage as the *Owner* may reasonably require. The *Owner* reserves the right to request such higher limits of insurance or otherwise alter the types of coverage requirements due to material or significant change arising from such matters as the nature of the work, agreement value, industry standards, and availability of insurance, as the *Owner* may reasonably require from time to time. Where such a right is exercised by the *Owner,* the *Owner* will compensate the *Contractor* for any resulting increase in applicable insurance premiums only where the *Contractor* can establish to the satisfaction of the *Owner*, acting reasonably, that such increase in applicable insurance premiums for the insurance required pursuant to the *Contract* does not result from the actions or

omissions, negligence, claims history or reassessment by the insurer of the insurable risk posed by the *Contractor*.

11.1.5 Any insurance coverage acquired under the *Contract* shall in no manner discharge, restrict or limit the liabilities assumed by the *Contractor* under the *Contract*. The dollar limit of insurance coverage shall not be limited to the *Contract Price*.

11.1.6 The *Contractor* shall pay all premiums on the policies as they become due provided that the *Owner* may pay premiums as they become due and deduct the amount thereof from monies due from the *Owner* to the *Contractor* should the *Contractor* fail to do so.

11.1.7 The *Contractor* shall deposit with the *Owner* such evidence of its insurance policies required under paragraph 11.1.1 at the time of execution of the Agreement and thereafter during the term of the *Contract*, no later than 20 Working Days prior to the renewal date of each applicable policy, a certificate of insurance originally signed by an authorized insurance representative confirming thereon relevant coverage information including but not limited to the Contract name and description, name of insurer, name of insurance broker, name of insured, name of additional insureds as may be applicable, commencement and expiry dates of coverage, dollar limits of coverage, deductible levels as may be applicable, cancellation/termination provisions; or at the *Owner's* election, a certified copy of the insurance policy or policies required under paragraph 11.1.1. The *Contractor* shall ensure that the certificate holder is identified on each certificate of insurance as the *Owner* at 71 Main Street West, Hamilton, Ontario L8P 4Y5, or at such other address as the *Owner* may advise in writing, and that all certificates, cancellation, nonrenewal or adverse change notices are mailed to that address.

11.1.8 The *Contractor* shall not do or omit to do anything that would impair or invalidate the insurance policies.

11.1.9 Delivery to and examination or approval by the *Owner* of any certificates of insurance or policies of insurance or other evidence of insurance does not relieve the *Contractor* of any of its indemnification or insurance obligations under the *Contract*. The *Owner* is not under a duty either to ascertain the existence of or to examine such certificates of insurance or policies of insurance, nor to advise the *Contractor* in the event such insurance coverage is not in compliance with the requirements set out in the *Contract*.

11.1.10 The *Contractor* shall promptly investigate claims reported to the *Contractor* by a third party or by the *Owner*. The *Contractor* shall make contact with the claimant within forty-eight (48) hours of the *Contractor's* receipt of notice of a claim. The *Contractor* shall initiate an investigation of the claim immediately upon notice, and advise the claimant by letter of its position regarding resolution of the claim within twenty (20) *Working Days* of the notice. The *Contractor* shall include in its letter of resolution the reasons for its position. Failing acceptance of the resolution by the claimant of the proposed

resolution, the *Contractor* agrees to report the claim to its insurer for further review and response to the claimant. Should the *Contractor* fail to follow this procedure, the *Owner* may investigate and resolve such claims, and offset the resultant costs against any monies due to the *Contractor*, from time to time, under the *Contract.*

## SC 57. GC 11.2 CONTRACT SECURITY

1. Delete paragraph 11.2.1 in its entirety and replace with the following:

    11.2.1 The *Contractor* shall, upon execution of the Agreement, provide to the *Owner*:

    .1 a performance bond , in an amount equal to 50% of the *Contract Price*, covering the performance of the *Contract*, including the warranty period and the *Contractor's* requirements with respect to the correction of deficiencies, excluding all extended warranties; and

    .2 a labour and material payment bond, in the form set out in the *Contract Documents*, in an amount equal to 50% of the *Contract Price* covering payment for labour, *Products*, or both.

2. Delete paragraph 11.2.2 in its entirety and replace with the following:

    11.2.2 The bonds referred to in paragraph 11.2.1 shall be issued by a duly licensed surety company authorized to transact the business of suretyship in the Province of Ontario, using the prescribed forms set out in the Construction Act, , and shall be maintained in good standing until the fulfillment of the *Contract*, including the warranty period.

## SC 58. GC 11.3 CERTIFICATE OF STATUS

1. Add new general condition GC 11.3 CERTIFICATE OF STATUS as follows:

    **GC 11.3 CERTIFICATE OF STATUS**

    11.3.1 The *Contractor* shall, upon execution of the Agreement, provide to the *Owner* a certificate of status from the Companies and Personal Property Security Branch of the Ontario Ministry of Government Services, or other ministry acceptable to the *Owner*, which indicates that the *Contractor* is an existing corporation and has not been dissolved.

## SC 59. GC 12.1 INDEMNIFICATION

1. Delete GC 12.1 INDEMNIFICATION in its entirety and replace with the following:

    **GC 12.1 INDEMNIFICATION**

    12.1.1 The *Contractor* shall indemnify, defend, and hold the *Owner*, including its elected officials, officers, employees, agents, affiliates and representatives (collectively referred to as the “Indemnified Party”) harmless against any and all

claims, demands, costs (including legal costs on a substantial indemnity basis), penalties, fines, fees, royalties, damages (including indirect, special, remote, and/or consequential damages) and causes of action, including, without limitation, proprietary or personal injury (including death) that arise from, either directly or indirectly, or relate to,

(a) the *Contractor*, its officials, directors, officers, employees, agents, affiliates, partners (general or limited), joint venturers, contractors, *Subcontractors*, and other representatives (collectively referred to as the "Indemnifying Party"), under this *Contract*,

(i) negligently carrying out any obligation to which it is subject,
(ii) failing to carry out any obligation to which it is subject,
(iii) negligently exercising any right to which it is entitled, or,
(iv) exercising any right to which it is entitled in a manner which is inconsistent with the terms and conditions of this *Contract*,

or any combination thereof, except to the extent that the same are caused by the negligence or deliberate wrong-doing of the Indemnified Party, or

(b) any patent, trademark, copyright infringement or other breach of any intellectual property right of any person, for which the Indemnifying Party is responsible.

12.1.2 The *Owner* shall notify the *Contractor* upon receipt of any such claim or demand that it receives. No settlement shall be made nor consent to judgment given without prior written approval of *Contractor* and its insurers, which approval shall not be unreasonably withheld.

12.1.3 The rights to indemnity contained herein shall survive the early termination or expiry of this *Contract*.

12.1.4 The *Owner* may enforce the rights of indemnity conferred on any Indemnified Party under this GC 12.1 on their behalf and to the same extent as if they were parties to this *Contract*.

12.1.5 The rights to indemnity provided for in this GC 12.1 shall be deemed to be in addition to any rights with respect to insurance in favour of the Indemnified Party provided in this *Contract*.

## SC 60. GC 12.2 WAIVER OF CLAIMS

1. Delete GC 12.2 WAIVER OF CLAIMS in its entirety.

## SC 61. GC 12.3 WARRANTY

1. Add to the end of paragraph 12.3.1 the following:

", unless the *Contract Documents* otherwise provide.

2. Add to the beginning of paragraph 12.3.2, the following:

   "Subject to paragraph 3.14.1,"

3. Delete "one year" from paragraph 12.3.3.

4. Delete "one year" from paragraph 12.3.4.

5. Delete "one year warranty period as described in paragraph 12.3.1" from paragraph 12.3.6 and replace with the following:

   "warranty period"

6. Add new paragraphs 12.3.7, 12.3.8, 12.3.9, 12.3.10, 12.3.11, 12.3.12, 12.3.13, 12.3.14, 12.3.15, 12.3.16, 12.3.17 and 12.3.18 as follows:

   12.3.7 Any material or equipment requiring excessive servicing during the warranty period (or free maintenance period, if applicable) shall be considered defective and the warranty shall be deemed to take effect from the time that the defect has been corrected so as to cause excessive servicing to terminate. Where an extended warranty is provided beyond the warranty period, and any material or equipment requires excessive servicing during the first fifteen percent (15%) of the extended warranty period (or free maintenance period, if applicable) the material or equipment shall be considered defective and the extended warranty shall be deemed to take effect from the time that the defect has been corrected so as to cause excessive servicing to terminate.

   12.3.8 The final payment certificate shall not relieve the *Contactor* from its responsibility under this GC 12.3 – WARRANTY.

   12.3.9 Following *Substantial Performance of the Work*, and without limiting the *Contractor's* warranty under this GC 12.3 WARRANTY, the *Contractor* shall assign to the *Owner*, to the extent assignable the benefit of all warranties and guarantees relating to the *Work*. The assignment shall expressly reserve the right of the *Contractor* to make any claims under such warranties and guarantees and such assignment shall in no way prejudice any rights of or benefits accruing to the *Contractor* pursuant to such warranties and guarantees.

   12.3.10 The *Contractor* shall provide to the *Owne*r for the duration of the warranty period, a maintenance security the value of which shall be derived from the following table:

| CONTRACT PRICE | | *VALUE OF MAINTENANCE* SECURITY $ |
|---|---|---|
| FROM $ | TO$ | |
| Less than $100,000.00 | | 4 % of final *Contract Price* |
| $100,000.00 | $499,999.99 | $4,000.00 on first $100,000.00 + 3.0% on next $399,999.99 |
| $500,000.00 | $999,999.99 | $16,000.00 on first $500,000.00 + 2.4% on next $499,999.99 |
| $1,000,000.00 | $1,999,999.99 | $28,000.00 on first $1,000,000.00 + 2.2% on next $999,999.99 |
| $2,000,000.00 | $3,999,999.99 | $50,000.00 on first $2,000,000.00 + 2.0% on next $1,999,999.99 |
| $4,000,000.00 | $5,999,999.99 | $90,000.00 on first $4,000,000.00 + 1.8% on next $1,999,999.99 |
| $6,000,000.00 | $9,999,999.99 | $126,000.00 on first $6,000,000.00 + 1.5% on next $3,999,999.99 |
| $10,000,000.00 or Greater | | $186,000.00 on first $10,000,000.00 + 1% on balance |

12.3.11 The maintenance security, which is at no time a part of the statutory holdback, shall be retained by the *Owner* in increments from monies that would otherwise be payable to the *Contractor*, commencing during the latter part of the period of construction, so that by the date of *Substantial Performance of the Work* the full value of the required maintenance security has been retained.

12.3.12 Except as otherwise provided hereunder, the maintenance security, less any deductions made therefrom as provided for in the *Contract*, shall be paid to the *Contractor* following the issuance by the *Consultant* of a final certificate at the end of the warranty period, provided that all defects and deficiencies in the *Work* have been corrected by the *Contractor*. No interest shall be payable to the *Contractor* on such funds withheld in accordance with 12.3.10.

12.3.13 The *Contractor* may apply in writing to the *Owner* at the time of *Substantial Performance of the Work* to substitute for the monies retained as the maintenance security an alternative maintenance security of equivalent or greater value comprising:

.1 one or more irrevocable letters of credit, or

.2 another readily negotiable security.

12.3.14 Acceptance of any such alternative shall be at the discretion of the *Owner*

12.3.15 Following receipt and acceptance of any such alternative, the *Owner* shall release to the *Contractor* the monies previously retained for maintenance security purposes.

12.3.16 The *Owner* may, in its discretion, allow the total maintenance security to be made up in part of monies retained under the *Contract* and in part of an

alternative maintenance security as indicated in paragraph 12.3.13 above provided that the total value of such parts, as determined by the *Owner*, shall be not less than the required value as derived from the table set out in paragraph 12.3.10 above.

12.3.17 Such alternative maintenance security or the monies derived therefrom, less any deductions made as provided for in the *Contract*, shall be released to the *Contractor* following the issuance by the *Consultant* of the final certificate at the end of the warranty period.

12.3.18 The *Contractor* will be responsible for extended warranty periods on equipment and materials as outlined in the *Specifications*. Warranties shall be provided for all inclusive replacement including all costs for labour and materials upon failure. Warranties shall be provided irrespective of the standard manufacturers, *Suppliers* and vendors' warranties and are in addition to the standard construction warranty of one year for general construction, materials and equipment.

## SC 62. MISCELLANEOUS

1. Add new PART 13 MISCELLANEOUS as follows:

### PART 13 MISCELLANEOUS
### GC 13.1 OWNERSHIP OF MATERIALS

13.1.1 All *Work* and *Products* delivered to the *Place of the Work* by the *Contractor* shall be the property of the *Owner*. The *Contractor* shall remove all surplus or rejected materials when notified in writing to do so by the *Consultant*.

### GC 13.2 REVIEW BY OWNER AND REVIEW BY CONSULTANT

13.2.1 Neither the *Owner's* and/or *Consultant's* receipt, review or approval of any documents of the *Work* nor the failure of the *Owner* and/or *Consultant's* to provide comments shall limit, waive or diminish the *Contractor's* obligations, responsibilities, duties or liabilities under the *Contract*. The review or approval by the *Owner* and/or *Consultant* is intended only to ascertain that the document or the performance of the *Contractor's* duties, liabilities, responsibilities, or obligations under the *Contract* including, without limitation, the *Work* generally meets the intention of the *Contract* and is not an assurance or confirmation of the adequacy, quality, fitness, suitability or correctness of the *Contractor's* obligations, responsibilities, duties and liabilities under the *Contract* including without limitation, the *Work*, for which the *Contactor* is solely responsible in accordance with the Contract.

### GC 13.3 USE AND/OR OCCUPATION OF COMPLETED PORTIONS OF THE WORK

13.3.1 Upon the *Owners'* request, the *Owner* shall, at any time or times, have the right of occupying and/or using any part of parts of the *Work* (including,

without limitation, for the purposes of installing and testing fittings and equipment), whether partially performed or entirely complete, or whether completed on schedule or not, before the completion of the *Work*.

13.3.2 In the event the *Owner* desires to exercise the privilege of occupancy and/or use of the *Work* as provided above, the *Contractor* shall co-operate with the *Owner* throughout in making available for the *Owners'* use such building services, as heating, ventilation, cooling, water, lighting, and telephone for the space or spaces to be occupied and/or used and if the equipment required to furnish such services is not entirely completed at the time the *Owner* desires to occupy and/or use the aforesaid space or spaces, the *Contractor* shall make every reasonable effort to complete same as soon as possible to the extent that the necessary equipment can be put into operation and use and any extra costs beyond that originally required to complete the *Work* arising from such early occupancy and/or use shall be borne by the *Owner.*

13.3.3 In the event that the *Owner* exercises the privilege of occupancy and/or use of the *Work* as provided above, it agrees to do so, as not to materially interfere with the respective work of the *Contractor*, *Subcontractors* or *Suppliers* and under the understanding that the *Owner* will be occupying premises within a construction site which will require compliance with all normal construction site requirements including, without limitation, health and safety requirements.

13.3.4 It shall be understood, however, that the *Owner's* occupancy and/or use of such space or spaces of the *Work* shall not constitute the *Owner's* acceptance of any Work, material or equipment which are not in accordance with the requirements of the *Contract Documents*, nor affect the warranty period under the *Contract* nor relieve the *Contractor* from his obligations, duties, responsibilities and liabilities to complete the *Work*, nor for responsibility for loss or damage due to or arising out of defects in, or malfunctioning of, any *Work*, material or equipment, nor from any other unfulfilled duties, liabilities, obligation or responsibilities under the *Contract* nor from any other duty, liability obligation or responsibility under the *Contract* including, without limitation, the *Contractors'* warranty obligation. If however, damage results from any act by the *Owner*, the *Owner* shall assume its share of the responsibility for such damage.

**GC 13.4 NON-INTERFERENCE**

13.4.1 The *Contractor* acknowledges that the *Place of the Work* is and will continue to be occupied by the *Owner* and the *Owner* will continue to carry out its normal operations at the *Place of the Work*. The *Contractor* agrees to perform the *Work* in the least intrusive manner possible. Without limiting the generality of the foregoing, the Contractor acknowledges and agrees that it shall carry out its duties, responsibilities, and obligations under the *Contract* in such a manner so as not to disrupt or interfere with any of the *Owner's* or any third party's existing facilities and ongoing operations or activities or other

operations located in the area adjacent to, in the vicinity of or proximate to the *Place of the Work*.

## GC 13.5 LIQUIDATED DAMAGES

13.5.1 It is expressly agreed by the parties that if the date of *Substantial Performance of the Work* occurs later than the *Substantial Performance Date,* the *Contractor* shall pay to the *Owner* liquidated damages calculated as ONE THOUSAND DOLLARS ($1,000.00) for each *Working Day* that *Substantial Performance of the Work* extends beyond the *Substantial Performance Date.*

13.5.2 It is expressly agreed that it is difficult to calculate the damages which would result from the Contractor's failure to attain *Substantial Performance of the Work* by the *Substantial Performance Date* and the parties agree that the liquidated damages are not intended to be penalties but rather represent the parties' best estimate of damages resulting from the delay.

13.5.3 The *Owner* may deduct any amount due under this paragraph from any monies that may be due or payable to the *Contractor* on any account whatsoever. The liquidated damages payable under this paragraph are in addition to and without prejudice to any other remedy, action or other right that may be available to the *Owner*.

## GC 13.6 CONTRACTOR DISCHARGE OF LIABILITIES

13.6.1 In addition to the obligations assumed by the *Contractor* pursuant to General Condition 3.7 – SUBCONTRACTORS AND SUPPLIERS, the *Contractor* agrees to discharge all liabilities incurred by it for labour, materials, services, *Subcontractors* and *Products*, used or reasonably required for use in the performance of the *Work*, except for amounts withheld by reason of legitimate dispute which have been identified to the party or parties, from whom payment has been withheld.

## GC 13.7 CONTRACTOR EVALUATION

13.7.1 In accordance with the *Owner's* policy for vendor performance evaluation, the *Owner* will evaluate the performance of the *Contractor* with respect to the *Work* using the following criteria:

.1 general responsiveness of the work relationship;
.2 conformity of the work done, materials supplied and provision of services with the description of *Project* and *Specifications*;
.3 general dependability and quality of all work done and any goods or services supplied;
.4 timely performance;
.5 general conformity with the reasonable expectations of the *Owner* under the terms of the *Contract* in their entirety;
.6 supervision of subcontractors and the maintenance of an orderly, neat and secure job site;
.7 accuracy of carrying out instructions.

13.7.2 Where a performance review is conducted at *Final Completion of the Work*, the *Contractor's* performance shall be ranked by the *Owner* at one of the following standards:

.1 Unacceptable (performance well below the general standard); or

.2 Satisfactory (performance in accordance of general standard).

13.7.3 Where at a performance review carried out prior to the completion of the *Contract*, one or more criteria of assessment are ranked as unacceptable:

.1 the parties shall agree at the time of the conduct of the review or within ten (10) *Working Days* thereafter, on the measures to be taken by the *Contractor* during the ensuing *Contract* review period to improve its performance to at least a good standard;

.2 within ten (10) *Working Days* of agreeing on those measures, the *Contractor* shall confirm in writing that the measures in question have been implemented.

13.7.4 Where the *Contractor* fails or refuses to implement measures as provided in paragraph 13.7.3, it shall be deemed to be in default under the *Contract*, and the *Owner* may take such remedies as provided for in the *Contract Documents* or are otherwise available at law or in equity.

13.7.5 Where the unsatisfactory performance of the *Contractor* is not corrected as required under this section, that performance may be taken into account by the *Owner* with respect to the award of any future contract to the *Contractor*.

## GC 13.8 RECORDS/DAILY REPORTS/DAILY LOGS

13.8.1 The *Contractor* shall maintain and keep accurate *Project* records (which means all tangible records, documents, computer printouts, electronic information, books, plans, *Drawings*, *Specifications*, accounts or other information relating to the *Work*) in its head office in accordance with requirements of *Applicable Laws*, but in any event for not less than four (4) years from *Substantial Performance of the Work* or until all claims have been settled. During this time, the *Contractor* shall allow the *Owner* access to the *Project* records during normal business hours upon the giving of reasonable notice. The *Contractor* shall ensure that equivalent provisions to those provided herein are made in each subcontract and shall require the *Subcontractor*s and *Suppliers* to incorporate them into every level of contract thereunder for any part of the *Work*.

## GC13.9 ONTARIANS WITH DISABILITIES ACT, 2001 (ODA) AND THE ACCESSIBILITY FOR ONTARIANS WITH DISABILITIES ACT, 2005 (AODA)

13.9.1 The *Contractor* shall ensure that all of its employees, agents, volunteers and any *Subcontractors* comply with all applicable accessibility laws, regulations and by-laws, including but not limited to the Ontarians with Disabilities Act, 2001 (ODA), the Accessibility for Ontarians with Disabilities Act, 2005

(AODA), Ontario Regulation 429/07 (Accessibility Standards for Customer Service) and Ontario Regulation 191/11 (Integrated Accessibility Standards), during the term of the Contract.

13.9.2 Without limiting the generality of the foregoing, the *Contractor* shall ensure that all of its employees, agents, volunteers and any *Subcontractors* who, as part of the *Contract*:

(a) deal with members of the public or other third parties, or
(b) participate in developing policies, practices and procedures governing the provision of goods or services to members of the public or other third parties,

receive training about the provision of its goods or services to persons with disabilities. The *Contractor* shall ensure that such training includes, without limitation, a review of the purposes of the AODA and the requirements of Ontario Regulation 429/07.

13.9.3 Prior to commencing the *Work*, the *Contractor* shall provide a Statement of Acknowledgement to the City of Hamilton that it has read and understands the City of Hamilton's AODA Customer Service Standard Handbook; that it has provided the training required by said Handbook; and that it will comply with the requirements of said Handbook and applicable accessibility laws, regulations and by-laws.

13.9.4 The *Owner* and the City of Hamilton reserve the right to inspect the *Contractor's* training records relating to Ontario Regulation 429/07 and Ontario Regulation 191/11, which must describe its training policy and summarize the training, including to whom the training has been given and when the training was given. The *Owner* and the City of Hamilton also reserve the right to require the *Contractor* to amend its training policies, practices and procedures if the *Owner* or the City of Hamilton deems the training is not compliant with the requirements of Ontario Regulation 429/07 and Ontario Regulation 191/11.

See City of Hamilton's AODA Customer Service Standard Handbook at:

hamilton.ca/government-information/accessibility-services/accessibility-standards

## GC13.10 SET-OFF

13.10.1 The parties agree that the *Owner* has the contractual right to set-off against any amounts owing by the *Owner* to the *Contractor* under this *Contract*, any amount owed to the *Owner* by the *Contractor*, whether such amount arises from this *Contract* or under any other contract between the *Owner* and the *Contractor*, irrespective of whether or not those contracts are related or arise at equity or law. This right of set-off shall be subject to the Construction Act, as applicable.

13.10.2 The costs to the *Owner* of sending or publishing any notice or document required by the Construction Act shall constitute damages to the *Owner* and may be retained by the *Owner* in accordance with its set-off rights.

## PROJECT SPECIFIC SUPPLEMENTARY CONDITIONS TO CONTRACT CCDC 2-2008

These Project Specific Supplementary Conditions presuppose the use of the Standard Construction Document CCDC 2-2008 Stipulated Price Contract, English version. These "Project Specific Supplementary Conditions" void, supersede or amend the "Agreement", "Definitions", "General Conditions" and "Supplementary Conditions" as hereinafter provided, as the case may be.

### GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

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

### PSSC 1. GC 3.5 CONSTRUCTION SCHEDULE

1. Add new paragraph 3.5.11 to SC20 of the Supplementary Conditions as follows:

   3.5.11 The *Work* under this *Contract* must achieve *Substantial Performance of the Work* by **July 31, 2020**.

### PSSC 2. GC 3.8 LABOUR AND PRODUCTS

1. Add new paragraph 3.8.15 to SC23 of the Supplementary Conditions as follows:

   3.8.15 By-law 07-170 (City of Hamilton Licensing Code) regulates the trade licensing process in Hamilton. The By-law regulates all businesses of plumbing, heating, ventilation and air-conditioning, drain repair, building repair, sprinkler and fire protection. The City of Hamilton's Licensing and By-law Services Division is responsible for the licensing of contractors and masters. Licenses are issued to contractors and masters working in the above-noted trades.

### PSSC 3. GC 3.10 SHOP DRAWINGS

1. Add after "SHOP DRAWINGS" in the title of GC 3.10, the following:

   "AND OTHER SUBMITTALS"

2. Add new paragraph 3.10.13 as follows:

   3.10.13 As the *Work* progresses, the *Contractor* shall keep a complete and accurate record of all changes or deviations from the *Contract Documents* and *Shop Drawings*, indicating the *Work* as actually installed. At the completion of the *Work*, the *Contractor* shall certify by endorsement thereof, that each of the revised prints of the *Drawings* and *Specifications* are

complete and accurate. Prior to the *Contractor*'s application for final payment, the record *Drawings* and *Specifications*, arranged in proper order, indexed and endorsed, and in the following form, shall be delivered to the *Owner*, namely:

.1 three (3) complete sets of reproducible final versions of the *As-Built Drawings*; and

.2 three (3) copies of the final versions of the *As-Built Drawings* in digital format in both AutoCAD and PDF formats (latest version of software).

## PSSC 4. GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK

1. Delete paragraph 5.4.3 in its entirety and replace with the following:

5.4.3 Prior to the issuance of the certificate of *Substantial Performance of the Work*, the *Contractor*, in consultation with the *Consultant*, shall establish reasonable dates for finishing the *Work* and correcting deficiencies.

2. Add new paragraphs 5.4.4, 5.4.5, 5.4.6, 5.4.7.and 5.4.8 as follows:

5.4.4 Within seven (7) calendar days of receiving a copy of the certificate of *Substantial Performance of the Work* signed by the *Consultant*, the *Contractor* shall publish a copy of the certificate in accordance with the *Construction Act*) and shall provide to the *Consultant* and the *Owner* the date of publication and the name of the construction trade newspaper in which the publication occurred. If the *Contractor* fails to comply with this provision, the *Owner* may publish a copy of the certificate and charge the *Contractor* with the costs so incurred.

5.4.5 Prior to submitting its written application for *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* all:

.1 guarantees;

.2 warranties;

.3 certificates;

.4 testing and balancing reports;

.5 distribution system diagrams;

.6 spare parts;

.7 operations and maintenance manuals which shall consist of three (3) hard copies and three (3) digital copies (on CD or DVD) and shall be well-organized and tabbed for ease of reference;

.8 samples;

.9 existing reports and correspondence from *Authorities Having Jurisdiction* in the *Place of the Work*; and

other materials or documentation required to be submitted under the *Contract*, together with written proof acceptable to the *Owner* and the *Consultant* that the *Work* has been substantially performed in conformance with the requirements of all *Governmental Authority* and utility authorities having jurisdiction in the *Place of the Work*.

5.4.6 Where the *Contractor* is unable to deliver the documents and materials described in paragraph 5.4.5, then, provided that none of the missing documents and materials interferes with the use and occupancy of the *Project* in a material way, the failure to deliver shall not be grounds for the *Consultant* to refuse to certify *Substantial Performance of the Work*. If the *Contractor* fails to deliver any of the materials required in subparagraphs 5.4.5.7 or 5.4.5.8, the *Consultant* may retain a reasonable amount or, where applicable, the amount specified in the Project Specific Supplementary Conditions from the payment of holdback under General Condition 5.5 - PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK. Should any documents or materials not be delivered in accordance with paragraph 5.4.5 by the earlier of sixty (60) calendar days following publication of the certificate of *Substantial Performance of the Work* and the submission of the *Contractor's* application for final payment under paragraph 5.7.1 of GC 5.7 – FINAL PAYMENT, then the amount previously retained pursuant to this provision shall be forfeited to the *Owner* as compensation for the damages deemed to have been incurred by the *Owner*, and not as a penalty, arising from the failure to deliver the documents or materials, and the *Contract Price* shall be reduced accordingly.

5.4.7 Together with the submission of its written application for *Substantial Performance of the Work*, the *Contractor* shall submit to the *Consultant* and to the *Owner* a *Statutory Declaration* setting forth in reasonable detail any then outstanding and unresolved disputes or claims between the *Contractor* and any *Subcontractor* or *Supplier,* including any claims allegedly arising from delay, which are, directly or indirectly, related to any then outstanding or anticipated disputes or claims between the *Contractor* and the *Owner,* and this disclosure shall, at a minimum:

.1 identify the parties involved;
.2 identify the amount in dispute;
.3 provide a brief statement summarizing the position of each party;
.4 include copies of any correspondence or documents in support of either party's position;
.5 include copies of any documents of any court or arbitration process related to the matter;
.6 identify the dispute or claim between the *Contractor* and the *Owner* to which the matter relates; and
.7 include a copy of any written agreement or a summary of any oral agreement between the parties related to resolution of the matter.

The disclosure requirements detailed herein are of a continuing nature and survive completion of the *Work*. Accordingly, the *Contractor* shall supplement the information provided with the original *Statutory Declaration* with additional materials pertaining to new or existing disputes or claims, as they become available. The *Contractor* shall not be entitled to recover from the *Owner* any amount pertaining to any claim or dispute referred to in this paragraph, if the provisions of this paragraph have not been fully complied with. For greater certainty, the *Contractor* is not obliged to make the aforementioned disclosure with respect to any dispute or claim that is not related to or does not touch

upon any then outstanding and unresolved dispute or claim between the *Contractor* and the *Owner*.

5.4.8 Prior to the issuance of the certificate of *Substantial Performance of the Work,* the *Commissioning* of the *Work* must be successfully completed and the associated submittals evidencing same must be provided by the Contractor to the *Consultant* in order for the *Consultant* to verify that the *Project* is ready to use and/or is being used for its intended purpose.

## PSSC 5. GC 5.8 WITHHOLDING OF PAYMENT

1. Add new paragraph 5.8.2 as follows:

5.8.2 The *Consultant* may withhold from the *Contractor*, a minimum of FIVE THOUSAND DOLLARS ($5,000.00) from any final payments pending submission and approval of all *Project* close-out documentation including operations & maintenance manuals, *As-Built Drawings*, warranty information, training of staff, and confirmation of any materials to be left on-site for future repairs.

## PSSC 6. FAIR WAGE POLICY

1. All references to the *Fair Wage Policy* shall only apply to the *Contract* where the *Contract Price* is FIVE HUNDRED THOUSAND DOLLARS ($500,000.00) or greater.

## PSSC 7. GC 11.1 INSURANCE

1. Delete GC 11.1.1.4 as set out in SC56 of the Supplementary Conditions and replace with the following:

.4 Property Installation Floater (All Risks) Insurance in an amount to adequately insure the *Contractor's* ownership interest in equipment and materials. The coverage shall provide for the full replacement value of the property, repairs, additions or equipment being installed, handled, or stored on or off premises awaiting installation and while in transit.

If the Property Installation Floater (All Risks) Insurance does not provide transportation coverage, separate Motor Truck Cargo or Transportation (All Risks) Insurance is to be provided for materials or equipment transported in the *Contractor's* vehicles or others hired by the *Contractor* from place of receipt to building sites or other storage sites.

# SECTION 01 00 00 PROJECT PROCEDURES

## PART 1 GENERAL

### 1.1 WORK SUMMARY

.1 The following is an overview of Work and is not complete. Contract Documents in their entirety fully describe Work, including items that may only be listed here. Work includes:

.2 Scope Summary

- .1 Rose and Oak Penthouse Mechanical Room
  - .1 Provide heating gylcol coil.
  - .2 Provide 2 glycol runaround loop coils.
  - .3 Provide air handler supply fan filters.
  - .4 Provide filter bank access doors.
  - .5 Provide 2 filter differential pressure transmitters.
  - .6 Provide heat exchanger.
  - .7 Provide 4 pumps.
- .2 Rose and Oak Living Area
  - .1 Demolish existing pneumatic zone thermostats, control valves, air compressor.
  - .2 Provide 51 zone temperature transmitters.
  - .3 Provide 51 zone control valves.
- .3 Rose and Oak Dining Room
  - .1 Provide 1 zone temperature transmitter, 2 duct temperature transmitters.
  - .2 Provide 2 radiant panel control valves.
- .4 Building Automation System
  - .1 Demolish Rose and Oak Air Handlers Johnson Controls FX BAS.
  - .2 Provide new Automated Logic controllers, graphics, sequences.
  - .3 Update administration area floor plan graphics to match existing conditions.
  - .4 Integrate added devices to BAS including sequences, programming, graphics.
  - .5 Configure email alarm notifications.
- .5 Provide air and hydronic testing and balancing.
- .6 Provide fully functional systems that are complete and ready for intended use and effect.
- .7 Provisional Items
  - .1 Administration Area and Administrator’s Office (Provisional Item 2.1)
    - .1 Provide 1 VAV box.
    - .2 Modify ductwork to Administrator's office to be served from AHU-3.
    - .3 Modify control of 2 radiant panel control valves.
    - .4 Integrate added devices to BAS including sequences, programming, graphics.
  - .2 First Floor Core Area (Provisional Item 2.2)
    - .1 Provide 9 radiant panel control valves.
    - .2 Integrate added devices to BAS including sequences, programming, graphics.
  - .3 Second Floor Core Area (Provisional Item 2.3)
    - .1 Provide 13 radiant panel control valves.
    - .2 Provide 1 zone temperature transmitter.
    - .3 Integrate added devices to BAS including sequences, programming, graphics.
  - .4 Air Handlers (Provisional Item 2.4)

.1 Provide 4 supply air humidity sensors.
.2 Provide 4 zone pressure sensors.
.3 Integrate added devices to BAS including sequences, programming, graphics.

.3 Design Boundaries
.1 Rose and Oak supply, exhaust, and outdoor air volumes are intended to match original design air volumes from Alterations and Additions, Group Eight Engineering Ltd, 1988, Tender.

.4 Work Considerations and Limitations
.1 Work may require use of particular means, methods, sequences, techniques, or procedures of construction not explicitly described in Contract Documents, which may require use of particular or specialty trades.
.2 Phase-in work to avoid disruption to existing services and operations, including:
.1 Rose and Oak Air Handler - Shutdowns of air handler limited to 8 hours duration during daytime hours.
.2 Rose and Oak Residence Area - Access to 4 residence rooms per day with advance notice.
.3 Rose and Oak Dining Rooms - Access to area is limited to 9:00pm to 5:00am.
.4 Core Areas - Access to area is limited to 9:00pm to 5:00am.
.5 Administration Areas - Access to area is limited to 9:00pm to 5:00am.
.3 Site is an active long-term care facility that operates 24 hours per day, 365 days per year. Specific security requirements are in place regarding personnel, supervision, photographs, tools and construction materials, and other aspects that may impact Work.
.4 Project includes Work on systems that may only be disrupted outside of respective heating and cooling seasons. Other project activities such as commissioning can only be completed during the seasons in which such systems are in operation.
.5 Control system must remain operational at all times during construction. Do not remove or disable existing controls until performance of new controls can be satisfactorily demonstrated.
.6 Available space for new equipment and services is limited. Modify layouts, routing, mounting and existing services as required by Work.
.7 Work will be completed in service rooms with operational ventilation systems. Coordinate prevention of migration or accumulation of dust, debris, fumes, smoke, gases, or odours.
.8 Work will be completed in occupied residence areas. Coordinate prevention of migration or accumulation of dust, debris, fumes, smoke, gases, or odours.
.9 Provide to Owner demolished components that Owner wishes to keep on site.
.10 Some loops may require isolation and draining of affected sections in order to complete aspects of Work. Coordinate in advance with Owner.
.11 Portions of Work may require local freezing or other similar techniques for temporary isolation of water and glycol piping.
.12 Work includes replacement of heating water control valves. Disruption or shutdown of heating water supply to entire building is not acceptable at any time for any duration.
.13 Disruption of any services for any duration requires advance notice and approval by Owner. Adhere to advance notice requirements stipulated by Owner.

**1.2 DEFINITIONS AND ACRONYMS**

.1 Inclusiveness
  .1 Specific words or terms including the following have been removed or replaced for brevity, the absence of which in no way limits the scope of the description:
    .1 "All".
    .2 "To" instead of "in accordance with".
  .2 The word "including" or the word "includes" shall be taken to mean "including but not limited to".
  .3 Lists of products, qualities, or responsibilities may be listed after inclusive statements for various purposes including for clarification, examples. The absence of list items shall not limit the inclusiveness of such statements.

.2 Abbreviations, Acronyms, Names and Terms: Where acronyms, abbreviations, names and terms are used in Drawings, Specifications or other portions of Contract Documents, they shall mean the recognized name of the trade association, document generating organization or body, document publishing organization or body, authority having jurisdiction or other entity applicable.
  .1 AABC: Associated Air Balance Council
  .2 ACG: AABC Commissioning Group
  .3 AHRI: Air-Conditioning, Heating, and Refrigeration Institute (formerly Air-Conditioning and Refrigeration Institute)
  .4 ANSI: The American National Standards Institute, Inc.
  .5 ASA: The Acoustical Society of America
  .6 ASC: The Adhesive and Sealant Council
  .7 ASHRAE: American Society of Heating, Refrigerating and Air-Conditioning Engineers
  .8 ASME: American Society of Mechanical Engineers
  .9 ASTM: American Society for Testing and Materials International
  .10 AWS: American Welding Society
  .11 BTL: BACnet Testing Laboratories, established by BACnet International
  .12 CAABC: Canadian Associated Air Balance Council
  .13 CGSB: Canadian Government Standards Board
  .14 CHC: The Canadian Hydronics Council
  .15 CSA: Canadian Standards Association
  .16 CWB: The Canadian Welding Bureau
  .17 ESA: Electrical Safety Authority (Ontario)
  .18 FCIA: Firestop Contractors International Association
  .19 HI: The Hydronics Institute, Inc. (currently a division of Air-Conditioning, Heating, and Refrigeration Institute, formerly a division of Gas Appliance Manufacturers Association Inc.)
  .20 IEC: International Electrotechnical Commission
  .21 IEEE: Institute of Electrical and Electronics Engineers, Inc.
  .22 IES: Illuminating Engineering Society (formerly Illuminating Engineering Society of North America)
  .23 ISO: The International Organization for Standardization
  .24 MICA: Midwest Insulation Contractors Association
  .25 NEBB: National Environmental Balancing Bureau
  .26 NECA: National Electrical Contractors Association
  .27 NEMA: National Electrical Manufacturers Association
  .28 NFPA: National Fire Protection Association
  .29 NIST: The National Institute of Standards and Technology
  .30 OSMCA: Ontario Sheet Metal Contractors Association

.31 PEO: Professional Engineers Ontario
.32 SMACNA: Sheet Metal and Air Conditioning Contractors' National Association, Inc.
.33 TIA: The Telecommunications Industry Association (formerly a part of the Electronic Industries Alliance)
.34 TIAC: Thermal Insulation Association of Canada
.35 UL: Underwriters Laboratories Inc.
.36 ULC: Underwriters Laboratories of Canada
.37 "Applicable": As appropriate for the particular condition, circumstance or situation.
.38 "Approve(d)": Approval action shall be limited to the duties and responsibilities of the party giving approval, as stated in Contract Documents. Approvals shall be valid only if obtained in writing and shall not apply to matters regarding the means, methods, techniques, sequences and procedures of construction. Approval shall not relieve Contractor from responsibility to fulfill requirements of Contract Documents. Where party giving approval is not indicated, approving party shall be Owner or Engineer.
.39 "Capability": Provide products as required including equipment and components ready for future configuration to make Work perform and/or operate as specified.
.40 "Code": Refer to "Regulation".
.41 "Concealed": Equipment, services and components that are not immediately exposed to view from a standing position on the normal walking path, including those that may be located behind doors, hatches, covers, access panels, inside enclosures, or in areas not easily accessible and visible without crouching, passing through spaces narrower than 24-in (61-cm), or using assistive devices not permanently mounted including ladders, lifts, illumination.
.42 "Configure": Complete activities required to meet performance or functionality requirements including initialization, jumper and dip switch setting, software parameter selection, programming, testing, commissioning, tuning and adjusting.
.43 "Consultant": Same as "Consultant" as defined in Contract Documents; Otherwise the administrator of the Contract Documents.
.44 "Contract Documents": Same as "Contract Documents" as defined in Contract Documents; Otherwise the documents which form the Contract.
.45 "Contractor": Same as "Contractor" as defined in Contract Documents; Otherwise the entity named to complete Work including construction and related activities required to meet Contract Documents.
.46 "Crown": The Crown in right of Canada and in right of all Canadian provinces.
.47 "Delegated Professional Design": As described in this Section.
.48 "Directed": Limited to duties and responsibilities of Owner or Engineer as stated in Contract Documents, meaning as instructed by Owner or Engineer, in writing, regarding matters other than the means, methods, techniques, sequences and procedures of construction. Terms such as "directed," "requested," "authorized," "selected," "approved," "required," and "permitted" mean "directed by Owner," "directed by Engineer," "requested by Owner," and similar phrases. No implied meaning shall be interpreted to extend the responsibility of Owner, Engineer or other professional designers as indicated into Contractor's supervision of construction.
.49 "Drawings": The electronic version of that portion of Contract Documents, containing graphical and pictorial portions of Contract Documents, wherever

located and whenever issued, showing the design, location, and dimensions of Work, generally including plans, elevations, sections, details, and diagrams.

.50 “Equal” or “Equivalent”: As determined by Engineer or other indicated responsible professional designer as being equivalent, considering such attributes as durability, finish, function, suitability, quality, utility, performance and aesthetic features.

.51 “Engineer”: Same as “Engineer” as defined in Contract Documents; Otherwise the designer of the technical documents.

.52 “Exposed”: Means not “concealed”.

.53 “Functionality”: Provide Work as required to be complete in every respect and fully functional, including installation, field finishing, configuration, and commissioning.

.54 “Furnish”: Supply and deliver to Site, ready for unloading, unpacking, assembly, installation, and similar operations.

.55 “Indicated”: Refers to graphic representations, notes, or schedules on Drawings, or other Paragraphs or Schedules in Specifications, and similar requirements in Contract Documents. Terms such as “shown,” “noted,” “scheduled,” and “specified” are used to help the reader locate the reference. There is no limitation on location of reference within Contract Documents.

.56 “Install”: Describes operations at Site including the actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, configuring and similar operations.

.57 “Installer”: The Contractor or an entity engaged by Contractor, including an employee, subcontractor or sub-subcontractor, for performance of a particular construction activity, including installation, erection, application and similar operations. Installers are required to be experienced in the operations they are engaged to perform.

.58 “Intent”: Refer to “Functionality”.

.59 “NIC”: Not In Contract. Indicates work completed or to be completed under separate contract.

.60 “OFCI”: Owner Furnished Contractor Installed. Indicates materials, products or equipment to be provided under separate contract, and may include field finishing, configuration, and commissioning.

.61 “Owner”: The entities that are the actual Owner, or the Owner's authorized agent or representative or other retained entities, and that have authority over the Site and Project.

.62 “Products”: Same as “Product” as defined in Contract Documents; Otherwise materials including equipment and components forming Work.

.63 “Project”: Construction and related services of which Work may be the whole or a part.

.64 “Proper”: As determined by Engineer or other indicated responsible professional designer as being proper for Work, excluding matters regarding the means, methods, techniques, sequences and procedures of construction, which are solely Contractor’s responsibility to determine.

.65 “Provide”: Furnish and install, complete and ready for the intended use and effect.

.66 “Regulation”: Includes laws, statutes, regulations, orders, ordinances, codes, and standards issued or used by authorities having jurisdiction over Work. Includes federal, provincial and municipal governmental agencies, governing and local authorities, utilities, utility districts and other agencies serving the

site. Includes rules, practices, conventions and agreements of authorities having jurisdiction and within the construction industry that control requirements and performance of Work.

.67 "Regulatory": As required by regulation.

.68 "Required": Necessary for performance of Work in conformance with requirements of Contract Documents including:

.1 Duties and responsibilities stated in the Bid Documents and Contract Documents.

.2 Requirements specified or referenced in the Specifications.

.3 Notes, schedules and graphic representations on the Drawings.

.4 Requirements of referenced documents.

.5 Regulatory requirements.

.6 Requirements generally recognized as accepted trade or industry practice.

.69 "Requirements": Aspects of Work that are required.

.70 "Selected": As selected by Owner, Engineer or other indicated responsible professional designer from the full selection of the manufacturer's products, unless specifically limited in Contract Documents to a particular aspect, including quality, color, texture or price range.

.71 "Site": Same as "Site of Work" or "Project Site" or "Job Site"; the area or areas or spaces occupied by Project and including adjacent areas and other related areas occupied or used by Contractor for construction activities, either exclusively or with others performing other construction on Project.

.72 "Specifications": The electronic version of that portion of Contract Documents, wherever located and whenever issued, containing written requirements for Products, components, equipment, systems, activities, procedures, execution, and services required for performance of Work.

.73 "Standby Power": Electrical power generated on site and used during periods of utility power failure, whether or not the site generated power is used only during periods of utility power failure, and whether or not the site generated power is used for loads required to be supplied by emergency power.

.74 "Statute": Refer to "Regulation".

.75 "Statutory": Same as "Regulatory" but for statutes.

.76 "Supply": Refer to "Furnish".

.77 "Work": Refer to "Consultant" as defined in Contract Documents, otherwise Construction and related activities required to meet Contract Documents.

.78 As determined by Engineer.

.79 As generally recognized by construction industry practice.

.80 As determined by Engineer when a conflict exists between any of the following.

.81 As described by regulation.

.82 As described by referenced documents.

.83 As described in specialty dictionaries in the following order:

.1 Dictionary of Architecture and Construction, Latest Edition (Cyril M. Harris, McGraw-Hill Professional).

.2 Encyclopedia of Associations, online directory by Thomson Gale, accessible through many public libraries.

.84 As determined by Engineer. Input may be provided by Contractor on definitions based on the following in the following order:

.1 As generally recognized by construction industry practice.

.2 As generally recognized by trade practice.

**1.3 MULTIPLE CONTRACT SUMMARY**

.1 Other Current Contracts
  .1 Owner has other ongoing or concurrent separate contracts including:
    .1 Maintenance, repairs and service.
  .2 Coordinate and cooperate with other contractors responsible for project health and safety in compliance with the Occupational Health and Safety Act.
  .3 Regularly meet with other contractors, and coordinate activities with other contractors as required.
.2 Other Products
  .1 All products indicated shall be considered to be fully part of Work unless otherwise denoted by NIC (Not in Contract) or OFCI (Owner Furnished Contractor Installed).

**1.4 PROJECT ADMINISTRATION**

.1 Submittals and Transmittals
  .1 Format: Provide submittals and transmittals in electronic format unless otherwise indicated.
    .1 Electronic Format
      .1 Transmit to recipients' e-mail addresses, or alternate means for large electronic file submissions.
      .2 Transmit photographs in JPG format acceptable to Engineer, including resolution, focus and light levels.
      .3 Transmit other submittals in file formats as indicated. Where file formats are not indicated, use Adobe PDF format acceptable to Engineer, including clarity, alignment, unsecured, provided with original PDF source files where available, converted to PDF with original source files. Unacceptable: Scans of other formats where PDF file can be provided or converted from original source files.
      .4 File Naming: Name electronic files appropriately and consistently. Electronic file naming convention subject to review and approval by Engineer.
      .5 Multiple Electronic File Submission: Maintain separate subject matter in separate electronic files.
    .2 Paper Format
      .1 Transmit to recipients at recipients' business addresses.
      .2 Transmit in paper format acceptable to Engineer, including size, colour, clarity and alignment.
  .2 Recipients: As required.
  .3 Response: Allow 10 working days for responses from Engineer unless otherwise indicated.
.2 Project Meetings: Conduct project meetings at Owner's preferred location at 1-week intervals.
  .1 Attendees: Owner, Engineer, Contractor, and project stakeholders as defined by Owner.
  .2 Coordination: Inform individuals whose presence is required of date and time of each meeting, including Contractor staff, subcontractors and suppliers. Inform individuals whose presence may not specifically be required but are involved of the project of date and time of each meeting to be available by phone during the meeting, including Contractor staff, subcontractors and suppliers. Notify Owner and Engineer of arranged meeting dates and times. Provide 2-week notification.
  .3 Agenda: Prepare meeting agenda. Distribute meeting agenda not less than 2 working days before the meeting to invited attendees.

.4 Minutes: Prepare meeting minutes. Distribute meeting minutes within 2 working days of meeting to invited attendees and appropriate stakeholders as determined by Owner. Include the following information:
.1 Attendance.
.2 Discussions.
.3 Agreements.
.4 Action items in a separate list, including responsible parties and individuals, and required completion dates.
.5 Modifications: Owner may modify project meeting requirements, including Engineer to take responsibility for project meeting minutes, at no change to Contract Price or Contract Time.

.3 Progress Meetings: Conduct progress meetings at 1-week intervals.
.1 Attendees: Contractor personnel familiar with or required to be familiar with Work and authorized to conclude matters relating to Work.
.2 Agenda
.1 Review and approve minutes of previous progress meeting, including modifications to minutes.
.2 Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Work.
.3 Review progress since last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule in relation to Contractor's construction schedule.
.4 Determine how construction schedule will be expedited.
.5 Secure commitments from parties involved to do so.
.6 Discuss whether construction schedule revisions are required to ensure that current and subsequent activities will be completed within Contract Time.
.3 Schedule
.1 Updates: Update construction schedule after each progress meeting where revisions to construction schedule have been made or recognized.
.2 Distribution
.1 Submit updated construction schedule in colour ledger sized paper format concurrently with each progress meeting report.
.2 Transmit updated construction schedule in electronic format to Engineer.
.3 Revisions: Review and evaluate construction schedule regularly during construction. Revise construction schedule as necessary as a result of review and resubmit within 2 working days.
.4 Format: Software generated Gantt chart as acceptable to Engineer including for ease of use of data.
.1 File Type: Microsoft Project and Adobe PDF of file.
.4 Reporting: Provide brief narrative progress report to define problem areas, potential yet not yet claimed clarifications and substitutions and changes, concealed work, anticipated delays, and impact on the construction schedule. Report actions taken or proposed, and its effect including impacts on separate contracts. Identify modifications since previous submittal, including activities and changes.
.5 Distribution
.1 Distribute reports and construction schedules within 2 working days of the meeting.
.2 Distribute to Contractor's site file, to subcontractors, suppliers, Engineer, Owner, and other concerned parties.

.3 Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

.4 Progress Completed Reporting: Conduct progress completed updates at Site at end of each working shift.
.1 Attendees: Owner, Contractor, and project stakeholders as defined by Owner.
.2 Agenda
.1 Review Work completed, which affected systems and areas are ready for use, which affected systems and areas are not fully operational.
.2 Discuss whether interim operating procedures are requested of Owner.
.3 Reporting: Provide verbal or written or both verbal and written summary as required by Owner.

.5 Progress Planned Reporting: Conduct progress planned updates at Site at beginning of each working day.
.1 Attendees: Owner, Contractor, and project stakeholders as defined by Owner.
.2 Agenda
.1 Review Work planned, which systems and areas will be affected, which other systems and areas may be affected.
.2 Discuss whether interim operating procedures are requested of Owner.
.3 Reporting: Provide verbal or written or both verbal and written summary as required by Owner.

.6 Other Meetings: Adhere to project meeting procedures for other meetings.

## 1.5 CASH ALLOWANCES EXTENT AND PROCEDURES

.1 Work Included in Cash Allowance Amounts
.1 Work described under this Article except as follows.
.1 Contractor costs related to Work performed under Cash Allowances include Contractor overhead, profit, management, supervision, coordination, administration. Such costs are to be included in Bid Price outside of Cash Allowance amounts.
.2 Work described under this Article is separate and additional to Work described elsewhere in Contract Documents except as specifically indicated in this Article.

.2 Scheduling: Complete site reviews and investigations within 14-days after contract award.

.3 Pricing of Work
.1 Owner reserves right to obtain themselves, or have Contractor obtain a single or multiple competitive quotations from potential subcontractors or suppliers for Work that is to be paid from Cash Allowance(s). In addition to the following, provide Owner with 7-days notification to allow Owner to decide on pricing approach.
.2 Where quotation(s) are obtained by Contractor:
.1 Ensure quotation(s) include reference to project Contract Documents and cover complete scope of Work for the Cash Allowance(s) described in Contract Documents.
.2 Obtain and submit quotation(s) within 14-days of instruction to obtain pricing for Work under Cash Allowance.
.3 Quantity of quotations required to be obtained is 3, or less as required by Owner.
.3 Submit quotation(s) to Engineer for authorization under Cash Allowance authorization procedures.

.4 Authorization to Proceed: Contractor shall not proceed with Work under Cash Allowance without written authorization. Submittal reviews are not considered authorization to proceed under Cash Allowance provisions.

## 1.6 PAYMENT PROCEDURES

.1 Schedule of Values: Provide schedule of values at least 15-days prior to first application for payment. Provide detailed schedule of values including:
- .1 Investigation, submittal, and mobilization costs.
- .2 Separate equipment material cost, and quantities for each equipment type.
- .3 Separate installation cost for major equipment.
- .4 Separate installation cost for each system.
- .5 Separate costs for balancing, start-up and system testing.
- .6 Individual itemized cash allowance amounts.
- .7 Commissioning costs.
- .8 Close-out costs.

## 1.7 ADDITIONAL REGULATORY REQUIREMENTS

.1 Crown Prerogative: Should Crown prerogative be applicable to Work, including statutes that may not bind the Crown, adhere to all laws as if Crown prerogative was not applicable and as if the Crown were bound by all statutes.

.2 Edition Dates: The edition date of applicable laws, regulations, orders and ordinances shall be that of the date of performance of Work. The edition date of applicable codes, standards and practices shall be that adopted at the time of issuance of documents or approvals by authorities having jurisdiction, and shall include modifications, additions and interpretations adopted by that jurisdiction.

.3 Precedence
- .1 Where specified requirements differ from the requirements of applicable regulation, the more stringent requirements shall take precedence.
- .2 Where Drawings or Specifications require or describe products or execution of better quality, higher standard or greater size than required by applicable laws, regulations, orders, and ordinances, Drawings and Specifications shall take precedence so long as such increase is legal.
- .3 Where no requirements are identified in Drawings or Specifications, comply with requirements of regulation.

.4 Permits
- .1 Obtaining: Obtain approvals for the Work including preparing, submitting, processing and obtaining approval. Approvals may include permits, certificates, licenses.
  - .1 Include the following, which may include items to complete on behalf of Owner:
    - .1 Electrical permits.
    - .2 As required.
  - .2 Exclude the following, which may be obtained by others:
    - .1 Building permits.
- .2 Reviews, Tests, and Inspections
  - .1 Despite which entity obtained approvals listed above, make arrangements for and ensure completion of reviews, tests, and inspections by authorities having jurisdiction including serving utilities, regardless if Owner or others solely have the responsibility to communicate with authorities having jurisdiction and serving utilities over specific matters. Owner and Engineer may inform Contractor of same. Notify Owner and Engineer of reviews, tests, inspections, or other site activities by authorities having jurisdiction minimum 48 hours prior to activities taking place.
  - .2 Includes reviews, tests, and inspections that may be required to be completed, or voluntary requested by Contractor, Owner, Engineer.

.3 Upon approval from Owner, arrange for reviews, tests, and inspections, and coordinate dates and times acceptable to Owner and Engineer.
.4 Participate in and be present during reviews, tests, and inspections, and as well as additional follow-up reviews, tests, and inspections.

**1.8 REFERENCES**

.1 Referenced Documents: Drawings and Specifications contain various references, including to various codes, standards, practices and requirements. Such references are used for various purposes, including for products, execution, tests and inspections.
.2 Relationship to Drawings and Specifications: Referenced documents in Drawings and Specifications are made a part of Drawings and Specifications and have the full force and effect as though printed in their entirety in Specifications, including design and installation requirements.
.1 Where referenced documents are indicated, requirements within referenced documents are fully applicable to Work regardless of whether such referenced documents or portions of them may otherwise be exempt from applicability to Work.
.2 Where referenced documents are indicated, including in a referenced documents list, adhere to requirements of referenced documents in their entirety including installation and design requirements, whether or not use of referenced documents is specifically identified elsewhere.
.3 Details and choices related to layouts, sizing and ratings are to be included with submittals.
.3 Completeness: Referenced documents include, whether specifically referred to or not, addenda, errata, interpretations, supplements, handbooks and guidelines as issued or used by:
.1 Referenced document issuing body(s).
.2 Authority(s) having jurisdiction(s).
.4 References Within References: Referenced documents include additional references to other reference documents. Adhere to requirements of these other referenced documents in their entirety to the extent applicable, including installation and design requirements. Details and choices related to layouts, sizing and ratings are to be included with submittals.
.5 Convenience: Specific references are for convenience only and do not limit completeness, including:
.1 Referencing Other Specification Sections: Specification Sections may contain references to other Specification Sections. Such references are made notwithstanding the specific inclusiveness of each Specification Section.
.2 Related Referenced Documents: References may include additional references to related documents, including addenda, errata, interpretations, supplements, handbooks and guidelines.
.6 Copies: Referenced documents are not furnished with Drawings and Specifications as it is presumed that Contractor, subcontractors, manufacturers, suppliers, trades and crafts are familiar with these generally recognized standards of the construction industry.
.7 Names: In the event a referenced document is no longer available or recognized, reference shall be understood to be either:
.1 Latest edition of replacement reference from same publishing organization or body.
.2 Latest edition of replacement reference from replacement publishing organization or body.
.8 Edition Dates

.1 Where an edition or effective date of a referenced document is given, it shall be understood to be the more stringent of:
  .1 As indicated.
  .2 Latest edition adopted by authorities having jurisdiction.
.2 Where an edition or effective date of a referenced document is not given, it shall be understood to be the more stringent of:
  .1 Latest edition adopted by authorities having jurisdiction.
  .2 Latest edition published at time of issuance of permits, certificates, licenses, or approvals by authorities having jurisdiction.
  .3 Latest edition published at time of execution of Contract Documents, whether or not reference has been adopted by authorities having jurisdiction.
.3 Previous Edition Related Referenced Documents: Related reference documents from previous editions of references are to be used in the absence of updates to related documents with indicated reference edition.

.9 Referenced Grades Classes and Types: Where an alternative or optional grade, class or type of product or execution is included in a reference but is not identified on Drawings or in Specifications, provide the highest, best and greatest of the alternatives or options for the intended use and prevailing conditions.

.10 Conflicting Requirements: Where compliance with 2 or more references are specified, or requirements from 2 or more references and/or related reference documents are present, and these references establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to decision by Engineer before proceeding.

## 1.9 DESIGN DOCUMENTS CONTENT

.1 Means and Methods
  .1 Intent of Drawings and Specifications are to describe design intent including scope and quality of Work in a finished state. Contractor is solely responsible for all means, methods, sequences, techniques, and procedures of construction to complete Work as so described.
  .2 Should Drawings and Specifications indicate specific means, methods, sequences, techniques, and procedures of construction, such specifics are for the purposes of minimum quality in completing the Work to a finished state.

.2 Warnings and Specific Limitations
  .1 Should Drawings and Specifications indicate certain types of warnings and specific limitations, such specifics in no way imply authorization of Work that otherwise does not meet requirements of Contract Documents when such warnings and statements are not made elsewhere, including:
    .1 Convenience Warnings: Cautionary notes or warnings or specific limitations are made for the purposes of convenience. Such warnings may include drawing Contractor's attention to matters regarding means, methods, sequences, techniques, and procedures of construction.
    .2 Prohibited Work: Statements on specific prohibited work are made for the purposes of highlighting specific limitations.

.3 Inconsistencies
  .1 Contractor shall report to Engineer immediately when mistakes are found in Drawings and Specifications, if design intent is unclear, or if elements essential to proper execution of Work are discovered to be missing.

.1 Should an essential element be discovered as missing or mistakes are found prior to receipt of Bids, an Addendum will be issued so that costs may be accounted for in Contract Price.
.2 Should an obvious omission or obvious mistake describing a necessary element be discovered and reported after execution of the Agreement, Contractor shall provide the element as though fully and correctly described, and a no-cost Instruction or Change Order shall be executed.
.3 Refer to related general requirements regarding construction interfacing and coordination.

.2 In case of inconsistency(s) between or within Drawings and Specifications, provide the following unless interpreted otherwise by Engineer:
.1 For differences in indicated quality, adhere to better quality of Work.
.2 For differences in indicated quantity, adhere to greater quantity of Work.
.3 For other differences, adhere to the more stringent requirement as determined by Engineer.

**1.10 ADDITIONAL TECHNICAL INFORMATION**

.1 The following information is not necessarily provided with Contract Documents, but is to be reviewed by Contractor as part of Contract Documents:
.1 Owner Requirements: The following information is available or can be made available on site upon request:
.1 City of Hamilton Master Specifications for Direct Digital Control System Upgrades
.2 Site Information: The following information is available or can be made available on site upon request:
.1 Building drawings.
.2 Supplemental project and renovation drawings.
.3 Asbestos reports.
.4 Hazardous materials reports.
.5 Operating and maintenance manuals.
.6 Other reports and plans.
.3 Specification Information: The following information will be available for review at Engineer’s business address with reasonable notice:
.1 Referenced documents.

**1.11 SUBMITTAL PROCEDURES**

.1 Provide submittals as indicated. Required submittals may only be described in submittals articles of each Section and may not be further described in products or execution articles of each Section.
.2 Submittals For Action
.1 Submit as indicated to Engineer and Owner for review. Reviews shall be for the limited purpose of reviewing general conformance with the design concept expressed in Contract Documents. Submittal comments or lack thereof in no way relieve Contractor’s responsibility for meeting all requirements of Contract Documents.
.2 It is Contractor’s sole responsibility to ensure that submittals are timely, complete and comprehensive.
.3 Engineer may not review information provided if such information is incomplete or not comprehensive.
.4 Engineer may comment on incomplete or missing submittals.
.5 Engineer may provide commentary, notes or warnings on review of submittal. Contractor shall carefully read submittal review, complete investigations as

required to address submittal review contents, and re-submit submittal prior to ordering products or proceeding.

.6 In the event Work requiring submittal for action has been completed without Engineer's written review, modify Work as required, including as indicated by Engineer, with no changes to Contract Price or Contract Time.

.3 Submittals For Information

.1 Submit as indicated to Engineer and Owner on behalf of Commissioning Authority and/or Owner. No review action will be taken by Engineer.

.4 Submittals For Closeout

.1 Submit as indicated to Engineer and Owner on behalf of Commissioning Authority and/or Owner. No review action will be taken by Engineer.

.5 Other Submittals

.1 Submit other submittals as indicated to Engineer and Owner.

.6 Submission

.1 Transmit each submittal with a letter of transmittal as acceptable to Engineer.

.2 Schedule submittals to expedite Work and coordinate submission of related items.

.7 Content: Identify relevant and required information, including:

.1 Project name.

.2 Contractor, subcontractor and supplier, as applicable.

.3 Pertinent Drawing and detail number, and Specification Section and Title, as appropriate, on each copy.

.4 Bill of materials for products or system features included in submittal. Bill of materials to include tag, description, quantities, makes, and model numbers or part to be ordered. Model numbers to be complete, including selected features and options, special instructions or custom aspects. Provide notes to describe special instructions or custom aspects, as well as notes on who is responsible and where to provide, i.e. at factory by manufacturer or in field by Contractor. Indicate selected features and options on each submittal page or product sheet by using annotation boxes or highlights.

.5 Variations from Contract Documents.

.6 Extent of impacts on requirements due to variations from Contract Documents, including performance requirements.

.7 Product or system limitations that may be detrimental to successful performance of completed Work.

.8 Custom fabrications or assemblies that may require professional engineering services.

.9 Changes made since previous submission.

.8 Apply Contractor's stamp to submittal documents stating submittal has been reviewed, complete with review date and reviewer name. Contractor stamp applied to submittal documents certifies Contractor investigations have been completed, including verification that product characteristics, field dimensions, adjacent construction Work, and coordination of information are in accordance with requirements of Work and Contract Documents.

.9 Format: Transmit submittals in electronic format unless otherwise indicated.

.10 Quantity: Unless otherwise indicated, submit 4 copies of submittals in paper format when printed or paper format is indicated.

.11 Distribution: Engineer will transmit reviewed submittals with further action as required to Contractor and others at Engineer's discretion. Submittals with completed review actions shall be distributed by Contractor as appropriate.

.12 Modifications: Engineer may at Engineer's discretion choose to:

.1 Review an incomplete submittal.

.2 Designate a transmittal as a request for substitution or Change Proposal.
.3 Designate a transmittal as a request for clarification.
.4 Review submittals for information or submittals for closeout.
.5 Change the submittal type, such as a submittal for information into a submittal for action.

**1.12 PRODUCT REQUIREMENTS**

.1 Selection: Provide products that are new, unused, undamaged.
.2 Ratings: Provide products that are rated for the conditions to which they will be subjected, including typical operation and potential extremes.
.3 Required Products: Provide products of types and kinds that meet regulatory requirements and standards including provisions of local building code. Various product requirements apply, including:
  .1 Combustible Materials: Provide products as indicated and that meet local building code, including to provisions of local building code even should local building code not apply, including where building is or is required to be of non-combustible construction to local building code, including:
    .1 Non-combustible materials.
    .2 Minor combustible components as specifically described. Provide submittals to Engineer on materials that may be defined as “similar minor components”.
    .3 Combustible materials and components and their application where specifically described.
  .2 Fire Resistance Ratings: Where materials and assemblies do or are required to have fire resistance ratings, provide products as indicated and that meet local building code, including to provisions of local building code even should local building code not apply, including:
    .1 Determination of ratings and minimum ratings.
    .2 Exceptions and exposure conditions of ratings.
.4 Standard Products: Where specific products are not specified or required be regulation, provide standard products of types and kinds that are suitable for intended purposes, use and effect, and that are usually and customarily used on similar projects under similar conditions. Products shall be subject to review and acceptance by Engineer.
.5 Completeness: Provide products complete with details and configuration needed for a complete installation and for intended purposes, use and effect, including accessories, trim, finish, safety guards, structural supports, platforms, braces, tie-rods, and other devices. Provide products with services and components connections of type(s) and configuration required to match the requirements for mating services and components.
.6 Service Connections: Coordinate requirements and types of connections to services and components by matching requirements for such services and components as indicated throughout Drawings and Specifications, or as required where not indicated.
.7 Consistency: Provide products of the same kind from the same manufacturer and from a single source over duration of Work. Provide specified product options from same manufacturer as product and native to product to the fullest extent possible.
.8 Visual Matching: Where sample matching is required, the decision by Engineer on whether a proposed product matches shall be final. Where no product visually matches but the product complies with other requirements, comply with provisions for substitutions for selection of a matching product in another category.

.9 Options Selection: Where requirements include the phrase “as selected from manufacturer’s standard colours, patterns and textures” or a similar phrase relating to options as well as features, selections of products will be made by indicated party or, if not indicated, by Engineer. Engineer will select options from the product line of submitted manufacturer if all other specified provisions are met.

.10 Specification Methods

.1 By Name: Where Specifications describe one or more manufacturer names, brand names or model numbers, provide a product to meet these requirements.

.2 By Description: Where Specifications describe a product, listing characteristics required, with or without use of a manufacturer name or brand name, provide a product to meet these requirements as determined by Engineer, including operational characteristics, performance attributes, quality, serviceability, and other relevant characteristics.

.3 By Performance Requirements or Intent: Where Specifications require compliance with performance requirements, intent, or functionality, provide product(s) and/or assemblies that comply and are recommended by the manufacturer for the intended application. Verification of manufacturer’s recommendations may be by product literature or by certification of performance from manufacturer.

.4 By Referenced Documents: Where Specifications require compliance with a referenced document including standards, provided product shall fully comply with the referenced document.

.5 By Combination of Methods: Where products are specified by a combination of attributes, including manufacturer’s name, product brand name, product catalogue or identification number, industry standards, referenced documents, or description of product characteristics, provide products conforming to specified attributes.

.11 Products, Assemblies and/or Systems Assemblies Specified by Performance and/or Future Requirements: Where Specifications require compliance with performance or future requirements, including intent, functionality, or capability, select products and design assemblies and/or systems to meet specified requirements, provide and revise submittals to satisfaction of Engineer, and demonstrate requirements met upon request to satisfaction of Engineer.

.12 Product Features: Product features specifically indicated or otherwise required may require custom configuration and customization from manufacturer, even for products where a specific manufacturer and/or product line is specified.

## 1.13 EXECUTION REQUIREMENTS

.1 Acceptance of Conditions

.1 Examine existing conditions, surfaces and substrata upon which Work depends.

.2 Drawings are diagrammatic and intended to convey scope of Work and indicate general and approximate location, arrangement and sizes of equipment and services including piping, ductwork, venting, and wiring.

.3 Obtain more accurate information about locations, arrangement and sizes from:

.1 Site inspection and measurement.

.2 Study and coordination of existing building drawings including base building drawings and supplemental project and renovation drawings, existing equipment and systems shop drawings, and manufacturers’ literature.

.2 Means, Methods, Sequences, Techniques, and Procedures of Construction
  .1 Engage a professional engineer under Delegated Professional Design to provide design documents on Work related to means, methods, sequences, techniques, and procedures of construction, including:
    .1 Temporary structures including shoring, bracing, hoarding, underpinning, and scaffolding.
    .2 Hoisting and rigging activities.
    .3 Modifications or alterations to surfaces or structures, including doorways, walls, floors, ceilings, roofs.
    .4 As required by regulation and Owner policies, including matters related to health and safety.
.3 Preparation
  .1 Determine exact location and routes for Work including equipment and services.
  .2 Relocation
    .1 Modify routing and/or relocate equipment and services as required.
    .2 Relocate existing equipment and services as required, including piping, ductwork, venting, electrical, controls, fire protection including sprinklers and detection.
  .3 Demolition and Removal
    .1 Remove existing equipment and services as indicated.
    .2 Remove existing and obsolete equipment and services to satisfaction of Owner within affected areas including:
      .1 Equipment and services affected by Work, including interference and components modified by Work.
      .2 Equipment and services not affected by Work.
      .3 As indicated including markings on site.
    .3 Relocate existing equipment and services that interfere with Work.
    .4 Refrain from cutting by dismantling whenever possible. If cutting is required, submit Demolition Plan for review before cutting.
    .5 Create or enlarge openings in surfaces or structures, including doorways, walls, floors, ceilings, roofs, as required to permit installation of equipment and services, and reinstate as required.
    .6 Patch openings, and refinish surfaces including walls where parts are removed or relocated.
      .1 Subject to Owner approval, openings in occupiable spaces with special finished surfaces that are not practical to match may be covered by plates matching existing décor. Covering plate material and finish subject to Owner approval.
.4 Digging and Excavation
  .1 Refrain from pumping waste, dirt, or suspended materials into waterways, sewer, or drainage systems without prior treatment.
  .2 Dust Control: Cover or wet down dry materials and rubbish to prevent blowing dust at all times.
  .3 Protect trees and plants from damage.
    .1 Regularly water trees and plants under stress from construction activities.
    .2 Wrap trees and plants, and construct temporary mechanical protection as required.
    .3 Protect roots from damage from excavation activities, and soil compaction.
    .4 Replace trees and plants damaged by construction activities.
.5 Transportation, Delivery and Handling

.1 Comply with manufacturer's instructions and recommendations.
.2 Provide all equipment and personnel as required.
.3 Coordinate with Owner for delivery and acceptance.
.4 Schedule delivery to minimize long-term storage and prevent overcrowding construction spaces. Coordinate with installation to ensure minimum holding time for items that are flammable, hazardous, easily damaged or sensitive to deterioration, theft and other losses.

.6 Storage
.1 Provide temporary off-site storage for products until ready for installation. Temporary on-site storage is prohibited unless approved by Owner.
.2 Store and protect products in accordance with manufacturers' instructions, with seals and labels intact and legible.
.3 Store sensitive products in weather-tight enclosures or covered with an impervious sheet covering. Provide adequate ventilation, temperature and humidity control to avoid condensation, corrosion and damage due to temperature and humidity limits.
.4 Periodically inspect storage areas to ensure that products are undamaged and are maintained under required conditions.
.5 Products damaged by improper storage or protection shall be removed and replaced with new products, with no changes to Contract Price or Contract Time.

.7 Products, Assemblies and/or Systems Assemblies Specified by Performance and/or Future Requirements: Where Specifications require compliance with performance or future requirements, including intent, functionality, or capability, select products and design assemblies and/or systems to meet specified requirements, provide and revise submittals to satisfaction of Engineer, and demonstrate requirements met upon request to satisfaction of Engineer.

.8 Installation of Products
.1 Comply with manufacturer's instructions and recommendations for installation of products, except where more stringent requirements are specified, are necessary due to Work, or are required by authorities having jurisdiction.
.2 Anchor each product securely in place, accurately located and aligned with other Work.
.3 Clean exposed surfaces and provide protection to ensure freedom from damage and deterioration.
.4 Provide sufficient clearance for servicing and maintenance access.
.5 Protect installed products from damage during construction, including surface marring, vibration and dust. Provide protective wrappings as required.

.9 Cleaning
.1 Conduct cleaning operations as required, including Owner requirements, applicable laws, regulations, orders and ordinances, codes, standards, and practices, including waste management and environmental protection laws.
.2 Clean areas, equipment, fixtures, surfaces, and products affected by construction including:
.1 Parking areas, sidewalks, driveways and streets.
.2 Metal surfaces.
.3 Floor surfaces.
.4 Horizontal and vertical surfaces.
.5 Lighting fixtures.
.6 Glass and mirrors.
.7 Exterior grounds and gardens.

.8 Metalwork: Clean and buff metalwork to be free of soiling and fingerprints. Mirror finished metal work shall be buffed to high lustre.

.3 Building Exterior Cleaning: Clean surfaces in existing and adjacent buildings where construction activities have caused soiling and migration and accumulation of dust and debris.
.1 Wash down exterior surfaces to remove dust.
.2 Clean exterior surfaces of mud and other soiling.
.3 Clean exterior side of windows, including window framing.

.4 Ventilation System Cleaning: Replace filters and clean heating and ventilating equipment used for temporary heating, cooling and ventilation.

.5 Cleaning Frequency
.1 Minimum daily and more frequently as required for the following:
.1 Occupiable and visible areas.
.2 Minimum weekly and more frequently as required for remaining areas.

.6 Cleaning Agents and Materials
.1 Non-hazardous to health or property.
.2 Use cleaning materials only on surfaces recommended by cleaning agent manufacturer.
.3 Use only those cleaning agents, materials and methods recommended by manufacturer of the material to be cleaned.

.7 Contract Completion Review Cleaning: Execute a thorough cleaning prior to Contract Completion review. Complete final cleaning before submitting final Application for Payment.

.10 Reinstatement
.1 Reinstate systems and components that may have been modified or relocated due to Work to satisfaction of Owner and Engineer.
.2 In addition, reinstate the following areas and with indicated frequency:
.1 Minimum daily and more frequently as required for the following:
.1 Occupied and visible areas.
.2 As required for remaining areas to not interfere with building operations.

.11 Waste Removal
.1 Conduct disposal operations as required, including Owner requirements, applicable laws, regulations, orders and ordinances, codes, standards, practices, waste management laws, and environmental protection laws.
.2 Provide waste removal facilities and services as required to maintain the site and existing facilities in clean and orderly condition.
.3 Provide containers with lids. Dispose of waste off-site periodically.
.4 Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

.12 Waste Management
.1 Separate and dispose of construction waste as required and in compliance with Owner requirements, applicable laws, regulations, orders and ordinances, codes, standards, and practices, including waste management and environmental protection laws.

.13 Reviews, Tests, and Inspections
.1 Inform Owner of scheduled reviews, tests, and inspections required, regardless if Owner solely has responsibility to communicate with other entities over specific matters. Owner and Engineer may inform Contractor of same.
.2 Includes reviews, tests, and inspections that may be required to be completed, or voluntary requested by Contractor, Owner, Engineer.

.3 Upon approval from Owner, arrange for reviews, tests, and inspections, and coordinate dates and times acceptable to Owner and Engineer.
.4 Participate in and be present during reviews, tests, and inspections, as well as additional follow-up reviews, tests, and inspections.

.14 Handover
.1 Operational Responsibility
.1 For systems, equipment, and components affected by Work, Contractor's operational responsibility includes all responsibilities that would otherwise fall to Owner, including operation to be to the safe, reliable, performing to expectations. Contractor responsibilities include coordination with Owner regarding operational requirements. Operational responsibility for new or existing affected systems, equipment, or components, remains with Contractor until such responsibility is transferred to Owner.
.2 Transfer of Operational Responsibility
.1 When Contractor has achieved a level of completion appropriate for transferring operational responsibility to Owner, Contractor shall:
.1 Provide written notice that Contractor intends on transferring operational responsibility to Owner, including clear indication of which specific aspects of Work are covered by the notice.
.2 Provide Owner with a detailed list of any outstanding items of Work related to the equipment or systems being transferred to Owner's responsibility.
.3 Provide a date and time acceptable to Owner for when the transfer of responsibility is to be become effective. Such date shall not be less than 7-days nor more than 31-days from the date the notice is provided to Owner.
.4 Provide confirmation acceptable to Owner that required training, documentation, regulatory approvals, functional testing, and commissioning have been completed and submitted to Owner as required.
.2 Should Owner choose to waive any such requirements for the purpose of interim operations, Contractor is not relieved of the responsibility for meeting such requirements at a later date.
.3 Demonstration of Interim Operation
.1 Based on Owner's discretion of completion level, including completion of specific areas or elements of Work, when Contractor has achieved a level of completion appropriate for demonstration to Owner for the purpose of operation by Owner, Contractor shall:
.1 Provide to Owner a summary of Work completed.
.2 Show Owner Work completed.
.3 Provide to Owner required training and documentation necessary for Owner to operate in the interim until final training is provided.
.4 Review and document logging and reporting requirements of Owner during interim operation.
.2 Should Owner choose to waive any such requirements for the purpose of interim operations, Contractor is not relieved of the responsibility for meeting such requirements at a later date.

## 1.14 SUBSTITUTION PROCEDURES

.1 Request for Substitution (RFS): A written request submitted by Contractor to deviate from specified product requirements.

.2 RFSs are only to be submitted after Contractor has completed thorough investigations and planning to incorporate substitution into Work to achieve full use and effect.
.3 RFSs will only be considered when submitted in sufficient time to permit review by Engineer.
.4 RFSs to include differences between specified requirements and substitution, including the following:
  .1 Clear title denoting the document as a “Request for Substitution”.
  .2 Reason for requesting substitution that is justifiable to Engineer.
  .3 A summarized comparison of physical properties and performance characteristics for specified requirements and substitution, and clearly highlighting variations.
  .4 Indication of reductions to contract costs and dates.
  .5 Verification that substitution will not result in additional costs or a reduction in performance to other portions of Work.
  .6 Additional information for products including:
    .1 Identification, including manufacturer’s name, address, telephone and fax numbers, and web site address where available.
    .2 Manufacturer’s data sheets, including material descriptions, compliance with regulation and referenced documents and applicable standards, performance and test data.
    .3 Indication of availability of maintenance services and sources of replacement materials and parts, including associated costs and time frames.
.5 Provide additional information requested by Engineer, including:
  .1 Demonstration that substitution will perform equally as well or better than specified product(s).
  .2 Demonstration that other provisions of this Article will be met.
.6 Clauses such as “or equal”, “or approved equal”, or other similar clauses, will not be construed as an invitation to submit RFSs or to unilaterally substitute in place of specified requirements.
.7 Failure to complete Work or portions of Work in adequate time to meet approved construction schedule will not be a valid reason to submit RFSs. Delays remain responsibility of Contractor, with no changes to Contract Price or Contract Time.
.8 RFSs may be rejected for any reason, including:
  .1 Proposed substitution is not equivalent to the specified product(s), as determined by Engineer.
  .2 RFS does not meet submission requirements or other provisions described in this Article.
  .3 Owner chooses not to entertain RFS.
.9 In the event a substitution has been incorporated into Work without obtaining written acceptance of the RFS:
  .1 Contractor shall remove the substitution and replace it with specified requirements, with no changes to Contract Price or Contract Time.
  .2 Alternatively, should substitution be reviewed by Engineer and later accepted by Owner, Contract Price shall be reduced by the sum of:
    .1 The amount that the installed price of specified requirements exceeds that of substitution, as determined by Engineer.
    .2 Engineer fees required to review and evaluate the substitution, regardless if substitution is accepted.
    .3 Additional engineer fees as required including administering substitution procedures, documentation.

.4 The net present value of lifecycle costs resulting from substitution, as determined by Engineer, including energy efficiency, maintenance costs, fees related to application and approval of permits, and modifications to related Work resulting from substitution.

.10 Substitutions shall not result in any delay in completion of Work, including other activities and projects under separate contracts by Owner.

.11 Substitutions shall not result in any increase in Contract Price and Contract Time.

.12 Should changes be required due to substitutions, such changes shall be made by Contractor, with no changes to Contract Price or Contract Time, whether or not such changes are known at the time substitution is accepted. Changes may result in additional costs incurred by Owner.

**1.15 GENERAL REVIEWS**

.1 Terms

.1 "General review" in Contract Documents is same as defined by regulation, including local building code, professional practice guidelines, or the same as other terms such as "conformance review" or "general assessment" for the whole of or any part of Work as determined by Engineer, including general review not specifically required by regulation including local building code.

.2 "Engineer" in this article is either Engineer as already defined, or professional engineer under Delegated Professional Design, as required for the whole of or any part of Work.

.2 Purpose: General reviews are completed by Engineer as required for the purpose of reviewing whether Work is in general conformance with the design concept and completed to regulatory requirements.

.1 No implied approval or acceptance of submittals, substitutions, or changes shall be inferred from general reviews.

.2 No implied approval or acceptance of changes in Contract Price and Contract Time shall be inferred from general reviews.

.3 General reviews are not to be relied upon for testing, commissioning, and required inspections by authorities having jurisdiction or other quality assurance purposes.

.4 General reviews do not relieve Contractor of responsibility for meeting all requirements of Contract Documents.

.3 Frequency: Frequency of general reviews determined by Engineer during Contract Time or after Contract Time.

.1 General reviews will continue to be made until the final general review.

.4 Reports: Engineer will submit a report for each general review.

.1 General review reports may include references to other documents that are considered as part of the general review report.

.2 Notify Engineer in writing within 3 working days of receiving general review report should Contractor disagree with items noted in report including references.

.5 Punch Lists: Prepare and maintain on site a comprehensive list of items to be completed and corrected to make Work ready for acceptance by Owner.

.1 Update punch list with items described in general review reports.

.2 Immediately correct deficiencies and incomplete items described in general review reports at no change in Contract Price or Contract Time.

.6 Final General Review

.1 Submit written request for final general review indicating completion of Work. Include date and signature.

.2 Final general review request will imply, whether stated or not, the following:

.1 Statement that all outstanding general review items have been rectified.

.2 Declaration that Contractor has prepared and completed all final completion submittals as described below.
.3 Upon receipt of request, Engineer will proceed with final general review.
.4 In the absence of written request for final general review, final general review will be completed after Substantial Performance has been first requested.

**1.16 QUALITY CONTROL**

.1 Quality Assurance: Ensure products, services, workmanship and site conditions comply with requirements by coordinating, supervising, testing and inspecting Work, and by utilizing only suitably qualified personnel.
.2 Minimum Quality: Where no quality basis is prescribed, quality shall be in accordance with the more stringent of:
.1 Best accepted practices of the construction industry for projects of this type, and in this location.
.2 Quality of the latest changes and renovations to the existing building installation, as it exists now.
.3 Quality of the existing base building installation, as it existed when newly installed.
.3 Quality of Installation: Produce Work plumb, level, square and true, or true to indicated angle, and with proper alignment and relationship between the various elements. Ensure Work is properly related to form close joints and appropriately aligned junctions, edges and surfaces and is free of warp, twist, wind, wave or other irregularities.
.4 Manufacturer's Instructions and Recommendations: Comply with manufacturer's instructions in preparing, fabricating, erecting, installing, applying, connecting and finishing Work, unless more stringent requirements are required, indicated or specified.
.5 Protection: Take measures necessary to preserve and protect existing and completed Work free from damage, deterioration, soiling and staining, until Acceptance by Owner.
.6 Defects and Blemishes: Correct defects, blemishes and other aesthetic issues identified by Engineer.
.7 Deviations: Document and explain deviations from requirements, including applicable standards, referenced documents, building code research report requirements, and manufacturer's product installation instructions and recommendations. Include written acknowledgment by manufacturer that such deviations are acceptable and appropriate for Work. Ensure Work does not infringe on applicable patents or intellectual property rights.
.8 Photo Documentation
.1 Photo document construction progress with time stamped digital photographs.
.9 Logs: Maintain daily sign in and sign out logs for all personnel on site. Owner may dictate location of logs.
.10 Verification of Quality: Work shall be subject to verification of quality by Owner or Engineer in accordance with provisions of Contract Documents.
.11 Inspections and Tests
.1 Inform Owner and Engineer of required inspections, tests, and reviews, including those required by:
.1 Conditions of warranty.
.2 Product, material or equipment manufacturers.
.3 Certification of Work.
.4 Commissioning.
.5 Contract Documents.
.6 Authorities having jurisdiction.

.7 Regulation.

.2 Contact manufacturers, suppliers, authorities having jurisdiction, and others as required sufficiently in advance to confirm which, if any, inspections, tests, and reviews are required, including when required as a condition of permits, certificates, and licences not obtained by Contractor.

.3 Make arrangements for required inspections, tests and reviews. Coordinate dates and times that are acceptable to Owner and Engineer.

.4 Participate in and be present during inspections, tests and reviews, as well as additional follow-up inspections, tests and reviews.

.1 Arrange and pay for the presence and participation of manufacturers, suppliers, service representatives, subcontractors, authorities having jurisdiction, and others that may be required to be present during such activities.

.12 Monitoring: Owner may monitor construction site including video surveillance to document construction progress and to provide evidence for valuing Change Directives.

## 1.17 USE OF SITE AND PREMISES

.1 Schedule Restrictions

.1 Schedule daily and weekly construction activities as required by Owner.

.2 Schedule Work around:

.1 Work being performed by others under separate contracts with Owner.

.2 Normal use of the facility, including in areas affected by Work.

.3 Schedule Work outside of occupied hours for:

.1 Work requiring disruption of services to occupiable areas.

.2 Work that may disrupt or disturb occupants.

.2 Request clarification of all matters regarding the use of site and premises that may impact construction activities.

.3 Meet Owner requirements during construction including:

.1 Allowable construction hours.

.2 Notices and scheduling of Work.

.3 Notices and scheduling of disruption of services.

.4 Facilities and utilities use.

.5 Parking.

.6 Security requirements.

.7 Identification requirements.

.8 Access requirements including availability and requirements of use for elevators, loading areas and pathways.

.9 Disruption mitigation requirements including noise, vibration, dust, combustion gases, and smoke.

.10 Submission of written plans for various aspects of Work, including phase-in planning, disruption mitigation, emergency procedures, Methods of Procedures (MOP).

.11 Hazardous materials.

.12 Storage requirements.

.13 Disposal requirements including for garbage and debris.

.14 Cleanliness and organization of work areas including for tools, materials, equipment.

.15 Cleanliness and visual appearance of areas affected by Work.

.16 Protection of surfaces and other items affected by Work.

.17 Specific Limitations

.1 Construction Hours

.1 Work in various areas is required to be completed outside of normal facility operating hours.
.2 Work in occupiable spaces is required to be completed outside of normal occupied hours.
.3 Work in some areas is required to be completed during scheduled shutdown periods.
.4 Prior to the beginning of scheduled operations each day, remove visual evidence of Work from occupied areas such that occupants should be unable to visually determine that areas were impacted by Work.

.2 Parking: Site has no parking available except for loading and unloading materials to Site.
.3 Identification Requirements: Contractor company and name tags for every individual must be worn readily visible and at all times while on site.
.4 Access Requirements: Minimize use of public access entrances and exits where possible, otherwise coordinate and schedule use.
.5 Disruption Scheduling: Specific other services may not be disrupted during normal facility operating hours, including fire detection system.
.6 Materials Storage: Storage space on site is limited to service rooms in working areas with the provision that stored materials cannot interfere with normal facility operations. 2 parking spots in nearby parking lot will be made available for storage.
.7 Security: Security is required after normal hours in all locations. Security by base building security provider.
.8 Fire Watch: Fire watch by base building fire watch provider.
.9 Cleaning: Cleaning of occupied areas by base building cleaning provider.

.4 Emergency Egress: Maintain means of egress during construction including pathways, exit ways, exit doors, drives, gates, as required by Owner and authorities having jurisdiction.
.5 Disruption
.1 Do not disrupt facility except as specifically permitted in Contract Documents.
.2 Disruption of facility includes interference with:
.1 Maintenance activities, site staff, Engineer or Owner's access to facility.
.2 Normal use of facility, including activities that may be temporarily suspended as a result of Work, either within or outside of areas affected by Work.
.3 Activities temporarily suspended as a result of Work may resume at various milestone dates, including full resumption of normal facility use in all areas as of the date substantial performance is required to be achieved, regardless of whether or not substantial performance is actually achieved by this date.

## 1.18 TEMPORARY FACILITIES AND CONTROLS

.1 Provide temporary facilities and controls as required.
.2 Temporary Services: Provide temporary services as required, including lighting, pumping, heating, ventilation, cooling, and de-humidification. Temporary services may be required of Work space or other spaces. Purposes of temporary services include:
.1 Maintain occupant comfort.
.2 Maintain building environment.
.3 Maintain equipment and system redundancy requirements.
.4 Maintain safety systems.
.5 Maintain protection.
.6 Prevent interference or disruption of occupant operations.

.7 Prevent damage, including to areas, systems, services, equipment, components, finishes.
.8 Provide adequate temperature and humidity levels for storage, curing or drying.
.9 Prevent migration and accumulation of dust, debris, fumes, smoke, gases, or odours.
.10 Prevent flooding and standing water.
.11 Prevent spills.

.3 Work Protection: Provide temporary protection for installed products and services. Control traffic in immediate area to minimize damage.

.4 Protective Coverings: Provide protective systems and barriers at services and systems, including at air inlets and grilles, to prevent maintenance and operational impacts outside of working area. Includes noise, sound, vibration, dust, debris, fumes, smoke, gases, odours.

.5 Surfaces Protection
.1 Protect existing surfaces from soiling and damage, including floors, with protective conversing as required.
.1 Minimum for Floors
.1 2 layers of 0.08-mm (3-mil) polyethylene sheets, extending sheets 460-mm (18-in) up the side walls.
.2 Cover polyethylene sheets with minimum 25-mm (1-in) fire-retardant plywood.
.2 Provide mats to clean dust and debris from traffic entering and existing the Work space.

.6 Temporary Barriers: Provide temporary fencing, barriers and guardrails as necessary to provide for public safety, to prevent unauthorized entry to construction areas, and to protect existing facilities and adjacent properties from damage from construction operations.

.7 Temporary Closures: Provide temporary closures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations and similar activities. Provide temporary weather-tight enclosure for building exterior.

.8 Temporary Communications: Provide temporary communications as required for proper performance of the Work.

.9 Other Temporary Provisions
.1 Maintain safety systems and occupant protection.
.2 Provide temporary fencing, trailers, sanitary facilities, and other structures as required. Obtain approval for type, aesthetics, and location.

.10 Supervision: Provide supervision of temporary facilities and controls, including utilities and HVAC, where disruption or failure of such services may impact occupants, cause interruption of critical services, cause safety concerns, increase risk to life and property, cause other damages.

.11 Removal of Temporary Facilities and Controls
.1 Remove temporary facilities and controls, including utilities, equipment, materials, prior to Substantial Performance Review.
.2 Remove underground installations to a minimum depth of 610-mm (2-ft). Grade site as required.
.3 Clean and repair damage caused by installation or use of temporary facilities and controls.
.4 Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to condition equal to or better than at commencement of construction.

## 1.19 UNKNOWN SITE CONDITIONS

.1 If all of the following conditions exist, Contractor shall stop Work and give written notice of the conditions before they are disturbed, and in no event later than 5 working days after first observance of the conditions.
  .1 Nature of condition is hidden or concealed from visual inspection or other inspection responsibilities identified in the Bid Documents.
  .2 Condition is materially different from those indicated in Contract Documents.
  .3 Condition is materially different from those indicated in Additional Technical Information.
  .4 Condition is materially different from those normally encountered.

.2 Contract dates including Contract Time may be considered for change only when all of the following conditions exist:
  .1 Work is complete in other areas without unknown conditions.
  .2 Contractor is not able to complete Work in areas with unknown conditions encountered or suspected.
  .3 Owner has not completed addressing any issues surrounding such conditions.

## 1.20 CLARIFICATION PROCEDURES

.1 Request for Clarification (RFC): A document submitted by Contractor requesting clarification of a portion of Contract Documents, hereinafter referred to as an RFC.
  .1 Submit a written RFC when any of the following occur:
    .1 Requirement Unclear: Exact material, process, or system to be installed is unclear.
    .2 Interference: Elements of construction are required to occupy the same space.
    .3 Requirements Conflict: Work is described differently in more than 1 place.
  .2 RFCs shall not be used for the following purposes:
    .1 To request review of submittals.
    .2 To request approval or acceptance of substitutions.
    .3 To request changes that only involve change in Contract Price and Contract Time.
    .4 To request methods of performing Work different than as indicated.
  .3 Requested Information: RFCs that request interpretation of requirements clearly indicated in Contract Documents will be returned without interpretation.
    .1 In cases in which RFCs are issued to request clarification of issues related to means, methods, sequences, techniques, and procedures of construction, Contractor to furnish information required for Engineer to analyze and/or understand the circumstances causing the RFC and prepare a clarification or direction as to how Contractor shall proceed. Examples include services routing including piping and ductwork, specific locations of Work shown diagrammatically, clearances indicated or required, apparent interferences.
    .2 If information included with this type of RFC by Contractor is insufficient, the RFC will not be answered.

.2 Disputed Requirements: In the event that Contractor believes that a clarification by Engineer results in changes to Contract Price or Contract Time, Contractor is to not proceed with Work indicated by the RFC until authorized to proceed by Owner and Engineer and claims, if any, are resolved in accordance with Contract provisions.

## 1.21 CONTRACT MODIFICATION PROCEDURES

.1 Instruction Supplement: Consultant will issue an Instruction Supplement (Supplemental Instruction) authorizing changes in Work not involving adjustment to Contract Price or Contract Time.

.2 Change Proposal: If conditions require modifications to Contract Documents and upon written request from Engineer, Contractor may document potential impacts to Contract Documents through submitting a Change Proposal. Adhere to instructions from Engineer which may include the following:

.1 Description of proposed change.

.2 Reason for change.

.3 Impacts to Contract Price, with additional details for explanation, including costs and hours from own forces, subcontractors, materials.

.4 Impacts to Contract Time, other Contract dates, or construction schedule, with additional details for explanation.

.3 Change Order: On Owner's approval of a Change Proposal, Engineer will issue a Change Order for signature by Owner and Contractor.

## 1.22 COMMISSIONING REQUIREMENTS

.1 Summary

.1 Contractor is responsible for implementing and completing commissioning activities to this Section.

.2 Commissioning is additional to activities indicated including start-up, quality control, quality assurance, testing and balancing.

.3 Commissioning is a prerequisite requirement for Substantial Performance application.

.2 Definitions

.1 "Commissioning": A planned program of tests, procedures and checks carried out systematically on systems and integrated systems of Work.

.2 "Commissioning Plan": A plan that details the intent, responsibilities, extent and submittals of commissioning that will be used to meet commissioning objectives.

.3 "Demonstrations": A test or simulation whereby evidence of properly functioning equipment or systems is provided by means of independent third-party witnessing.

.4 "System State": A recorded snapshot of the system operation, including temperature, humidity, pressure, flow, amperes, actuator position, efficiency.

.3 Objectives

.1 Commission systems, services, equipment and components directly or indirectly impacted by Work unless otherwise indicated.

.2 Verify and provide documented evidence that installed systems, services, equipment and components operate to Contract Documents and design intent.

.4 Commissioning Procedures

.1 Complete commissioning activities to approved schedule.

.2 Submit commissioning submittals.

.3 Arrange and facilitate demonstrations.

.5 Commissioning Plan

.1 Provide Commissioning Plan describing how Work will be commissioned to this Section, including:

.1 Schedules: Provide a schedule of commissioning activities.

.2 Commissioning Check List: Prepare a check list of activities required to properly commission systems as indicated.

.3 Seasonal Adjustments and Tuning: Describe methodology for testing, verifying, and adjusting systems periodically throughout the year to ensure that systems as required in each season.

.2 Prepare Commissioning Plan to referenced documents in this Section.

.3 Submit Commissioning Plan for review minimum 20-days prior to commissioning.

.4 Revise Commissioning Plan as required to satisfaction of Engineer.

.6 Referenced Documents

.1 ASHRAE-202: ANSI/ASHRAE/IES-202-2013 Commissioning Process for Buildings and Systems.

.2 ASHRAE-G-0: ASHRAE-G-0-2013 Guideline on The Commissioning Process.

.3 ASHRAE-G-0.2: ASHRAE-G-0.2-2015 Guideline on The Commissioning Process for Existing Systems and Assemblies.

.4 ASHRAE-G-1.1: ASHRAE-G-1.1-2007 Guideline on HVAC&R Technical Requirements for the Commissioning Process.

.5 ASHRAE-G-11: ASHRAE-G-11-2009 Guideline on Field Testing of HVAC Controls Components.

.6 ACG-CG: ACG Commissioning Guideline 2005.

.7 Commissioning Submittals

.1 Documentation

.1 Warranties.

.2 Certifications.

.3 Test results.

.4 Quality control and quality assurance submittals.

.5 Commissioning activities.

.6 Closeout submittals.

.2 Documentation of System State at full and part load conditions for the following states and modes of operation:

.1 Start-up conditions.

.2 Normal operating conditions.

.3 Simulated maximum capacity.

.4 Simulated minimum capacity.

.5 All other modes of operation.

.6 Interlocks and failure modes.

.3 Letter certifying that Work has been installed and commissioned according to Contract Documents.

.4 Submittals shall include the time, date, and the person(s) who completed commissioning activities.

.8 Demonstrations

.1 Demonstrations shall be witnessed by Engineer, Owner, or approved third party Commissioning Authority.

.2 Demonstrate the following quantity of components, equipment and systems unless otherwise indicated.

.1 Quantity 10 or 10-% of the total quantity, whichever is greater, of each distinct type of component, equipment and system as determined by Engineer.

.3 Demonstrate performance including:

.1 System is working in accordance with design intent.

.2 Capacity, staging control, and efficiency of equipment at full and part load scenarios.

.3 Modes of operation for all equipment and systems.

.4 Interlocks including fire alarm, equipment fail-safe, over-current, over-vibration, flow, low level, over temperature, over pressure, gas detection, and other life safety interlocks or safeties required for safe operation.
.5 Equipment and component failure and fail-over modes and test consequences and responses.
.6 Other demonstrations upon request.

**1.23 FINAL COMPLETION SUBMITTALS**

.1 Project Drawings: Provide drawing types and formats as follows.
.1 Drawing Type - Contractor As-Built Marked-Up Drawings
.1 Mark up prints to show the actual installation where installation varies from that shown in previous and most recent complete drawing sets.
.2 Provide complete details on concealed elements that cannot be readily identified and recorded later, including layouts, schematics, products, components, installation methods.
.3 Markups to be made with non-erasable red colour lines. Use other colors to distinguish between changes for different categories of Work at the same location.
.4 Prominently cross out the following components from each drawing sheet:
.1 Engineer's logo and address.
.2 Engineering seal(s).
.5 Identify and date each drawing sheet including the designation "AS-BUILT DRAWING" in a prominent location, whether or not there are markups on each sheet.
.6 Apply Contractor stamp in red non-erasable ink to each drawing sheet.
.2 Drawing Format
.1 Printed: ANSI D size paper unless otherwise indicated. Colour.
.1 Organize into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
.2 Electronic: Adobe PDF format of drawing contents.
.3 Drawing Type - Project Design Drawings
.1 Drawings provided by Engineer in electronic format to reflect consolidation of agreed changes to contract documents for which Engineer is assuming design responsibility.
.2 Format: Printed
.4 Drawing Type - Project As-Built Drawings
.1 Drawings provided by Engineer in electronic format based on Contractor As-Built Marked-up Drawings.
.2 Format: Printed
.2 Project Binders: Provide binders in the formats, types, and with contents as follows.
.1 Binder Formats
.1 Paper Format
.1 Bound and indexed binder volume sets.
.2 Each binder type and copy of each binder within a single binder, unless otherwise accepted by Engineer or Owner.
.3 Thickness as necessary to accommodate contents and ensure ease of use.
.4 Matching heavy duty, 3-ring loose-leaf binders, having clear vinyl pouch on front and spine for title page and spine index insertion.
.5 Front cover and spine indexed, formatted and containing content including binder volume number, client project number, project name,

date of substantial completion, site name, site address, and client site ID number.
.6 Plastic sheet lifter to facilitate page turning.
.7 Table of contents located on front page, laminated with reinforced holes, and including contents of multiple binder volume set.
.8 Section dividers.
.9 Paper format of contents, printed in colour.
.10 Electronic version of all contents, contained in a sleeved inside each binder type, in both DVD(s) and USB flash drive(s).
.2 Electronic Format
.1 Format: Adobe PDF.
.2 Organization: Individual folders and files, with appropriate and representative names for recognition and ordering.
.2 Binder Type - Project Record Manual
.1 Contract: Contract documents, including signed contracts, bonding and insurance documentation.
.2 Drawings: All issued drawings sets including those issued for tender, permits, changes, Contractor As-Built Marked-Up, Project Design, Project As-Builts.
.1 Paper Format: Size ANSI B or ANSI C as acceptable to Engineer.
.3 Specifications
.4 Meetings: Meeting agendas, minutes, memos, and communications.
.5 Submittals: Contract submittal information including submittals and reviews.
.6 Instructions and Clarifications: Contract instruction supplements including clarification information.
.7 Changes: Contract change documentation including notices, proposals, reviews, orders, directives.
.8 Notices: Contract notices in writing, written statements.
.9 Site Reviews: Site reviews, reports, deficiency lists, observation lists.
.10 Payments: Contract payment documentation including certification, reviews.
.11 Permits: Application documents and approvals for permits, certificates, licenses, testing and inspections required including regulatory.
.12 Certificates: Other documents including certificates demonstrating compliance with requirements including regulatory.
.13 Guaranties and Warranties: Contract and overall project.
.14 Lien Documentation
.3 Binder Type - Operating and Maintenance Manual
.1 Products
.1 Bill of Materials: Include tag, description, quantities, makes, and model numbers or part to be ordered. Model numbers to be complete, including selected features and options, special instructions or custom aspects.
.2 Submittals: Manufacturer’s submittals or product data. Indicate selected features and options on each submittal page or product sheet by using annotation boxes or highlights.
.3 Product Data: Manufacturer’s information on products, shop drawings, specifications, installation manuals, operation manuals, warranties.

.4 Maintenance Data: Manufacturer's information, list of spare parts, maintenance procedures, maintenance and service schedules for preventive and routine maintenance
.5 Operating Data: Emergency instructions and procedures, system and equipment descriptions, operating procedures, health and safety information, troubleshooting procedures, and sequence of operations.
.6 Maintenance contracts.
.2 Systems
.1 Submittals: System related submittals and documents, including shop drawings, schematics, layouts, diagrams.
.2 Tests: Balancing, measurements and testing data and reports.
.3 Commissioning: Data and reports.
.4 Other submittals as required.
.5 Maintenance contracts.
.4 Binder Type - Training Manual
.1 Software user manuals.
.2 Software training manuals.
.3 Training documentation, presentation slides, and other training related documentation.
.4 Sleeve containing DVD(s) of training videos, tutorial software, and other media related to training.
.3 Provide other closeout items including:
.1 Spare parts and materials.
.2 Software and license codes, including specific assignment of ownership to Owner requirements.
.3 Tools.
.4 Keys.
.4 Acceptance Procedures and Final Copies
.1 Prior to Substantial Performance application, complete and submit each binder type to Engineer, Owner, and Commissioning Authority for review and acceptance. Submit electronic copies, as well as printed copies if required by Owner.
.2 Acceptance Criteria
.1 To the more stringent of the following, including quality, content, and format:
.1 ASHRAE-G-4: ASHRAE-G-4-2008 (RA 2013) Preparation of Operating and Maintenance Documentation for Building Systems.
.2 Additional requirements indicated in commissioning requirements.
.3 Create, add or modify and resubmit as required, including quality, content, and format.
.4 Upon written acceptance, provide 3 final copies of each document, binder or drawings set, in addition to electronic formats.

**1.24 TRAINING REQUIREMENTS**

.1 Provide sufficient training to deliver a thorough understanding of operation and maintenance of all systems, equipment, and components and their interrelationship with other systems.
.2 Provide training on the following systems and equipment:
.1 Systems, equipment, components and services.
.2 Control systems.
.3 Equipment and components requiring control.
.4 Systems, equipment and components requiring manufacturer's start-up activities.

.5 Fluid treatment and filling.

.3 General Training

.1 Provide the following training sessions on indicated training topics.

.2 General Structure

.1 Classroom based training at Owner's preferred location on site, unless otherwise indicated.

.2 Walk through of facility areas and rooms to identify locations of equipment and components, familiarization of systems and equipment.

.3 Training documentation, including presentation slides, tutorial software, and other media related to training.

.4 Hands-on demonstrations with attendee involvement.

.5 Questions and answers period.

.6 Additional requirements as indicated in commissioning requirements.

.3 Quantities

.1 Provide training sessions as indicated below each for up to 8 attendees excluding instructors.

.2 Provide 4 half day training session(s) after major construction has been completed and before Substantial Performance.

.3 Provide 1 additional half day training session(s) 6 months following Substantial Performance.

.4 Provide 1 additional half day training session(s) after above but before end of warranty period and scheduled to capture seasonal operational variance due to weather and/or operations.

.4 Topics: Include the following training topics on indicated systems and equipment:

.1 Overview and Description

.1 Design intent.

.2 System capabilities, modes of operation, and limitations.

.3 System sequences of operation for all modes of operation.

.4 Acceptable tolerances for system adjustments in all operating modes.

.2 Operations and Documentation

.1 Overview and use of documentation including product literature and operating manuals.

.2 Overview of independent controllers including programming, sequences, settings, troubleshooting, alarms, manual overrides, interfaces.

.3 Overview of digital controllers including programming, sequences, settings, troubleshooting, alarms, manual overrides, interfaces.

.4 Overview of controllers interfacing with other controllers, including digital, independent, equipment.

.5 Procedures for abnormal and emergency operating situations, including during power outage and fire.

.6 Procedures for conservation operating modes and strategies including utilities, energy, demand.

.7 Health and safety issues, concerns, personal protective gear, and special safety features.

.8 Recommended site informative documentation, including labels, posted instructions, posted documents, safety signage.

.3 Maintenance and Materials

.1 Overview and use of maintenance manuals.

.2 Troubleshooting procedures.

.3 Service, maintenance, and preventive maintenance requirements including scheduling, frequency and administrative procedures.
.4 Review of spare parts inventory, special tool use, and service contacts.
.5 Health and safety issues, concerns, personal protective gear, and special safety features.

.4 Training Providers
.1 Personnel Qualifications
.1 Experienced and skilled in training to target audience including:
.1 Owner representatives.
.2 Facility managers.
.3 Project managers.
.4 Operations staff.
.5 Tenant/occupant representatives.
.6 Service and maintenance staff.
.2 Experienced and skilled in training with a wide variety of topics including:
.1 Installation.
.2 Start-up.
.3 Troubleshooting.
.4 Service and maintenance.
.5 Emergency operations.
.3 Full time employees on the staff of the listed training provider types.
.2 Training Provider Types
.1 Manufacturer: The product manufacturer.
.2 Manufacturer's Representative: The product manufacturer's local authorized product representative for product sales and service.
.3 Manufacturer's Start-up: The product manufacturer's local authorized start-up and troubleshooting for product.
.4 Installer: The installer of products and systems on this project.
.5 Service Company: The company providing service for the installed products and systems.
.3 Specific Training Providers: Use the following approved service providers for applicable training activities:
.1 Building Automation Systems: Manufacturer and manufacturer's start-up and service company.
.2 Fluid Treatment: Owner's fluid treatment service company(s).
.3 Other: Manufacturer's representatives and manufacturer's start-up for systems, equipment and components requiring manufacturer's start-up services.
.4 Personnel Coordination
.1 Controls Interfacing: All training providers and personnel to be present when training is occurring for controllers that are interfacing with other controllers, including digital, independent, equipment.
.5 Alternate providers will not be accepted.

.5 Training Plan
.1 Prepare and submit training plan to Owner including the following:
.1 Schedule, location, duration, instructor names and qualifications, and detailed itinerary of training topics to be covered.
.2 Copies of training documentation to be provided.
.2 No later than 4 weeks prior to Substantial Performance, complete and submit details of training plan for review and acceptance.
.3 Create, add or modify training plan and resubmit as required.

.4 Upon acceptance, coordinate, arrange, and deliver training in accordance with accepted plan.

.6 Additional Owner Requirements

.1 After training sessions, meet with Owner representatives including site Occupational Health and Safety Committee to review additional requirements that may be required for the site including signage, additional training.

**1.25 ADDITIONAL RESPONSIBILITIES**

.1 Adherence to Procedures

.1 Failure to adhere to procedures, including submittals and changes, in no way relieves Contractor of their responsibility for Work.

.2 Site Reviews Before Proceeding

.1 Contractor to complete site visits to inspect the general and local site conditions that could affect Work.

.3 Non-conforming Work

.1 When Contractor seeks additional opinion regarding conformance of Work, Contractor to retain and pay for a representative(s) from applicable entity to review or inspect Work for such entity to provide opinion. Opinion from such entity will be subject to review by Engineer, as well as resubmission by entity. Entities include:

.1 Products: Manufacturer's representative.

.2 Regulatory: Authority having jurisdiction.

.3 Service: Owner's service contractor.

.2 Correct non-conforming Work, with no changes to Contract Price or Contract Time.

.4 Additional Fees from Engineer

.1 Certain actions or omissions by Contractor may result in Engineer charging additional fees to Owner. Should this occur, Owner may choose to modify Contract Price through Contract change procedures by deducting some or all of the value of these additional fees charged by Engineer. Actions or omissions of Contractor that may result in Engineer charging additional fees to Owner may include:

.1 Failing to meet construction schedule including milestone dates. Activities of Engineer that may contribute to additional fees charged to Owner may include:

.1 Additional project or commissioning meetings.

.2 Additional site visits.

.3 Additional deficiency lists and deficiency reviews.

.4 Additional General Reviews.

.5 Additional payment certifications.

.6 Administration of additional related changes to Contract.

.2 Submission of Request for Substitution, whether or not such request is in the prescribed form. Activities of Engineer that may contribute to additional fees charged to Owner may include:

.1 Reviewing and responding to Request for Substitution.

.2 Redesigning aspects of Work as a result of substitution.

.3 Actions or omissions resulting in Engineer repeating activities that may include:

.1 Commissioning activities.

.2 Project or commissioning meetings.

.3 Site visits.

.4 Deficiency lists and deficiency reviews.

.5 General reviews.

.6 Payment certifications.

.2 Additional Engineer fees include time, travel expenses, other related expenses.

.5 Contract Dates

.1 Owner may incur significant costs as a result of Contractor failing to meet contractual obligations, including:

.1 Milestone dates.

.2 Disruption of services beyond permitted durations.

**END OF SECTION 01 00 00**

# SECTION 15 00 00 MECHANICAL EQUIPMENT

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Heating, cooling, pumps, heat exchangers.

### 1.2 REFERENCED DOCUMENTS

.1 AHRI-410: AHRI-410-2001 Forced-Circulation Air-Cooling and Air-Heating Coils.
.2 AHRI-880: ANSI/AHRI-880/881-2011 Performance Rating of Air Terminals.
.3 AHRI-885: AHRI-885-2008 Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.
.4 ASA-S12.12: ANSI/ASA-S12.12-1992 (R2012) Engineering Method for the Determination of Sound Power Levels of Noise Sources Using Sound Intensity.
.5 ASHRAE-15: ANSI/ASHRAE-15-2013 Safety Standard for Mechanical Refrigeration.
.6 ASHRAE-62.1: ANSI/ASHRAE-62.1-2016 Ventilation for Acceptable Indoor Air Quality, including User's Manual.
.7 ASHRAE-90.1: ANSI/ASHRAE/IES-90.1-2016 Energy Standard for Buildings Except Low-Rise Residential, including User's Manual.
.8 ASTM-A653: ASTM-A653/A653M-15 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.9 CSA-Z317.2: CAN/CSA-Z317.2-15 Special Requirements for HVAC Systems in Health Care Facilities.
.10 NEMA-250: NEMA-250-2014 Enclosures for Electrical Equipment (1000 Volts Maximum).

### 1.3 DEFINITIONS

.1 "BACnet": A communications protocol adhering to ASHRAE-135.
.2 "HVAC": Heating, ventilating and air-conditioning, including outdoor air, air quality, pressurization, cooling, humidification, de-humidification.
.3 "TAB": TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.

### 1.4 SUBMITTALS FOR ACTION

.1 Product Data
  .1 Manufacturer's printed product literature, specifications, and datasheets, including product characteristics, materials, finish, dimensions, clearances, performance criteria, certifications, options, and limitations.
  .2 Include the following additional information:
    .1 Capacity and efficiency, including full and part loading.
    .2 Performance curves, including flow and resistance.
    .3 Electrical, including schematics, ladder logic, wiring diagrams, control sequences.
    .4 Required services, including utilities and distribution systems.
    .5 Sound and vibration ratings.
    .6 Certifications.
.2 Shop Drawings
  .1 Schedule: List of products, including quantities, sizes, dimensions, locations.
  .2 Layout and Interference Plans: Scaled sketches indicating clearances, interferences, and relocation of interfering services, components, objects, and structures.
    .1 Drain Pan Layouts: Additional scaled sketches indicating materials, dimensions, slopes, connection points, construction of corners.

.3 Mounting: Details of product mounting, including foundation details with loadings, anchor bolt arrangements, roof curb details, point loads, roof structure details.
.4 Suspension Systems: Details of suspended products, including:
.1 Location of suspension.
.2 Maximum load at each of the suspension points.
.3 Size of suspension rods or members.
.4 Details of supplementary structural steel framing members.
.5 Vibration and seismic control measures.
.6 Electrical Power: Details of electrical power connections.
.7 Interlocks: Details of electrical interlocks and life safety system interfaces, including schematics, ladder logic, wiring diagrams, control sequences.
.3 Demolition Plan: Details of demolition requirements, including manufacturer's certification, or lab reports describing the materials being cut into.

**1.5 SUBMITTALS FOR INFORMATION**

.1 Certificates
.1 Equipment Start-up: Letter from manufacturer certifying:
.1 Start-up, installation, adjustments and testing has been executed in accordance with manufacturer's instructions and recommendations, and no warranty conditions have been violated.
.2 Equipment is performing in accordance with expectations.
.2 Vibration Hardware Installation: Letter from manufacturer certifying start-up and installation has been executed in accordance with manufacturer's recommendations and Contract Documents.
.3 Performance
.1 Letter certifying ASHRAE-90.1 compliance.
.2 Letter certifying ASHRAE-62.1 compliance.
.2 Manufacturer Information
.1 Operating and Maintenance Manual
.2 Installation Instructions
.3 Users Manuals
.4 Start-up Checklists
.3 Test and Evaluation Reports
.1 Start-up Reports: Completed manufacturer's start-up checklists and notes.
.2 Electrical: Measurements for equipment when off and powered up, for power as well as voltage and current measurements for each phase.
.3 Testing and Balancing Reports
.4 Combustion Tests and Analysis Reports
.4 Qualification Statements
.1 Noise and Vibration: Proof of certifications for company personnel.
.2 TAB: Proof of certifications for company and personnel.

**1.6 SUBMITTALS FOR CLOSEOUT**

.1 Tools
.1 Special tools required for operation and maintenance.

**1.7 QUALITY ASSURANCE**

.1 Qualifications
.1 Noise and Vibration Testing
.1 Company NEBB certified.
.2 Personnel to be NEBB Sound and Vibration Certified Professional.
.2 TAB
.1 Company and personnel members of AABC and CAABC, or NEBB.

.2 Company and personnel AABC or NEBB certified.
.3 Subject to approval.

## PART 2 PRODUCTS

### 2.1 COMMON PRODUCT REQUIREMENTS

.1 Efficiency Performance: Provide equipment to meet the more stringent requirements of as indicated or as follows:
  .1 To ASHRAE-90.1.
.2 Noise Performance: Provide equipment and services, including piping and ductwork, to meet the following requirements:
  .1 Occupied Areas: Less than 35-N.C. Level.
  .2 Service Areas: Less than 50-N.C. Level.
  .3 Vibration created by mechanical equipment must be below the level of perception in occupied areas of the building.
.3 Start-up Control Requirements
  .1 For equipment capable of being powered by standby power, provide the following to limit total start-up current upon power failure:
    .1 Soft start: Less than 200-% of full load current upon start-up.
    .2 Random or pre-set start-up delay.
.4 Ventilation Equipment
  .1 To ASHRAE-62.1.
  .2 To CSA-Z317.2.

### 2.2 PUMPS - VERTICAL INLINE

.1 Provide as indicated.
.2 Manufacturers
  .1 Bell and Gossett, e-80 Series
  .2 S.A. Armstrong Limited, 4380 Series
  .3 Taco Inc., KV Series
.3 Features
  .1 Close coupled.
  .2 Single stage impeller.
  .3 Internally flushed mechanical seal.
  .4 Gauge tappings.
  .5 Drain ports.
  .6 Sight flow indicator.
  .7 Flush line filer.
.4 Motors
  .1 To Section 26 00 00 Electrical Distribution.
  .2 Select motors to operate at or below nameplate shaft horsepower at all pump operating conditions including run-out, except as may be permitted below.
    .1 Motors may be selected to operate into their service factor on pump run-out condition only if all of the following conditions are met:
      .1 Pump motors with variable frequency drives.
      .2 Pump motors with adjustable electrical overloads.
      .3 Motor shaft horsepower at run-out does not exceed the lesser of 67-% motor service factor or 10-% higher than nameplate horsepower.
      .4 Proof from motor manufacturer that warranty covers operation into service factor as selected.
  .3 Prohibited: Selection of pump motors that causes a motor to operate into service factor at less than pump run-out conditions.
.5 Ratings
  .1 Working Pressure: 862-kPa (175-psi).

.2 Working Temperature: 107-°C (225°-F).
.3 Flanges: ANSI 125.
.6 Materials
.1 Impeller: Stainless steel.
.2 Volute: Cast iron.
.7 Certifications, Listings and Registrations
.1 Impeller: Balanced to ANSI/HI Grade G6.3.
.2 Factory Pressure Test: To Hydraulic Institute standards.
.8 Ancillary Components: Indicated ancillary components may be substituted with the following from pump manufacturer to Section 23 05 00 Piping:
.1 Combination Strainer/Flow Straightener: Combined strainer and flow straightener.
.2 Combination Balancing/Check Valve: Combined balancing valve and check valve.
.1 Not Acceptable: Use as a shutoff valve.

## 2.3 AIR HANDLERS

.1 Modify as indicated.
.2 Type
.1 Filter Access Service Door: Hot dip galvanized steel, Z700 (G235) to ASTM-A653.

## 2.4 VARIABLE AIR VOLUME BOXES - SINGLE DUCT

.1 Provide as indicated.
.2 Manufacturers
.1 Johnson Controls Inc., TSS or TSL Series
.2 Daikin Applied, MQTH Series
.3 Trane Inc., VariTrane VC Series
.3 Features
.1 Cabinet
.1 Suitable for modifications including penetrations for services.
.2 Mounting brackets.
.2 Dampers: Damper shaft position indicator.
.3 Electrical: Wiring enclosure. Minimum NEMA Type 1 rated to NEMA-250.
.4 Controls
.1 Control devices as required to Section 26 90 00 Control Devices.
.2 Equipment controller to Section 25 05 00 Building Automation System.
.4 Options
.1 LOW - Low Profile
.5 Performance
.1 Air Leakage: 1-% of maximum inlet rated airflow at 750-Pa (3-inWC).
.6 Materials
.1 Box
.1 Single wall construction of 22-guage galvanized steel to Section 23 30 00 Ductwork.
.2 Insulation
.1 13-mm (1/2-in) fibreglass insulation.
.7 Certifications, Listings and Registrations
.1 To AHRI-410.
.2 To AHRI-880.
.3 To AHRI-885.
.8 Substitution Limitations

.1 Substitutions may be accepted under substitution provisions described in Contract Documents.
.2 Substitutions may be limited by various requirements and may require re-design, including:
.1 Physical characteristics, including weight, height, length, width.
.2 Minimum and maximum airflows, maximum pressure drops, noise.
.9 Re-design differences as a result of substitution to Delegated Professional Design requirements described in Contract Documents.

**2.5 COILS**

.1 Provide as indicated.
.2 Manufacturers
.1 Daikin Applied
.2 Greenheck Fan Corporation
.3 Trane Inc.
.3 Features
.1 Cased, complete with endplates and side plates.
.2 Rows and circuiting as required.
.3 Handing as required.
.4 Materials
.1 Cooling, Condensation Risk: 304 stainless steel, 2.0-mm (14-ga) thick.
.2 Heating Only, No Condensation Risk: Galvanized steel, 2.0-mm (14-ga) thick, Z270 (G90) to ASTM-A653.
.2 Tubes: Copper. Minimum wall thickness 0.41-mm (0.016-in).
.3 Fins: Aluminum. Minimum thickness 0.15-mm (0.006-in).
.5 Performance
.1 Sizing based on:
.1 Fouling Factors
.1 Service Liquid: 0.0009-m2·°C/W (0.005-h·ft2·°F/Btu)
.2 Air: 0.0017-m2·°C/W (0.01-h·ft2·°F/Btu)
.6 Certifications, Listings and Registrations
.1 Certified and labelled to AHRI-410.

**2.6 HEAT EXCHANGERS**

.1 Provide as indicated.
.2 Manufacturers
.1 Bell and Gossett, GPX Series
.2 S.A. Armstrong Limited
.3 Taco Inc.
.3 Type
.1 Plate and frame.
.4 Connection type as required.

**2.7 EXPANSION TANKS**

.1 Provide as indicated.
.2 Manufacturers
.1 Non-Potable Water
.1 Amtrol Inc., Extrol Line
.2 Potable Water
.1 Amtrol Inc., Therm-X-Trol Line
.3 Type
.1 Diaphragm.
.2 Orientation: As indicated.
.4 Size

.1 Tank Volume: As indicated.
.2 Acceptance Volume: As indicated.
.5 Ratings
.1 Maximum Working Pressure: As indicated.
.2 Maximum Operating Temperature: 240-°F (115-°C).
.6 Materials
.1 Shell: ASME approved steel, finished with red oxide primer.
.2 Bladder/Diaphragm: Heavy Duty Butyl Rubber / EPDM
.3 Thickness: Minimum 0.087-in (2.1-mm).
.4 Air Valve: Schrader valve with EPDM seats.
.5 Mounting: On piping services.
.7 Certifications: ASME-BVPC Section VIII, Division 1.

**2.8 NOISE AND VIBRATION CONTROL**

.1 Provide noise and vibration control hardware supplied by a single supplier.

**2.9 EQUIPMENT MOUNTING**

.1 Provide mounting including frames, supports, pads and curbs as required.

## PART 3 EXECUTION

**3.1 EXAMINATION**

.1 Pre-Installation Pressure Test
.1 Prior to installation, pressure test existing system in its entirety to identify deficiencies in existing piping.
.1 Identify and report on all pressure relief devices and equipment maximum pressure ratings.
.2 Increase system pressure by 25-psi until target pressure is reached. Target pressure as determined by Engineer, including maximum operating pressure, design limit pressure.
.3 Maintain system pressure for minimum 4-hour duration.
.4 Inspect piping connections, seals, and equipment for leaks.
.5 If there are no leaks, repeat above steps until pressure reaches target pressure.
.6 If there are leaks, report on findings, allow minimum 10-days for Owner to repair, repeat above until pressure reaches target pressure.
.2 Verification of Conditions
.1 Confirm all dimensions indicated.
.2 Ensure clearances and maintenance access to equipment meet or exceed manufacturer's recommendations. Notify Engineer of problems.
.3 Investigate required relocation of objects to prevent interference. Submit interference drawings as required.
.4 Investigate wall construction for structural members, hazardous material, and building and utility services before opening.
.3 Evaluation and Assessment
.1 Evaluate condition of equipment before Work. Report deficiencies to Engineer.
.2 Review proposed retrofits with manufacturers.

**3.2 COMMON EXECUTION REQUIREMENTS**

.1 Provide equipment with identification as indicated. Nameplates to match quality and style of existing.
.2 Provide services, including electrical, to equipment as required.
.3 Insulate equipment as indicated and as required where not indicated

.4 Replace services around equipment to fit equipment and to suit equipment requirements, including piping, ductwork, venting, wiring.
.5 Install products in locations providing appropriate ambient conditions for its operation and allowing for adequate ventilation.
.6 Provide clearances around systems, equipment and components for inspection, servicing and maintenance and as required. Minimum clearance of 300-mm (1-ft).
.7 Provide clearances around products to prevent interference with adjacent systems, equipment and components.
.8 Provide valves and either unions or flanges to connect piping to equipment for ease of maintenance and assembly.
.9 Support equipment such that no loads are transmitted to services including piping, ductwork, venting, wiring.
.10 Noise and Vibration Control
  .1 Install vibration control hardware in accordance with manufacturer's instructions (and supervision where required) and only by workmen experienced in the installation of such systems.
  .2 Replace isolation pads and modify supports as required to mitigate vibration and noise to Owner's satisfaction.
.11 Provide equipment safeties and interlocks as required.
.12 Manufacturer Services
  .1 Supervision: Manufacturer to supervise field assembly of equipment to ensure warranty and performance provisions are met.
  .2 Start-up: Manufacturer to approve installation, to supervise start-up, and to instruct Owner, unless otherwise indicated.
  .3 Adjusting: Adjust for optimal performance, under manufacturer supervision.

**3.3 EQUIPMENT MOUNTING**

.1 Intent: Contractor responsibility as requirements depends in part on final selection and installation location.
.2 Design mounting including frames, supports and curbs as required where not indicated.
.3 Support equipment such that no loads are transmitted to services including piping, ductwork, venting, wiring.
.4 Provide concrete housekeeping pads for base-mounted equipment.
  .1 Size: Minimum 100-mm (4-in) high, larger in width and depth by 75-mm (3-in).
.5 Provide stands for equipment that can be wall mounted but are not located on walls unless otherwise indicated. Anchor bolt to surfaces.
.6 Performance: Design equipment mounting:
  .1 To make equipment level.
  .2 To protect equipment from water damage.
  .3 To withstand seismic events with seismic restraint as required.
  .4 To minimize noise and vibration transmitted to services and building structure.
  .5 To withstand concentrated loads of 2-kN (450-lbf) applied at any point in any direction.

**3.4 PUMPS**

.1 Install as required.
.2 Ancillary Components: Provide straight piping lengths for inlet and outlet connections as recommended by manufacturer.
.3 Condensation Protection: For pumps at risk of condensation, complete the following:

.1 Finish uninsulated surfaces with 2 coats epoxy paint to , excluding stainless steel materials.
.2 Connect drains from uninsulated surfaces to drain piping, including pedestal reservoir, top of pump housing.

.4 Insulation: Provide Type EF insulation, fabricated to allow removal. Insulation thickness based on largest pipe size of connected piping service type.

**3.5 AIR HANDLERS**

.1 Modify as indicated. Install components as required.
.2 Filter Access Doors
.3 Filters
.1 To ASHRAE-62.1.
.2 Filter bank frame and filter section sizing to maximize filtered cross-sectional area, including if 1 row of filters must be a different size from remaining.
.3 Filter bank frame and filter sections to be accessible for maintenance and inspection.

**3.6 VARIABLE AIR VOLUME BOXES**

.1 Install as required.
.2 Modifications: Manufacturer to review and approve methods for modifications including cabinet penetrations for services.

**3.7 COILS**

.1 Install as required.

**3.8 HEAT EXCHANGERS**

.1 Install as required.

**3.9 EXPANSION TANKS**

.1 Install as required.
.2 Set and coordinate pre-charge air pressure with requirements of system and other pressure control devices including make-up water, pressure reducing and regulating valves, pumps.
.1 Adjust pre-charge air pressure as required. Complete all adjustments of pre-charge air pressure prior to connecting expansion tank to piping system.
.2 Document in permanent marker on visible section of tank exterior the pre-charge air pressure selected, and the date pre-charge pressure was applied, whether or not pre-charge pressure was adjusted from factory default value.

**3.10 FIELD QUALITY CONTROL**

.1 Field Tests
.1 Complete TAB and submit report.
.2 Field Inspections
.1 Submit report from vibration control hardware supplier certifying that the installation has been carried out in accordance with manufacturer's recommendations.
.3 Non-Conforming Work
.1 Provide sound and vibration test report upon request for non-conforming area.
.2 Re-fabricate and re-install any installation of equipment, piping, and ductwork judged by Engineer to be unsound or poor with regard to the sound and vibration requirements.
.4 Manufacturer Services
.1 Complete required tests on equipment.
.2 Complete combustion tests on equipment.
.5 Fluid Level, Low Fluid, Flow Sensors and Switches

.1 Set and coordinate settings with requirements of system and other flow devices including pumps and control valves.
.2 Allow for 4additional site visits after start-up and during Warranty Period for adjustments to flow sensors and switches during system operation and shutdown to achieve desired operation under various conditions including peak and seasonal loads.

## 3.11 LABELLING AND DOCUMENTATION

.1 Nameplates: Affix manufacturer's nameplates to equipment in a readily visible location.
.2 Identification: Provide lamacoid nameplates for identification on each enclosure, panel, or field equipment, including existing.
  .1 Construction: Laminated plastic with a different coloured core and engraved lettering to clearly show lettering with style as follows, unless otherwise specified:
    .1 Style: Capital letters, minimum 12-mm (1/2-in) high, equal character spacing, centered (not justified).
    .2 Colours: Colours of letters and background may change for each type of equipment or component. Provide colours to Owner requirements, otherwise provide white letters and black background.
.3 Warning: Install warning labels as required, including:
  .1 Warning of automatic control.
  .2 Warning of safety related matters.
  .3 Warning of restricted access by authorized and/or qualified personnel.
  .4 Warning of implications related to breaking means of restricting access including seals.
.4 Ceiling Labelling
  .1 Provide coloured labels on ceiling surfaces to indicate equipment and components including the following. Colours indicated are indicative of requirements and Owner may change for each type of equipment or component.
    .1 Blue
      .1 Fan powered boxes without coils.
      .2 Variable air volume boxes without coils.
      .3 Dampers.
      .4 Other air terminal devices without coils.
    .2 Purple
      .1 Fan powered boxes with coils or heaters.
      .2 Other coils or heaters.
      .3 Other air terminal devices with coils or heaters.
    .3 Grey
      .1 Communication or sound components.
    .4 Black
      .1 Other building services.
  .2 Provide labels as acceptable to Owner, including label type, material, size and colour. Owner may require lamacoids, adhesive labels with text, adhesive labels with no text.
  .3 Mark each label as acceptable to Owner, including equipment label, type, power circuit.

## 3.12 START-UP

.1 Provide the services of a qualified factory-trained manufacturer's representative to assist with installation and start-up.

.1 Submit manufacturer's start-up report, and written certification that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

**3.13 ADJUSTING**

.1 Adjusting: Adjust settings as required before Total Performance and throughout Warranty Period to address performance issues, including safeties, operating limits, noise, vibration, efficiency, equipment longevity.

**END OF SECTION 15 00 00**

# SECTION 23 05 00 PIPING

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Fluid piping and systems, water piping, glycol piping, closed and open loop systems, heating, service water systems, drain piping.
.2 Piping and piping components including components fittings, connectors, supports, valves, vents, drains, gauges, regulators.

### 1.2 REFERENCED DOCUMENTS

.1 AABC-TBP: AABC Test and Balance Procedures.
.2 AABC-TSB: AABC National Standards for Total System Balance, 2016.
.3 ASME-A13.1: ASME-A13.1-2015 Scheme for the Identification of Piping Systems.
.4 ASME-B16.1: ASME-B16.1-2015 Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
.5 ASME-B16.3: ASME-B16.3-2011 Malleable Iron Threaded Fittings: Classes 150 and 300.
.6 ASME-B16.5: ASME-B16.5-2013 Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
.7 ASME-B16.9: ASME-B16.9-2012 Factory-Made Wrought Buttwelding Fittings.
.8 ASME-B16.15: ASME-B16.15-2013 Cast Copper Alloy Threaded Fittings: Classes 125 and 250.
.9 ASME-B16.18: ASME-B16.18-2012 Cast Copper Alloy Solder Joint Pressure Fittings.
.10 ASME-B16.22: ASME-B16.22-2013 Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
.11 ASME-B16.24: ASME-B16.24-2016 Cast Copper Alloy Pipe Flanges and Flanged Fittings: Classes 150, 300, 600, 900, 1500, and 2500.
.12 ASME-B18.2.1: ASME-B18.2.1-2012 Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
.13 ASME-B31.9: ASME-B31.9-2014 Building Services Piping.
.14 ASME-B40.100: ANSI/ASME-B40.100-2013 Pressure Gauges and Gauge Attachments.
.15 ASTM-A47: ASTM-A47/A47M-99 (2014) Standard Specification for Ferritic Malleable Iron Castings.
.16 ASTM-A53: ASTM-A53/A53M-12 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
.17 ASTM-A312: ASTM-A312/A312M-16 Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless-Steel Pipes.
.18 ASTM-B32: ASTM-B32-08 (R2014) Standard Specification for Solder Metal.
.19 ASTM-B88: ASTM-B88-16 Standard Specification for Seamless Copper Water Tube.
.20 ASTM-B209: ASTM-B209-14 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
.21 ASTM-B813: ASTM-B813-16 Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.
.22 ASTM-B828: ASTM-B828-16 Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.
.23 ASTM-C547: ASTM-C547-15 Specification for Mineral Fiber Preformed Pipe Insulation.
.24 ASTM-C585: ASTM-C585-10 (R2016) Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing.

.25 ASTM-C921: ASTM-C921-10 (R2015) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
.26 ASTM-C1136: ASTM-C1136-16 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
.27 ASTM-E96: ASTM-E96/E96M-16 Standard Test Methods for Water Vapor Transmission of Materials.
.28 AWS-A5.8: ANSI/AWS-A5.8/A5.8M-2011 Specification for Filler Metals for Brazing and Brazed Welding.
.29 CGSB-24.3: CAN/CGSB-24.3-92 Identification of Piping Systems.
.30 CGSB-51.53: CAN/CGSB-51.53-95 Jacketing, Polyvinyl Chloride Sheet, for Insulating Pipes, Vessels, and Round Ducts.
.31 CSA-B51: CSA-B51-14 Boiler, Pressure Vessel, and Pressure Piping Code.
.32 CSA-B214: CAN/CSA-B214-16 Installation Code for Hydronic Heating Systems, including CHC Handbook on Hydronic Heating Systems.
.33 CSA-C22.2-60529: CAN/CSA-C22.2-60529-16 Degrees of Protection Provided by Enclosures (IP Code).
.34 CSA-O80: CSA-O80-Series-15 Wood Preservation.
.35 CSA-W47.1: CSA-W47.1-09 (R2014) Certification of Companies for Fusion Welding of Steel.
.36 CSA-W47.2: CSA-W47.2-11 (R2015) Certification of Companies for Fusion Welding of Aluminum.
.37 CSA-W48: CSA-W48-14 Filler Metals and Allied Materials for Metal Arc Welding.
.38 CSA-W59: CSA-W59-13 Welded Steel Construction (Metal Arc Welding).
.39 CSA-Z317.1: CAN/CSA-Z317.1-16 Special Requirements for Plumbing Installations in Health Care Facilities.
.40 CSA-Z317.13: CAN/CSA-Z317.13-12 Infection Control During Construction or Renovation of Health Care Facilities.
.41 CSA-Z317.13: CAN/CSA-Z317.13-17 Infection Control During Construction or Renovation of Health Care Facilities.
.42 FED-STD-595: United States Federal Standard 595 Colors Used in Government Procurement, issued by the General Services Administration, Revision C.
.43 ISO-14726: ISO-14726-2008 Ships and Marine Technology - Identification Colours for the Content of Piping Systems.
.44 MICA-NISM: MICA National Commercial and Industrial Insulation Standards Manual, 2016 (8th Edition).
.45 NEBB-TABES: NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems, 2015 (8th Edition).
.46 NEMA-Z535.1: ANSI/NEMA-Z535.1-2006 (R2011) Safety Colors.
.47 NFPA-90A: NFPA-90A-15 Standard for the Installation of Air-Conditioning and Ventilating Systems.
.48 NFPA-90B: NFPA-90B-15 Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
.49 TIAC-BPG: TIAC Mechanical Insulation Best Practices Guide.
.50 ULC-S102: CAN/ULC-S102-10 Surface Burning Characteristics of Building Materials and Assemblies.
.51 ULC-S115: CAN/ULC-S115-11 (R2016) Standard Method of Fire Tests of Firestop Systems.

## 1.3 DEFINITIONS

.1 “DN”: Diameter Nominal (Metric)
.2 “NPS”: Nominal Pipe Size (Imperial)
.3 “NPT”: National Pipe Thread

.4 "Piping Components": Additional hardware required to complete a fully functional piping system, including piping, fittings, connectors, anchors, guides, supports, hangers, air vents, vacuum breakers, valves, vents, drains, gauges, flow and pressure control and limiting, pump ancillary components, expansion tanks, chemical treatment systems.
.5 "TAB": Testing, Adjusting, and Balancing
.6 "Tubing": Same as piping.

## 1.4 SUBMITTALS FOR ACTION

.1 Product Data
  .1 Manufacturers' product literature, specifications, and datasheets. Include product characteristics, performance criteria, options, and limitations.
  .2 Control Valve Schedule including a separate line for each valve provided and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type and Details.
.2 Shop Drawings
  .1 Piping Routing
    .1 Layout and Interference Plans: Isometric sketches indicating clearances, interferences, and relocation of interfering services, components, objects, and structures.
    .2 Fire Separations: Location of penetrations through fire separations and other assemblies.
    .3 Pipe Drainage: Indicate details of piping slope angles and drainage where applicable.
    .4 Expansion Compensation: Location of piping expansion control measures.
    .5 Vibration Isolation: Location of vibration isolation connectors.
    .6 Ports and Thermowells: Location of ports and thermowells.
  .2 Mounting: Details of bases, hangers, and supports.
  .3 Fire Stopping and Smoke Seals
    .1 Locations and types marked on plan drawing.
    .2 ULC assembly number certification.
    .3 Required temperature rise and flame rating.
    .4 Hose stream rating where applicable.
    .5 Materials of fire stopping and smoke seals, primers, reinforcements, damming materials, reinforcements, and anchorages/fastenings.
    .6 Assembly and penetration type and required ratings, adjacent materials.
    .7 Openings size, thickness, dimensions.
    .8 Proposed installation methods.
    .9 Summaries of similar types of penetrations, assembly type and construction, service penetrating assembly, adjacent materials, fire stopping and smoke seal type, ratings, other work required.
    .10 Copies of ULC certifications for proposed systems and designs for specific devices and materials.
    .11 Image of sample tag.
  .4 Labels: Scaled drawings indicating label types, dimensions, layout, locations, wording, font, spacing, colours. Specifically identify letter sizes larger than indicated minimum heights.

## 1.5 SUBMITTALS FOR INFORMATION

.1 Certificates

.1 Letter certifying piping support as installed has been designed and installed in compliance with required seismic restraint provisions.
.2 Letter certifying that materials comply with specified performance characteristics and physical properties.
.3 Letter from piping support manufacturer certifying pipe support systems have been installed in compliance with Contract Documents.
.4 Letter from fire stopping and smoke seals installer certifying that fire stopping and smoke seals have been installed in accordance with regulatory requirements and Contract Documents.

.2 Manufacturer Information
.1 Fluid Treatment: Submit written operating instructions on treatment dosages, control charts and test procedures.

.3 Balancing Reports
.1 Balancing Reports compliant with AABC-TBP and AABC-TSB, NEBB-TABES recommendations.
.2 Pressure Test Reports compliant with AABC-TBP and AABC-TSB, NEBB-TABES recommendations.

.4 Qualification Statements
.1 Welding: Proof of certifications for company and personnel.
.2 TAB: Proof of certifications for company and personnel.
.3 Professional Engineering: Proof of licences for company and personnel.

.5 Documentation
.1 Shutoff valve charts.

.6 Other/Photographs
.1 Required photographs.

### 1.6 QUALITY ASSURANCE

.1 Qualifications
.1 Welding
.1 Company certified by CWB to CSA-W47.1 and CSA-W47.2.
.2 Personnel to have welding qualifications to CSA-B51.

.2 TAB
.1 Company and personnel members of AABC and CAABC, or NEBB.
.2 Company and personnel AABC or NEBB certified.
.3 Subject to approval.

.3 Fire Stopping and Smoke Seals: Company member of FCIA.
.4 Professional Engineering
.1 Company and personnel licensed to practice Professional Engineering by PEO.
.2 Subject to approval.

## PART 2 PRODUCTS

### 2.1 COMMON PRODUCT REQUIREMENTS

.1 The precise type, quantity and location of products furnished under this Section depends, in part, on routing and installation choices made by Contractor. Provide products:
.1 Rated to handle the extremes of temperature, pressure, abrasion, and corrosion to which they will be subjected.
.2 With materials suitable for the fluid type and conditions to which they will be exposed.
.3 Appropriately sized as required.
.4 As indicated.
.5 To ASME-B31.9.

.6 To CSA-B214.
.7 To CSA-Z317.1.
.8 To CSA-Z317.13.

.2 Piping Components and Fittings
.1 Materials: Match pipe unless otherwise indicated or required for system performance.
.2 Size: Match pipe size unless otherwise indicated or required for system performance including control.
.3 Type: Match type consistent with Work where not indicated.
.4 Joints: Use flanges for larger than NPS-2 unless otherwise indicated.

## 2.2 PIPES

.1 Provide as required.
.2 Types
.1 CO-T - Copper Tube
.1 To ASTM-B88.
.2 Type
.1 CO-T-K - Type K (Metric Type A)
.2 CO-T-L - Type L (Metric Type B)
.3 Weight
.1 CO-T-xH - Hard: Use unless otherwise required.
.2 CO-T-xS - Soft
.2 CS-P - Carbon Steel Pipe
.1 To ASTM-A53.
.2 Type
.1 CS-P-E - Type E: Electric-Resistance Welded, Grade B
.2 CS-P-S - Type S: Seamless, Grade B
.3 Weight
.1 CS-P-x40 - Schedule 40
.2 CS-P-x80 - Schedule 80
.3 SI-H - Silicone Hose
.1 Manufacturers
.1 Nexgen Hose Inc., Silicone Tubing, Class 791 Nexsil FDA
.2 Type: Minimum of:
.1 Manufacturers as listed above.
.2 As recommended by combustion equipment manufacturer.
.4 SS-P - Stainless Steel Pipe
.1 To ASTM-A312.
.2 Weight
.1 SS-P-10 - Schedule 10
.5 Drainage Waste Vent
.1 Plumbing
.1 PVC or DWV or as required.
.2 Other Services
.1 As indicated, otherwise as required for service, otherwise match piping requirements.

## 2.3 FITTINGS

.1 Provide as required, including unions, flanges, tees, and elbows including long and short radius.
.2 Steel: Screwed and welded including flanged:
.1 Screwed Fittings: Malleable iron, to ASME-B16.3.
.2 Flanges and Flanged Fittings

.1 Steel: To ASME-B16.5.
.3 Buttwelding Fittings: Steel, to ASME-B16.9.
.4 Unions: Malleable iron, to ASTM-A47 and ASME-B16.3.
.5 Bolts and Nuts: To ASME-B18.2.1.

.3 Copper: Screwed and soldered including flanged:
.1 Cast Copper: To ASME-B16.18.
.2 Wrought Copper: To ASME-B16.22.
.3 Bolts and Nuts: To ASME-A307.

.4 Bronze: Screwed and brazed including flanged:
.1 Screwed Fittings: Cast bronze, to ASME-B16.15.
.2 Flanges and Flanged Fittings: To ASME-B16.24.

.5 Elbows
.1 Select elbows with equal inlet and outlet port diameters unless otherwise indicated.
.2 Provide long radius type unless otherwise indicated.
.3 Provide short radius type when approved by Engineer.

## 2.4 ANCHORS, GUIDES, SUPPORTS, AND HANGERS

.1 Design of piping support depends, in part, on routing and installation choices made by Contractor. Design of piping support is Contractor responsibility.

.2 Provide as required.
.1 Design to ASME-B31.9.
.2 Design for easy removal.

.3 Performance
.1 Design pipe supports to withstand seismic events as required. Seismic restraint provisions shall meet or exceed requirements for post-disaster buildings in the respective seismic zone.
.2 Prevent pipe noise and vibration from being transferred to supporting structure.
.3 Angularity of rod hanger resulting from horizontal movement of piping from cold to hot position not to exceed 4-degrees from vertical.
.4 For piping at risk of condensation mount hangers over insulation and vapour barrier to prevent condensation of hanger rods, including chilled piping, domestic water, cooling condensate piping, humid or wet environments.

## 2.5 FIRE STOPPING AND SMOKE SEALS

.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases to ULC-S115.

.2 Materials
.1 Fire stopping and smoke seal components: Certified by test laboratory to ULC-S115.
.2 In assemblies: Systems tested to ULC-S115.
.3 In wet environments, waterproof assemblies, or exterior assemblies including foundations and below grade floors: Waterproof, non-hardening.
.4 Penetrations requiring vibration control: Elastomeric seal.
.5 Damming and backup materials, supports and anchoring devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
.6 Other locations: As required.

.3 Performance: Rating: 2-hours, unless otherwise required.

## 2.6 BUTTERFLY SHUTOFF VALVES

.1 Provide as required.

.2 Manufacturers

.1 Bray International, Inc., 31H Series
.2 Milwaukee Valve Company, ML Series
.3 Kitz Corporation, 6122 Series

.3 Type
.1 Heavy duty design.

.4 Features
.1 Extended neck body.
.2 Seats of any of the following types:
.1 Phenolic cartridge.
.2 Moulded.
.3 Low profile disc with materials follows:
.1 Aluminum-bronze.
.2 Stainless steel.
.4 Low torque liner.
.5 Liner material as recommended by manufacturer.
.6 Bubble tight seal.
.7 Blowout proof stems.
.8 Stems of 316 or 416 stainless steel.
.9 Close-off pressure rated for dead-end service with piping on 1 side of shutoff valve disconnected.
.10 Operators
.1 Up to and including NPS-6, when located less than 6-ft above floor: Locking Lever Style
.2 Larger than NPS-6, or any size when located more than 6-ft above floor: Gear Wheel Style

## 2.7 BALL SHUTOFF VALVES

.1 Provide as required.
.2 Manufacturers
.1 Crane Co., Crane
.2 Crane Co., Jenkins
.3 Kitz Corporation

.3 Type
.1 Heavy duty design.
.2 Full port balls.
.3 Solid balls with materials as follows as required:
.1 Chrome plated.
.2 Stainless steel.
.4 Double o-ring.
.5 Full sized lever handle.
.6 Body materials with materials as follows as required:
.1 Brass.
.2 Stainless steel.
.7 Close-off pressure rated for dead-end service with piping on 1 side of shutoff valve disconnected.

## 2.8 CONTROL VALVES

.1 Provide as indicated.
.2 Manufacturers
.1 Belimo Automation AG
.2 Bray International, Inc.
.3 Delta Control Products, Inc.

.3 Size: As indicated where all characteristics are indicated. Where all characteristics are not indicated, as required including for performance of entire system.
.4 Materials: As required.
.5 Actuators: To Section 26 90 00 Control Devices.
.6 3-Way Valves
.1 Select valve port configuration as required.

**2.9 GLOBE MANUAL BALANCING VALVES**

.1 Provide as indicated.
.2 Manufacturers
.1 Armstrong Fluid Technology, CBV-V/CBV-F Series
.2 IMI Hydronic Engineering, STAD/STAF Series
.3 Oventrop Corporation, Hydrocontrol R/F Series
.3 Features
.1 Globe style valve body.
.2 2 x 6-mm (1/4-in) threaded brass metering ports with check valves and gasketed caps.
.3 Handwheel capable of minimum 5 full 360-degree turns, complete with micrometer type indicators.
.4 Hidden memory stop to set and lock valve position at balance point.
.5 Straight or angled configuration as required.
.6 If available in product line:
.1 Venturi style measuring port built into valve body if available.
.2 Flow smoothing fins downstream of valve seat.
.4 Materials
.1 Valve Body, Stem, Disk: Cast iron for flanged, brass otherwise.
.2 Seat: EPDM or Viton as required.
.3 Handhweel: Reinforced nylon.
.5 Options
.1 Provide metering port extensions for insulated piping.
.6 Not Acceptable: Use as a shutoff valve.

**2.10 STRAINERS**

.1 Provide as indicated.
.2 Manufacturers
.1 Armstrong International, Inc.
.2 ISLIP Flow Controls Inc.
.3 Spirax-Sarco Limited
.3 Type
.1 NPS-2 and under:
.1 “Y” type.
.2 Screwed cleanout plug.
.2 NPS-2-1/2 to NPS-8:
.1 “Y” type.
.2 Bolted cleanout plug.
.3 Above NPS-8:
.1 “T” type.
.2 Bolted cleanout plug.
.4 Screen: Stainless steel.
.5 Materials: As required.
.6 Blowout: 19-mm (3/4-in) blow off valve unless otherwise indicated.

**2.11 CHECK VALVES**

.1 Provide as indicated.
.2 Manufacturers
  .1 Crane Co.
  .2 ISLIP Flow Controls Inc.
  .3 Spirax-Sarco Limited
.3 Type
  .1 NPS-2 and under:
    .1 Type: Swing.
    .2 Body: Y pattern with integral seat at 45-degrees, screw in cap with hex head.
    .3 Disc: Renewable rotating disc, 2-piece hinge disc construction.
    .4 Seat: Regrindeable.
  .2 NPS-2-1/2 and above:
    .1 Type: As required.
    .2 Body: Bolted cover, tapped and plugged opening on each side for hinge pin.
    .3 Disc: Secured to stem, rotating for extended life.
    .4 Seat: Regrindable, integral with body.
  .3 Materials: As required.

**2.12 AIR VENTS**

.1 Provide as required.
.2 Manufacturers
  .1 Maid-O'-Mist, No. 7 Series
  .2 Taco, Inc., 409
  .3 Honeywell International Inc., EA122 Series
  .4 Spirax-Sarco Limited, 13WS

**2.13 COMBINED AIR VENT AND VACUUM BREAKERS**

.1 Provide as required.
.2 Manufacturers
  .1 Armstrong International Inc., TAVB Series
  .2 Spirax-Sarco Limited, VB-VS Series
  .3 Watts Industries (Canada) Inc., FV-4M1

**2.14 PRESSURE GAUGES**

.1 Provide as required.
.2 Size
  .1 Piping system served by gauge not greater than NPS-2: 63-mm (2-1/2-in) diameter dial face.
  .2 Piping system served by gauge greater than NPS-2: 100-mm (4-in) or 113-mm (4-1/2-in) diameter dial face.
  .3 Increase dial size by 50-mm (2-in) diameter when located at more than 2.4-m (8-ft) away from viewing area including floor, operating platform.
.3 Scale
  .1 Pressure not greater than 6.9-kPa (1-psi): Dual scale, inches of water gauge and ounces/in2 gauge.
  .2 Pressure greater than 6.9-kPa (1-psi): Dual scale, psi gauge and kilopascal gauge.
.4 Range: Select scale ranges to suit the application, including operating pressures that may be both above and below atmospheric pressure, with readings at approximately mid-point on the dial.
.5 Materials

.1 Case
.1 Exterior: Stainless steel.
.2 Interior: Painted steel or aluminum.
.6 Housing
.1 Minimum IP65, certified to CSA-C22.2-60529.
.7 Performance
.1 Accuracy: +/-1-% Grade 1A to ASME-B40.100.

**2.15 TEMPERATURE GAUGES**

.1 Provide as required.
.2 Size
.1 Piping system served by gauge not greater than NPS-2: 50-mm (2-in) dial face.
.2 Piping system served by gauge greater than NPS-2: 100-mm (4-in) or 113-mm (4-1/2-in) diameter dial face.
.3 Increase dial size by 50-mm (2-in) diameter when located at more than 2.4-m (8-ft) away from viewing area including floor, operating platform.
.3 Scale: Dual scale, both Fahrenheit and Celsius degrees, direct reading to 1-°C (2-°F).
.4 Range: Select scale ranges to suit the application, including operating temperatures.
.5 Materials
.1 As required, including compatible with thermowells.
.6 Housing
.1 Minimum IP65, certified to CSA-C22.2-60529.
.7 Performance
.1 Accuracy: 1-% to 1-1/2-%

**2.16 THERMOWELLS**

.1 Provide as required, including for thermometers and other devices including fluid temperature sensors and switches.
.2 Provide spare thermowells as indicated.
.3 Provide device and thermowell as a complete assembly, including wellhead and Greenfield fitting.
.4 Materials: 316 stainless steel
.5 Construction: Component machined as a single part.
.6 Unacceptable: Component welded together from separate parts.

**2.17 PIPE INSULATION**

.1 Provide insulation on piping and piping components unless otherwise indicated.
.2 Provide adhesive, tape, sealants, cement, and mastic as recommended by, and compatible with, insulation and insulation jacket manufacturers.
.3 Common Performance Requirements
.1 Flame-Spread: Maximum 25 tested to ULC-S102.
.2 Smoke Developed: Maximum 50 tested to ULC-S102.
.4 Type MF - Preformed Mineral Fibre
.1 Manufacturers
.1 Johns Manville, Micro-Lok
.2 Manson Insulation, ALLEY-K
.5 Certifications, Listings and Registrations
.1 To ASTM-C547.
.2 To ASTM-C585.
.3 To ASTM-C1136.
.4 To NFPA-90A.

.5 To NFPA-90B.

**2.18 JACKETS**

.1 Provide jackets around insulated piping and piping components unless otherwise indicated.

.2 Common Performance Requirements
- .1 Flame-Spread: Maximum 25 tested to ULC-S102.
- .2 Smoke Developed: Maximum 50 tested to ULC-S102.

.3 Type AL - Aluminum Jacket
- .1 Provide as required.
- .2 To ASTM-B209.
- .3 Thickness: 0.4-mm (0.016-in)
- .4 Finish: Corrugated unless otherwise indicated.
- .5 Joining: Longitudinal and circumferential slip joints with 50-mm (2-in) laps.
- .6 Fittings: 0.5-mm (0.02-in) thick die shaped fitting covers with factory attached protective liner.
- .7 Banding and Mechanical Seals: 12-mm (1/2-in) wide; 0.5-mm (0.02-in) thick stainless steel.

.4 Type CAN - Canvas Jacket
- .1 Provide as required.
- .2 ULC listed.
- .3 Fabric: ASTM-C921, 220-g/m2 (6-oz/yd2), plain weave cotton treated with dilute fire-retardant lagging adhesive.

.5 Type PVC - Polyvinyl Chloride Jacket
- .1 Provide as required.
- .2 Provide preformed, moulded type jacketing as required for a complete vapour barrier jacket.
- .3 To CGSB-51.53.
- .4 Colour: White unless otherwise indicated.
- .5 Moisture Vapour Transmission: To ASTM-E96, 0.02-metric-perm (0.03-USperm).
- .6 Thickness: 0.5-mm (0.02-in)
- .7 Fastenings: Solvent weld adhesive, unless other fastening means are accepted by Engineer, including tacks, pressure sensitive colour matching vinyl tape.

.6 Type SS - Stainless Steel Jacket
- .1 Provide as required.
- .2 Materials: 304 stainless steel.
- .3 Thickness: 0.4-mm (0.016-in)
- .4 Finish: Corrugated unless otherwise indicated.
- .5 Joining: Longitudinal and circumferential slip joints with 50-mm (2-in) laps.
- .6 Fittings: 0.5-mm (0.02-in) thick die shaped or fabricated fitting covers.
- .7 Banding and Mechanical Seals: 12-mm (1/2-in) wide, 0.5-mm (0.02-in) thick stainless steel.

**2.19 BACKING BOARD**

.1 Provide as required.

.2 Materials
- .1 Rigid high-density polyethylene minimum 9.5-mm (3/8-in) thick laminated on top of pressure impregnated treated plywood minimum 19-mm (3/4-in) thick with fire-retardant chemicals to CSA-O80.
  - .1 Size polyethylene board to extend 12.7-mm (1/2-in) beyond edges of plywood backing.

.3 Performance
.1 Flame-Spread: Maximum 25 tested to ULC-S102.
.4 Finish: Painted plywood to match components and equipment. Select paint type to provide protection of plywood from water or moisture contact.
.1 Paint plywood in its entirety before attaching to polyethylene or support mechanism.

**2.20 FLUID TREATMENT CHEMICALS**

.1 Provide chemicals as required for start-up and flushing activities.
.2 Provide chemicals as required for control of corrosion, scale, and biological growth including algae.

**2.21 GLYCOL**

.1 Provide as required.
.2 Features
.1 Pre-mixed glycol/water solution with corrosion inhibiting chemicals suitable for intended application.
.2 Dyed fluorescent colour to aide leak detection.
.3 Concentration
.1 Pre-mixed to indicated concentration.
.2 Where concentration not indicated, 50-% by weight.
.3 Prohibited: Field adjustments of glycol concentration or inhibitor levels.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

.1 Inspect distribution piping for the existence of piping dead legs and sections that cannot be drained down. Notify Engineer of discoveries.
.2 Determine exact location and routes for piping. Modify routing and/or relocate existing services as required.
.3 Complete x-ray scans, consultation, and other investigative work as required to verify structural member construction, verify suitable locations, and ensure drilling and coring through structural members will not affect integrity.
.4 Investigate fire separations and non-fire-resistance rated assemblies in affected areas for existing fire stopping or smoke sealing that is improperly sealed or defective, as well as for penetrations not fire stopped, or smoke sealed.

**3.2 PREPARATION**

.1 Eliminate piping dead legs and sections that cannot be drained down.
.2 Flush and clean affected piping systems including new and existing piping and piping components before being put into service.

**3.3 COMMON EXECUTION REQUIREMENTS**

.1 Install products including piping joining method:
.1 As indicated.
.2 To ASME-B31.9.
.3 To CSA-B214.
.4 Welding
.1 To CSA-W59.
.2 Filler metals and allied materials to CSA-W48.
.3 Prepare galvanized components before welding by scraping off galvanizing prior to welding.
.5 Soldering
.1 Soldering to ASTM-B828.
.2 Solders to ASTM-B32.
.3 Fluxes for soldered joints to ASTM-B813.

.4 Solders and fluxes to have less than 0.2-% lead content.

.6 Brazing

.1 In addition to soldering requirements, brazing alloys to AWS-A5.8, BCuP range.

.7 Solvent Welding

.1 To piping manufacturer's instructions.

.2 Unless otherwise indicated, provide and install piping and components to meet equipment manufacturer's requirements.

.3 Install concealed piping to minimize furring space, maximize headroom, and conserve space.

.4 Install piping components in accessible locations.

.5 Install to permit separate thermal insulation of each pipe unless otherwise indicated.

.6 Install to eliminate piping dead legs and sections that cannot be drained down.

.7 Group piping wherever possible.

.8 Grade: Slope piping as required to ensure proper drainage.

.9 Di-electric Connections: Provide for cathodic protection wherever dissimilar piping materials are connected together.

.10 Ensure piping is not supported from other services, including other piping systems.

.11 Ensure other services are not supported from piping, including other piping systems and wiring.

**3.4 PIPES**

.1 Install as required.

.2 Completely remove burrs, sharp edges, and other discontinuities from inside and outside surfaces of pipes and fittings prior to joint connection.

.3 Promptly remove excess flux from inside and outside surfaces of pipes and fittings following soldering or brazing.

.4 Minimize time between application of flux and completion of soldering or brazing.

**3.5 FITTINGS**

.1 Install as required.

**3.6 ANCHORS, SUPPORTS, GUIDES AND HANGERS**

.1 Design and provide anchors, supports, guides and hangers as required.

.2 Fasteners: Wedge, sleeve or epoxy type anchor bolts. Refrain from using self-drilling or power-driven anchor bolts.

.3 Anchors: Locate concrete anchors for equipment away from edges, stress joints, or existing fractures. Follow manufacturer's instructions on minimum anchor spacing.

.4 Hangers: Use trapeze type hangers where pipes are grouped together, unless otherwise indicated. Suspend horizontal member by adjustable rods with locking feature for maintaining level and slope. Provide auxiliary steel required to support trapeze between building steel.

.5 Refrain from hanging pipe from another pipe unless otherwise indicated.

.6 Adjust support system including hangers to equalize load.

**3.7 PENETRATIONS**

.1 Provide sleeves at penetrations and where piping passes through assemblies including walls, floors and ceilings.

.2 Pack sleeves with resilient packing or fire rated packing and materials as required.

.3 Flash parts built into or passing through to wet environments, waterproof assemblies, or exterior assemblies including roofs, outside walls.

.4 Patch holes to match existing surfaces.
.5 Provide minimum clearances as required between sleeves and uninsulated or insulated piping with minimum of:
  .1 From Combustibles: As required.
  .2 Below Grade: 25-mm (1-in)
  .3 Other Locations: 13-mm (1/2-in)
.6 Sleeve Materials
  .1 Exterior Assemblies: Carbon steel schedule 40, primed and painted.
  .2 Masonry and Concrete Assemblies: Carbon steel schedule 40, primed and painted.
  .3 Interior Frame Construction Assemblies in Conditioned Spaces: Carbon steel schedule 40.
  .4 Other Frame Construction Assemblies: Carbon steel schedule 40 primed and painted.
.7 Extend floor sleeves 38-mm (1-1/2-in) above floor surface.
.8 Seal floor sleeves with an approved stiff setting caulking compound to serve as a water dam.
.9 Conceal sleeves at penetrations in finished areas with approved escutcheons.

**3.8 FIRE STOPPING AND SMOKE SEALS**

.1 Fire stop and smoke seal at fire-resistance rated assemblies including:
  .1 Penetrations through masonry, concrete, and frame construction including gypsum board partitions and walls.
  .2 Penetrations through floor slabs, ceilings and roofs.
  .3 Openings and sleeves installed for future use.
  .4 Services, including mechanical and electrical.
  .5 As indicated.
.2 Fire stop and smoke seal at non-fire-resistance rated assemblies including:
  .1 Assemblies not fire-resistance rated but constructed as such.
  .2 As indicated.
.3 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
.4 Install to allow for movement and thermal expansion of services including piping and ducting.
.5 Ensure integrity of fire stopping and smoke seals are such that passage of flame, smoke and gases is prevented to unexposed side of assembly. Repair as required.
.6 Ensure integrity of insulation and vapour barriers. Repair as required.
.7 Repair holes, gaps, openings and improperly fire stopped and smoke sealed penetrations in affected assemblies.
.8 Provide tags for each fire stopping and smoke seal. Include relevant information on tags including installer name, company, trade license, installation date, fire stopping and smoke seal assembly number. Mount at locations as approved by Owner or as required by authorities having jurisdiction.

**3.9 SHUTOFF VALVES**

.1 Install as required.
.2 Provide shutoff valves to facilitate isolation and maintenance of serviceable equipment and piping components in addition to indicated locations.
.3 Install with stems above horizontal position unless otherwise indicated.
.4 Install isolating shutoff valves at branch take-offs for isolating purposes, unless otherwise specified.

.5 Install remote operators including chains on shutoff valves NPS-2-1/2 or larger where installed more than 2.4-m (8-ft) above floor.
.6 Provide caps for shutoff valves that terminate at end of piping. Provide threaded caps complete with chain for shutoff valves NPS-2 and smaller. Provide joint type as indicated for piping on shutoff valves larger than NPS-2.
.7 Provide numbered brass tags for identification for existing and new shutoff valves in affected areas. Coordinate numbering with existing and new shutoff valve charts. Provide new shutoff valve chart for affected areas, listing new and existing shutoff valves. Provide appropriately sized frames with glass cover for each affected area. Match existing shutoff valve chart frames unless otherwise approved by Owner. Mount shutoff valve charts in frames on walls of affected areas in locations approved by Owner.
.8 Install with sufficient clearance to allow valve handle to travel through its full swing without contacting any materials and without modification to valve or adjacent materials such as bending valve handle or removing insulation.

**3.10 CONTROL VALVES**

.1 Install as required.
.2 Provide numbered brass tags for identification for existing and new control valves in affected areas. Coordinate numbering with existing and new control valve charts. Provide new control valve chart for affected areas, listing new and existing control valves. Provide appropriately sized frames with glass cover for each affected area. Match existing valve chart frames unless otherwise approved by Owner. Mount valve charts in frames on walls of affected areas in locations approved by Owner.

**3.11 GLOBE MANUAL BALANCING VALVES**

.1 Install as required.
.2 Install with stems above horizontal position unless otherwise indicated.
.3 Provide 1 temperature/pressure test gauge kit for every 100 installed valves.
.4 Provide numbered brass tags for identification for existing and new balancing valves in affected areas. Coordinate numbering with existing and new balancing valve charts. Provide new balancing valve chart for affected areas, listing new and existing balancing valves. Provide appropriately sized frames with glass cover for each affected area. Match existing balancing valve chart frames unless otherwise approved by Owner. Mount balancing valve charts in frames on walls of affected areas in locations approved by Owner.

**3.12 STRAINERS**

.1 Install as required.
.2 Coordinate strainer basket mesh size for multiple strainers within same piping loop to:
  .1 Protect equipment, components and services as required.
  .2 Provide downstream strainer with finer mesh size on strainer basket.
.3 Provide drain piping for blowdown valves.

**3.13 CHECK VALVES**

.1 Install as required.

**3.14 PRESSURE REDUCING VALVES**

.1 Install as required.

**3.15 RELIEF VALVES**

.1 Install as required.
.2 Set and coordinate temperature and pressure settings with requirements of system and other temperature and pressure control devices including safeties.

.3 Provide discharge piping to floor drain and terminate in a manner that minimizes the risk of damage or personal injury, including discharging directly above floor drain, funnel or hub drain unless otherwise indicated.

**3.16 DRAINS AND DRAIN PIPING**

.1 Provide drain valves and drain connections at low points of piping systems, at equipment, and at section isolating valves, in addition to indicated locations.
.2 Provide drain valves, drain connections, hose bibs, automatic air vents and vacuum breakers as required to ensure proper operation and ease of servicing.
.3 Provide threaded drip caps complete with chain on drain valves, drain connections and hose bibs.
.4 Provide drain piping as indicated.
.5 Provide drain piping to floor drains and terminate where discharge is visible, including to nearest floor drain, funnel or hub drain unless otherwise indicated.
.6 Provide drain piping with drain piping routed to avoid tripping, except as follows:
.1 Unless otherwise indicated.
.2 Drain pipe is a tripping hazard as determined by Owner.
.7 Provide hoses to connect drain connections to floor drains in cases where drain piping for blowdown valves are not provided.

**3.17 AIR VENTS AND VACUUM BREAKERS**

.1 Provide combined air vents and vacuum breakers unless otherwise indicated.
.2 Provide automatic air vents, vacuum breakers, and combined air vents and vacuum breakers:
.1 As indicated.
.2 At high points of piping systems in addition to indicated locations.
.3 Provide isolating valves at each device.
.4 Provide drain piping.

**3.18 PRESSURE GAUGES**

.1 Install in locations that facilitate easy reading including aiming.
.2 Install in locations to prevent restriction of fluid flow in piping. Increase size of piping as required.
.3 Mount not higher from the viewing area including floor, operating platform, as follows unless otherwise required:
.1 Differential Pressure Gauges: 1.5-m (5-ft)
.2 Non-differential Pressure Gauges: 2.4-m (8-ft)
.4 Provide stem pipes and ancillary components as indicated. Where not indicated, provide stem pipes complete with full port ball type shutoff valve.
.5 For gauges with multiple connections and shutoff valves, document various shutoff valve modes for specific purposes, including mode title, valve tags, valve positions. Document to be complete with laminated chart.

**3.19 TEMPERATURE GAUGES**

.1 Install in locations that facilitate easy reading including aiming.
.2 Mount not higher than 2.4-m (8-ft) from the viewing area including floor, operating platform.

**3.20 THERMOWELLS**

.1 Mount in a threadolet or 13-mm (1/2-in) NPT saddle to allow easy access to thermometers and other devices for repair or replacement.
.2 Install in locations to prevent restriction of fluid flow of piping. Increase size of piping as required.
.3 Fill thermowells with a high temperature mineral grease prior to insertion of thermometers and other devices.

**3.21 FINISHING**

.1 Paint piping as indicated, and as required where not indicated.

**3.22 PIPE INSULATION AND JACKETS**

.1 Replace insulation and jackets on existing piping as indicated.
.2 Replace damaged insulation and jackets on existing piping affected by Work.
.3 Provide vapour barrier on piping at risk of condensation.
.4 Install insulation, and seal seams and joints to prevent corrosion of pipe surface by condensation or precipitation.
.5 Install to:
  .1 MICA-NISM.
  .2 TIAC-BPG.
.6 Maintain continuity and integrity of vapour retarder jacket and finishes to prevent corrosion of pipe surface by condensation or precipitation.
.7 Insulated Components
  .1 Provide removable insulation to serviceable components and devices, including nameplates, access hatches and doors, drains, measurement ports, operable components.
    .1 For smaller removable insulation, use insulation with same or better thermal performance but a type that can be installed with tight fitting friction fits
  .2 Provide labels on covered components and devices.
.8 Seams
  .1 Seal seams using seam sealant acceptable to manufacturer and Engineer.
  .2 Match seam sealant to jacket.
  .3 Minimize the number of seams by using full length insulation pieces.
  .4 Position overlaps to shed water.
  .5 Locate longitudinal seams at bottom of pipe.
.9 Supports and Hangers
  .1 Install supports and hangers outside vapour retarder jacket.
  .2 Install high compressive strength insulation under pipe supports to prevent compression of insulation.
.10 Additional Finishing
  .1 Type CAN - Canvas Jacket: Paint jackets.

**3.23 PIPE LABELLING**

.1 Provide labels for piping denoting service type, piping service function, and flow direction.
  .1 Materials: Pressure sensitive vinyl with protective overcoating, waterproof adhesive undercoating, suitable for ambient conditions of continuous 100-%RH and continuous operating temperature of 150-°C (300-°F) with intermittent temperatures of 200-°C (390-°F).
  .2 Common Requirements
    .1 To ASME-A13.1.
    .2 To CGSB-24.3.
  .3 Text Label: Provide labels with text on full description of service and indication of flow direction and function as applicable, including supply, return, bypass, discharge, relief.
    .1 Text Description: As required by Owner, including as indicated or match existing, otherwise to indicated requirements and referenced documents.
    .2 Text Font Type: As required by Owner, otherwise match existing, otherwise to indicated requirements and referenced documents.
    .3 Text Font Size

.1 Minimum 25-mm (1-in) high for services 50-mm (2-in) diameter and smaller based on finished diameter including insulation and jacket.
.2 Minimum 75-mm (3-in) high for services 300-mm (6-in) diameter and larger based on finished diameter including insulation and jacket.
.3 Minimum 50-mm (2-in) high for other finished services.
.4 Increase letter size by 25-mm (1-in) high for services located at more than 2.4-m (8-ft) above floor.

.4 Text Colour: As indicated, otherwise as required by Owner, otherwise match existing, otherwise to indicated requirements and referenced documents.

.5 Text Label Size
.1 Borders: Minimum 25-mm (1-in) border widths around and in addition to text.
.2 Width: Minimum 300-mm (12-in) overall width.

.6 Background Colour
.1 As required by Owner, including as indicated or match existing, otherwise to ASME-A13.1 for label colour scheme and NEMA-Z535.1 for colours.
.2 Colour may vary for each service.

.4 Flow Direction Label: Provide labels with arrows to indicate flow direction.

.1 Arrow Direction
.1 Provide arrows for normal flow direction of operating service.
.2 Provide additional arrows for services intended to normally have flow in both directions including flow reversal.

.2 Size
.1 Width: Minimum 50-mm (2-in) width.
.2 Height: To accommodate full circumference of finished service.

.3 Colour: Arrow colour to match text colour. Background colour to be opposite of text colour, or clear if approved by Engineer.

.5 Band Label: Provide coloured bands to indicate specific service type group and function.

.1 Arrangement: As indicated, otherwise as required by Owner, otherwise to ISO-14726.

.2 Size
.1 Width: Minimum 90-mm (3-1/2-in) width, including for main colour and additional colour.
.2 Height: To accommodate full circumference of finished service.

.3 Colours
.1 As required by Owner, including as indicated or match existing, otherwise to ISO-14726 for label colour scheme and colours.
.2 Colour may vary for each service. Multiple colour labels may be required.

.6 Locations
.1 To facilitate easy reading.
.2 To indicated requirements and referenced documents.

.7 Intervals
.1 As follows, or at each change of flow direction, or as required if approved by Engineer.
.2 Every 3-m (10-ft) of length for services with 25-mm (1-in) high and shorter text.
.3 Every 6-m (20-ft) of length for services with 25-mm (3-in) high and taller text.

.4 Every 4.5-m (15-ft) of length for other services.

.2 Ceiling Labelling

.1 Provide coloured labels on ceiling surfaces to indicate equipment and components including the following. Colours indicated are indicative of requirements and Owner may change for each type of equipment or component.

.1 Purple

.1 Fan powered boxes with coils or heaters.

.2 Other coils or heaters.

.3 Other air terminal devices with coils or heaters.

.2 Pink

.1 Control valves.

.2 Other liquid distribution control components.

.3 Grey

.1 Communication or sound components.

.4 Black

.1 Other building services.

.2 Provide labels as acceptable to Owner, including label type, material, size and colour. Owner may require lamacoids, adhesive labels with text, adhesive labels with no text.

.3 Mark each label as acceptable to Owner, including equipment label, type, power circuit.

**3.24 GLYCOL FILL STATIONS**

.1 Modify existing as required.

**3.25 FIELD QUALITY CONTROL**

.1 Concealment Documentation: Photograph piping work at each stage of concealment including:

.1 Painting.

.2 Insulating.

.3 Installation of jacket.

.4 Wall finishing.

.5 Other obstructions or concealment.

.2 Testing Documentation: Photograph piping system and service fluid conditions at each stage of testing including:

.1 Flushing.

.2 Cleaning.

.3 Leak testing.

.4 Pressure testing.

.5 Other quality control activities.

.3 Leak Testing

.1 Leak test each closed system while under test pressure with both a soap solution and an electronic leak detector.

.4 Pressure Testing: Hydrostatically pressure test each closed system for a minimum of 4-hours or as required. Pressure test to a holding pressure of the minimum of:

.1 As required.

.2 1.5-times the maximum potential operating pressure.

.3 1,034-kPa gauge (150-psi gauge).

.4 Maximum component pressure ratings.

**3.26 START-UP**

.1 Fill new or existing piping loops affected by Work with appropriate fluids.

.2 Complete testing and flushing activities.
.3 Replace filters and strainers on equipment and systems during construction as required and immediately before equipment start-up.
.4 Replace existing and new filters and strainers on equipment and systems immediately after substantial performance.
.5 Promptly following filling or addition of any fluid to affected piping loops, provide quantities of fluid treatment chemicals necessary to restore chemical concentrations to levels recommended by fluid treatment service provider.
.6 Execute equipment start-up procedures as required.

**3.27 FLUSHING**

.1 Flush and clean affected piping systems including new and existing piping and piping components before being put into service.
.2 Flush with appropriate chemicals and fluid temperature as required.
.3 Flush piping with water flowing at velocity of minimum 1.8-m/sec (6-ft/sec) or as required for period of 2-hours or longer as required to remove dirt, scale, and cuttings from entire length of piping.
.4 For components at risk of damage due to flushing activities, temporarily replace such components with appropriate fittings for duration of flushing. Return required components to their proper places at the conclusion of flushing activities.
.5 Disposal of cleaning solutions/chemicals to be approved by authorities having jurisdiction.
.6 Manufacturers Assistance: Flushing to be approved and completed under supervision of Owner's fluid treatment service company(s).

**3.28 BALANCING**

.1 Balance flows as indicated.
.2 Balance flows as required where not indicated.
.3 Tolerance: +/-2-%
.4 Tolerance: As required to assure flows can be adjusted by others using only balancing valves to achieve required flow rates.
.5 Allow for 2 additional site visits after receipt of Owner written approval for adjustments.

**3.29 ADJUSTING**

.1 Supports and Hangers
  .1 Vertical under normal operating conditions.
  .2 Equalize loads.
.2 Make-up Water and Expansion Tanks
  .1 Set and coordinate pressure settings with requirements of system and other pressure control devices including make-up water and expansion tanks.
  .2 Make adjustments under the following combinations of conditions:
    .1 Flow rate or withdrawal is at maximum, 25-% of maximum, no flow rate.
    .2 Pressure is at maximum and minimum.
  .3 Allow for 4 additional site visits after start-up and during Warranty Period for adjustments to pressure settings during system operation and shutdown to improve system performance under various conditions including peak and seasonal loads.

**3.30 MAINTENANCE**

.1 Include bi-monthly visit by Owner's fluid treatment service company(s) for first 6-months operation, to check operation and to conduct tests of pertinent fluid treatment systems and submit written report on same.

**END OF SECTION 23 05 00**

# SECTION 23 30 00 DUCTWORK

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Ducts, dampers, connectors, diffusers, grilles, registers.

### 1.2 REFERENCED DOCUMENTS

.1 AABC-TBP: AABC Test and Balance Procedures.
.2 AABC-TSB: AABC National Standards for Total System Balance, 2016.
.3 ASME-A13.1: ASME-A13.1-2015 Scheme for the Identification of Piping Systems.
.4 ASTM-A480: ASTM-A480/A480M-16 Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip.
.5 ASTM-A653: ASTM-A653/A653M-15 Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.6 ASTM-B209: ASTM-B209-14 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
.7 ASTM-C553: ASTM-C553-15 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
.8 ASTM-C612: ASTM-C612-14 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
.9 ASTM-C921: ASTM-C921-10 (R2015) Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
.10 ASTM-C1071: ASTM-C1071-16 Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
.11 ASTM-C1136: ASTM-C1136-16 Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation.
.12 ASTM-C1290: ASTM-C1290-16 Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts.
.13 CSA-Z317.2: CAN/CSA-Z317.2-15 Special Requirements for HVAC Systems in Health Care Facilities.
.14 CSA-Z317.13: CAN/CSA-Z317.13-17 Infection Control During Construction or Renovation of Health Care Facilities.
.15 CGSB-1-GP-12: CGSB-1-GP-12-91 Standard Paint Colors.
.16 CGSB-24.3: CAN/CGSB-24.3-92 Identification of Piping Systems.
.17 ISO-14726: ISO-14726-2008 Ships and Marine Technology - Identification Colours for the Content of Piping Systems.
.18 MICA-NISM: MICA National Commercial and Industrial Insulation Standards Manual, 2016 (8th Edition).
.19 NEBB-TABES: NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems, 2015 (8th Edition).
.20 NEMA-Z535.1: ANSI/NEMA-Z535.1-2006 (R2011) Safety Colors.
.21 NFPA-90A: NFPA-90A-15 Standard for the Installation of Air-Conditioning and Ventilating Systems.
.22 NFPA-90B: NFPA-90B-15 Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
.23 SMACNA-006: ANSI/SMACNA-006-2005 HVAC Duct Construction Standards - Metal and Flexible.
.24 SMACNA-OBUC: SMACNA IAQ Guideline for Occupied Buildings Under Construction, 2007.
.25 TIAC-BPG: TIAC Mechanical Insulation Best Practices Guide.

.26 ULC-S102: CAN/ULC-S102-10 Surface Burning Characteristics of Building Materials and Assemblies.
.27 ULC-S109: CAN/ULC-S109-14 Flame Tests of Flame Resistant Fabrics and Films.
.28 ULC-S115: CAN/ULC-S115-11 (R2016) Standard Method of Fire Tests of Firestop Systems.

**1.3 DEFINITIONS**

.1 As defined by SMACNA, unless otherwise defined.
.2 “Ductwork”: This refers to the sheet metal, joints, turning vanes, transitions, flanges, hangers, insulation mounts, and other accessories making up a duct section or sections.

**1.4 SUBMITTALS FOR ACTION**

.1 Product Data
  .1 Manufacturers’ product literature, specifications, and datasheets. Include product characteristics, performance criteria, options, and limitations.
  .2 Control Damper Schedule including a separate line for each damper provided and a column for each of the damper attributes, including: ID, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type and Details.
.2 Shop Drawings
  .1 Duct Routing
    .1 Layout and Interference Plans: Isometric sketches indicating clearances, interferences, and relocation of interfering services, components, objects, and structures.
    .2 Fire Separations: Location of penetrations through fire separations and other assemblies.
    .3 Duct Drainage: Indicate details of duct slope angles and drainage where applicable.
    .4 Expansion Compensation: Location of ductwork expansion control measures.
    .5 Vibration Isolation: Location of vibration isolation connectors.
    .6 Ports and Gauges: Location of ports and gauges.
  .2 Mounting: Details of bases, hangers, and supports.
  .3 Suspension Systems: Indicate the following for all suspended equipment:
    .1 Location of suspension.
    .2 Maximum load at each of the suspension points.
    .3 Size of suspension rods or members.
    .4 Details of supplementary structural steel framing members.
  .4 Penetrations
    .1 Location of penetrations.
    .2 Support details including lintels.
    .3 Sleeve details including dimensions, fasteners, and sealing.
  .5 Fire Stopping and Smoke Seals
    .1 Locations and types marked on plan drawing.
    .2 ULC assembly number certification.
    .3 Required temperature rise and flame rating.
    .4 Hose stream rating where applicable.
    .5 Materials of fire stopping and smoke seals, primers, reinforcements, damming materials, reinforcements, and anchorages/fastenings.
    .6 Assembly and penetration type and required ratings, adjacent materials.
    .7 Openings size, thickness, dimensions.

.8 Proposed installation methods.
.9 Summaries of similar types of penetrations, assembly type and construction, service penetrating assembly, adjacent materials, fire stopping and smoke seal type, ratings, other work required.
.10 Copies of ULC certifications for proposed systems and designs for specific devices and materials.
.11 Image of sample tag.

.6 Labels: Scaled drawings indicating label types, dimensions, layout, locations, wording, font, spacing, colours. Specifically identify letter sizes larger than indicated minimum heights.

.3 Indoor Air Quality Management Plan: Submit Indoor Air Quality (IAQ) Management Plan in accordance with SMACNA-OBUC.

## 1.5 SUBMITTALS FOR INFORMATION

.1 Certificates
.1 Letter certifying duct supports are in compliance with required seismic restraint provisions.
.2 Letter certifying that materials comply with specified performance characteristics and physical properties.
.3 Letter certifying duct supports are in compliance are in compliance with Contract Documents.
.4 Letter from fire stopping and smoke seals installer certifying that fire stopping and smoke seals have been installed in accordance with regulatory requirements and Contract Documents.
.5 Letter from licensed fire protection company certifying fire suppression and detection services are in compliance with regulatory requirements.

.2 Manufacturer Information
.1 Operating and Maintenance Manuals
.2 Installation Instructions

.3 Balancing Reports
.1 Balancing Reports compliant with AABC-TBP and AABC-TSB, NEBB-TABES recommendations.
.2 Pressure Test Reports compliant with AABC-TBP and AABC-TSB, NEBB-TABES recommendations.
.3 Provide system schematic diagram with recorded measurements and requirements. Include time of measurements.
.4 Indicate pressure drops across components, including intake and exhaust locations including louvers and grilles.
.5 Indicate air conditions for outdoors as well as throughout system at different measurement times.

.4 Qualification Statements
.1 Fire Protection: Proof of licenses for company and personnel.
.2 TAB: Proof of certifications for company and personnel.
.3 Professional Engineering: Proof of licences for company and personnel.

## 1.6 SUBMITTALS FOR CLOSEOUT

.1 Certificates
.1 Letter from Contractor certifying all required fire dampers have been provided and installed correctly, and fire dampers product data has been provided including maintenance data for periodic testing.

## 1.7 QUALITY ASSURANCE

.1 Qualifications
.1 Ductwork: Company member of SMACNA and OSMCA.

.2 Fire Protection: Company and personnel to be licensed sprinkler and fire protection installers.
.3 Fire Stopping and Smoke Seals: Company member of FCIA.
.4 TAB
.1 Company and personnel members of AABC and CAABC, or NEBB.
.2 Company and personnel AABC or NEBB certified.
.3 Subject to approval.
.5 Professional Engineering
.1 Company and personnel licensed to practice Professional Engineering by PEO.
.2 Subject to approval.

## PART 2 PRODUCTS

### 2.1 COMMON PRODUCT REQUIREMENTS

.1 The precise quantity and location of ductwork depends on routing and installation choices made by Contractor. Provide ductwork:
.1 Rated to handle the extremes of temperature, pressure, abrasion, and corrosion to which they will be subjected.
.2 Constructed from materials suitable for the fluid type and conditions to which they will be exposed.
.3 Constructed to pressure classification of the greater of unless otherwise indicated:
.1 SMACNA 3-inWC
.2 Existing ductwork.
.4 As indicated.
.5 To CSA-Z317.1.
.6 To CSA-Z317.13.
.2 Duct dimensions indicate clear inside dimensions. Adjust duct sizes to accommodate liners and other obstructions.
.3 Certification: ULC labelled.
.4 Performance
.1 Noise Tolerances: Provide ductwork free from vibration, rattling or drumming under operating conditions.

### 2.2 DUCTWORK MATERIALS

.1 Buried Ductwork: Galvanized steel with PVC coating on inside and outside.
.2 Uninsulated Unpainted Exterior Ductwork: Stainless steel type 304 to ASTM-A480.
.3 Unpainted Ductwork: Galvanized steel with Z275 (G90) zinc coating to ASTM-A653, unless otherwise indicated.
.4 Painted Ductwork: Galvanized steel with ZF75 (A25) zinc coating to ASTM-A653, unless otherwise indicated.

### 2.3 ELBOWS AND TRANSITIONS

.1 Provide elbows of standard radius design with inner radius equal to width of elbow unless otherwise indicated.
.2 Provide mitred elbows in areas with restricted free space.
.3 Type
.1 90-degree Radius Elbows: Smooth centre line radius of 1.5-times duct diameter, or 5-piece construction, subject to approval.
.2 45-degree Radius Elbows: 3-piece construction.
.1 Provide branch connections to mains of eccentric conical configuration.
.3 Mitered Elbows: Provide air turning vanes for mitered elbows, from 90-degree square elbows up to 45-degree elbows.

.4 Air Turning Vanes: Provide small radius, single wall construction air turning vanes. Provide larger radius or double wall construction as required.
.5 Exterior Air Intake: Provide 38-mm (1-1/2-in) drain flange in low point of ductwork.

.4 Size: Fabricate rectangular duct elbows, transition sections and take-off fittings of metal 1 gauge heavier than duct thickness of adjacent duct.

**2.4 JOINTS**

.1 To SMACNA standards.
.2 Type
.1 Longitudinal Joints: Use Pittsburgh Lock joints tightly closed along full length of seam.
.2 Transverse Joints: Use class to suit duct size and requirements.
.3 Elbows: Use Pittsburgh Lock seams, with ends to match transverse joints of duct.

**2.5 SEAMS**

.1 Seal joints on ductwork to SMACNA standards.
.2 Common Performance Requirements
.1 Flame Resistance: To fabric requirements of ULC-S109.
.2 Flame-Spread: Maximum 25 tested to ULC-S102.
.3 Smoke Developed: Maximum 50 tested to ULC-S102.
.3 Manufacturers
.1 3M Canada Company, EC800
.2 Foster Products, No. 30-07
.3 Carlisle Coatings & Waterproofing Inc., Hardcast, Iron Grip 601
.4 Duro-Dyne Canada Inc., S-2 or Transcontinental Equipment “MP”
.4 Type
.1 Exterior Air Intake: Continuously solder or seal joints to prevent dripping of moisture through joints.

**2.6 SUPPORTS AND HANGERS**

.1 Design of ductwork support depends, in part, on routing and installation choices made by Contractor. Design of ductwork support is Contractor responsibility.
.2 Provide as required.
.1 To SMACNA standards.
.2 Design for easy removal.
.3 Performance
.1 Design ductwork supports to withstand seismic events as required. Seismic restraint provisions shall meet or exceed requirements for post-disaster buildings in the respective seismic zone.
.2 Prevent ductwork venting noise and vibration from being transferred to supporting structure.
.3 Angularity of rod hanger resulting from horizontal movement of ductwork from cold to hot position not to exceed 4-degrees from vertical.
.4 Hangers
.1 Provide mild steel rod hangers of 10-mm (3/8-in) dia. minimum size for ducts over 760-mm (30-in) in width. Provide 38-mm by 38-mm by 3-mm (1-1/2-in by 1-1/2-in by 1/8-in) steel angle across bottom of duct, attached to steel rods.
.2 Provide strap hangers of 3-mm by 25-mm (1/8-in by 1-in) mild steel bar stock for ducts up through 760-mm (30-in) width unless otherwise indicated.

**2.7 FIRE STOPPING AND SMOKE SEALS**

.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases to ULC-S115.

.2 Materials
  .1 Fire stopping and smoke seal components: Certified by test laboratory to ULC-S115.
  .2 In assemblies: Systems tested to ULC-S115.
  .3 In wet environments, waterproof assemblies, or exterior assemblies including foundations and below grade floors: Waterproof, non-hardening.
  .4 Penetrations requiring vibration control: Elastomeric seal.
  .5 Damming and backup materials, supports and anchoring devices: To manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
  .6 Other locations: As required.
.3 Performance: Rating: 2-hours, unless otherwise required.

**2.8 FLEXIBLE DUCT - INSULATED**

.1 Provide as required.
.2 Features
  .1 Single ply aluminum construction with mechanical lock spiral joints.
  .2 Fibreglass Insulation
  .3 Continuous lengths, not exceeding 3-m (10-ft).
.3 Options
  .1 FSK: Foil scrim craft.
  .2 PE: Polyethelene vapour barrier.
.4 Performance
  .1 Thermal Resistance: As indicated.
.5 Size: Provide continuous lengths, not to exceed 3-m (10-ft).

**2.9 BALANCING DAMPERS**

.1 Provide as required, including at supply terminations including diffusers and grilles.
.2 Constant Volume Systems
  .1 Provide balancing dampers at each branch duct and where necessary for proper balancing of system.
.3 Variable Air Volume Systems
  .1 Provide balancing dampers at each main branch duct and where necessary for proper balancing of system.

**2.10 FIRE DAMPERS**

.1 Provide as required, including provide fire dampers in ductwork passing through fire separations.
.2 To NFPA-90A, ULC labelled.
.3 Materials: Provide fire dampers and frames constructed of same materials as duct in which they are installed.
.4 Type
  .1 Hinged, fusible link type with channel frames, blades and housing.
  .2 Type A: For rectangular ducts 250-mm (10-in) or greater.
  .3 Type B: For rectangular ducts less than 250-mm (10-in). Ensure damper blades are outside of air stream when in open position.
  .4 Type C: For round ductwork.

**2.11 ACCESS HATCHES**

.1 Provide access hatches:
  .1 At fire dampers, automatic dampers, duct balancing dampers, coils.
  .2 At equipment and components requiring maintenance, inspections and for convenience purposes.
  .3 In fixed surfaces including walls, ceilings.

.4 At other locations as required.
.2 Type: Quick opening hardware. Lockable.
.3 Fasteners
.1 General: Provide countersunk holes where fasteners are not concealed.
.2 Size: Square with minimum free opening 0.37-m2 (4-ft2). Other shapes to be approved by Owner.
.4 Finish: To match fixed surfaces.

**2.12 DUCT INSULATION**

.1 Provide insulation on all ductwork, unless otherwise indicated.
.2 Provide adhesive, tape, sealants, cement, and mastic as recommended by, and compatible with, insulation and insulation jacket manufacturers.
.3 Common Performance Requirements
.1 Flame-Spread: Maximum 25 tested to ULC-S102.
.2 Smoke Developed: Maximum 50 tested to ULC-S102.
.4 Type MF-B - Mineral Fibre Board
.1 Manufacturers
.1 Johns Manville, 800 Series Spin-GlasManson Insulation, AK Board
.2 Owens Corning Canada LP, 700 Series FIBERGLASFeatures
.1 Thickness: As indicated.
.3 Density: 3-lb/ft3 (48 kg/m3)Certifications, Listings and Registrations
.1 To ASTM-C612.
.2 To ASTM-C1136.
.3 To NFPA-90A.
.4 To NFPA-90B.
.5 Type MF-L - Mineral Fibre Liner Board
.1 Manufacturers
.1 Johns Manville, Linacoustic R-300Manson Insulation, Akousti-Liner R
.2 Owens Corning Canada LP, QuietRFeatures
.1 Thickness: As indicated.
.2 Density: 3-lb/ft3 (48 kg/m3)
.3 Performance
.1 Sound Absorption Coefficient (NRC): Minimum 0.9.
.4 Certifications, Listings and Registrations
.1 To ASTM-C1071.
.2 To NFPA-90A.
.3 To NFPA-90B.
.6 Type MF-W - Mineral Fibre Wrap
.1 Manufacturers
.1 Johns Manville, Microlite EQManson Insulation, Alley Wrap
.2 Owens Corning Canada LP, SOFTRFeatures
.1 Thickness: As indicated.
.3 Density: 1.5-lb/ft3 (24 kg/m3) Certifications, Listings and Registrations
.1 To ASTM-C553.
.2 To ASTM-C1136.
.3 To ASTM-C1290.
.4 To NFPA-90A.
.5 To NFPA-90B.

**2.13 JACKETS**

.1 Provide jackets around insulated ductwork unless otherwise indicated.
.2 Common Performance Requirements
.1 Flame-Spread: Maximum 25 tested to ULC-S102.

.2 Smoke Developed: Maximum 50 tested to ULC-S102.

.3 Type AL - Aluminum Jacket
.1 Provide as required.
.2 To ASTM-B209.
.3 Thickness: 0.4-mm (0.016-in)
.4 Finish: Smooth unless otherwise indicated.
.5 Joining: Longitudinal and circumferential slip joints with 50-mm (2-in) laps.
.6 Fittings: 0.5-mm (0.02-in) thick die shaped fitting covers with factory attached protective liner.
.7 Metal jacket banding and mechanical seals: 12-mm (1/2-in) wide; 0.5-mm (0.02-in) thick stainless steel.

.4 Type CAN - Canvas Jacket
.1 Provide as required.
.2 ULC Listed.
.3 Fabric: ASTM-C921, 220-g/m2 (6-oz/yd2), plain weave cotton treated with dilute fire-retardant lagging adhesive.

.5 Type COM - Composite Membrane
.1 Provide as required.
.2 Multi-ply embossed UV-resistant aluminum foil and polymer laminate applied to rubberized asphalt layer complete with a metalized polyester film that is coated with low temperature acrylic adhesive.

### 2.14 GRILLES - RETURN - PERFORATED FACE

.1 Provide as indicated.

.2 Features
.1 Ducted.
.2 Hinged, removable perforated face.
.3 White powder coat finish.

.3 Materials: Steel.

## PART 3 EXECUTION

### 3.1 INSTALLERS

.1 Use any the following approved installers for fire protection including suppression and detection:
.1 Owner’s fire protection service company(s).

.2 Alternate installers will not be accepted.

### 3.2 EXAMINATION

.1 Photograph, document and submit descriptions of existing deficiencies in affected systems, equipment, services and surrounding areas prior to commencing Work.

.2 Complete x-ray scans, consultation, and other investigative work as required to verify structural member construction, verify suitable locations, and ensure drilling and coring through structural members will not affect integrity.

.3 Investigate fire separations and non-fire-resistance rated assemblies in affected systems for existing fire stopping or smoke sealing that is improperly sealed or defective, as well as for penetrations not fire stopped, or smoke sealed.

.4 Investigate ductwork through fire separations and non-fire-resistance rated assemblies in affected systems for fire dampers that are improperly selected, installed, defective, or missing.

.5 Investigate and review affected systems for as-built conditions, equipment, components, services.

.6 Record and submit findings, updates and corrections on marked-up existing drawings or other reporting means as approved.

## 3.3 PREPARATION

.1 Demolition and Removal
.2 Clean new services before being put into service.

## 3.4 COMMON EXECUTION REQUIREMENTS

.1 To SMACNA-006.
.2 Provide screens of 13-mm (1/2-in) mesh x 2.7-mm (0.105-in) diameter removable galvanized wire for air intakes, exhausts and open ends of ductwork, unless otherwise indicated or unless insect screen is required.
.3 Cross-break flat surfaces as required to prevent vibration or buckling.
.4 Provide necessary reinforcements, bracing, framing and gaskets.
.5 Provide required offsets and transitions, whether specifically indicated or not, to facilitate duct arrangement and to avoid interference with building structure, piping, equipment and services.
.6 Install ductwork as close as possible to walls, partitions and overhead structures to attain maximum headroom and clearance.
.7 Group ductwork wherever possible.
.8 Install to permit separate thermal insulation of each duct unless otherwise indicated.
.9 Install air sealing gaskets between flanged joints at duct connections to equipment.
.10 Install ductwork size transitions such that angle between the transition and straight run does not exceed 15-degrees, unless otherwise indicated.
.11 In occupied areas, paint interior of ductwork for at least 600-mm (2-ft) behind supply and exhaust grilles with matte black paint so as to render ductwork invisible from occupied space.
.12 Slope exhaust ductwork up away from register and without seams in bottom of duct for at least 3-m (10-ft) of duct run behind register.
.13 Slope exterior air intake ducts down at 1:100 to permit moisture induced by air intake to be drained. Install 38-mm (1-1/2-in) drain flange in bottom of duct at low point and run drain line to nearest floor drain unless otherwise indicated.
.14 Relocate and extend fire protection systems as required, including fire detection and adding sprinkler heads as required.

## 3.5 SUPPORTS AND HANGERS

.1 Design and provide supports and hangers as required.
  .1 Include as required steel framing, braces.
.2 Unless otherwise indicated, install supports and hangers at intervals not over 2.4-m (8-ft) centres for ducts up to 1.5-m (5-ft) in width and at 1.2-m (4-ft) centres for ducts 1.2-m (5-ft) in width and over.
.3 Install miscellaneous steel angles or channels as required between joists or building steel for structural support of duct where building framing spacing does not coincide with the required hanger spacing.
.4 Install 1 handle on either side of short dimension of duct to allow easy removal. Install backing washers or plate for added strength. Match materials to prevent galvanic corrosion.
.5 Bend strap hanger around bottom of duct with a minimum of 38-mm (1-1/2-in) overlap and attach to sides and bottom of duct.
.6 Adjust support system including hangers to equalize load.

## 3.6 PENETRATIONS

.1 Provide sleeves at penetrations and where ductwork passes through assemblies including walls, floors and ceilings.

.2 Pack sleeves with resilient packing or fire rated packing and materials as required.
.3 Install sheet metal closure plates on each side of wall to cover sleeve.
.4 Flash parts built into or passing through to wet environments, waterproof assemblies, or exterior assemblies including roofs, outside walls.
.5 Patch holes to match existing surfaces.
.6 Provide minimum clearances as required between sleeves and uninsulated or insulated ductwork with minimum of:
  .1 Below Grade: 25-mm (1-in)
  .2 Other Locations: 13-mm (1/2-in)
.7 Sleeve Materials
  .1 Exterior Assemblies: 12-gauge galvanized steel, primed and painted.
  .2 Masonry and Concrete Assemblies: 12-gauge galvanized steel, primed and painted.
  .3 Interior Frame Construction Assemblies in Conditioned Spaces: 18-gauge galvanized steel.
  .4 Other Frame Construction Assemblies: 18-gauge galvanized steel primed and painted.
.8 Seal floor sleeves with an approved stiff setting caulking compound to serve as a water dam.

**3.7 FIRE STOPPING AND SMOKE SEALS**

.1 Fire stop and smoke seal at fire-resistance rated assemblies including:
  .1 Penetrations through masonry, concrete, and frame construction including gypsum board partitions and walls.
  .2 Edge of floor slabs at curtain wall and pre-cast concrete panels.
  .3 Top of masonry and gypsum board partitions.
  .4 Intersection of masonry and gypsum board partitions.
  .5 Control and sway joints in masonry and gypsum board partitions and walls.
  .6 Penetrations through floor slabs, ceilings and roofs.
  .7 Openings and sleeves installed for future use.
  .8 Services, including mechanical and electrical.
  .9 As indicated.
.2 Fire stop and smoke seal at non-fire-resistance rated assemblies including:
  .1 Assemblies not fire-resistance rated but constructed as such.
  .2 As indicated.
.3 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
.4 Install to allow for movement and thermal expansion of services including piping and ducting.
.5 Ensure integrity of fire stopping and smoke seals such that passage of flame, smoke and gases is prevented including to unexposed side of assembly of single sided fire stopping and smoke seals. Repair as required.
.6 Ensure integrity of insulation and vapour barriers. Repair as required.
.7 Repair holes, gaps, openings and improperly fire stopped and smoke sealed penetrations in affected assemblies.
.8 Provide tags for each fire stopping and smoke seal. Include relevant information on tags including installer name, company, trade license, installation date, fire stopping and smoke seal ULC assembly number certification. Mount at locations as approved by Owner or as required by authorities having jurisdiction.

**3.8 FLEXIBLE DUCT**

.1 Install as required.

.2 Supports and Hangers
.1 In addition to other indicated requirements, install supports and hangers at intervals not over 1.2-m (4-ft) centres.

**3.9 BALANCING DAMPERS**

.1 Install as required.

**3.10 FIRE DAMPERS**

.1 Install as required.

**3.11 ACCESS HATCHES**

.1 Install as required.

**3.12 DUCT INSULATION AND JACKETS**

.1 Provide as indicated.
.2 Replace insulation and jackets on existing ductwork as indicated.
.3 Replace damaged insulation and jackets on existing ductwork affected by Work.
.4 Install insulation, and seal seams and joints to prevent condensation or precipitation.
.5 Install to:
.1 MICA-NISM.
.2 TIAC-BPG.
.6 Provide 25-mm (1-in) thick acoustic insulation as indicated.
.7 Insulated Components
.1 Provide removable insulation to serviceable components and devices, including nameplates, access hatches and doors, drains, measurement ports, operable components.
.1 For smaller removable insulation, use insulation with same or better thermal performance but a type that can be installed with tight fitting friction fits
.2 Provide labels on covered components and devices.
.8 Seams
.1 Seal seams using seam sealant acceptable to manufacturer and Engineer.
.2 Match seam sealant to jacket.
.3 Minimize the number of seams by using full length insulation pieces.
.4 Position overlaps to shed water.
.5 Locate longitudinal seams at the side of the ductwork that is least visible.
.9 Supports and Hangers
.1 Install supports and hangers outside vapour retarder jacket.
.2 Install high compressive strength insulation under duct supports to prevent compression of insulation.
.10 Additional Finishing
.1 Type CAN - Canvas Jacket: Paint jackets.

**3.13 DUCTWORK LABELLING**

.1 Provide labels for ductwork denoting service type, ductwork service function, and flow direction.
.1 Materials: Pressure sensitive vinyl with protective overcoating, waterproof adhesive undercoating, suitable for ambient conditions of continuous 100-%RH and continuous operating temperature of 150-°C (300-°F) with intermittent temperatures of 200-°C (390-°F).
.2 Common Requirements
.1 To ASME-A13.1.
.2 To CGSB-24.3.

.3 Text Label: Provide labels with text on full description of service and indication of flow direction and function as applicable, including supply, return, bypass, discharge, relief.
  .1 Text Description: As indicated, otherwise as required by Owner, otherwise to match requirements for piping from indicated requirements and referenced documents.
  .2 Text Font Size
    .1 Minimum 25-mm (1-in) high for services 50-mm (2-in) diameter and smaller based on finished diameter including finsulation and jacket.
    .2 Minimum 75-mm (3-in) high for services 300-mm (6-in) diameter and larger based on finished diameter including finsulation and jacket.
    .3 Minimum 50-mm (2-in) high for other finished services.
    .4 Increase letter size by 25-mm (1-in) high for services located at more than 2.4-m (8-ft) above floor.
  .3 Text Colour: As indicated, otherwise as required by Owner, otherwise match existing, otherwise to match requirements for piping from indicated requirements and referenced documents.
  .4 Text Label Size
    .1 Borders: Minimum 25-mm (1-in) border widths around and in addition to text.
    .2 Width: Minimum 300-mm (12-in) overall width.
  .5 Background Colour
    .1 As required by Owner, including as indicated or match existing, otherwise to match requirements for piping from ASME-A13.1 for label colour scheme and NEMA-Z535.1 for colours.
    .2 Colour may vary for each service.

.4 Flow Direction Label: Provide labels with arrows to indicate flow direction.
  .1 Arrow Direction
    .1 Provide arrows for normal flow direction of operating service.
    .2 Provide additional arrows for services intended to normally have flow in both directions including flow reversal.
  .2 Size
    .1 Width: Minimum 50-mm (2-in) width.
    .2 Height: To accommodate full circumference of finished service.
  .3 Colour: Arrow colour to match text colour. Background colour to be opposite of text colour, or clear if approved by Engineer.

.5 Band Label: Provide coloured bands to indicate specific service type group and function.
  .1 Arrangement: As indicated, otherwise as required by Owner, otherwise to match requirements for piping from ISO-14726.
  .2 Size
    .1 Width: Minimum 90-mm (3-1/2-in) width, including for main colour and additional colour.
    .2 Height: To accommodate full circumference of finished service.
  .3 Colours
    .1 As required by Owner, including as indicated or match existing, otherwise to match requirements for piping from ISO-14726 for label colour scheme and colours.
    .2 Colour may vary for each service. Multiple colour labels may be required.

.6 Locations
  .1 To facilitate easy reading.

.2 To match requirements for piping from indicated requirements and referenced documents.

.7 Intervals

.1 As follows, or at each change of flow direction, or as required if approved by Engineer.

.2 Every 3-m (10-ft) of length for services with 25-mm (1-in) high and shorter text.

.3 Every 6-m (20-ft) of length for services with 25-mm (3-in) high and taller text.

.4 Every 4.5-m (15-ft) of length for other services.

.2 Ceiling Labelling

.1 Provide coloured labels on ceiling surfaces to indicate equipment and components including the following. Colours indicated are indicative of requirements and Owner may change for each type of equipment or component.

.1 Blue

.1 Fan powered boxes without coils.

.2 Variable air volume boxes without coils.

.3 Dampers.

.4 Other air terminal devices without coils.

.2 Purple

.1 Fan powered boxes with coils or heaters.

.2 Other coils or heaters.

.3 Other air terminal devices with coils or heaters.

.3 Green

.1 Balancing dampers.

.2 Other air distribution components.

.4 Red

.1 Fire dampers.

.2 Other fire safety system components.

.5 Yellow

.1 Controllers.

.2 Control devices.

.3 Electrical distribution components.

.6 Grey

.1 Communication or sound components.

.7 Black

.1 Other building services.

.2 Provide labels as acceptable to Owner, including label type, material, size and colour. Owner may require lamacoids, adhesive labels with text, adhesive labels with no text.

.3 Mark each label as acceptable to Owner, including equipment label, type, power circuit.

## 3.14 DIFFUSERS, GRILLES AND REGISTERS

.1 Install as required.

## 3.15 FIELD QUALITY CONTROL

.1 Photograph ductwork at each stage of concealment including:

.1 Painting.

.2 Insulating.

.3 Installation of jacket.

.4 Wall finishing.

.5 Other obstructions or concealment.

.2 Test ductwork before ducts are insulated, painted or concealed.

.3 Immediately correct defects discovered during tests and retest systems as required.

.4 Inspect and test ductwork for air leakage at joints and connections to equipment, under normal operating conditions. Provide systems leakage tests to SMACNA requirements.

**3.16 CLEANING**

.1 Prior to start-up of fans, blow out complete systems of ductwork with high velocity air for not less than 2-hours using where possible using the installed air handling equipment to full capacity and by blanking off duct sections to achieve required velocity.

.2 Do not install air filters prior to blow out of ductwork systems. Use auxiliary portable blowers for cleaning where installed fan systems are not adequate to blow out complete system free from dust and dirt.

.3 Clean interior of plenums, coils, and register, grille or diffuser outlet collars with industrial type vacuum cleaner.

.4 On completion of cleaning process, replace filters before placing systems in final operation.

**3.17 BALANCING**

.1 To Section 23 90 00 Balancing.

**3.18 ADJUSTING**

.1 Supports and Hangers

.1 Vertical under normal operating conditions.

.2 Equalize loads.

.3 Adjust and modify to provide ductwork free from vibration, rattling or drumming under operating conditions.

.2 Balancing

.1 Allow for 2 additional site visits after receipt of Owner written approval for comfort adjustments.

**END OF SECTION 23 30 00**

# SECTION 23 90 00 BALANCING

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Balancing including measurements, testing, adjusting, verification of existing.

### 1.2 REFERENCED DOCUMENTS

.1 AABC-TBP: AABC Test and Balance Procedures.
.2 AABC-TSB: AABC National Standards for Total System Balance, 2002.
.3 ASHRAE-111: ASHRAE-111-2008 Practices for Measurement, Testing, Adjusting, and Balancing of Building Heating, Ventilating, Air-Conditioning, and Refrigeration Systems.
.4 NEBB-TABES: NEBB Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems, 2015 (8th Edition).

### 1.3 DEFINITIONS

.1 As defined by SMACNA, unless otherwise defined.

### 1.4 INTENT

.1 Perform TAB such that indicated systems, equipment and components perform as required.
.2 Perform TAB on new equipment and affected systems.

### 1.5 SUBMITTALS FOR ACTION

.1 TAB Plan
  .1 Methodology and procedures for performing TAB.
  .2 Highlighted specific procedures different from referenced documents and other specification sections.

### 1.6 SUBMITTALS FOR INFORMATION

.1 Certificates
  .1 Letter certifying TAB has been completed in accordance with Contract Documents and commissioning requirements.
.2 Balancing Reports
  .1 Balancing Reports compliant with AABC-TBP and AABC-TSB, and NEBB-TABES recommendations.
  .2 Provide system schematic diagram with recorded measurements and requirements. Include time of measurements.
  .3 Indicate pressure drops across components, including intake and exhaust locations including louvers and grilles.
  .4 Indicate air conditions for outdoors as well as throughout system at different measurement times.
  .5 Provide calibration certificates for test equipment used.
.3 Marked Up Drawings
  .1 Marked up drawing indicating extent of differences between Drawings, building drawings and actual as-built conditions.
.4 Qualification Statements
  .1 TAB: Proof of certifications for company and personnel.

### 1.7 QUALITY ASSURANCE

.1 Qualifications
  .1 Company and personnel members of AABC and CAABC, or NEBB.
  .2 Company and personnel AABC or NEBB certified.
  .3 Subject to approval.

### 1.8 ADMINISTRATIVE REQUIREMENTS

.1 commissioning requirements.

.2 TAB Plan Review Meeting
  .1 Schedule and conduct TAB plan review meeting review meeting as required.
  .2 specific procedures different from referenced documents and other specification sections. Provide written detailed justification for choice of TAB methodology and procedures when requested by Engineer or Commissioning Authority.
  .3 Revise and resubmit TAB plan as required.
.3 Phase In Coordination Meeting
  .1 Coordinate and hold a phase in meeting with Owner to discuss and plan installation plan in coordination with other Work, including controls.

## PART 2 PRODUCTS

### 2.1 TEST INSTRUMENTS

.1 Accuracy Tolerances: Provide test instruments with scale ranges, accuracies, and resolutions to NEBB-TABES minimum requirements unless otherwise specified.
.2 Calibrate instruments within 6 months of TAB.

## PART 3 EXECUTION

### 3.1 PRE TAB INSPECTION

.1 Prior to initiating TAB, complete thorough evaluation of systems, equipment, services and components.
  .1 Add access hatches as required to access components, including where access hatches are missing or inadequate.
  .2 Confirm if available documentation has correctly and accurately identified distribution system equipment and components.
  .3 Confirm if balancing devices and components affecting balancing and distribution systems isolation are present.
  .4 Inspect condition of balancing devices and components to discover improperly installed, missing, defective or failed components including:
    .1 Control dampers, manual dampers, draft dampers, fire dampers, balancing dampers.
    .2 Control valves, shutoff valves, check valves, balancing valves.
  .5 Confirm if test ports and locations are present and adequate.
  .6 Confirm clearances and maintenance access to equipment and components are adequate.
  .7 Confirm physical access to concealed equipment and components are present and adequate.
  .8 Investigate and review possible system installation deficiencies, including openings, connections.
.2 Provide written report including photographs and descriptions of existing deficiencies and conditions impacting the Work.

### 3.2 PREPARATION

.1 Review existing balancing reports, equipment data, and building drawings.
  .1 Required commissioning forms and activities have been fully completed.
.2 Review and document status of related and potentially related components and systems within or near the vicinity of affected systems and zones that may impact measurements and results of TAB, including open or closed doors, operational ventilation systems, neighbour zone conditions, outdoor ambient conditions.

### 3.3 COMMON EXECUTION REQUIREMENTS

.1 Perform TAB to:
  .1 As indicated.
  .2 ASHRAE-111.

.3 AABC-TSB and AABC-TBP, or NEBB-TABES.
.4 Equipment and component manufacturers recommendations.

.2 Balance flows:
.1 As indicated.
.2 Where flows are not indicated:
.1 Balance equal sized terminals or equipment with equal flows.
.2 Proportion flows between unequal sized terminals or equipment proportional to approximate or estimated capacity.
.3 Adjust flows as required to minimize overall noise.
.3 Balance existing systems to the most recent document available from the following:
.1 Balanced flows from most recent Owner accepted balancing report.
.2 Design flows from supplemental project and renovation drawings.
.3 Design flows from building drawings.

.3 Balance to optimize system, including as follows.
.1 Open existing balancing components and devices to reduce required head before balancing.
.2 Rebalance balancing components and devices to reduce required head, including at energy sinks and sources and loads, throughout distribution systems.

.4 Determine branch and main duct airflows by using multiple Pitot tube traverse method.

.5 Determine grill, register, and diffuser flows by using a flow measuring hood, calibrated using Pitot tube traverse.

**3.4 VENTILATION EQUIPMENT - GENERAL**

.1 After air distribution supply system has been balanced, balance ventilation equipment to maximum air flow requirements.

.2 Adjust fan drives including belts and pulleys as required to balance air flows to values as indicated.

.3 Record duct static pressure setpoint and fan speeds at the following:
.1 Ventilation equipment inlet and outlet.
.2 Fans.
.3 At each major component within ventilation equipment.

**3.5 BRANCH BALANCING DEVICES - VARIABLE FLOW**

.1 After balancing downstream of the terminal boxes, set all branch dampers to be 100% open.

.2 Set air terminal airflow setpoints to a fixed percentage of maximum airflow, where the percentage represents the diversity factor for the system.

.3 Adjust static pressure setpoint until the most open terminal box damper position is equal to 95% open.

.4 Leave the balancing damper for the duct branch serving the most open terminal box at 100% open.

.5 Adjust each branch balancing damper until the maximum open damper position of all the terminal boxes served by the duct branch equals 95%.

**3.6 AIR TERMINAL BOXES - GENERAL**

.1 Coordinate with other trades, including controls and building automation system, to calibrate box minimum and maximum flow settings.
.1 Verify a minimum of 100-% of each box by Pitot Tube Traverse to NEBB-TABES.

.2 Verify existing flow measuring device calibration by comparing Pitot Tube Traverse volume measurements and measured pressure drops across existing flow measuring device to manufacturer's performance curves.

**3.7 DIFFUSER, GRILLS, AND REGISTERS**

.1 Measure noise levels at maximum airflow, using the Noise Criteria (NC) method.
.2 Report on areas having a NC measurement of 35 or greater.

**3.8 PUMPS - GENERAL**

.1 Run pumps at maximum operating flow. Record the following:
  .1 Pump inlet and outlet pressure.
  .2 Pump RPM, motor current, motor power factor, and motor power.
  .3 When diversity factor is not provided, determine and record diversity factor.

**3.9 HYDRONIC DISTRIBUTION SYSTEMS - GENERAL**

.1 Balance individual hydronic terminal devices as required including reheat coils, fan coils, forced flow heaters, unit heaters, air handler coils.
.2 Balance heating, cooling, heat recovery, system main and branch balancing valves.

**3.10 ADJUSTING**

.1 Re-balancing
  .1 Re-balance system after additional repairs have been implemented.

**3.11 CONTROLS COORDINATION**

.1 Coordinate with controls contractors to confirm setpoints, and suitable operating ranges for:
  .1 Differential and absolute pressure sensors and switches.
  .2 Current sensors and switches.
  .3 Flow sensors and switches.
  .4 Minimum and maximum flow settings on variable speed pumps.
  .5 Minimum and maximum flow settings on variable speed fans.

**3.12 REPORTING**

.1 After settings and adjustments are completed, repeat completing all measurements throughout equipment and systems without making adjustments.
.2 Document status of related and potentially related components and systems within or near the vicinity of affected systems and zones that may impact measurements and results of TAB, including open or closed doors, operational ventilation systems, neighbour zone conditions, outdoor ambient conditions.
.3 Prepare report to NEBB-TABES recommendations.

**3.13 VERIFICATION**

.1 Reported results subject to verification.
.2 Provide personnel to verify up to 20-% of reported results, unless otherwise indicated.
.3 Repeat TAB as required to satisfaction of Engineer.

**3.14 SETTINGS**

.1 After TAB is completed, restore systems, equipment and components back to good working order, including remount drive guards, close access doors, lock devices in set positions, and ensure sensors and automatic controls are reverted back to normal operation.
.2 Permanently mark settings to allow restoration of original settings.

**END OF SECTION 23 30 00**

# SECTION 25 05 00 BUILDING AUTOMATION SYSTEM

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Building automation hardware and software, controllers.

### 1.2 REFERENCED DOCUMENTS

.1 ASHRAE-135: ANSI/ASHRAE-135-2012 BACnet - A Data Communication Protocol for Building Automation and Control Networks.

.2 ASHRAE-G-11: ASHRAE-G-11-2009 Guideline on Field Testing of HVAC Controls Components.

.3 IEEE-802.3: IEEE-802.3-2015 Carrier Sense Multiple Access with Collision Detection (CMSA/CD) Access Method and Physical Layer Specifications.

.4 NEMA-250: NEMA-250-2014 Enclosures for Electrical Equipment (1000 Volts Maximum).

### 1.3 DEFINITIONS

### 1.4 INTENT

.1 Provide design, construction, and commissioning services required to provide a system that meets the specified intent and requirements.

.2 BAS Replacement

.1 Demolish existing BAS including controllers, network wiring, end devices, signal conditioners, conduit, power wiring, end device wiring, pneumatic tubing, and control enclosures.

.2 Provide new BAS.

.3 Match sequences and performance of existing system unless otherwise indicated.

.4 Where existing BAS performance or features conflict with specified performance or features, the more stringent requirements shall take precedence.

.5 Existing programmable controllers must be replaced with controllers from a single manufacturer.

.6 Existing end devices, wiring, and conduit compatible with new system may be reused unless otherwise indicated.

.7 Contractor agrees to assume all responsibility for assessing extent, nature and capabilities of the existing system, and waives future claims against errors or omissions in documentation or graphics screens.

.8 Contractor acknowledges that depictions of extent of existing system contained within Contract Documents are for the sole purpose of providing a general description of existing BAS extent, and not to provide an accurate or comprehensive points list or BAS description.

### 1.5 SUBMITTALS FOR ACTION

.1 Product Data

.1 Manufacturers' product literature, specifications, and datasheets. Include the following information:

.1 Product characteristics.

.2 Performance criteria.

.3 Options.

.4 Limitations.

.5 Photographs.

.6 Supplier information.

.2 Performance criteria for end devices includes accuracy, operating environment tolerances, and stability criteria.

.3 Detailed Bill of material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.

.2 Shop Drawings
- .1 BAS in its entirety, distinctly indicating existing parts and new Work.
- .2 BAS network architecture diagrams including controllers, interconnections, repeaters and interfaces.
- .3 Control panel and controller schedules.
- .4 Floor plan drawings showing location of system components.
- .5 System schematics and flow diagrams indicating point location, name, and hardware address.
- .6 Diagrams indicating power wiring for all controllers and devices. Include panel numbers, panel locations, circuit breaker numbers, and wiring and conduit details.
- .7 Points list describing hardware location, function, signal conditioning, and end devices for each point.
- .8 Details of BAS programming including:
  - .1 Sequences of operation.
  - .2 Descriptions of variables and constants.
  - .3 Software architecture.
  - .4 For sequential-style programming languages, provide commented line by line listings of code.
  - .5 For graphical-based programming languages, provide commented logic drawings.
- .9 Details of BAS data visualization and format including:
  - .1 Proposed trend log point grouping and scaling.
  - .2 Archive data format.
- .10 Sample of archived data in specified format.
  - .1 Minimum 24-hour duration.
  - .2 All required points.
- .11 Room Schedule including a separate line for terminal unit indicating location and associated BAS point, including airside and waterside terminal units, including air terminal boxes.
- .12 Wiring and Ladder Logic
  - .1 Diagrams detailing BAS interfaces and hardware interlocks for all equipment affected by Work.
  - .2 Diagrams describing existing undocumented BAS interfaces and hardware interlocks.
- .13 Interlocks: Schematic and wiring diagrams detailing electrical interlocks and life safety system interfaces.
- .14 Labels: Scaled drawings indicating locations, as well as details of labelling including dimensions, layout, lettering, font, spacing, colours.

.3 Samples
- .1 Zone End Devices: Submit samples of end devices, including zone temperature, humidity, and pressure sensors, to be located in occupied areas or visible from exterior.

## 1.6 SUBMITTALS FOR INFORMATION

.1 Certificates
- .1 Conformance: BACnet Protocol Implementation Conformance Statement to ASHRAE-135 for all BACnet devices and controllers.
- .2 Letter from BAS manufacturer certifying proposed controllers are fully compatible with each other or any parts of existing system being reused where allowed.

.2 Existing BAS
  .1 Detailed English language description of existing control sequences.
  .2 Complete list of existing BAS points.
.3 Manufacturer Information
  .1 Operating and Maintenance Manuals
  .2 Installation Instructions
.4 Testing Report: A report detailing the results of testing activities including the following:
  .1 Dates of testing activities.
  .2 Names and contact information of testing technician.
  .3 Point Calibration Results: Include points and devices tested, description of testing method, observations including point values, measured values, discrepancies, and a description of corrective action taken.
  .4 Output Testing Results: Include points and devices tested, description of testing method, observations including point values, measured values, discrepancies, and a description of corrective actions taken.
  .5 Failure Mode Test Results
  .6 Software State Test Results
  .7 Interlocks Test Results
  .8 Completed Testing Check List
.5 Test and Evaluation Reports
  .1 Report on air terminal box test, including:
    .1 Hardware address of distributed controller.
    .2 List of rooms served.
    .3 Location of temperature sensors.
    .4 Programmed maximum and minimum flow settings.
    .5 Measured flow rates at maximum and minimum flows, per box.
.6 Periodic Inspection Reports
  .1 Provide written reports for each required post construction inspection including:
    .1 Date of inspection.
    .2 Climate conditions.
    .3 Notes.
    .4 Trend log printouts.
    .5 Summary of adjustments or changes made.
    .6 Updated documentation.
    .7 Updated electronic copies of documentation.
.7 Marked Up Drawings
  .1 Marked up drawings indicating extent of differences between issued Drawings, building drawings and actual as-built conditions.

**1.7 SUBMITTALS FOR CLOSEOUT**

.1 Operating and Maintenance Data
.2 Electronic Data
  .1 Editable electronic files for drawings in both AutoCAD and Visio format.
  .2 A duplication of the contents of the manual in Adobe PDF format.
  .3 Archive copy of site-specific databases, software, configuration and sequences.
  .4 Electronic copy of controller database including point configuration, sequences, and other programmable parameters.
.3 Spare Parts
  .1 Keys: 4 sets of common keys to BAS enclosures.
.4 Tools and Software

.1 Licenses to use and own proprietary software and documentation for an unlimited duration without additional fees. Licenses shall include required software updates to maintain functionality.
.2 Copies hardware security devices, documentation.
.3 Digital copies of software.
.4 Provide BAS software and tools needed for full functional use, including programming and configuration of new and existing controllers, programming changes, network management and expansion, and GUI use and development. Provide training required for use of software and tools.
.5 Provide system and programming manuals that describe system overview, programming and testing, in hard copy and electronic copy. Manuals to include detailed description of each software feature including:
.1 Editing and writing control programs
.2 Reading or modifying printout and logs
.3 Adding, deleting and modifying user password
.6 Provide highest level passwords and security access to hardware functions, configurations, and upgrades.

## 1.8 QUALITY ASSURANCE

.1 Installer Qualifications
.1 BAS Configuration
.1 Regularly engaged in the engineering, programming, installation and service of similar systems.
.2 Office within a 150-km radius of Site, that offers complete maintenance and support services on a 24-hour/day, 7-days/week, 365-days/year basis. This office shall have direct access to or inventory of spare parts and all necessary test and diagnostic equipment required for installation, commissioning and servicing.
.2 GUI Mock-up
.1 Prepare working mock-up of GUI screens.

## 1.9 ADMINISTRATIVE REQUIREMENTS

.1 Pre-Submittal Review Meeting
.1 Schedule and conduct pre-submittal review meeting as required, or upon request. Adhere to project meeting procedures as described in Section 01 00 00 Project Procedures.
.2 Meet with Engineer to review Drawings and Specifications in detail before preparation of submittals.
.3 Walk through products and execution requirements in detail and provide commentary to convey understanding of requirements.
.4 Notify Engineer of problems or concerns with meeting design intent.
.5 Follow request for clarification procedures to clarify issues regarding design intent.
.6 Provide written detailed justification for BAS network architecture when requested by Engineer.
.2 Graphical User Interface Mock-up Procedures
.1 Install GUI mock-up on a computer (subject to approval), for review.
.2 Revise GUI mock-up as required, until approved, including for style, layout, aesthetics, units of measurement, buttons, links.
.3 Proceed with full programming and configuration of GUI.
.4 Completed GUI shall be subject to approval, based on requirements defined by approved GUI mock-up.
.3 Testing Plan Review

.1 Submit Testing Plan for approval 20-days prior to testing.
.2 Revise the Testing Plan as required to the satisfaction of the Engineer.
.3 Submit the Testing Report demonstrating results of testing activities.

.4 Field Documentation Review
.1 Arrange meeting no later than 1 week after shop drawings have been submitted to review field documentation plan with Owner.
.2 Provide a description of the following for approval:
.1 Colour coding scheme for communication, power, and control wiring.
.2 Labelling scheme for all wiring.
.3 Point naming conventions.
.4 Panel, equipment, and system naming conventions.
.5 Field labelling names, format, and information.

.5 Trend Log Data Review
.1 Trend log data is critical to commissioning and correction activities.
.2 Submit sample trend log data in the following electronic format:
.1 File Format: Microsoft Excel
.2 Minimum Interval: 1-min
.3 Points: Physical Analog and Digital Input and Output Points
.4 Format: Database quality table format, having columns containing point names and rows containing each sample, with no gaps, column shifts, or text between rows.
.5 Data shall be obtained through direct database query. Manual editing of text reports shall not be accepted.

.6 Phase In Coordination Meeting
.1 Coordinate and hold a phase in meeting with Owner to discuss and plan installation and migration plan from old control system to new control system.

## 1.10 WARRANTY

.1 Special Warranty
.1 Include replacement of failed reused controllers, end devices, and sensors during Warranty Period.
.2 Include modifications and adjustments during Warranty Period, including logic, and sequences, settings, limits, tuning of PID controllers.
.3 Include labour and materials costs to remove, replace, and re-configure products provided under this contract should they become obsolete within 5-years.
.1 A product is deemed to be obsolete when the manufacturer ceases to manufacture, supply, or support replacement products that can directly replace the obsolete product.
.2 A product is deemed to be obsolete where replacement products are available, but require extraordinary configuration, costs, or additional hardware to replace the obsolete product.
.4 Provide the following throughout the Warranty Period to inspect BAS operation and performance, including under varying climate conditions, loads, schedules, modes.
.1 4 site visit(s) per year, evenly scheduled throughout each calendar year unless modified by Owner, each site visit for 4-hours.
.2 12 remote access session(s) per year, evenly scheduled throughout each calendar year, each remote access session for 2-hours
.5 Update site documentation to reflect current system configuration, including paper and electronic versions as required.
.6 Create backup copies, complete with version designations, notations, modifications, changes.

## PART 2 PRODUCTS

### 2.1 EXISTING PRODUCTS

.1 Devices: Devices approximately as indicated. Confirm quantities and details by site investigation and review of available documentation.

### 2.2 SYSTEM ARCHITECTURE

.1 Expand the existing system architecture as required, including:
- .1 Replace existing controllers, provide new controllers and/or provide expansion modules as required.
- .2 Provide additional expansion modules, sub-networked controllers, or other forms of point expansion on new and existing controllers to accommodate new and existing points.
- .3 Provide network cabling, repeaters, routers, bridges, and gateways as required.
- .4 Provide new sequences, and modify existing sequences as required.
- .5 Map BACnet points from indicated components.

.2 System
- .1 Manufacturers
  - .1 Provide system hardware and software from the same manufacturer and capable of being serviced from a single vendor.
- .2 Features
  - .1 System shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices.
  - .2 System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.
  - .3 Organize sub-networks logically by floor or wing such that sub-networks match logical physical building areas.
  - .4 GUI must appear as a single integrated system, accessible and controlled by a single application.
  - .5 System components, including controllers, devices, power supplies, signal conditioning hardware, wiring and other equipment, shall be rated to operate properly in the extremes of the environment that they are to be located in.
- .3 Performance
  - .1 System Scan Rate: System capable of refreshing physical point values once every 5-sec.
  - .2 GUI Refresh Delay: Maximum 5-sec from request for refresh.
  - .3 Memory: Provide sufficient controllers, memory, and/or servers as required.
- .4 System Management: Provide minimum supervisory and management functionality as defined by BACnet Advanced Workstation (B-AWS) to ASHRAE-135.
- .5 Synchronization
  - .1 Controllers relying on real time information (for scheduling, trending, etc.) shall be periodically, automatically synchronized with one other.
  - .2 Controller real time clocks to be periodically, automatically synchronized with a third-party Network Time Server, such as ntp.com.
- .6 Integration

.1 Provide gateway devices or controllers having on board gateways to convert existing proprietary protocols to native BACnet to allow BACnet access to existing proprietary controllers.
.2 Provide BACnet Protocol Implementation Conformance Statement for gateways.
.3 Gateways shall be tested and listed on BACnet Testing Laboratories website for all functions available from proprietary network controllers.

.3 Communications Networks
.1 Identify requirements for communication networks, including wiring and additional components required to make communication networks fully functional including repeaters, gateways, boosters, interfaces and other equipment.
.2 Provide required communication network wiring and cables.
.3 Provide required additional components including repeaters, gateways, boosters, interfaces and other equipment.
.4 Coordination
.1 Coordinate configuration, remote access, security, and equipment specifications with Owner. Allow for 4-weeks notification.
.2 Owner will provide internet connection and jack on Site to allow for remote access to BAS. Provide communications networks to internet connection and jack.
.5 Prohibited
.1 Use of existing non-dedicated BAS networks or other tenant and occupant networks for BAS architecture unless otherwise indicated.

.4 Communications Networks - Ethernet
.1 Provide ethernet network where wireless has not been indicated. Provide wiring for spare ethernet network for future use.
.2 Intent: Additional controllers are intended to be added in future. Network shall be fully functional, with capability for future expansion.
.3 Coordination: Coordinate configuration, security, and equipment specifications with Owner. Allow for 4-weeks notification.
.4 Type
.1 Ethernet to IEEE-802.3.
.1 Provide continuous lengths of wiring and cables. Repeaters or other signal boosting devices are prohibited.
.5 Performance: Minimum 100-Mbit/s.

## 2.3 SUPERVISORY PLATFORM

.1 Provide as required.
.2 Manufacturers
.1 Automated Logic Corporation, WebCTRL

## 2.4 CONTROLLERS

.1 Provide as required.
.2 Manufacturers
.1 Automated Logic Corporation, LGR series, ME series, SE series, ZN series
.3 Minimum Functionality
.1 Building Controllers
.1 To BACnet Building Controller (B-BC) to ASHRAE-135.
.2 Advanced Application Controllers
.1 To BACnet Advanced Application Controller (B-AAC) to ASHRAE-135.
.3 Application Specific Controllers
.1 To BACnet Application Specific Controller (B-ASC) to ASHRAE-135.

.4 DS-COV-B (Data Sharing, Change of Value Provider) to ASHRAE-135.
.5 Intrinsic alarm and event management to ASHRAE-135.
.6 Support for calendar objects for scheduling.

.4 Communication Protocols
.1 BACnet.
.2 Certifications and Standards
.1 BACnet Protocol Implementation Conformance Statement for all BACnet objects as required to meet indicated intent and performance requirements.
.2 Tested and listed on BTL website.

## 2.5 CONTROL ENCLOSURES AND PANEL ASSEMBLIES

.1 Provide enclosures for controllers and related components, and for control devices in service areas or not protected from damage.
.2 Features
.1 To NEMA-250, rated for the environment as required.
.2 Provide ventilation, heating, and humidity conditioning as required.
.3 Provide hinged, enamelled steel enclosures, and locking slotted flush latch for control panel assemblies.
.4 Provide convenience 120-VAC duplex receptacle in each enclosure, complete with fused on/off power switch, and GFCI protection, except for the following:
.1 Enclosures for controllers serving unitary equipment and not located in service areas.
.3 Layouts
.1 Securely mounted components.
.2 Neat and tidy layouts including cables and wiring.
.3 Cables and wiring to be concealed using slotted PVC wiring ducts complete with covers.
.4 Cables and wiring to be colour coded and labelled.
.5 Mount controller LCD or LED display modules flush in panel faces unless otherwise indicated.
.4 Existing Enclosures and Panels
.1 Remove obsolete components including controls and wiring when interfacing to existing panels.

## 2.6 CONFIGURATION

.1 Alarms and Events
.1 Configure alarms and events to trigger on abnormal operation of equipment and systems including:
.1 Failure of life safety devices.
.2 Alarm contact closure on equipment or other controllers.
.3 Alarm states of equipment connected over network.
.4 Equipment failure indicated by status signals not matching start/stop commands.
.5 Sensors showing values outside of expected range.
.6 Failed sensors, controllers, or communications network.
.7 Other alarms and events that are useful in operation and maintenance of building systems.
.2 Prioritize alarms as follows:
.1 Level 1: Events impacting life safety.
.2 Level 2: Events risking damage to building or equipment.
.3 Level 3: Events risking disruption to high priority zones or areas.
.4 Level 4: Events risking disruption to occupant comfort.

.5 Level 5: Other alarms.

.3 Alarms shall include information including:
.1 Date and time of alarm.
.2 Point name, state, and value (if applicable).
.3 Priority.

.4 Performance
.1 Duration between alarm occurrence and alarm annunciation at the local GUI shall not exceed 5-seconds.
.2 Duration between alarm occurrence and alarm annunciation at a remote device shall not exceed 60-seconds.

.5 Alarm Management
.1 Provide full alarm management capabilities including:
.1 Security privileges restricting access to alarm management.
.2 Functionality to acknowledge, silence, or cancel alarms.
.3 Functionality to view and sort alarms by date/time, priority, point name, or other alarm attributes.
.4 Functionality to maintain an audit trail of user activities including user name, date and time of activity, details of alarm (acknowledge, delete, or cancel).

.6 Remote Notification
.1 Provide remote notification to notify remote staff of alarm conditions.
.1 Level 1 and 2 Alarms: Default notification to printer(s), pager(s), text message(s), e-mail(s).
.2 Level 3-5 Alarms: Default notification to printer(s), e-mail(s).
.2 Alarm messages shall contain an informative response message describing the alarm event.
.3 Provide additional and separate remote notifications for specific alarm levels when alarm has not been acknowledged within Owner specified time periods.

.7 Communications
.1 Configure messaging system(s) to describe alarm condition, including alphanumeric pages, short message service (SMS) text messages, e-mails.

.8 Automatic Report Generation
.1 Provide automatic report generation capability.
.1 Include up to 8 data points per report.
.2 Format: Printed, ASCII (comma delimited).
.3 Sampling Duration: As required.
.4 Reporting Frequency: As required.
.5 Report Triggering: Automatically scheduled without user intervention.

.2 Schedules
.1 Provide the following schedule types:
.1 Time of Day
.2 Weekly Schedules
.3 Annual Holiday Schedules
.2 Provide the ability to temporarily override schedules with the system automatically resetting to original scheduling after a defined time period.
.3 Provide for automatic compensation for periodic time variances, including leap years, daylight savings.

.3 Trend Logs
.1 Provide logs with information grouped by system in a logical manner to meet intent.

.2 Provide graphs for trend logs.
.3 For staged equipment, provide an analog variable representing the number of active stages to allow graphic representation of staging performance.
.4 Provide trend logs to meet the following:
.1 15-minute sampling interval, minimum duration 1-month, for:
.1 Zone conditions, including temperature and humidity.
.2 Outdoor conditions, including temperature and humidity.
.3 User adjustable setpoints.
.4 Other slowly changing analog signals and control.
.2 5-minute sampling interval, minimum duration 2-weeks, for:
.1 Moderately changing system temperatures, including ductwork, tanks.
.2 Device position control and feedback, including actuators.
.3 Equipment control commands and status, including VFDs.
.4 Equipment operating states, including stages.
.5 Equipment and system modes, including heating/cooling/free cooling, occupied/unoccupied.
.6 Calculated setpoints.
.7 Other moderately changing analog signals and control.
.3 1-minute interval, minimum duration 24-hours, for:
.1 Other system pressures, including ductwork and piping.
.2 Other system temperatures, including piping.
.3 Other quickly changing analog signals and control.
.4 Run-Time Log/ Change of Value Log, minimum duration 1-month, for:
.1 Equipment on/off status and digital commands.
.2 Other digital points.
.3 Equipment and system modes, including heating/cooling/free cooling, occupied/unoccupied.
.4 Daily schedules.
.5 Digital alarms.
.5 Others Not Listed: As required by Engineer.
.6 Duration: Maintain a continuous record in random access memory.
.5 Provide additional trend logs as required under commissioning requirements, or as requested by Owner or Engineer.
.4 Reports
.1 Provide graphical plots of trend log reports from random access memory or archive, as required under commissioning requirements, or as requested by Owner or Engineer during Warranty Period.

## 2.7 GRAPHICAL USER INTERFACE

.1 Provide GUI to allow operators to easily view, control, and investigate building environmental systems through uncluttered graphics screens, consistent use of colours and animation, alarming and data visualization techniques.
.2 Provide floor layouts of building with relevant zone information displayed, including:
.1 Site plan.
.2 Floor layout details including elevators, stairwells, partitions, suite numbers, room labels.
.3 Multiple floor plans on a single screen to launch individual floor plans.
.4 Shall allow building operator to navigate through an entire facility both in two-dimensional and three-dimensional multi-floor view, allowing for fast and easy navigation.
.5 Use light shaded background colours to distinctly identify major zone systems and zones served by various equipment and systems. For each coloured

zone, provide a text description of the system serving the area. Text description will link to representative equipment graphics screen.

.6 Provide zone conditions, including temperature, humidity, monitored gas values, positioned on the floor plan representing actual physical location. Values will link to graphics of equipment and components for corresponding room or area.

.7 Partition floor plans as required to ensure that information is legible on a single screen without scrolling.

.8 Display icons and symbols for equipment in zone. Graphics configured such that single click on zone equipment icons and symbols launches more detailed graphical screen on associated equipment.

.3 Provide schematic representation of each system being controlled. Schematics to:

.1 Include all points relevant to each system on the graphic.

.2 Include point names.

.3 Be accurate to actual configuration.

.4 Be organized such that major equipment is positioned on the screen in a manner that is representative of the actual physical location and layout.

.5 Be partitioned as required to ensure information is legible on a single screen without scrolling.

.4 Provide additional non-graphical based information screens summarizing point information from zone equipment and components, including variable air volume boxes, fan powered boxes, heat pumps.

.1 Group terminal equipment and components into areas or systems on 1 or more screens.

.2 Present data aligned in tabular format with each column representing a point value.

.3 Include room number, room description, terminal equipment and component identifier, zone conditions, zone setpoints.

.4 Include additional point information indicating status and operation of each point on respective terminal equipment and components.

.5 Include tables for design settings and values where applicable and as required by Engineer.

.1 Include air terminal settings for minimum and maximum in various modes such as heating and cooling and show critical zone per system.

.6 Provide link to graphics screen for each terminal equipment.

.5 Provide the following on all GUI screens:

.1 Detailed sequence of operation available for systems, equipment and components. Configure graphics such that single click on graphical screen launches sequence of operation for associated graphical screen.

.2 Schedules for equipment and systems. Configure graphics such that single click on graphical screen launches summary of schedules for equipment and systems.

.3 Trend logs for equipment and systems. Configure graphics such that clicking on a trend log icon launches trend logs.

.4 Clear written and graphical identification of specific operation(s) and mode(s) occurring.

.5 Units of measurement: Metric.

.6 Navigation links using consistent button graphics, or hyperlink formatted text to allow user to move from one display to another with a single click. Graphics screens shall include a return to previous screen link.

.6 Provide additional user interface functions as requested by Owner to improve operations and maintenance activities.
.7 Provide functionality for modifying setpoints, states, and operator overrides directly from graphics screens.
.8 Provide indication of variables in alarm mode to Owner requirements.

## PART 3 EXECUTION

### 3.1 INSTALLERS

.1 Use the following approved installers for programming and configuration of the associated products in Part 2 of this Section:
  .1 Automated Logic Corporation
    .1 Installer: Automated Logic - Ontario
      .1 Address: 259 Edgely Boulevard, Unit 5, Concord, Ontario L4K 3Y5
      .2 Contact: N: Jarrod Julien, T: (905) 695-0636, M: (416) 554-8844
.2 Alternate installers will not be accepted.

### 3.2 EXAMINATION

.1 Complete the following examination activities within 20-days after the date of execution of Contract.
  .1 Verify type, quantity and condition of existing end devices and controllers.
  .2 Confirm the suitability of the points for the specific installation, purpose, goal, and final system installed.
  .3 Complete a detailed investigation of existing network architecture and network wiring topology.
  .4 Photograph, document and submit descriptions of existing controllers and network components, including:
    .1 Main controllers.
    .2 Main equipment controllers.
    .3 Terminal component controllers, including air terminals.
    .4 Panels.
    .5 Network components.
  .5 Submit written notification of the results of the investigation.
.2 Submit relocation plan, and obtain approval before relocating services, panels, or equipment not indicated.
.3 Complete sufficient examination of existing controls system, including controllers, devices, sequences, including modifications, to properly implement replacement controls including functionality that is not currently documented.
.4 Investigate and review point mapping and point naming convention(s).
.5 Investigate entire BAS to verify as-built condition. Mark up copy of existing BAS drawings or create new drawings as required to indicate as-built conditions of the BAS including the following:
  .1 Network architecture.
  .2 Panel types and locations.
  .3 Points list.

### 3.3 PREPARATION

.1 Existing System Decommissioning
  .1 Photograph existing GUI screens, points lists, graphics, trend log plots, and sequences.
  .2 Back up existing system including:
    .1 Relevant data on computer hard drive.
    .2 Controller memory, points lists, programming, configuration, data history, security levels and passwords, and other software attributes.
.2 Existing System Updates

.1 Remove obsolete and non-existent points, sequences, and graphics from software of reused controllers and workstations.

.3 Existing Parts to be Removed and Stored on Site

.1 Check existing parts to be removed for functionality. Failed or non-functional parts to be labelled for tests conducted and specific failure or issues.

## 3.4 COMMON EXECUTION REQUIREMENTS

.1 Provide additional components as required, including repeaters, gateways, interfaces and other equipment.

.2 Locate BAS components in accessible local enclosures.

.3 Complete configuration on site, including programming and GUI.

.4 Provide hard wired interlocks between equipment and safety devices.

.5 Access: Provide passwords and software required to allow full read and write access to all BAS features.

.6 Provide point naming convention(s) to Owner requirements.

.1 Match or improve upon existing point mapping and point naming convention(s).

.2 Ensure consistency.

.3 Ensure point naming includes information related to input vs. output, analog vs. digital, variables and setpoints, physical device vs. interface vs. mapped object.

## 3.5 CONTROL ENCLOSURES AND PANEL ASSEMBLIES

.1 Locate enclosures in accessible locations within service areas, except for the following:

.1 Controllers serving unitary equipment and not located in service areas.

.2 Locate enclosures at an elevation of not less than 610-mm (2-ft) from the bottom edge of the panel to the finished floor, subject to Owner approval.

.3 Ensure panel locations do not interfere with existing electrical panel clearance requirements.

## 3.6 INTERFACING WITH OTHER NETWORKED CONTROLLERS

.1 Other networked controllers include various controllers as indicated, including equipment, components, devices, other controllers.

.2 Map all networked points and interfacing points back to supervisory controller with required communications protocol, including for interfacing to equipment, components, controllers, devices, other controllers.

.1 Provide read and write capability in both supervisory controller and other networked controllers for required parameters and objects, including user adjustable variables. Follow BAS point naming convention

.2 For other points, maintain other networked controller point naming convention.

.3 Coordinate remote device point naming conventions for consistent point naming.

## 3.7 POWER SUPPLY SOURCES

.1 Provide power supplied from building emergency power supply for the following:

.1 Controllers

.2 End Devices

.3 Communications Hardware

.2 Provide uninterruptable power supply for the following:

.1 Workstations

.2 Servers

.3 Communications Hardware

.3 Provide control power from a power source that originates from the panel board, splitter, or switchboard that directly feeds equipment being controlled.
.4 Provide automatic protection for electronic equipment from power line transients and surges.

**3.8 WIRING AND CABLES**

.1 Make ready for conduit connections for wiring and cables unless otherwise indicated.
.2 Trough Boxes: Use trough boxes to pull field wiring to central panels. Include minimum 610-mm (2-ft) of extra field wire length in the box.
.3 Connections: Terminate signal wires at controllers with screw terminals. Terminate 1 wire to each BAS Controller terminal.
.4 Location: Terminate communications wiring leading to computers, office areas, or other finished areas in a junction box. Match cover plates and wall jacks with existing décor. Refrain from wiring through holes in surfaces including walls or from ceiling plenums.
.5 Clearance: Maintain minimum 610-mm (2-ft) clearance from equipment that may emit electromagnetic fields, including lighting ballasts.
.6 Power: Use dedicated circuits for power to controllers, power supplies, and electronic equipment.
.7 Labelling: Label wiring and cables in same manner as wiring and cables to Section 26 05 00 Wiring and Cables. Follow existing labelling convention if possible.

**3.9 LABELLING**

.1 Controllers and Panels
  .1 Label with nameplate identifying controller and equipment/system (if applicable).
    .1 Minimum 75-mm (3-in) wide by 25-mm (1-in) high.
    .2 Laminated plastic with black face and white centre.
    .3 Letters engraved.
  .2 Include printed label indicating network address.
  .3 Include laminated printout of points list for all controllers within panel.
  .4 Communicate and obtain confirmation of controller naming convention prior to installation.
  .5 As approved by Owner, create new labelling convention or follow existing labelling convention if possible.
.2 Devices in Occupied Spaces
  .1 Manufacturers
    .1 Thomas & Betts Limited
    .2 Brady Worldwide, Inc.
  .2 Type: 12-character metalized polyester labels.
  .3 Colours: Black lettering on clear backing.

**3.10 FIELD QUALITY CONTROL**

.1 Field test systems independently and then in unison with other related systems, to ASHRAE-G-11 including:
  .1 New points, and all points on new controllers.
  .2 Hard wired controls, safeties, and interlocks for new equipment.
  .3 Existing points for systems impacted by the Work.
  .4 Hard wired controls, safeties, and interlocks for parts affected by Work, including systems, equipment, components.
.2 Complete point by point tests on all points and devices, including digital, analog, input, output, network, independent devices.

.1 Test and calibrate network points.
.2 Test and calibrate analog input points.
.3 Test each digital input switching contacts, and digital input signal.
.4 Test each digital output to ensure proper operation, fail mode, and lag time.
.5 Test each analog output to ensure proper operation of controlled devices.
.6 Stroke actuated devices fully open and fully closed. Verify installation including tight closure, mechanical limit setting, and proper spring return orientation.
.7 Test and verify fail modes, interlocks, and other software modes of operation.

.3 Test wireless communications devices.
.1 Verify performance of wireless communications, including wireless networks, operations radios, wireless equipment and components.
.2 Confirm performance of 25-% of networked wireless devices in the presence of other electromagnetic emitting devices, including wireless, radios, microwave ovens, transformers.

.4 Adjust, test, and reconfigure the following to maintain original operation:
.1 New control points.
.2 Existing control points for systems impacted by the Work.
.3 New and existing interlocks, third party controllers, and controls

.5 Correct problems with affected systems during the warranty period.
.6 Submit test reports as required.
.7 Fire Testing: Provide assistance as required for the next scheduled fire test.
.8 Coordinate testing activities with Commissioning activities.

## 3.11 ADJUSTING

.1 Adjust configuration as required, including to meet design intent and performance requirements. Adjust configuration including the following:
.1 Point calibration.
.2 Logic.
.3 Sequences.
.4 Programming.
.5 Settings.
.6 Limits.
.7 Control loops and logic tuning and parameters.
.1 Tune control loops and logic to prevent undershoot and overshoot and to ensure proper response times, including PID control.
.8 Trend logs.
.9 Graphics.

## 3.12 CLOSEOUT ACTIVITIES

.1 Demonstration
.1 Demonstrate operation of systems including sequence of operations in various modes including normal and emergency, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs, fail conditions.

.2 Owner’s Instructions
.1 On-Line Documentation: After completion of tests and adjustments, provide documentation including as-built information and product data for installation on an Owner designated computer workstation or server.

.3 Existing Parts to be Removed and Stored on Site
.1 Store removed parts including controls and devices on site at Owner’s preferred location. Dispose of parts upon Owner request. Specific additional requirements:

.1 Air Terminal Controls: Only store functional parts.
.2 Other Controls: All parts, functional or otherwise.

**END OF SECTION 25 05 00**

# SECTION 25 90 00 CONTROL SEQUENCES

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Control sequences and configuration requirements for controllers, including building automation system, independent controllers, equipment controllers, programmable devices.

### 1.2 REFERENCED DOCUMENTS

.1 ASHRAE-62.1: ANSI/ASHRAE-62.1-2016 Ventilation for Acceptable Indoor Air Quality, including User's Manual.

.2 ASHRAE-90.1: ANSI/ASHRAE/IES-90.1-2016 Energy Standard for Buildings Except Low-Rise Residential, including User's Manual.

.3 ASHRAE-G-13: ASHRAE-G-13-2007 Guideline on Specifying Direct Digital Control Systems.

.4 CSA-Z317.1: CAN/CSA-Z317.1-16 Special Requirements for Plumbing Installations in Health Care Facilities.

.5 CSA-Z317.2: CAN/CSA-Z317.2-01 Special Requirements for HVAC Systems in Health Care Facilities.

.6 CSA-Z317.2: CAN/CSA-Z317.2-15 Special Requirements for HVAC Systems in Health Care Facilities.

### 1.3 DEFINITIONS

.1 Refer to other controller sections including Section 25 05 00 Building Automation System.

.2 Air Systems

.1 "Exhaust": Air exhausted from indoor zones or at air handler.

.2 "Relief": Excess return air that is exhausted from a supply/return air handler.

.3 "Mixed": A mixture of air, usually return air from the zones and outdoor air.

.4 "Outdoor": Air from outside the building.

.5 "Return" and "Entering": Air returning to equipment and ductwork systems, usually from indoor zones.

.6 "Supply" and "Leaving": Air leaving equipment and ductwork systems, for the purposes of ventilation and conditioning of air including heating, cooling, humidification, dehumidification.

.3 Liquid Systems

.1 "Heating Boiler Loop" and "Building Heating Loop": "Heating Boiler Loop" refers to the piping directly connected to the heating boilers. "Building Heating Loop" refers to the piping which obtain their heating from the Heating Boiler Loop, and which are typically controlled to a temperature different than the Heating Boiler Loop.

.2 "Primary" and "Secondary": When referring to central plant heating or cooling piping, Primary refers to the piping directly connected to the central plant. Secondary refers to the piping which obtain their heating or cooling from the primary loop, and which are typically controlled to a temperature different than the primary loop.

.3 "Return" and "Entering": Water entering equipment and piping systems including heating and cooling. Same as glycol and liquid.

.4 "Supply" and "Leaving": Water leaving equipment and piping systems including heating and cooling. Same as glycol and liquid.

.4 Other

.1 "Max(A, B, C, …)": Arithmetic function returning the maximum of all arguments contained within parentheses.

.2 “Min(A, B, C, …)”: Arithmetic function returning the minimum of all arguments contained within parentheses.
.3 “Sum(A, B, C, …)”: Arithmetic function returning the sum of all arguments contained within parentheses.

### 1.4 SUBMITTALS

.1 Refer to other controller sections including Section 25 05 00 Building Automation System for submittal requirements.

### 1.5 ADMINISTRATIVE REQUIREMENTS

.1 Sequences Review Meeting
.1 Schedule and conduct sequences review meeting as required, or upon request. Adhere to project meeting procedures as described in Section 01 00 00 Project Procedures.
.2 Meet with Engineer to review sequences in detail before implementation.
.3 Walk through sequences in detail and provide step by step commentary on control assumptions.
.4 Demonstrate how intent and programming requirements will be achieved.
.5 Notify Engineer of problems or concerns with meeting design intent.
.6 Follow request for clarification procedures to clarify issues regarding design intent.
.7 Submit work in progress sequences and walk through programming logic with Engineer upon request.
.8 Provide written detailed justification for choice of control strategy when requested by Engineer.

## PART 2 PRODUCTS

### 2.1 EXISTING PRODUCTS

.1 Refer to other controller sections including Section 25 05 00 Building Automation System.

## PART 3 EXECUTION

### 3.1 EXAMINATION

.1 Evaluation and Assessment
.1 Evaluate and inspect existing controller configuration, performance, and functionality.

### 3.2 COMMON REQUIREMENTS

.1 Configure controllers as required to meet design intent, including supervisory controllers, distributed controllers, independent controllers and programmable devices.
.2 Unless otherwise indicated, controllers shall be selected, installed, and configured to achieve the following control stability and accuracy tolerances:
.1 Ambient Dry Bulb Air Temperatures: +/-0.2-°C (+/-0.4-°F)
.2 Ambient Dew Point Air Temperatures: +/-1.5-°C (+/-2.7-°F)
.3 Zone Air Temperatures: +/-0.3-°C (+/-0.5-°F)
.4 Carbon Dioxide: +/-3-% of reading, +/-40-ppm.
.5 Carbon Monoxide: +/-5-ppm
.6 Air Duct Static Pressures: +/-25-Pa (+/-0.1-inWC)
.7 Zone Air Pressures: +/-3-Pa (+/-0.01-inWC)
.8 Liquid Pressure: +/-2-% of reading.
.9 Liquid Temperatures: +/-0.5-°C (+/-0.9-°F)
.10 Differential Temperature: +/-0.15-°C (+/-0.27-°F)
.11 Air Humidities: +/-5-%RH
.12 Heating Hot Water Flow: +/-2-% of reading.

.13 Air Duct Temperatures: +/-0.5-°C (+/-0.9-°F)
.14 Air Flow Stations: +/-5-% of reading down to 0.75-m/s (150-ft/min).
.15 Air Flow Terminal: +/-10-% of reading.
.16 Minimize the number of equipment on/off cycles.
.17 Maximize the duration of equipment cycles.
.18 Eliminate unnecessary staging of equipment.
.19 Prevent undershoot and overshoot on modulating equipment and actuator control.
.20 Maximize systems and equipment longevity.
.21 Control systems and equipment to maximize energy efficiency.
.22 Minimize concurrent heating and cooling including for humidification, dehumidification.
.23 Automatically handle failed components, including equipment and end devices, by starting backup devices, and taking actions to minimize consequences.
.24 Automatically prevent damage from failed components, including equipment and end devices.
.25 Minimize occupant discomfort in case of failed components, including equipment and end devices.
.26 Maximize occupant comfort.

.3 Configure controllers to meet requirements of:
.1 ASHRAE-62.1
.2 ASHRAE-90.1
.3 CSA-Z317.1
.4 CSA-Z317.2

.4 Create user adjustable variables used in programming logic, including for setpoints, limits, delays, offsets, scaling factors, and other constants. Minimize the number of such variables where possible.

.5 Complete necessary tests, trending, debugging, observation, and adjustments required to fine tune, adjust and modify controller configuration and setpoints to meet design intent.

.6 Indicated equipment operating limits should be considered as starting points or guidelines only. Consult with equipment manufacturer regarding recommended limits and operating constraints. Coordinate water pressure, air pressure, and flow setpoints with TAB and commissioning requirements. Notify Engineer of any conflicts that may arise in meeting design intent.

.7 Indicated sequences are intended to communicate suggested control strategies, and in no way absolve Contractor of responsibility as outlined in Contract Documents.

.8 Provide automatic switchover between specified modes of operation without manual user intervention.

.9 Configure controllers to coordinate with safeties, safety systems, independent controls and interlocks.

.10 Configure controllers to coordinate and account for responses and interactive effects of existing or affected systems with controls.

.11 Schedule equipment based on occupancy schedules, outdoor air temperature switch-point, or on demand.

.12 Document sequences to ASHRAE-G-13, Article 5.3.3., using the operating mode method.

.13 Summarize sequences, limits and settings, including interfaces to equipment and components.

**3.3 EXISTING SEQUENCES**

.1 Duplicate other existing functionality when changing or replacing controllers.
.2 Coordinate and adjust sequences to account for responses and interactive effects of existing or affected systems.

**3.4 COMMON SEQUENCES**

.1 Occupancy Override
  .1 Occupancy Override allow users to override default schedules and force zone into occupied mode for a user adjustable duration.
  .2 Start all required equipment in proper sequence and maintain zone climate at occupied setpoint for the duration of the override.
.2 Occupant Adjustment
  .1 Occupant Adjustment allows users to adjust zone temperature setpoints using features of the zone temperature sensor.
  .2 Provide adjustable maximum and minimum limits to allowable adjustments for each zone.
  .3 Provide feature to automatically reset adjustments on an adjustable time period per zone. Provide feature to allow operator to disable this reset feature per zone.
.3 Equalized Run Time
  .1 Equalize the run time of equipment where possible by rotating the sequence to which staged equipment are enabled unless otherwise indicated.
  .2 For lead/lag equipment, alternate lead equipment weekly.
  .3 Schedule switchover during unoccupied periods, where possible.
.4 Automatic Failover
  .1 Provide sequences to automatically and gracefully handle failure by starting backup equipment, including equipment, components, end devices.
.5 Trim and Respond Logic
  .1 Trim and respond is an alternative to PID control and is used in cases where a central controller must adjust to information from multiple distributed controllers. Includes less complex tuning and ability to remove “rogue” zones.
  .2 Where PID control or tuned controllers are indicated, trim and respond logic may be used as an alternative where PID control is impractical or not possible to achieve performance.
  .3 Variables and Constants
    .1 SP: Dynamically adjusted setpoint.
    .2 SPo: Initial setpoint.
    .3 SPmin: Minimum setpoint.
    .4 SPmax: Maximum setpoint.
    .5 Td: Delay timer (minutes).
    .6 T: Time step (seconds).
    .7 I: Number of ignored requests.
    .8 R: Number of requests from zones/systems.
    .9 SPtrim: Trim amount.
    .10 SPres: Respond amount (must be opposite sign of SPtrim).
    .11 SPres-max: Maximum response within time interval.
  .4 Setpoint Adjustment
    .1 When associated device is off, set SP to SPo.
    .2 When associated device is on wait for Td minutes before initiating logic.
    .3 Once activated, every T seconds:
      .1 SP = SP + SPtrim
      .2 SP = SP + Max(SPres * Max(R - I, 0) , SPres-max)

.3 SP = Max(SP, SPmax)
.4 SP = Min(SP, SPmin)

.5 Default Values
.1 Unless otherwise specified, use the following values:
.1 SPo, SPmin, SPmax: Setpoint as determined by TAB contractor.
.2 Td: 10-min
.3 T: 120-sec
.4 I: 2
.5 SPtrim: 5-% * (SPmax - SPmin)
.6 SPres: SPtrim * 1.1
.7 SPres-max: SPtrim * 3

.6 Adjust and tune variables and constants as required to meet performance requirements.

**3.5 MODES OF OPERATION**

.1 Occupied Mode
.1 This mode optimizes central equipment and distribution system reset schedules and enable/disable switch-points for occupied loads and zone temperatures.
.2 Scheduled based on daily, weekly and annual schedules.

.2 Unoccupied Mode
.1 This mode optimizes central equipment and distribution system reset schedules and enable/disable switch-points for unoccupied loads and zone temperatures.
.2 Scheduled based on daily, weekly and annual schedules.

.3 Morning Start-up
.1 This mode is used to bring the building out of setback to achieve occupied setpoint temperatures.
.2 Scheduled based on daily, weekly and annual schedules, and adjusted for optimal start algorithms.

.4 Optimal Start Mode
.1 This mode optimizes start-up of equipment to minimize energy use while ensuring zone temperatures are at setpoint during occupancy.
.2 Based on occupancy schedules, adjusted by calculating the minimum amount of time required to run equipment before occupancy to meet occupied space conditions.
.3 Time may vary based on outdoor air conditions, a recorded past history of heating and cooling times, and zone temperature feedback.
.4 Maintain unoccupied sequences for outdoor airflow requirements.
.5 GUI override button.

.5 Optimal Stop Mode
.1 This mode optimizes the early shutdown of equipment to minimize energy use by taking advantage of building thermal mass.
.2 Based on occupancy schedules, adjusted by calculating the maximum amount of time possible to disable equipment before vacancy, while meeting occupied space requirements.
.3 Time may vary based on outdoor air conditions, a recorded past history of heating and cooling times, and zone temperature feedback.
.4 Maintain unoccupied sequences for outdoor airflow requirements.
.5 GUI override button.

.6 Heating Mode
.1 This mode is active when the building may require heating, and is used to enable heating equipment.

.2 Based on outdoor air temperature, having separate setpoints for both occupied and unoccupied modes.
.3 Include a deadband to prevent cycling.

.7 Cooling Mode
.1 This mode is active when the building may require heating and is used to enable cooling equipment.
.2 Based on outdoor air temperature, having separate setpoints for both occupied and unoccupied modes.
.3 Include a deadband to prevent cycling.

**3.6 ZONE SETPOINTS**

.1 Background and Intent
.1 This article describes sequences for determining and adjusting temperature setpoints.

.2 Zone Temperature Setpoints - Default
.1 Occupied
.1 Set zone temperature setpoint to 21-°C (69.8-°F)/23-°C (73.4-°F) in Heating Mode/Cooling Mode respectively.
.2 Unoccupied
.1 Set zone temperature setpoint to 16-°C (60.8-°F)/28-°C (82.4-°F) in Heating Mode/Cooling Mode respectively.

.3 Zone Temperature Setpoints - Service Rooms
.1 Set zone temperature setpoint to 16-°C (60.8-°F)/30-°C (86-°F) in Heating Mode/Cooling Mode respectively.

.4 Zone Temperature Setpoints - Computer Rooms
.1 Set zone temperature setpoint to 16-°C (60.8-°F)/22-°C (71.6-°F) in Heating Mode/Cooling Mode respectively.

.5 Setpoint Adjustment
.1 Limit heating setpoint less than cooling setpoint -1-°C (1.8-°F).
.2 Limit unoccupied heating setpoint less than occupied heating setpoint -1-°C (1.8-°F).
.3 Limit unoccupied cooling setpoint greater than occupied cooling setpoint -1-°C (1.8-°F).
.4 For zones having local adjustable setpoint features:
.1 Limit setpoint adjustment to +/-3-°C (5.4-°F).
.2 Adjust occupied setpoints only.
.3 Limit active heating setpoints between 18-°C (64.4-°F) and 23-°C (73.4-°F).
.4 Limit active cooling setpoints between 20-°C (68-°F) and 28-°C (82.4-°F).

**3.7 VENTILATION - AIR HANDLING UNIT CONTROL - SF-1/EF-1**

.1 Background and Intent
.1 Air handler includes:
.1 Hydronic glycol heating coil.
.2 Multi-stage DX cooling.
.3 Hydronic pre-heat coil.
.4 Hydronic heat recovery loop.
.5 Constant speed supply fan.
.6 Constant speed exhaust fan.
.2 The air handler is controlled by a local controller networked to the BAS system.
.3 Each air handler serves:
.1 Multiple constant volume zones with reheat.

.2 Supply/Exhaust Fan Control
  .1 Enable/Disable fans to schedule. Fan is scheduled to operate at all hours.
.3 Heat Recovery Control
  .1 Glycol Heat Recovery
    .1 Start/stop pumps when Heating Mode is enabled/disabled.
    .2 When Heating Mode is enabled, modulate heat recovery valve to maintain leaving air temperature at supply air temperature setpoint minus 2-°C (3.6-°F).
    .3 When Heating Mode is disabled, close heat recovery valve.
  .2 Defrost Control
    .1 Start/stop defrost mode when outdoor air temperature drops below -15-°C (5-°F) /rises above -13-°C (8.6-°F).
.4 Supply Air Temperature Control
  .1 Reset supply air temperature setpoint according to the following schedule:
    .1 Minimum supply air temperature of 16-°C (60.8-°F) when exhaust air temperature is 24-°C (75-°F).
    .2 Maximum supply air temperature of 21-°C (69.8-°F) when exhaust air temperature is 20-°C (68-°F).
  .2 Ensure reset schedule is user adjustable.
.5 Heating Control
  .1 Enable heating mode when outdoor air temperature falls below supply air temperature + offset (user adjustable).
  .2 In sequence, modulate heat recovery valve from 0-% to 100-% open, then modulate heating valve from 0-% to 100-% open to increase supply air temperature to setpoint.
  .3 In sequence, modulate heating valve from 100-% to 0-% open, then modulate heat recovery valve from 100-% to 0-% open to decrease supply air temperature to setpoint.
  .4 Start/Stop heating coil pumps, heat exchanger pumps when Heating Mode is enabled/disabled.
  .5 Close heating valve when not in Heating Mode.
.6 Cooling Control
  .1 Enable air cooled condenser when outdoor air temperature is above supply air temperature +offset (user adjustable).
  .2 Stage air cooled condenser to maintain supply air temperature to setpoint.
  .3 Disable cooling when:
    .1 Cooling Mode is disabled, or
    .2 Heating Mode is enabled.
.7 Humidification Control
  .1 Enable humidification when outdoor temperature falls below 41-°C (50-°F) (user adjustable). Disable humidification when outdoor temperature rises above 10-°C (50-°F) (user adjustable).
  .2 Disable humidification when air handler is off.
  .3 Control humidifier to maintain return air humidity at setpoint (user adjustable).
  .4 Stop humidifier when hard wired high limit humidistat activates.
.8 Filters
  .1 Monitor filter differential pressures.

**3.8 VENTILATION - AIR HANDLING UNIT CONTROL - SF-2/EF-2**

.1 Background and Intent
  .1 Air handler includes:
    .1 Multi-stage DX cooling.
    .2 Constant speed supply fan.

.3 Constant speed return fan.
.2 The air handler is controlled by an independent local controller networked to the BAS system.
.3 Each air handler serves:
.1 Multiple constant volume zones with reheat.
.2 Unit Control
.1 Enable/Disable unit to schedule. Unit is scheduled to operate at all hours.
.3 Supply Air Temperature Control
.1 Reset supply air temperature setpoint based on zone reheat valve positions.
.4 Dining Room Reheat Control
.1 Reset reheat supply air temperature setpoint to minimize required zone reheat.
.2 Modulate control valve to maintain discharge air temperature at setpoint.
.5 Outdoor Air Control
.1 When unit is operational, minimum outdoor air damper position of 10-%.
.2 Increase/decrease damper position to maintain return air CO2 concentration below 900-ppm.
.6 Independent Controller
.1 The local air handler controller is configurable Engineered Air C-TRAC3 and controls the following
.1 Economizer mode.
.2 Cooling control.
.3 Override of outdoor air to maintain mixed air temperature above freezing.

**3.9 PERIMETER HEATING LOOP - ROSE AND OAK**

.1 Background and Intent
.1 Heating loop includes
.1 Constant speed pump.
.2 Perimeter heating with control valves.
.2 Pump Control
.1 Start/stop pump when outdoor air temperature is above 18-°C (64.4-°C) (user adjustable).
.3 Perimeter Heating Loop Temperature Control
.1 Set loop temperature setpoint to building heating loop temperature setpoint minus 5-°C (9-°F).
.4 Perimeter Heating Control
.1 Modulate control valve to maintain loop temperature at setpoint.

**3.10 VENTILATION - AIR HANDLING UNITS CONTROL - AHU-1,2,3,4**

.1 Building Pressure
.1 Monitor building pressure
.2 Supply Air Humidity
.1 Monitor supply air humidity.

**3.11 VENTILATION - VAV TERMINAL UNITS**

.1 Background and Intent
.1 Match existing VAV terminal control strategy.
.2 Add the following sequence to VAVs indicated:
.1 Coordinated Perimeter Heating Control (Zone Heating Mode)
.1 When VAV is at minimum position:
.1 Modulate applicable perimeter control valves from 0-% to 100-% as heating loop controller varies from 0-% to 50-%.

**3.12 ALARMING**

.1 Alarming of points shall be assigned priorities as follows:

.1 Priority 1 alarms are reserved for “life and death safety” situations.
.2 Priority 2 alarms are reserved for “building damage” situations such as sump levels, etc.
.3 Priority 3-5 alarms are dependent on system by system parameters.

.2 BAS operators with access level 3 or higher (based on system having 6 or more levels of access) will be able to acknowledge alarms.
.3 Priority 1 Alarms
.4 Priority 2 Alarms
.1 Heating Boiler Failure Alarm: When all heating boilers fail for more than 60-min, and outdoor air temperature is less than 0-°C (32-°F).
.2 Zone Freeze Alarm: When any zone drops below 5-°C (41-°F) for more than 30-min.
.3 Air Handler Freeze Alarm: When mixed air temperature falls below 5°C (41-°F) for more that 5-min.
.4 Reheat Freeze Alarm: When duct temperature falls below 5°C (41-°F) for more that 5-min.
.5 Air Handler High Humidity Alarm: When supply air humidity is above high limit for more than 30-min.
.6 Perimeter Loop Alarm: When perimeter loop temperature drops below
.7 Reheat Loop Freeze Alarm: When reheat loop temperature drops below 5-°C (41-°F) for more than 5-min.
.5 Priority 3 Alarms
.1 Pump Failure Alarm: When a pump fails.
.2 Failure Alarm: When components fail to achieve commanded status for more than 2-min.
.3 Cold Air Temperature: When mixed air temperature is less than 3-°C (37.4-°F) or more than 30-°C (86-°F) for more than 5-min. Alarm will clear when temperature has returned more than 0.5-°C (0.9-°F) into non-alarm state for more than 1-min.
.4 Differential Pressure Alarm: When differential pressure is greater than 25-% higher than setpoint for more than 5-min.
.5 Courtroom/Important Zones Alarms: When temperatures are off setpoint by more than 2-°C (3.6-°F) for more than 10-min.
.6 Priority 4 Alarms
.1 Hot/Cold Room Alarm: When room temperature is greater than 26-°C (78-°F) or less than 20-°C (68-°F) for more than 15-min during 'occupied' mode. Alarm will clear when temperature has returned more than 0.5-°C (0.9-°F) into non-alarm state for more than 1-min.
.2 Other Temperatures Too Cold or Too Hot: When other temperature not specifically listed above are off setpoints by more than 10-°C (50-°F) for more than 20-min.
.3 Water Meter: Flow above alarm setpoint for more than 30-min.
.7 Priority 5 Alarms
.1 Filter Pressure Alarm: When filter pressure differential is greater than 250-Pa (1-inWC) or less than 25-Pa (0.1inWC) for more than 15-min during when main supply fan is operating. Alarm will clear when pressure has returned more than 10-Pa (0.07-inWC) into non-alarm state for more than 1-min.
.2 Supply Air Temperature Alarm: When supply air temperature is more than 2-°C (3.6-°F) from set point for more than 15-min after main fan has been operating for more than 60-min. Alarm will clear when temperature has returned more than 0.5-°C (3.6-°F) into non-alarm state for more than 1-min.

**3.13 ADJUSTING**

.1 Adjust configuration as required including sequences.
.2 To Section 25 05 00 Building Automation System.

**3.14 CLOSEOUT ACTIVITIES**

.1 To Section 25 05 00 Building Automation System.

**END OF SECTION 25 90 00**

# SECTION 26 00 00 ELECTRICAL DISTRIBUTION

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Disconnects, breakers, over-current protection, motor starters, motors.

### 1.2 REFERENCED DOCUMENTS

.1 ASHRAE-90.1: ANSI/ASHRAE/IES-90.1-2016 Energy Standard for Buildings Except Low-Rise Residential, including User's Manual.
.2 Electrical Installations, including Handbook (23rd Edition).
.3 CSA-C22.1: CSA-C22.1-15 Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, including Handbook (23rd Edition).
.4 CSA-C22.2: CSA-C22.2 Canadian Electrical Code, Part 2.
.5 CSA-O80: CSA-O80-Series-15 Wood Preservation.
.6 CSA-Z317.13: CAN/CSA-Z317.13-17 Infection Control During Construction or Renovation of Health Care Facilities.
.7 ESA-OESC: ESA Ontario Electrical Safety Code, 2015 (26th Edition).
.8 NEMA-MG-1: NEMA-MG-1-2014 Motors and Generators.
.9 ULC-S102: CAN/ULC-S102-10 Surface Burning Characteristics of Building Materials and Assemblies.

### 1.3 DEFINITIONS

.1 As defined by ESA-OESC and CSA-C22.1, unless otherwise defined.

### 1.4 SUBMITTALS FOR ACTION

.1 Product Data
  .1 Manufacturers' product literature, specifications, and datasheets. Include product characteristics, performance criteria, options, and limitations.
.2 Shop Drawings
  .1 Layout and Interference Plans: Isometric sketches indicating clearances, interferences, and relocation of interfering services, components, objects, and structures.
  .2 Interlocks: Schematic and wiring diagrams detailing electrical interlocks.
  .3 Disconnecting Means: Schematic and wiring diagrams detailing methods of disconnecting means.
  .4 Mounting: Submit layout drawings for equipment mounting, including splitters, starters, disconnects, VFDs. Detail mounting methods, including pads, stands, backing boards.
  .5 Suspension systems for all suspended equipment. Indicate the following:
    .1 Location of suspension.
    .2 Maximum load at each of the suspension points.
    .3 Size of suspension rods or members.
    .4 Details of supplementary structural steel framing members.
  .6 Distribution panels documentation including:
    .1 Schematics and wiring diagrams.
    .2 Motor starter and component schedule.
    .3 Front view elevation, top view.
    .4 Nameplate schedule.
    .5 Conduit entry and exit locations.
    .6 Assembly ratings including short circuit rating, voltage, continuous current.
    .7 Major component ratings including voltage, continuous current, interrupting ratings.
    .8 Key interlock scheme drawing and sequence of operation.

.3 Samples

**1.5 SUBMITTALS FOR INFORMATION**

.1 Certificates
- .1 Letter from supplier of refurbished over-current devices, confirming extent of refurbishment, test results, and certification of suitability for intended use.
- .2 Letter from a qualified factory-trained manufacturer's representative certifying equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.
- .3 Seismic certification and equipment anchorage details.
- .4 Certified production test results.

.2 Delegated Professional Design Submittals
- .1 Design and design documents completed by a professional engineer for the following:
  - .1 Mounting components and restraints are suitable for application and requirements, including seismic provisions of local building code.

.3 Manufacturer Information
- .1 Operating and Maintenance Manuals
- .2 Installation Instructions

.4 Source Quality Control Submittals

.5 Test and Evaluation Reports
- .1 Load Balance Report: Report detailing line to line, and line to neutral currents, voltage, and power factor, before and after adjustments.
- .2 Motor Starter Report: Report detailing motor inrush currents, full load current, and overload setting.
- .3 Power Quality Report: Report detailing harmonic analysis of waveforms and total harmonic distortion measurement.
- .4 Insulation Testing Report
  - .1 Meg-ohm meter (megger) measurements.
  - .2 Visual inspection of insulation.
  - .3 Summary and recommendations.
- .5 Existing Condition Report: Report documenting condition of existing electrical equipment.
  - .1 Photographs of interior of panels.
  - .2 Photographs of identified deficiencies in existing system.
  - .3 Documentation of existing cable size and quantity, insulation type, and conduit size.
  - .4 Written description of existing deficiencies.

.6 Qualification Statements
- .1 Electrical: Proof of licences for company and personnel.
- .2 Professional Engineering: Proof of licences for company and personnel.

.7 Documentation
- .1 Single line power diagram.

**1.6 QUALITY ASSURANCE**

.1 Regulatory Requirements

.2 Qualifications
- .1 Electrical: Company and personnel to be licensed electricians.
- .2 Professional Engineering
  - .1 Company and personnel licensed to practice Professional Engineering by PEO.
  - .2 Subject to approval.

.3 Preconstruction Testing

.4 Storage and Handling Requirements
.5 Packaging Waste Management

## PART 2 PRODUCTS

### 2.1 COMMON PRODUCT REQUIREMENTS

.1 Designed, manufactured, tested and certified in accordance with the latest applicable standards including ANSI, CSA, NEMA, UL and ULC.
.2 The precise type, rating, quantity and location of electrical products depend, in part, on routing and installation choices made by Contractor.
  .1 Provide electrical products meeting relevant standards, including CSA-C22.2 and NEMA.
.3 Match fault current ratings equal to that of upstream over-current protection.
.4 Provide electrical products rated to suit environment.

### 2.2 EQUIPMENT MOUNTING

.1 Provide mounting as required including pads, stands, backing boards, frames, supports.

### 2.3 MOTOR STARTERS

.1 Provide as required.
.2 Manufacturers
  .1 Motor starters installed in motor control centres:
    .1 Same manufacturer and series as the motor control center.
  .2 Motor starters not installed in motor control centres:
    .1 Eaton Corporation, Cutler-Hammer
    .2 Schneider Electric
    .3 Siemens Canada Limited
.3 Type: AMS - Automatic Motor Starter
  .1 Features
    .1 Solid state overload relays.
      .1 Self-powered.
      .2 Phase loss protection.
      .3 Visible trip indication.
      .4 Test trip feature.
      .5 Ambient temperature compensated.
    .2 Indicating lights for RUN and FAULT.
    .3 Selector switch for HAND-OFF-AUTO.
    .4 Fused control power transformer.
    .5 Integral disconnect switch.
  .2 Size: As required.
.4 Type: MMS - Manual Motor Starter
  .1 Features
    .1 Bi-metallic overload relays.
      .1 Single phase sensitivity.
      .2 Visible trip indication.
      .3 Test trip feature.
    .2 Indicating lights for RUN and FAULT.
    .3 Integral disconnect switch.
  .2 Size: As required.

### 2.4 DISCONNECTS

.1 Provide as indicated.
.2 Manufacturers
  .1 Eaton Corporation, Cutler-Hammer

.2 Schneider Electric
.3 Siemens Canada Limited

.3 Type
.1 Fused or unfused as required.
.2 Industrial heavy duty, quick-make, quick-break, arc quenching.
.3 Lockout rings for “ON” and “OFF” position.
.4 Ratings: Horsepower rated to twice the disconnect load unless otherwise indicated.

**2.5 OVER-CURRENT PROTECTION**

.1 Provide as required.
.2 Manufacturers: Match manufacturer, features, type, quality, and interrupting current rating of existing over-current protection where possible. Otherwise:
.1 Eaton Corporation, Cutler-Hammer
.2 Schneider Electric
.3 Siemens Canada Limited
.3 Type
.1 As required to maintain selective coordination.
.4 Options: Provide the following:
.1 Circuit Breaker Adjustable Trip Unit
.1 Provide on circuit breakers 300-A or larger. Provide on circuit breakers 300-A or less as required to maintain selective coordination
.2 Manufacturers: Eaton Corporation, Cutler-Hammer, Digitrip RMS510
.3 Features: Long delay, short delay, instantaneous and ground fault trip settings.
.5 Ratings

**2.6 MOTORS - INDUCTION - 1-HP AND LARGER**

.1 Provide as indicated.
.2 Manufacturers
.1 Baldor Electric Company
.2 Leeson Electric
.3 Weg Electric Corp.
.3 Features
.1 Motor Enclosure
.1 Provide as required for environment.
.2 For replacement motors with existing enclosures rated to exceed environment, match existing.
.2 Bearings: Sealed
.3 Vertical Oriented Motors: Lock Bearing Construction
.4 Thermal Protection: Use Automatic Thermal Overloads for motors less than 1-hp, Manual Thermostats for larger motors.
.5 Thermistors: Provide thermistors in windings for motors greater than or equal to 40-hp.
.6 Condensation Protection: For motors at risk of condensation, provide integral strip heaters and paint.
.7 Frame
.1 Provide as required.
.2 Match existing frame where applicable.
.3 Provide frame conversion kit as required.
.8 Coupling and Shaft
.1 Provide as required.
.2 Match existing coupling and shaft where applicable.

.3 Provide conversion kit and custom modify shaft as required.

.4 Type

.1 Inverter Ready and General Purpose

.1 Application: For variable frequency drive and non-variable frequency drive applications.

.2 Features

.1 Insulation: Minimum Class F.

.2 Service Factor: Minimum 1.15.

.3 Performance

.1 Turndown Ratio: Minimum 20:1 rated for variable torque applications.

.2 Windings: To NEMA-MG-1, Part 31.4.4.2. Capable of withstanding 1,860-V single amplitude zero to peak line to line voltage spikes when subjected to a minimum 0.1-µs rise time.

.4 Options: Provide the following:

.1 Motor shaft grounding ring.

.5 Performance

.1 Speed: 1800-rpm unless otherwise indicated.

.2 Except as otherwise permitted, select motors to operate at or below nameplate shaft horsepower at all load operating conditions including run-out.

.3 Efficiency: To greater of the following:

.1 ASHRAE-90.1 minimum nominal full load efficiency for motor type and purpose.

.2 ASHRAE-90.1 minimum average full load efficiency for motor type.

.3 NEMA-MG-1 premium efficiency.

## 2.7 STANDS

.1 Provide as required.

.2 Type: Prefabricated metal channel, weldless connections.

.3 Size: Minimum 19-mm (3/4-in) thick.

.4 Finish: Painted including for corrosion protection.

## 2.8 BACKING BOARD

.1 Provide as required.

.2 Materials: Pressure impregnated treated plywood with fire-retardant chemicals to CSA-O80.

.3 Performance

.1 Flame-Spread: Maximum 25 tested to ULC-S102.

.4 Size: 19-mm (3/4-in) thick.

.5 Finish: Painted to match panels and equipment.

## 2.9 STANDOFFS

.1 Provide as required.

.2 Type: Prefabricated metal channel, weldless connections.

Size: Minimum 19-mm (3/4-in) thick.

.3 Finish: Painted including for corrosion protection.

## 2.10 SOURCE QUALITY CONTROL

.1 Complete factory tests in accordance with NEMA, UL and ULC standards.

.2 Complete all laboratory and manufacturer testing required to refurbish existing over-current protection devices and obtain required re-certification.

.3 Submit documentation and certified copies of test results.

## PART 3 EXECUTION

### 3.1 EXAMINATION

.1 Photograph, document and submit descriptions of existing deficiencies in affected systems, equipment, services and surrounding areas prior to commencing Work.
.2 Confirm the condition, installation, location, quantity and type of applicable equipment.
.3 Complete x-ray scans, consultation, and other investigative work as required to verify structural member construction, verify suitable locations, and ensure drilling and coring through structural members will not affect integrity.
.4 Investigate affected fire separations for existing improperly sealed or defective fire stopping.
.5 Verify circuits on affected panels.

### 3.2 EXISTING MOTOR CONTROL CENTERS AND PANELBOARDS

.1 Pre-installation Measurement
  .1 Energize all loads to simulate full load conditions.
  .2 Measure line to line, and line to neutral currents, voltage, and power factor before installation.
  .3 Report on panels that may become loaded more than 80-%.

### 3.3 COMMON EXECUTION REQUIREMENTS

.1 To CSA-Z317.13.
.2 Provide services, including mechanical, to equipment as required.
.3 Provide equipment with identification as indicated. Nameplates to match quality and style of existing.
.4 Replace services around equipment to fit equipment and to suit equipment requirements, including piping, ductwork, venting, wiring.
.5 Install products in locations providing appropriate ambient conditions for its operation and allowing for adequate ventilation.
.6 Provide clearances around systems, equipment and components for inspection, servicing and maintenance and as required. Minimum clearance of 300-mm (1-ft).
.7 Provide clearances around products to prevent interference with adjacent systems, equipment and components.
.8 Noise and Vibration Control
  .1 Install vibration control hardware in accordance with manufacturer's instructions (and supervision where required) and only by workmen experienced in the installation of such systems.
  .2 Provide anti-vibration mounts or anti-vibration couplings when connecting wiring, conduit, or enclosures to mechanical equipment.
  .3 Replace isolation pads and modify supports as required to mitigate vibration and noise to Owner's satisfaction.
.9 Repair/Restoration
  .1 Use new original manufacturer parts for replacement where possible.
  .2 Obtain all registrations or certifications required for original parts sent to a third party for refurbishment. Submit parts re-certification as required.
  .3 Obtain all certifications and testing required when modifying existing equipment.
.10 The precise type, rating, quantity and location of electrical products depend, in part, on routing and installation choices made by Contractor.
  .1 Verify specified cable size, raceway size, insulation type, and over-current protection.
  .2 Adjust sizing and selection of products as required.

.11 Provide equipment safeties and interlocks as required.
.12 Disconnecting Means: Provide disconnecting means as required, including disconnects.
.13 Power Surges: Protect upstream electrical equipment from power line, voltage transients and damage during construction power surges.
.14 Should complications arise due to incorrect selection, Contractor shall be responsible for costs incurred in replacing damaged components.
.15 Manufacturer Services
.1 Supervision: Manufacturer to supervise field assembly of equipment to ensure warranty and performance provisions are met.
.2 Start-up: Manufacturer to approve installation, to supervise start-up, and to instruct Owner, unless otherwise indicated.
.3 Adjusting: Adjust for optimal performance, under manufacturer supervision.

**3.4 EQUIPMENT MOUNTING**

.1 Intent: Contractor responsibility as requirements depend in part on final selection and installation location.
.2 Design mounting as required where not indicated, including pads, stands, backing boards, frames, supports.
.3 Support equipment such that no loads are transmitted to services including piping, ductwork, venting, wiring.
.4 Provide concrete housekeeping pads for base-mounted equipment.
.1 Size: Minimum 100-mm (4-in) high, larger in width and depth by 75-mm (3-in).
.5 Provide stands for equipment that can be wall mounted but are not located on walls unless otherwise indicated. Anchor bolt to surfaces.
.6 Provide backing boards with standoffs for wall mounted equipment unless otherwise indicated. Anchor bolt to surfaces.
.7 Provide standoffs for wall mounted equipment as indicated, or in environments and locations not suitable for backing boards. Anchor bolt to surfaces. Use of standoffs only instead of backing boards as approved by Engineer.
.8 Performance: Design equipment mounting:
.1 To make equipment level.
.2 To protect equipment from water damage.
.3 To withstand seismic events with seismic restraint as required.
.4 To minimize noise and vibration transmitted to services and building structure.
.5 To withstand concentrated loads of 2-kN (450-lbf) applied at any point in any direction.

**3.5 MOTOR STARTERS**

.1 Install as required.
.2 Adjust overload settings as required.
.3 Modify existing as required, including:
.1 Provide manual override (HAND-OFF-AUTO) functionality.
.2 Remove and blank off spaces from abandoned components including HAND-OFF-AUTO controls when new motor starters including VFDs are installed downstream.

**3.6 DISCONNECTS**

.1 Install as required.

**3.7 OVER-CURRENT PROTECTION**

.1 Install as required.
.2 Coordinate over-current protection with upstream and downstream over-current devices. Set adjustable settings for proper coordination.

**3.8 MOTORS**

.1 Install as required.
.2 Wire thermisters to VFDs.
.3 Measure inrush and full load current upon start-up of motors.
.4 Adjust overload settings or replace overloads as required.
.5 Replace upstream over-current protection as required to prevent nuisance tripping on motor start-up and operation.

**3.9 LABELLING**

.1 Nameplates: Affix manufacturer's nameplates to equipment in a readily visible location.
.2 Identification: Provide lamacoid nameplates for identification on each enclosure, panel, or field equipment, including existing.
  .1 Construction: Laminated plastic with a different coloured core and engraved lettering to clearly show lettering with style as follows, unless otherwise specified:
    .1 Style: Capital letters, minimum 12-mm (1/2-in) high, equal character spacing, centered (not justified).
    .2 Colours: Colours of letters and background may change for each type of equipment or component. Provide colours to Owner requirements, otherwise provide white letters and black background.
  .2 Nameplate Content
    .1 Equipment: Name tag of equipment.
    .2 Panels, switchboards, transformers, or other distribution equipment: Name tag of equipment and location of electrical power feed(s).
.3 Warning: Provide warning labels as required, including:
  .1 Warning of automatic control.
  .2 Warning of enclosures containing multiple voltages or multiple voltage sources.
.4 Directories: Prepare updated written circuit directory on affected panels. Affix updated circuit directory to panel door, enclosed in a plastic protective sleeve.
.5 Ceiling Labelling
  .1 Provide coloured labels on ceiling surfaces to indicate equipment and components including the following. Colours indicated are indicative of requirements and Owner may change for each type of equipment or component.
    .1 Red
      .1 Emergency lighting components.
      .2 Other fire safety system components.
    .2 Yellow
      .1 Controllers.
      .2 Control devices.
      .3 Electrical distribution components.
    .3 Grey
      .1 Communication or sound components.
    .4 Black
      .1 Other building services.
  .2 Provide labels as acceptable to Owner, including label type, material, size and colour. Owner may require lamacoids, adhesive labels with text, adhesive labels with no text.
  .3 Mark each label as acceptable to Owner, including equipment label, type, power circuit.

**3.10 START-UP**

.1 Motor Control Centers and Panel boards
  .1 After installation of new circuits, energize all loads to simulate full load conditions.
  .2 Measure line to line, and line to neutral currents, voltage, and power factor.
.2 Insulation Testing
  .1 Test insulation integrity on circuits before powering:
    .1 Visually inspect insulation.
    .2 Complete sufficient meg-ohm meter (megger) measurements to confirm quality and integrity of insulation.
.3 Provide services of qualified factory-trained manufacturer's representative to assist with installation and start-up.
  .1 Submit manufacturer's start-up report, and written certification that the equipment has been installed, adjusted and tested in accordance with the manufacturer's recommendations.

**3.11 ADJUSTING**

.1 Adjusting: Adjust settings as required before Total Performance and throughout Warranty Period to address performance issues, including safeties, operating limits, noise, vibration, efficiency, equipment longevity.

**3.12 CLEANING**

.1 Cleaning: Clean and vacuum enclosures and junction boxes after completion of work.

**3.13 CLOSEOUT ACTIVITIES**

.1 Documentation
  .1 Provide new single line power diagram for affected areas, including new systems and existing systems. Verify existing systems. Coordinate diagram style and notations with existing and new diagrams. Provide appropriately sized frames with glass cover for each affected area. Match existing single line power diagram frames unless otherwise approved by Owner. Mount single line power diagram in frames on walls of affected areas in locations approved by Owner.

**END OF SECTION 26 00 00**

# SECTION 26 05 00 WIRING AND CABLES

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Wiring and cables for power, communication networks, control, raceway.

### 1.2 REFERENCED DOCUMENTS

.1 ASHRAE-90.1: ANSI/ASHRAE/IES-90.1-2016 Energy Standard for Buildings Except Low-Rise Residential, including User's Manual.
.2 CSA-C22.1: CSA-C22.1-15 Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations, including Handbook (23rd Edition).
.3 CSA-C22.2: CSA-C22.2 Canadian Electrical Code, Part 2.
.4 CSA-C22.2-0.3: CSA-C22.2 No. 0.3-09 (R2014) Test Methods for Electrical Wires and Cables.
.5 CSA-C22.2-45.2: CSA-C22.2 No. 45.2-08 (R2013) Electrical Rigid Metal Conduit - Aluminum, Red Brass, and Stainless Steel.
.6 CSA-C22.2-56: CSA-C22.2 No. 56-13 Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
.7 CSA-C22.2-83: CSA-C22.2 No. 83-M1985 (R2013) Electrical Metallic Tubing.
.8 CSA-C22.2-83.1: CSA-C22.2 No. 83.1-07 (R2012) Electrical Metallic Tubing - Steel.
.9 CSA-C22.2-211.2: CSA-C22.2 No. 211.2-06 (R2011) Rigid PVC (Unplasticized) Conduit.
.10 CSA-C22.2-227.1: CSA-C22.2 No. 227.1-06 (R2016) Electrical Non-metallic Tubing.
.11 CSA-C22.2-262: CAN/CSA-C22.2 No. 262-16 Optical Fiber Cable and Communication Cable Raceway Systems.
.12 CSA-C22.2-2420: CSA-C22.2 No. 2420-09 (R2014) Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
.13 CSA-C22.2-2515: CSA-C22.2 No. 2515-09 (R2014) Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
.14 CSA-C22.2-2515.1: CSA-C22.2 No. 2515.1-13 Supplemental Requirements for Extra Heavy Wall (XW) Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
.15 CSA-Z317.13: CAN/CSA-Z317.13-17 Infection Control During Construction or Renovation of Health Care Facilities.
.16 ESA-OESC: ESA Ontario Electrical Safety Code, 2015 (26th Edition).
.17 NECA-1: ANSI/NECA-1-2015 Standard for Good Workmanship in Electrical Construction.
.18 NEMA-250: NEMA-250-2014 Enclosures for Electrical Equipment (1000 Volts Maximum).
.19 TIA-568.2: ANSI/TIA-568-C.2 Balanced Twisted-Pair Telecommunication Cabling and Components Standard (Edition C, 2012).
.20 TIA-568.3: ANSI/TIA-568.3-D Optical Fiber Cabling and Components Standard (Edition D, 2016).
.21 ULC-S115: CAN/ULC-S115-11 (R2016) Standard Method of Fire Tests of Firestop Systems.
.22 ULC-S139: CAN/ULC-S139-12 Standard Method of Fire Test for Evaluation of Integrity of Electrical Cables.

### 1.3 DEFINITIONS

.1 As defined by ESA-OESC and CSA-C22.1, unless otherwise defined.

**1.4 SUBMITTALS FOR ACTION**

.1 Product Data
- .1 Manufacturers' product literature, specifications, and datasheets. Include product characteristics, performance criteria, options, and limitations.

.2 Shop Drawings
- .1 Layout and Interference Plans: Isometric sketches indicating clearances, interferences, and relocation of interfering services, components, objects, and structures.
- .2 Single Line: Single line electrical schematic showing:
  - .1 Cable sizes and quantities.
  - .2 Conductor types and quantities per cable.
  - .3 Insulation types and temperature ratings per conductor and cable.
  - .4 Raceway types, dimensions.
  - .5 Maximum current capacity.
  - .6 Overcurrent protection details.
  - .7 Other code requirements.
  - .8 Other regulatory requirements.
- .3 Interlocks: Schematic and wiring diagrams detailing electrical interlocks.
- .4 Disconnecting Means: Schematic and wiring diagrams detailing methods of disconnecting means.
- .5 Fire Separations: Location of penetrations through fire separations and other assemblies.
- .6 Fire Stopping and Smoke Seals
  - .1 Locations and types marked on plan drawing.
  - .2 ULC assembly number certification.
  - .3 Required temperature rise and flame rating.
  - .4 Hose stream rating where applicable.
  - .5 Materials of fire stopping and smoke seals, primers, reinforcements, damming materials, reinforcements, and anchorages/fastenings.
  - .6 Assembly and penetration type and required ratings, adjacent materials.
  - .7 Openings size, thickness, dimensions.
  - .8 Proposed installation methods.
  - .9 Summaries of similar types of penetrations, assembly type and construction, service penetrating assembly, adjacent materials, fire stopping and smoke seal type, ratings, other work required.
  - .10 Copies of ULC certifications for proposed systems and designs for specific devices and materials.
  - .11 Image of sample tag.

**1.5 SUBMITTALS FOR INFORMATION**

.1 Certificates
- .1 Production test results.
- .2 Seismic certification and equipment anchorage details.
- .3 Letter from fire stopping and smoke seals installer certifying that fire stopping and smoke seals have been installed in accordance with regulatory requirements and Contract Documents.

.2 Manufacturer Information
- .1 Installation Instructions

.3 Qualification Statements
- .1 Electrical Work: Company and personnel to be licensed electricians.

**1.6 QUALITY ASSURANCE**

.1 Qualifications

.1 Electrical Work: Company and personnel to be licensed electricians.
.2 Fire Stopping and Smoke Seals: Company member of FCIA.

## PART 2 PRODUCTS

### 2.1 COMMON PRODUCT REQUIREMENTS

.1 Designed, manufactured, tested and certified in accordance with the latest applicable standards including ANSI, CSA, NEMA, UL and ULC.
.2 The precise type, rating, quantity and location of electrical products depend, in part, on routing and installation choices made by Contractor.
  .1 Provide electrical products meeting relevant CSA-C22.2 standards.
.3 Match fault current ratings equal to that of upstream over-current protection.
.4 Provide electrical products rated to suit environment.

### 2.2 POWER WIRING AND CABLES

.1 Provide as required.
.2 Materials
  .1 Copper for all conductors including integral ground/bonding wires.
  .2 Stranded for #10-AWG and larger.
.3 Size: To the larger of:
  .1 One size larger than required by ESA-OESC.
  .2 One size larger than equipment MCA.
  .3 As required by ASHRAE-90.1.
  .4 #12-AWG.
  .5 As indicated.
.4 Ratings
  .1 Temperature: Minimum 90-°C (200-°F) unless otherwise required.
  .2 Voltage
    .1 Minimum 1,000-V for cables between 575-V rated variable frequency drives and motors.
    .2 Minimum 600-V otherwise.
  .3 Flame Test Rating
    .1 FT6 to CSA-C22.2-0.3 as required by local building code, including for plenums, combustible construction.
    .2 FT4 to CSA-C22.2-0.3 otherwise.
  .4 Fire Rating: Minimum 2-hour fire rating certified to ULC-S139 where fire rating is indicated.
.5 Cable Types
  .1 RW90-XLPE: Chemically cross linked thermosetting polyethylene material with CSA type RW90. Suitable for wet and dry locations.
  .2 RWU90-XLPE: Chemically cross linked thermosetting polyethylene material with CSA type RWU90. Suitable for underground burial.
  .3 T90/TWN75: Thermoplastic insulation with CSA type TWH, with nylon jacket. Suitable for wet and dry locations.
  .4 TECK90: Armoured cable, polyvinyl chloride jackets on the outside and inside of the armour. Suitable for wet and dry locations.
    .1 Armour: Interlocked aluminum.
    .2 Conductor Insulation: Chemically cross linked thermosetting polyethylene material with CSA type RW90.
  .5 ACWU90: Armoured cable, polyvinyl chloride jacket, suitable for wet and dry locations.
    .1 Armour: Interlocked aluminum.
    .2 Conductor Insulation: Chemically cross linked thermosetting polyethylene material with CSA type RW90.

.6 AC90: Armoured cable, no jacket, CSA type AC90. Suitable for dry locations.
.1 Armour: Interlocked aluminum.
.7 RA90: Aluminum sheathed cable, CSA type RA90, polyvinyl chloride jacket. Suitable for wet and dry locations.
.1 Armour: Continuous aluminum sheath.
.2 Conductor Insulation: Chemically cross linked thermosetting polyethylene material with CSA type RW90.
.8 FAS: CSA type FAS and applicable UL ratings.
.9 VFD: Application specific cable design for variable frequency drive applications.
.1 Voltage: 1,000-V
.2 Construction: 3 bare bonding conductors symmetrically located within cable and/or 100-% coverage foil, braided, or taped shields.
.10 EMERG: 2-hour fire rated cable and raceway assembly certified to ULC-S139 including hose stream application.

## 2.3 COMMUNICATION NETWORKS WIRING AND CABLES

.1 Provide as required.
.2 Coordinate requirements as required, including for communication network repeaters, gateways, boosters, interfaces, and other equipment, components and accessories.
.3 Cable Types
.1 CAT5, CAT5e, CAT6 - Category #: To TIA-568.2, TIA-568.2, TIA-568.3, multiple shielded twisted pair.
.2 STP - Shielded Twisted Pair: #18 AWG, 100-ohm to 130-ohm impedance, capacitance less than 30-pF per foot.
.4 Ratings
.1 Flame Test Rating
.1 FT6 to CSA-C22.2-0.3 as required by local building code, including for plenums, combustible construction.
.2 FT4 to CSA-C22.2-0.3 otherwise.

## 2.4 CONTROL WIRING AND CABLES

.1 Provide as required.
.2 Coordinate requirements as required, including for signal conditioning and isolation, and other equipment, components and accessories.
.3 Cable Types
.1 CLA1 - Class 1: To TIA-568.2, TIA-568.2, TIA-568.3, shielded twisted pair.
.2 STP - Shielded Twisted Pair: #18 AWG, 100-ohm to 130-ohm impedance, capacitance less than 30-pF per foot.
.4 Size
.1 Size control wires to manufacturer’s recommendations.
.2 Minimum #18-AWG unless otherwise specifically required by manufacturer.
.5 Materials: Copper.
.6 Ratings
.1 Temperature: Minimum 90-°C (200-°F) unless otherwise required.
.2 Flame Test Rating
.1 FT6 to CSA-C22.2-0.3 as required by local building code, including for plenums, combustible construction.
.2 FT4 to CSA-C22.2-0.3 otherwise.

## 2.5 RACEWAYS

.1 Provide as required.
.2 Size: Minimum 21-mm (3/4-in), even if smaller size may otherwise be permissible.

.3 Type
.1 EMT - Electrical Metallic Tubing: To CSA-C22.2-83.1.
.1 Materials: Hot dipped galvanized steel.
.2 ENT - Electrical Non-metallic Tubing: To CSA-C22.2-227.1.
.1 Flame Test Rating
.1 FT6 to CSA-C22.2-262 and as required by local building code, including for plenums, combustible construction.
.2 FT4 to CSA-C22.2-262 otherwise.
.3 FMC - Flexible Metal Conduit: To CSA-C22.2-56.
.4 FMC-LT - Liquid Tight Flexible Metal Conduit: To CSA-C22.2-56.
.5 PVC - Rigid PVC (Unplasticized) Conduit: To CSA-C22.2-211.2.
.6 RMC - Rigid Metal Conduit: To CSA-C22.2-45.2.
.1 Materials: Aluminum.
.7 RTRC-AG - Aboveground Reinforced Thermoset Rigid Conduit, or Fibreglass Conduit: To CSA-C22.2-2515.
.8 RTRC-AG-XW - Aboveground Extra Heavy Wall Reinforced Thermoset Rigid Conduit: To CSA-C22.2-2515.1.
.9 RTRC-BG - Belowground Reinforced Thermoset Rigid Conduit, or Fibreglass Conduit: To CSA-C22.2-2420.
.10 SMR - Surface Metallic Raceway: To CSA-C22.2-62.
.11 SNR - Surface Non-metallic Raceway: To CSA-C22.2-62.

## 2.6 SUPPORTS AND HANGERS

.1 Design of wiring and cables support depends, in part, on routing and installation choices made by Contractor. Design of wiring and cables support is Contractor responsibility.
.2 Provide as required.
.3 Materials: Metal, corrosion resistant.
.4 Unacceptable
.1 Wire lashing.
.2 Perforated straps.

## 2.7 ACCESS HATCHES

.1 Provide access hatches:
.1 At concealed electrical components.
.2 At equipment and components requiring maintenance, inspections and for convenience purposes.
.3 In fixed surfaces including walls, ceilings.
.4 At other locations as required.
.2 Type: Quick opening hardware. Lockable.
.3 Fasteners
.1 General: Provide countersunk holes where fasteners are not concealed.
.2 Size: Square with minimum free opening 0.1-m2 (1-ft2). Other shapes to be approved by Owner.
.4 Finish: To match fixed surfaces.

## 2.8 OTHER ACCESSORY PRODUCTS

.1 Receptacles
.1 Provide at the following locations:
.1 As required.
.2 Where mounts are ready for receptacles.
.2 Provide types as required.
.2 Receptacle Weatherproof Covers
.1 Provide as required.

.2 Locations: Damp, wet, outdoor. Not exposed to public access.
.1 Manufacturers
.1 Hubbell Electrical Systems, Hubbell Wiring Device-KellemsLeviton Manufacturing Co., Inc.
.2 Materials
.1 Cover: Powder coated cast zinc.
.2 Hinges: Stainless steel.
.3 Gasket: Closed-cell foam.
.3 Locations: Damp, wet, outdoor. Exposed to public access.
.1 Manufacturers
.1 Hubbell Electrical Systems, Hubbell Wiring Device-Kellems
.2 Materials
.1 Cover: Die cast A360 aluminum with less than 0.004-% copper content, baked lacquer finish.
.2 Hinges: Stainless steel.
.3 Gasket: Closed-cell foam.
.4 Selection: Suitable for horizontal and vertical mounting as required.
.5 Features
.1 Weatherproof “while in use”.
.2 Labelled “extra duty”.
.3 Latching extra deep cover with large cord openings.
.4 Mounting drill points in 4 corners for mounting receptacle plate.
.5 Padlock hole 6.4-mm (0.25-in) diameter.
.6 Pre-mounted heavy-duty gasket.
.6 Other Ratings
.1 Ingress Protection
.1 Minimum NEMA Type 3R rated to NEMA-250.
.2 Maintain ratings while in use.
.7 Certifications, Listings and Registrations
.1 CSA certified.
.2 UL listed.

### 2.9 FIRE STOPPING AND SMOKE SEALS

.1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases to ULC-S115.
.2 Materials
.1 Fire stopping and smoke seal components: Certified by test laboratory to ULC-S115.
.2 In assemblies: Systems tested to ULC-S115.
.3 In wet environments, waterproof assemblies, or exterior assemblies including foundations and below grade floors: Waterproof, non-hardening.
.4 Penetrations requiring vibration control: Elastomeric seal.
.5 Damming and backup materials, supports and anchoring devices: To manufacturer’s recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
.6 Other locations: As required.
.3 Performance: Rating: 2-hours, unless otherwise required.

## PART 3 EXECUTION

### 3.1 EXAMINATION

.1 Photograph, document and submit descriptions of existing deficiencies in the affected wiring, raceway and support systems prior to commencing Work.

.2 Complete x-ray scans, consultation, and other investigative work as required to verify structural member construction, verify suitable locations, and ensure drilling and coring through structural members will not affect integrity.
.3 Investigate fire separations and non-fire-resistance rated assemblies in affected areas for existing fire stopping or smoke sealing that is improperly sealed or defective, as well as for penetrations not fire stopped, or smoke sealed.
.4 Verify characteristics of indicated components, including sizes and types, including raceways, wiring and cables, insulation, and over-current protection. Adjust sizing and selection as required.

**3.2 PREPARATION**

.1 Demolition and Removal
  .1 Remove existing unused plenum cable in affected areas.
  .2 Remove existing unused and obsolete services and components including wiring, raceway, and support systems.

**3.3 COMMON EXECUTION REQUIREMENTS**

.1 The precise type, rating, quantity and location of electrical products depend, in part, on routing and installation choices made by Contractor.
.2 Complete Work:
  .1 To ESA-OESC.
  .2 To CSA-C22.1.
  .3 To NECA-1 unless otherwise indicated.
  .4 To CSA-Z317.13.
.3 Locations
  .1 Install products in locations providing appropriate ambient conditions for its operation and allowing for adequate ventilation.
  .2 Install products to allow maintenance access and to prevent interference with adjacent equipment.
  .3 Install products to facilitate various activities including maintenance and inspection:
    .1 Provide sufficient additional wiring lengths.
    .2 Provide wiring quick disconnecting means.
  .4 Install in a manner to not interfere with normal traffic patterns.
  .5 Install above 150-mm (6-in) of floor and other similar surfaces, including surface of housekeeping pads and other similar horizontal surfaces.
  .6 Install above snow drift region, including surface of ground and roof and other similar surfaces, including equipment mounting curbs and flashing.
  .7 Install and layout to account for extremes of expansion and contraction that system may be subject to.
.4 Grounding and Bonding: Provide a separate insulated grounding and bonding conductor in raceways containing power circuits, even if such separate conductor may not otherwise be required due to raceway material construction.
.5 Power Surges: Protect upstream loads and equipment from power line, voltage transients and damage during construction power surges.
.6 Enclosures
  .1 Use dedicated enclosures.
  .2 Document enclosures that contain mixed voltages, and/or circuits operating under separate control.
.7 Junctions and Splicing: Unless otherwise indicated or required:
  .1 When modifying or extending existing wiring and cables, maximum 1 junction or splice allowed for each wire and cable, excluding terminations at required equipment, components and accessories.

.2 Otherwise, install wiring and cables in continuous lengths, free from junctions and splices, except for terminations at required equipment, components and accessories.

**3.4 POWER WIRING AND CABLES**

.1 Install as required.
.2 Locations: Provide the following.
  .1 Outdoor, fully exposed to elements, service traffic areas, subject to mechanical damage from moving objects including forklifts, carts, and vehicles:
    .1 RW90-XLPE cable in RTRC-AG-XW raceway.
  .2 Outdoor, fully exposed to elements:
    .1 RW90-XLPE cable in RTRC-AG raceway.
  .3 Outdoor, wet, or damp locations except for underground burial:
    .1 RW90-XLPE cable in RMC raceway.
  .4 Service traffic areas, including corridors and hallways and pathways within rooms, subject to mechanical damage from moving objects including forklifts, carts, and vehicles:
    .1 RW90-XLPE cable in RMC raceway.
  .5 Service areas, including rooms, exposed:
    .1 #10-AWG and smaller:
      .1 RW90-XLPE cable in EMT raceway.
    .2 Service areas, including rooms, #8-AWG and larger:
      .1 RW90-XLPE cable in EMT raceway.
  .6 Ceiling cavities, non-ducted return air plenums:
    .1 #12-AWG and smaller:
      .1 RW90-XLPE cable in EMT raceway.
    .2 #10-AWG and larger:
      .1 RW90-XLPE cable in EMT raceway.
  .7 Walls, concealed:
    .1 RW90-XLPE cable in FMC raceway.
  .8 Concealed chases, service areas, behind other surfaces:
    .1 RW90-XLPE cable in EMT raceway.
.3 Loads, Equipment and Systems Served: Provide the following superseding requirements.
  .1 Life Safety Power: Wiring and cables serving or related to an emergency power system or load, supplementary power source system or load, power to fire alarm system, or power to other life safety system:
    .1 EMERG
  .2 Life Safety Other: Wiring and cables for communications and control serving or related to fire alarm or other life safety systems wiring:
    .1 FAS cable in minimum EMT raceway or stronger raceways as required.
.4 Terminations to Loads and Equipment: Provide the following superseding requirements.
  .1 Junction Boxes
    .1 Provide junction boxes from raceways located not more that 3-m (10-feet) from equipment.
  .2 Vibration Terminations: Wiring and cables serving vibrating loads and equipment:
    .1 FMC-LT raceway.
  .3 Vibration Isolation: Terminations intended for vibration isolation:
    .1 Provide anti-vibration mounts or anti-vibration couplings at equipment.
    .2 Minimum length 1-m (40-in).

.4 Removable: Wiring and cables serving devices or components that are expected to normally be removed from mounting, regardless of frequency of removal, including for service or inspection:
.1 FMC-LT raceway.

.5 Other
.1 For other locations, terminations, and parts served, match to most similar indicated above, with minimum as follows:
.1 RW90-XLPE cable in EMT raceway.
.2 Specifically Prohibited
.1 Exposed wiring and cables.
.2 Exposed raceways in non-service areas.
.3 Exposed raceways unless specifically indicated above.

## 3.5 COMMUNICATION NETWORKS WIRING AND CABLES

.1 To power wiring and cables in this Section, with specific modifications and additional requirements under this Article.
.2 Communication Network Types: Provide the following:
.1 Ethernet:
.1 CAT5e or CAT6, installed to TIA-568.2, TIA-568.2, TIA-568.3.
.2 RS-232, RS-485, and proprietary MS/TP networks:
.1 CAT5e or CAT6, installed to TIA-568.2, TIA-568.2, TIA-568.3.
.3 Communication Network Types Modified: If controller product manufacturer has specific requirements that are of a lesser quality than as indicated above, submit for review and agreement.
.4 Raceways Modified: Raceway requirements may be modified, unless otherwise required by regulation, as follows:
.1 Raceways may be substituted with SMR raceway.
.1 Circuits: Class 2 circuits to ESA-OESC that are less than 30-V.
.2 Purpose: Wiring and cables not for the purposes of life safety, including fire.
.3 Locations
.1 Rooms.
.2 Raceways are waived for the following:
.1 Circuits: Class 2 circuits to ESA-OESC that are less than 30-V.
.2 Purpose: Wiring and cables not for the purposes of life safety, including fire.
.3 Locations
.1 Walls, concealed.
.2 Concealed chases, service areas, behind other surfaces.
.3 Ceiling cavities, non-ducted return air plenums.
.5 Components: Provide required additional components including repeaters, gateways, boosters, interfaces, and other equipment and accessories.
.6 Locations: Minimum 1-m (3.2-ft) separation from power and control wiring.
.7 Spare Lengths: Provide spare 3-m (10-ft) length at each termination.

## 3.6 CONTROL WIRING AND CABLES

.1 To power wiring and cables in this Section, with specific modifications and additional requirements under this Article.
.2 Control Types: Provide the following:
.1 All: CLA1, installed to TIA-568.2, TIA-568.2, TIA-568.3.
.3 Control Types Modified: If controller product manufacturer has specific requirements that are of a lesser quality than as indicated above, submit for review and agreement.

.4 Raceways: Install in separate raceways from power and communication network wiring and cables.
.5 Raceways Modified: Raceway requirements may be modified, unless otherwise required by regulation, as follows:
.1 Raceways may be substituted with SMR raceway.
.1 Circuits: Class 2 circuits to ESA-OESC that are less than 30-V.
.2 Purpose: Wiring and cables not for the purposes of life safety, including fire.
.3 Locations
.1 Rooms.
.2 Raceways are waived for the following:
.1 Circuits: Class 2 circuits to ESA-OESC that are less than 30-V.
.2 Purpose: Wiring and cables not for the purposes of life safety, including fire.
.3 Locations
.1 Walls, concealed.
.2 Concealed chases, service areas, behind other surfaces.
.3 Ceiling cavities, non-ducted return air plenums.
.6 Components: Provide required additional components including signal conditioning and isolation, and other equipment and accessories.
.7 Spare Lengths: Provide spare 0.5-m (1.6-ft) length at each termination.

**3.7 RACEWAYS**

.1 Size: Fill raceways to the lesser of 40-% of free area, to ESA-OESC, to CSA-C22.1.
.2 Installation and Routing
.1 Conceal raceways, except within mechanical, electrical or service rooms.
.2 Install and lay out raceways for drainage.
.3 Maintain 150-mm (6-in) minimum clearance from piping, ductwork or venting.
.4 Install raceways level, plumb, at right angles to building lines. Follow contours of supporting surfaces.
.5 Install bends and offsets uniformly without flattening.
.1 Bend raceways with minimum radius of 10-times nominal size of raceway.
.3 Fittings
.1 Connections and Couplings: Provide throughout raceway installation, including at enclosures, boxes, and final terminations.
.2 Liquid Tight Connectors: Use as follows:
.1 Locations: Damp, wet, corrosive.
.2 Terminations: Final terminations to motors and vibrating equipment.
.3 Ends
.1 Provide insulated bushings on raceway ends.
.2 Cap and seal top end of vertical raceways.
.4 Expansion: Provide telescoping joints where raceways cross building expansion joints, complete with flexible copper ground jumper.
.4 Finish: Paint as follows:
.1 To match surrounding surfaces, including colour and gloss or matte finish.
.5 Pull Wire: Provide non-abrasive pull wire in each raceway, with 300-mm (12-in) of slack at either end, and ends terminated under a screw.
.6 Enclosures and Boxes
.1 Pull Boxes: Provide pull boxes in raceways such that no wiring or cable will have to be pulled more than 2 90-degree bends or 30-m (100-ft) of raceways in 1 pulling operation.
.2 Junction Boxes: Provide as required, including for junctions and splices.

.3 Covers: Provide new covers to enclosures or boxes missing covers. Use proper screws to secure covers.
.4 Supports: Support enclosures and boxes independently of raceways and wiring and cables.

**3.8 SUPPORTS AND HANGERS**

.1 Design and provide supports and hangers as required.
.2 Support components and accessories independently of raceways.
.3 Adjust support system including hangers to equalize load.

**3.9 ACCESS HATCHES**

.1 Install as required.

**3.10 OTHER ACCESSORY PRODUCTS**

.1 Receptacles
  .1 Install as required.
.2 Receptacle Weatherproof Covers
  .1 Install as required.
  .2 Finish: Paint as follows:
    .1 As required by Owner, including colour and gloss or matte finish.
    .2 To match surrounding surfaces, including colour and gloss or matte finish.

**3.11 PENETRATIONS**

.1 Provide sleeves at penetrations and where wiring passes through assemblies including walls, floors and ceilings.
.2 Pack sleeves with resilient packing or fire rated packing and materials as required.
.3 Flash parts built into or passing through to wet environments, waterproof assemblies, or exterior assemblies including roofs, outside walls.
.4 Patch holes to match existing surfaces.
.5 Provide minimum clearances as required between sleeves and uninsulated or insulated wiring with minimum of:
  .1 Below Grade: 25-mm (1-in)
  .2 Other Locations: 13-mm (1/2-in)
.6 Sleeve Materials
  .1 Exterior Assemblies: Carbon steel schedule 40, primed and painted.
  .2 Masonry and Concrete Assemblies: Carbon steel schedule 40, primed and painted.
  .3 Interior Frame Construction Assemblies in Conditioned Spaces: Carbon steel schedule 10.
  .4 Other Frame Construction Assemblies: Carbon steel schedule 10 primed and painted.
.7 Extend floor sleeves 38-mm (1-1/2-in) above floor surface.
.8 Seal floor sleeves with an approved stiff setting caulking compound to serve as a water dam.

**3.12 FIRE STOPPING AND SMOKE SEALS**

.1 Fire stop and smoke seal at fire-resistance rated assemblies including:
  .1 Penetrations through masonry, concrete, and frame construction including gypsum board partitions and walls.
  .2 Penetrations through floor slabs, ceilings and roofs.
  .3 Openings and sleeves installed for future use.
  .4 Services, including mechanical and electrical.
  .5 As indicated.

.2 Fire stop and smoke seal at non-fire-resistance rated assemblies including:
  .1 Assemblies not fire-resistance rated but constructed as such.
  .2 As indicated.
.3 Install fire stopping and smoke seal material and components in accordance with manufacturer's certified tested system listing.
.4 Install to allow for movement and thermal expansion of services including piping and ducting.
.5 Ensure integrity of fire stopping and smoke seals such that passage of flame, smoke and gases is prevented including to unexposed side of assembly of single sided fire stopping and smoke seals. Repair as required.
.6 Ensure integrity of insulation and vapour barriers. Repair as required.
.7 Repair holes, gaps, openings and improperly fire stopped and smoke sealed penetrations in affected assemblies.
.8 Provide tags for each fire stopping and smoke seal. Include relevant information on tags including installer name, company, trade license, installation date, fire stopping and smoke seal ULC assembly number certification. Mount at locations as approved by Owner or as required by authorities having jurisdiction.

## 3.13 LABELLING

.1 Labelling to match existing labelling scheme if possible and if approved by Owner, otherwise to meet Owner requirements.
.2 Wiring and Cables
  .1 Maintain consistent color-coding.
  .2 Match colour coding of internal wiring and cables of pre-wired components where possible.
  .3 Provide wire markers at the following locations.
    .1 Both ends.
    .2 At enclosures and boxes, including junction and pull boxes.
    .3 At other terminations.
.3 Controls and Communications Wiring and Cables
  .1 Label with point or controls or network name with 3 rows of characters per label.
  .2 Locations
    .1 Both ends.
    .2 At enclosures and boxes, including junction and pull boxes.
    .3 At other terminations.
  .3 Manufacturers
    .1 Thomas & Betts Limited
    .2 Brady Worldwide, Inc.
  .4 Type: 12-character metalized polyester labels.
.4 Enclosures and Boxes
  .1 Label enclosures and boxes with permanent means, including junction and pull boxes.
  .2 Identify purpose and power circuit(s).
.5 Directories: Prepare updated written circuit directory on affected panels. Affix updated circuit directory to panel door, enclosed in a plastic protective sleeve.

## 3.14 STARTUP

.1 Insulation Testing
  .1 Test insulation integrity on circuits before powering:
    .1 Visually inspect insulation.
    .2 Complete sufficient meg-ohm meter (megger) measurements to confirm quality and integrity of insulation.

**END OF SECTION 26 05 00**

# SECTION 26 90 00 CONTROL DEVICES

## PART 1 GENERAL

### 1.1 SECTION INCLUDES

.1 Control devices, end devices, actuators, transmitters, transducers, sensors, probes.

### 1.2 REFERENCED DOCUMENTS

.1 ASHRAE-G-11: ASHRAE-G-11-2009 Guideline on Field Testing of HVAC Controls Components.
.2 CSA-C22.2-60529: CAN/CSA-C22.2-60529-16 Degrees of Protection Provided by Enclosures (IP Code).
.3 CSA-E60730-1: CAN/CSA-E60730-1-15 Automatic Electrical Controls for Household and Similar Use - Part 1: General Requirements.
.4 EUL-RoHS: European Union Legislation 2002/95/EC Restriction of Hazardous Substances Directive (RoHS).
.5 IEC-60529: ANSI/IEC-60529-2013 Degrees of Protection Provided by Enclosures (IP Code).
.6 NEMA-250: NEMA-250-2014 Enclosures for Electrical Equipment (1000 Volts Maximum).

### 1.3 DEFINITIONS

.1 “Affected Systems”: Systems, equipment, services and control systems that are not part of Work but whose operation may be impacted by Work.
.2 “Device”: Transmitters, sensors, probes, and any other device or component in whole or in part that either provides a signal as an input to a controller, or accepts a control signal from a controller, whether or not the device or component may itself act as a controller.

### 1.4 SUBMITTALS FOR ACTION

.1 Product Data
  .1 Manufacturers’ product literature, specifications, and datasheets. Include the following information:
    .1 Product characteristics.
    .2 Performance criteria.
    .3 Options.
    .4 Limitations.
    .5 Photographs.
    .6 Supplier information.
  .2 Performance criteria for end devices includes accuracy, operating environment tolerances, and stability criteria.
  .3 Detailed bill of material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
.2 Shop Drawings
  .1 Floor plan drawings showing location of system components.
  .2 System schematics and flow diagrams indicating point location, name, and hardware address.
  .3 Device list describing location, function, power supplies, signal conditioning.
  .4 Wiring and ladder logic diagrams detailing required interfaces and hardware interlocks.
  .5 Wiring and ladder logic diagrams describing important existing undocumented interfaces and hardware interlocks.
  .6 Interlocks: Schematic and wiring diagrams detailing electrical interlocks and life safety system interfaces.

### 1.5 SUBMITTALS FOR INFORMATION

.1 Manufacturer Information
  .1 Operating and Maintenance Manuals
  .2 Installation Instructions
.2 Testing Report: A report detailing the results of testing activities including the following:
  .1 Dates of testing activities.
  .2 Names and contact information of testing technician.
  .3 Point Calibration Results: Include points and devices tested, method for testing, potential variances, observations including point values, measured values, discrepancies, and a description of corrective action taken.
  .4 Output Testing Results: Include points and devices tested, method for testing, potential variances, observations including point values, measured values, discrepancies, and a description of corrective actions taken.
  .5 Failure Mode Test Results
  .6 Software State Test Results
  .7 Interlocks Test Results
  .8 Completed Testing Check List

### 1.6 SUBMITTALS FOR CLOSEOUT

.1 Tools and Software
  .1 4 sets of common keys to enclosures.
  .2 Control device test kits and calibration kits.

### 1.7 ADMINISTRATIVE REQUIREMENTS

.1 Testing Plan Review
  .1 Submit Testing Plan for approval 20-days prior to testing.
  .2 Revise the Testing Plan as required to the satisfaction of the Engineer.
  .3 Submit the Testing Report demonstrating results of testing activities.
  .4 Coordinate testing activities with Commissioning activities.

### 1.8 WARRANTY

.1 Special Warranty
  .1 Update site documentation including paper and electronic versions as required.

## PART 2 PRODUCTS

### 2.1 EXISTING PRODUCTS

.1 Indicated devices approximately as indicated. Confirm quantities and details by site investigation and review of available documentation.

### 2.2 COMMON PRODUCT REQUIREMENTS

.1 Select and size devices to be suitable for the application, including compatibility with controllers, power supplies, signal conditioning hardware, wiring and other equipment, ease of maintenance, adjustability, tolerances, signal resolution, inrush currents, and operating environment.
.2 Devices including sensors to be complete with transmitters unless otherwise indicated.
.3 Select device scale ranges to suit the application, including operating temperatures, pressure or vacuum, with readings at approximately mid-point on the scale where applicable.
.4 Options
  .1 Available product options are defined for each device.
  .2 Provide devices with the specific product options indicated in Contract Documents.

.3 Where specific product options are not indicated elsewhere in Contract Documents, including where a product options field is blank or not present, provide all options for that device.
.1 In cases of inconsistency(s) or conflict(s) between options, provide options of greater quality or that meet more stringent requirements as determined by Engineer.

.5 Indicated device accuracies and stability include errors associated with the sensor, including lead wire, and analog to digital conversion, unless otherwise indicated.

.6 Substitution Limitations
.1 Substitutions may be accepted under substitution provisions described in Contract Documents.
.2 Substitutions may be limited by various requirements and may require re-design, including:
.1 Performance requirements.
.2 Physical characteristics, including weight, height, length, width.
.3 Aesthetics.
.4 Additional and separate components required.
.3 Acceptable Substitution Manufacturers
.1 As indicated, otherwise where not indicated, to controller manufacturer.

## 2.3 COMMON PRODUCT OPTIONS

.1 Where the following options are indicated, provide devices to this Section except requirements are superseded or supplemented by these common product options.
.1 AM-CS: Add additional manufacturer to manufacturers listed under device with control system manufacturer.
.2 AM-TU: Add additional manufacturer to manufacturers listed under device with terminal unit manufacturer.
.3 MM-CS: Match device manufacturer to that of control system manufacturer, instead of manufacturers listed under device.
.4 MM-TU: Match device manufacturer to that of terminal unit manufacturer, instead of manufacturers listed under device.

## 2.4 ACTUATORS - ELECTRONIC

.1 Provide as required.
.2 Manufacturers
.1 Belimo Automation AG
.2 Bray International, Inc.
.3 Johnson Controls, Inc.
.3 Features
.1 Motor: Brushless DC motor with overload protection.
.2 Stall Protection: Mechanical or electronic stall protection to prevent damage to actuator throughout rotation of actuator.
.3 Manual Positioning: Manual position override with handwheel if available in product series or 5-mm (3/16-in) hex key.
.4 Adjustable Stop: Accessible, field adjustable mechanical stop to limit travel in either direction.
.5 Compatibility: Ensure compatibility to equipment and components, including valves, dampers, and other devices being positioned by actuator.
.6 Visual Position Indication: Clearly visible position indicator driven directly by actuator shaft.
.4 Options
.1 Control Input

.1 3PF: 3 point floating modulating positioning control. 2 digital signals will open or close the actuator accordingly.
.2 O/O: On/off positioning control. Open or close position based on a single digital control signal.
.3 PC: Phasecut modulating positioning control.
.4 PRO: Proportional modulating positioning control.
.1 Repeatable positioning based on a 2-VDC to 10-VDC or 4-mA to 20-mA control signal.
.2 Resolution/positioning accuracy minimum 80:1.
.5 PWM: Pulse width modulating positioning control.

.2 Actuator Speed
.1 FA: Fast acting. Move full stroke within 10-sec when driven by motor at temperatures above -20-°C (-4-°F), independent of load.
.2 QA: Quick acting. Move full stroke within 20-sec when driven by motor at temperatures above -20-°C (-4-°F), independent of load.
.3 SA: Standard acting. Move full stroke within 90-sec when driven by motor temperatures above -20-°C (-4-°F), independent of load.
.4 SP-ADJ: Adjustable speed. Field adjustable full stroke travel time.
.1 Minimum range: 40-% to 100-%.

.3 Position
.1 ES: End switches. Quantity 2 built-in SPDT auxiliary switches. 1 switch fixed at no more than 10-° actuator position, 1 switch field adjustable between 10-° and 90-°.
.2 FB: Feedback signal. Built-in true position feedback.

.4 Failure Positioning
.1 FS: Fail safe. Upon loss of line power, integral batteries or capacitors drive actuator to field adjustable fail position between 0-° and 90-°.
.1 Move full stroke within 60-sec at temperatures above -20-°C (-4-°F), independent of load.
.2 SR: Spring return. Upon loss of line power, an internal spring drives actuator to field adjustable fail position to either full open or full closed.
.1 Move full stroke within 60-sec at temperatures above -20-°C (-4-°F), independent of load.
.3 SR-QA: Spring return quick acting. Upon loss of line power, an internal spring drives actuator to field adjustable fail position to either full open or full closed.
.1 Move full stroke within 20-sec at temperatures above -20-°C (-4-°F), independent of load.

.5 Enclosure
.1 ENC: Minimum IP54, certified to CSA-C22.2-60529.
.2 ENC5: Minimum IP65, certified to CSA-C22.2-60529. Provide HTR with this enclosure.

.6 Other
.1 HTR: Heater. Line voltage electric heater, sized to prevent condensation on actuator body.
.2 QM: Quiet motion. Noise level not more than 46-dB(A) under motor power at minimum speed.

.5 Performance
.1 Torque: Minimum 125-% of recommended torque for application.
.2 Angle of Rotation: 95-°

.6 Ratings: Without HTR option:
.1 Temperature: -20-°C to 50-°C (-4-°F to 122-°F).

.2 Humidity: 0-%RH to 95-%RH, non-condensing.

.7 Certifications, Listings and Registrations

.1 CSA-E60730-1.

**2.5 ELECTRICAL CURRENT TRANSDUCERS**

.1 Provide as indicated.

.2 Features

.1 Split core current sensor.

.2 Self powered from conductor cable.

.3 Field selectable current ranges.

.4 LED indication.

.3 Performance

.1 Accuracy: +/-2.0-% of selected range.

.2 Sensor Response Time: Maximum 2-sec.

.4 Ratings

.1 Current: Maximum 120-A continuous.

.2 Ambient Temperature: -15-°C to 60-°C (5-°F to 140-°F)

.3 Ambient Humidity: 0-%RH to 95-%RH

**2.6 ELECTRICAL CURRENT SWITCHES**

.1 Provide as indicated.

.2 Features

.1 Split core current switch.

.2 Self powered from conductor cable.

.3 Field adjustable current trip setpoint.

.4 Over/under current sensing switching mode.

.5 Normally open status switch.

.6 LED indication.

.3 Options

.1 OUT: Output relay module. SPST-NO relay rated at 10-A@260-VAC and 5-A@30-VDC.

.4 Performance

.1 Current: 1.25-A to 135-A

.5 Ratings

.1 Output Relay

.2 Ambient Temperature: -15-°C to 60-°C (5-°F to 140-°F)

.3 Ambient Humidity: 0-%RH to 95-%RH

.6 Certifications, Listings and Registrations

.1 EUL-RoHS compliant.

**2.7 ELECTRIC SWITCHES - CONTROL RELAY**

.1 Provide as required.

.2 Features

.1 Plug-in relays with separate base.

.2 Light emitting diode indicator.

**2.1 ELECTRIC SWITCHES - INTEGRATED HAND-OFF-AUTO CONTACTOR**

.1 Features

.1 Integrated status relay.

.2 Hand/Off/Auto selector switch.

.3 Integrated motor overloads with adjustable trip.

.2 Ratings

.1 1-hp at 120-VAC, 1.5-hp at 277-VAC.

.3 Certifications, Listings and Registrations

.1 UL listed.

**2.2 ELECTRIC SWITCHES - POWER CONTACTOR**

.1 Provide as indicated.
.2 Features
  .1 Screw terminals.
  .2 Visible state indicator.
  .3 Power: 3 phase unless otherwise required.
.3 Size: Minimum 150-% of circuit rating.

**2.3 HUMIDITY TRANSMITTERS - AIR - DUCT**

.1 Provide as indicated.
.2 Features
  .1 Sensor: Thermoset polymer based capacitive sensor.
  .2 Transmitter Enclosure
    .1 Hinged.
    .2 Filter to protect sensor from contaminants, 60-µm (2.36-in/1,000), HDPE.
  .3 Protection Circuitry: Reverse voltage protected and output limited.
.3 Materials
  .1 Probe: 304 stainless steel.
.4 Options
  .1 Sensor
    .1 AC2: Accuracy +/-2-%RH at 25-°C (77-°F).
    .2 AC3: Accuracy +/-3-%RH at 25-°C (77-°F).
    .3 NTC: NTC thermistor temperature sensor. Additional to humidity sensor.
      .1 Accuracy: +/-0.2-°C (-0.4-°F) over range.
    .4 RTD: Platinum RTD temperature sensor. Additional to humidity sensor.
      .1 Accuracy: +/-0.3-°C (+/-0.54-°F) at 0-°C (32-°F).
  .2 Display
    .1 LCD: Liquid crystal display of temperature, configurable to display in Celsius and Fahrenheit, minimum 3 digits.
  .3 Transmitter Enclosure
    .1 ABS1: ABS enclosure. Minimum IP61, certified to CSA-C22.2-60529.
    .2 ABS5: ABS weatherproof enclosure. Minimum IP65, certified to CSA-C22.2-60529.
    .3 GS: Galvanized steel enclosure. Minimum IP50, certified to CSA-C22.2-60529.
    .4 ALU: Cast aluminum weatherproof enclosure. Minimum IP64, certified to CSA-C22.2-60529.
.5 Performance
  .1 Sensor Range Capability: 0-%RH to 100-%RH.
  .2 Temperature Dependence: Maximum +/-0.05-%RH/°C.
  .3 Hysteresis: Maximum +/-1.5-%RH.
  .4 Repeatability: Maximum +/-0.5-%RH.
  .5 Linearity: Maximum +/-0.5-%RH.
  .6 Stability: Maximum +/-1-%RH at 50-%RH in 5-year.
  .7 Sensor Response Time: Maximum 15-sec.
  .8 Sensitivity: Minimum 0.1-%RH.
.6 Ratings
  .1 Ambient Temperature: -40-°C to 85-°C (-40-°F to 185-°F)
  .2 Ambient Humidity: 0-%RH to 95-%RH non-condensing.
.7 Certifications, Listings and Registrations
  .1 EUL-RoHS compliant.

## 2.4 PRESSURE TRANSMITTERS - AIR - DIFFERENTIAL

.1 Provide as indicated.
.2 Type
  .1 Low differential pressure for air or similar non-conducting gases.
.3 Features
  .1 Transmitter Enclosure: Hinged.
  .2 Probes: 6.3-mm (0.25-in) diameter with baffles to prevent velocity pressure errors.
  .3 Settings
    .1 Field zeroing.
    .2 Bidirectional output at zero.
  .4 Ranges
    .1 Available ranges for unidirectional of from 0-Pa (0-inWC) to 25-Pa, 63-Pa, 125-Pa, 250-Pa, 623-Pa, 2,490-Pa (0.1-inWC, 0.25-inWC, 0.5-inWC, 1.0-inWC, 2.5-inWC, 10-inWC).
  .5 Connections
    .1 Strain reliefs and raceways openings as required.
.4 Materials
  .1 Transmitter Enclosure: Polycarbonate, painted finish.
  .2 Probes: Extruded aluminum.
  .3 Pressure Fittings: Brass.
.5 Options
  .1 Transmitter
    .1 AC02
      .1 Accuracy: +/-0.25-% full scale of root sum square for non-linearity, hysteresis, and non-repeatability.
      .2 Non-Linearity: +/-0.22-% full scale of best fit line method.
    .2 AC04
      .1 Accuracy: +/-0.4-% full scale of root sum square for non-linearity, hysteresis, and non-repeatability.
      .2 Non-Linearity: +/-0.38-% full scale of best fit line method.
    .3 AC05
      .1 Accuracy: +/-0.5-% full scale of root sum square for non-linearity, hysteresis, and non-repeatability.
    .4 AC1
      .1 Accuracy: +/-1.0-% full scale of root sum square for non-linearity, hysteresis, and non-repeatability.
      .2 Non-Linearity: +/-0.98-% full scale of best fit line method.
    .5 FSR - Field Selectable Ranges
      .1 Selectable to the following of full range: 100-%, 50-%, 25-%.
  .2 Sensor
    .1 UNI - Unidirectional
    .2 BID - Bidirectional
  .3 Display
    .1 LCD - Liquid Crystal Display: Display of line pressure and differential pressure, minimum 3 digits.
.6 Performance
    .1 Hysteresis: +/-0.10-% full scale.
    .2 Non-Repeatability: +/-0.5-% full scale.
  .2 Thermal Effects: Maximum thermal error calibrated at nominal 21-°C (70-°F).
    .1 Compensated Temperature Range: 5-°C to 65-°C (40-°F to 150-°F)
    .2 Zero/Span Shift: +/-0.06-°C (+/-0.033-°F) full scale.

.3 Long Term Stability: 0.1-% full scale.

.7 Ratings
.1 Housing: Minimum IP65, certified to CSA-C22.2-60529.
.2 Pressures
.1 Line Pressure: Upper limit of 69-kPa (10-psi) or greater.
.2 Over Pressure: Upper limit of 69-kPa (10-psi) or greater at maximum range.
.3 Temperatures
.1 Transmitter: Ambient: -18-°C to 65-°C (0-°F to 150-°F)
.2 Sensor: Pressure Media: Wider range than ambient temperature for transmitter.

.8 Certifications, Listings and Registrations
.1 NIST traceable calibration.

**2.5 TEMPERATURE SWITCHES - AIR - DUCT - LOW LIMIT (FREEZESTATS)**

.1 Provide as indicated.
.2 Features
.1 Controller
.1 Low limit controller with 1 NO SPST snap switch as well as separate 1 SPST NC snap switch.
.2 Manual reset.
.3 Setpoint scale and adjustment with slotted screw.
.2 Sensor: 6.1-m (20-ft) sensing element.
.3 Enclosure: Steel with enamel paint.
.3 Performance
.1 Setpoint Range Capability: -9-°C to 113-°C (15-°F to 55-°F)
.2 Differential: Non-adjustable and additive 2.77-°C (5-°F)
.4 Ratings
.1 Ambient Temperature
.1 Case: 7-°C (20-°F) to 60-°C (140-°F)
.2 Element: Maximum 121-°C (250-°F)
.5 Certifications, Listings and Registrations
.1 UL Listed.
.2 CAS Listed.

**2.6 TEMPERATURE TRANSMITTERS - AIR - DUCT**

.1 Provide as indicated.
.2 Features
.1 Transmitter Enclosure: Hinged.
.2 Protection Circuitry: Reverse voltage protected, and output limited.
.3 Options
.1 Sensor
.1 Probe or cable length as required including quantity of multiple points where applicable.
.2 NTC: NTC thermistor.
.1 Accuracy: +/-0.2-°C (-0.4-°F) over range.
.3 RTD: Platinum RTD.
.1 Accuracy: +/-0.3-°C (+/-0.54-°F) at 0-°C (32-°F).
.4 MPC-F: Multi-point probe with flexible cable.
.1 Materials: FT6 plenum rated cable.
.5 MPP-F: Multi-point flexible probe.
.1 Materials: Copper.
.6 MPP-R: Multi-point rigid probe.
.1 Materials: 304 stainless steel.

.7 SPP-R: Single point rigid probe.
.1 Materials: 304 stainless steel.
.2 Display
.1 LCD: Liquid crystal display of temperature, configurable to display in Celsius and Fahrenheit, minimum 3 digits.
.3 Transmitter Enclosure
.1 ABS1: ABS enclosure. Minimum IP61, certified to CSA-C22.2-60529.
.2 ABS5: ABS weatherproof enclosure. Minimum IP65, certified to CSA-C22.2-60529.
.3 GS: Galvanized steel enclosure. Minimum IP50, certified to CSA-C22.2-60529.
.4 ALU: Cast aluminum weatherproof enclosure. Minimum IP64, certified to CSA-C22.2-60529.
.4 Performance
.1 Sensor Range Capability: -20-°C to 105-°C (-4-°F to 221-°F)
.2 Transmitter Accuracy: +/-0.1-% of span, including linearity.
.5 Ratings
.1 Ambient Temperature: 0-°C to 70-°C (32-°F to 158-°F), or -40-°C to 85-°C (-40-°F to 185-°F) if required by location.
.2 Ambient Humidity: 0-%RH to 95-%RH non-condensing.
.6 Certifications, Listings and Registrations
.1 EUL-RoHS compliant.

## 2.7 TEMPERATURE TRANSMITTERS - AIR - ZONE

.1 Provide as indicated.
.2 Features
.1 Protection Circuitry: Reverse voltage protected, and output limited.
.3 Options
.1 Sensor
.1 NTC: NTC thermistor temperature sensor. Additional to humidity sensor.
.1 Accuracy: +/-0.2-°C (-0.4-°F) over range.
.2 Sensor Range Capability: 0-°C to 50-°C (32-°F to 122-°F)
.2 RTD: Platinum RTD temperature sensor. Additional to humidity sensor.
.1 Accuracy: +/-0.3-°C (+/-0.54-°F) at 0-°C (32-°F).
.2 DSE: Décor style enclosure.
.1 Colour: White.
.2 Materials: ABS
.3 Ratings: Minimum IP20, certified to CSA-C22.2-60529.
.4 Dimensions: 70-mm x 114-mm x 32-mm (2.75-in x 4.5-in x 1.25-in)
.5 Ratings
.1 Ambient Temperature: 0-°C to 70-°C (32-°F to 158-°F)
.2 Ambient Humidity: 0-%RH to 95-%RH non-condensing.
.3 MFE: Multi-function enclosure.
.1 Colour: White.
.2 Materials: ABS
.3 Ratings: Minimum IP20, certified to CSA-C22.2-60529.
.4 Dimensions: 84-mm x 117-mm x 29-mm (3.3-in x 4.6-in x 1.15-in)
.5 Display Options
.1 LCD: Liquid crystal display of temperature, configurable to display in Celsius and Fahrenheit, minimum 3 digits.
.2 LED-G: LED indicator, green colour.
.3 LED-R: LED indicator, red colour.
.4 LED-Y: LED indicator, yellow colour.

.5 SPA-T: Temperature setpoint adjustment. Front panel mount, slide potentiometer.
.6 Other Options
.1 ORS: Override switch. Front panel mount, momentary push-button, 2 wire dry contact (NO SPST 50-mA@12-VDC).
.2 SSS5: Speed selector switch. Side panel mount, 5 position switches. Typically used for fans. Range: Off, Auto, Low, Medium, High.
.3 COMJ: Communications jack. 4-pin header connector to 4-pin terminal block.
.7 Ratings
.1 Ambient Temperature: 0-°C to 50-°C (32-°F to 122-°F)
.2 Ambient Humidity: 0-%RH to 95-%RH non-condensing.
.4 SPE: Moisture resistant steel plate enclosure.
.1 Materials: 304 stainless steel plates.
.2 Ratings: Minimum IP20, certified to CSA-C22.2-60529.
.3 Dimensions: 71-mm x 114-mm (2.78-in x 4.5-in)
.4 Features: Neoprene gasket. Filter to protect sensor from contaminants, 100-µm (3.94-in/1,000), sintered stainless steel.
.5 Ratings
.1 Ambient Temperature: 0-°C to 70-°C (32-°F to 158-°F)
.2 Ambient Humidity: 0-%RH to 95-%RH non-condensing.
.4 Performance
.1 Transmitter Accuracy: +/-0.1-% of span, including linearity.
.5 Certifications, Listings and Registrations
.1 EUL-RoHS compliant.

**2.8 ELECTRIC ACCESSORY PRODUCTS**

.1 Signal Isolation Transducers
.1 Provide signal isolation transducers for analog output signals to be interfaced as inputs, including to and from controllers and independent control systems.
.2 Signal Conditioning
.1 Provide as required.
.3 Control Transformers
.1 Provide as required.
.2 Type
.1 Fused or current limiting type.
.3 Size: 125-% rated load capacity.
.4 Power Supplies
.1 Provide as required.
.2 Type
.1 Switching or full bridge rectification.
.3 Features
.1 Fused.
.2 Power disconnect switch.
.4 Size: 125-% rated load capacity.
.5 Performance
.1 Line Regulation: +0.05-% for 10-% line change.
.2 Load Regulation: +0.05-% for 50-% load change.
.3 Ripple and Noise: 1-mV rms, 5-mV peak to peak.
.5 Wiring and Cables
.1 Provide interfacing as required.

**2.9 PNEUMATIC ACCESSORY PRODUCTS**

.1 Air Static Pressure Probes

.1 Provide as required, including accessories, mounts.
.2 Insertion depths and arrangements as required for high performance and limited by service size.
.3 Sensors
.1 Stainless steel static pressure tips.
.2 Mounting flanges with integral rubber gasket.
.4 Gauges and Switches
.1 Brass static pressure tips.
.2 Angled tip.
.3 Minimum 4 radially drilled 1-mm (0.040-in) diameter sensing holes.
.2 Electronic/Pneumatic Transducers
.1 Provide as required.
.2 Manufacturers
.1 Greystone Energy Systems Inc.
.2 Johnson Controls, Inc.
.3 Mamac Systems, Inc.
.3 Features
.1 Manual output adjustment.
.2 External replaceable supply air filter.
.3 Pressure gauge.
.3 Tubing and Piping
.1 Provide as required.
.2 Materials
.1 Copper: Provide unless otherwise required.
.2 Plastic: Flame retardant PVC tubing with minimum burst gauge pressure of 1.4-MPa (200-psi) at 80-°C (176-°F).

### 2.10 FIRE STOPPING AND SMOKE SEALS

.1 Provide as required.
.2 To Section 23 05 00 Piping and to Section 26 05 00 Wiring and Cables.

## PART 3 EXECUTION

### 3.1 EXAMINATION

.1 Complete the following examination activities within 5-days after the date of execution of Contract.
.1 Verify type, quantity and condition of existing devices and controllers.
.2 Confirm the suitability of the points for the specific installation, purpose, goal, and final system installed.
.3 Complete a detailed investigation of existing network architecture and network wiring topology.
.4 Submit written notification of the results of the investigation.
.2 Submit relocation plan, and obtain approval before relocating services, panels, or equipment not indicated.
.3 Complete sufficient examination of existing controllers or equipment ladder logic, including modifications, to properly interface and interlock controls.

### 3.2 COMMON EXECUTION REQUIREMENTS

.1 Location
.1 Install devices and related accessories in local enclosures where possible.
.2 Install devices in accessible locations.
.3 Maintain minimum 610-mm (2-ft) clearance from equipment that may emit electromagnetic fields, including transformers, coils.
.2 Provide hard wired interlocks for safety devices, including on equipment, components, devices, controllers.

.3 Interfacing
  .1 Controls may require interfacing, including to equipment, components, devices, controllers. Interfacing requirements apply whether or not specific control or end device(s) is provided.
  .2 Investigate and report on failed or deficient functionality and capability of existing products, including safeties and interlocks.
  .3 Interfacing to be completed in a manner that maintains functionality and capability including safeties, interlocks, whether or not these items were previously functional.
  .4 Provide instructions from manufacturers of new and existing products on requirements for interfacing. Manufacturers to complete site investigations as required.
.4 Provide additional components as required, including additional points, end devices, power supplies, signal conditioning, interfaces, piping, tubing, wiring.
.5 Complete configuration on site, including settings, programming and user interface.
.6 Configure device scale ranges to suit the application, including operating temperatures, pressure or vacuum, with readings at approximately mid-point on the scale where applicable.
.7 Provide, test, and calibrate devices as required, including sensors, transmitters, voltage and current measurement devices, analog to digital converters, and other input devices.

**3.3 DEVICE APPLICATION - DUCT**

.1 Mount duct sensors in an electrical box through a hole in duct.

**3.4 DEVICE APPLICATION - OUTDOOR**

.1 Install devices that record outdoor environmental conditions (including temperature, humidity, pressure) outdoors on north facing side of building, at highest location on building (for temperature and humidity), or at location closest in elevation to secondary pressure reference point (for pressure), and shielded from sun and wind as well as reflection and other heat or vent sources including ventilation, combustion, piping, plumbing.
.2 Provide aluminum vented sun and wind shield, securely mounted to building, formed to mount above and at top sides of sensor, primed and painted and finished.

**3.5 DEVICE APPLICATION - ZONE**

.1 Mount sensors on surfaces or supports as required. Subject to Owner approval.
.2 Relocate existing devices into zone area as required, including devices incorrectly located in ceiling plenums and ceiling areas.

**3.6 DEVICE MOUNTING - IMMERSION STYLE**

.1 Provide thermowells as required.

**3.7 DEVICE TYPE - ACTUATORS**

.1 Configure as required, including rotation, rotation limits, fail position and direction, speed, signal.
.2 Mount such that rotation indicator is visible from floor.
.3 Feedback Signal: When not connected directly to a controller input, wire back to a terminal strip in the control panel or relevant enclosure for trouble-shooting purposes.

**3.8 DEVICE TYPE - ELECTRICAL CURRENT**

.1 Motor Status: Calibrate to indicate positive run status only when motor is operating under load. Account for motors running under no or low load. A motor running with a broken belt or coupling shall indicate a negative run status.

**3.9 DEVICE TYPE - ELECTRIC SWITCHES**

.1 Contactors
  .1 Install as required.
  .2 Location: Within enclosures.

.2 Relays
  .1 Install as required.
  .2 Locations
    .1 Within enclosures.
    .2 Mount relay in equipment or component wiring compartments or chases. Otherwise mount relay remotely to nearest accessible junction box.
    .3 When mounted in wiring compartments or chases of heating equipment or component without separation between control and power circuits, provide Class 1 circuit for control circuit including Class 1 transformer, and raceway within enclosures.

**3.10 DEVICE TYPE - FLOW**

.1 Install to provide required straight services lengths upstream and downstream of device. Modify services as required, including piping and ductwork.

**3.11 DEVICE TYPE - OTHER SWITCHES**

.1 Install as required.

.2 Locate in appropriate locations for full performance and protection of systems.

.3 Provide interlocks as required.

**3.12 DEVICE TYPE - PRESSURE**

.1 Unless otherwise indicated, locate devices, including tubing and piping and reference ports, at locations most appropriate for performance and optimum system efficiency. As approved by Engineer. Requirements include:
  .1 Suitable for intended use and effect.
  .2 Device concealment in specific locations, including occupied zones.
  .3 Device mounting locations, including at farthest end of distribution system.
  .4 Reference ports to various locations that may be distinctly remote from device.
  .5 Accounting for impact on pressure readings due to stack effect, wind, zone pressure. Protection from pressure variations and moving air including ventilation, stack effect, wind effects, elevator doors and lobbies, as well as to protect from debris and insects.
  .6 Device mounting in locations for easy reading of any displays.

.2 Provide additional devices and reference tubing and piping components as required, including pitot tubes and probes.

.3 Tubing: Mount outdoor reference tubing and piping in enclosures, minimum NEMA Type 4 rated to NEMA-250, protected from sun, reflection, wind, weather, and other heat or vent sources including ventilation, combustion, piping, plumbing.

.4 Piping
  .1 Pipe connections to manufacturers recommended location for pipe orientation.
  .2 Provide minimum 50-mm (1/2-in) lines to device. Reduce at device.
  .3 Provide enclosure mounted tee fittings and shutoff valves in the high and low sensing pick-up lines to allow permanent, easy-to-use testing, calibration, and maintenance.

.5 Documentation: For devices with multiple connections and shutoff valves, document various shutoff valve modes for specific purposes, including mode title, valve tags, valve positions. Document to be complete with laminated chart.

**3.13 DEVICE TYPE - TEMPERATURE - DUCT**

.1 Where specific type and options not indicated, select the following probe types:
- .1 Provide multi-point flexible probe (MPP-F) sensors for ductwork greater than 1.5-m (5-ft) in width or height and greater than 1.5-m2 (15-ft2), or in conditions with unevenly distributed air, including air temperature stratification and air turbulence.
- .2 Provide multi-point rigid probe (MPP-R) sensors for ductwork less than 1.5-m (5-ft) in width or height but greater than 1.0-m (3-ft) in width or height, or in conditions with unevenly distributed air, including air temperature stratification and air turbulence.
- .3 Otherwise, provide single point rigid probe (SPP-R) sensors.

.2 Increase quantity of devices per indicated point to suit duct size and achieve performance as determined by Engineer.

**3.14 DEVICE TYPE - TEMPERATURE AND HUMIDITY**

.1 Seal openings including signal wiring and cable to prevent air from other areas affecting the readings.

.2 Seal sensors located on walls and other surfaces to prevent air currents from within surface impacting sensor readings.

**3.15 ELECTRIC ACCESSORY PRODUCTS**

.1 Signal Isolation Transducers
- .1 Install as required.

.2 Signal Conditioning
- .1 Install as required.

.3 Control Transformers
- .1 Install as required.

.4 Power Supplies
- .1 Install as required.

.5 Wiring and Cables
- .1 Install as required.
- .2 Make ready for raceway connections for wiring and cables unless otherwise indicated.

**3.16 PNEUMATIC ACCESSORY PRODUCTS**

.1 Electronic/Pneumatic Transducers
- .1 Install as required.

.2 Tubing And Piping
- .1 Protection: Mechanically protect tubing and piping from mechanical damage.
- .2 Gauges and Filters: Provide pressure gauges on the output side of each pneumatic output point. Provide disposable cartridge filter (in clear plastic casing) at input (main air side) of each electro-pneumatic transducer (EPT).
- .3 Supports and Hangers: Fasten tubing and piping to walls, ceilings, ductwork, supports, and enclosures as required.
- .4 Labelling: Label tubing and piping in same manner as wiring and cables to Section 26 05 00 Wiring and Cables. Follow existing labelling convention if possible.

**3.17 OTHER ACCESSORY PRODUCTS**

.1 Zone Device Guards
- .1 Install as required. Obtain approval from Owner.

.2 External Manual Override Stations

.1 Install as required.

**3.18 FIRE STOPPING AND SMOKE SEALS**

.1 Install as required.
.2 To Section 23 05 00 Piping and to Section 26 05 00 Wiring and Cables.

**3.19 LABELLING**

.1 Labelling to match existing labelling scheme if possible and if approved by Owner, otherwise to meet Owner requirements.
.2 Label with point or controls or network name with 3 rows of characters per label.
.3 Type: 12-character metalized polyester labels.
.4 Colours: Black lettering on clear backing.
.5 Ceiling Labelling
    .1 Provide coloured labels on ceiling surfaces to indicate equipment and components including the following. Colours indicated are indicative of requirements and Owner may change for each type of equipment or component.
        .1 Red
            .1 Other fire safety system components.
        .2 Yellow
            .1 Controllers.
            .2 Control devices.
            .3 Electrical distribution components.
        .3 Grey
            .1 Communication or sound components.
        .4 Black
            .1 Other building services.
    .2 Provide labels as acceptable to Owner, including label type, material, size and colour. Owner may require lamacoids, adhesive labels with text, adhesive labels with no text.
    .3 Mark each label as acceptable to Owner, including equipment label, type, power circuit.

**3.20 FIELD QUALITY CONTROL**

.1 Field test each system independently and then in unison with other related systems, to ASHRAE-G-11, including non-HVAC systems and points.
.2 Complete point by point tests on all points and devices, including digital, analog, input, output, network, independent devices.
    .1 Test and calibrate network points.
    .2 Test and calibrate analog input points.
    .3 Test each digital input switching contacts, and digital input signal.
    .4 Test each digital output to ensure proper operation, fail mode, and lag time.
    .5 Test each analog output to ensure proper operation of controlled devices.
    .6 Stroke actuated devices fully open and fully closed. Verify installation including tight closure, mechanical limit setting, and proper spring return orientation.
    .7 Test and verify fail modes, interlocks, and other software modes of operation.
.3 Adjust, test, and reconfigure affected systems to maintain original operation.
.4 Correct problems with affected systems during the warranty period.
.5 Submit test reports as required.
.6 Fire Testing: Provide assistance as required for the next scheduled fire test.

**3.21 ADJUSTING**

.1 Set and adjust as required.
.2 Adjust the following as required:

.1 Device settings and adjustable parameters.
.2 Device calibration.

.3 Fluid Level, Low Fluid, Flow Sensors and Switches
.1 Set and coordinate settings with requirements of system and other flow devices including pumps and control valves.
.2 Allow for 4 additional site visits after start-up and during Warranty Period for adjustments to flow sensors and switches during system operation and shutdown to achieve desired operation under various conditions including peak and seasonal loads.

## 3.22 CLOSEOUT ACTIVITIES

.1 Demonstration
.1 Demonstrate 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 26 90 00**

# C13-04-20 - Tender for Building Automation System (BAS) & Mechanical (HVAC) Upgrades at Wentworth Lodge

Opening Date: January 28, 2020 3:30 PM

Closing Date: February 24, 2020 12:00 PM

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## Schedule of Prices

* Denotes a "**MANDATORY"** field

Do not enter $0.00 dollars unless you are providing the line item at zero dollars to the City of Hamilton (unless otherwise specified).

If the line item and/or table is "**NON-MANDATORY**" and you are not bidding on it, leave the table and/or line item blank. Do not enter a $0.00 dollar value.

## Cost of Work

| Description | Quantity | Unit Price * | Lump Sum Price | |
|---|---|---|---|---|
| Cost of Work | 1 | | | * |
| | | | Subtotal: | |

## Provisional Items

| Description | Quantity | Unit Price * | Lump Sum Price | |
|---|---|---|---|---|
| Provide Administration area upgrades including VAV box, ductwork modifications, controls upgrades. | 1 | | | * |
| Provide 9 1st floor radiant panel control valves including piping, controls, wiring, control devices. | 1 | | | * |
| Provide 13 2nd floor radiant panel control valves including piping, controls, wiring, control devices. | 1 | | | * |
| Provide air handler controls as indicated on G. Air Handlers AHU-1,2,3,4 | 1 | | | * |
| | | | Subtotal: | |

## Summary Table

| Bid Form | Amount |
|---|---|
| Cost of Work | |
| Provisional Items | |
| Total Contract Price: | |

## Specifications

## Bidder's Business Structure

The City of Hamilton reserves the right to verify the business name and structure of the bidder, whether or not this section is completed, to ensure that the bidder is an existing legal entity. If the bidder is not an existing legal entity, the Bid will be rejected.

| Business Structure of Bidder * | If 'Corporation' Selected, Specify Where Incorporated: | If 'Other' Selected, Specify Business Structure: | Registered Business Name of Bidder (if applicable): | |
|---|---|---|---|---|
| Select A Value | | | | |

### Documents

It is your responsibility to ensure the uploaded file(s) is/are not defective or corrupted and are able to be opened and viewed by the City. If the attached file(s) cannot be opened or viewed, your Bid shall be rejected.

**BONDING UPLOAD SECTION**

Each Bid submission must be accompanied by a **digital** bid bond.

The City will only accept submissions that include the bid bond in an electronically verifiable and enforceable (e-Bond) format.

**A scanned PDF copy of the bond is not acceptable.**

- Digital Bond * (mandatory)

## Addenda, Terms and Conditions

**The bidder hereby acknowledges and agrees:**

**1. Submission of Bid**

I/We the undersigned bidder, having examined the locality and site of the Work as well as all the Request for Tenders documents, hereby tenders and offers to furnish all material, labour, service, equipment, scaffolding and all incidentals, and to render all services and pay all applicable customs duties and taxes (other than any Value Added Taxes) and all other charges as specified and/or as necessary for performance and completion of the above referred to Work, all in full accordance with the Request for Tenders documents provided to the bidder by the City (receipt of which is hereby acknowledged) for the Base Bid Price (which is included in the "Contract Price" in the CCDC2 Stipulated Price Contract 2008).

**2. Base Bid Price**

I/We confirm all prices provided in this Bid:

- · **are in Canadian funds**
- ·**include Provisional Items, if applicable**
- ·**include contingency allowances, if applicable**
- ·**include cash allowances, if applicable**
- ·**do not include Value Added Taxes**

Any Value Added Taxes payable are for the account of the City and are in addition to the Base Bid Price stated in the Schedule of Prices.

I/We understand that if this Request for Tenders contains a contingency allowance, Provisional Item(s) or cash allowances, I/we are not entitled to payment thereof except for the extra or additional work carried out by me/us, as directed by the City and in accordance with the Contract and only to the extent of such extra or additional work and payment approved by the City.

**3. Addenda**

I/We have made any necessary inquiries with respect to Addenda issued by the City and have ensured that we have received, examined and provided for all Addenda to the Request for Tenders in this Bid.

**4. Commencement and Completion**

If awarded the Request for Tenders, I/we agree and undertake that:

- ·I/we will provide all necessary documents required as set forth prior to the commencement of the Work.
- 
- ·I/we will commence the Work following receipt of a notice to proceed and otherwise in accordance with the Contract. I/We agree to have the Works "substantially performed" as described in the Construction Act (Ontario) and in accordance with the requirements set out in the Contract.
- 
- ·**in the event that I/we fail to perform the Contract as provided, I/we understand and agree that I/we shall be liable to liquidated damages and other remedies as specified in the contract documents.**

**5. Contract**

I/We understand and agree that a binding contract shall come into being upon acceptance of this Bid by the City and the award of the Request for Tenders to me/us. The subsequent execution of the Contract for the Work is a formality and not a condition precedent to the existence of a binding contract.

**6. Occupational Health and Safety**

I/We understand and agree that the Work must be conducted in a safe manner. Accordingly, I/we confirm that I/we and all subcontractors used on the Work for the City of Hamilton will comply with all applicable laws, regulations and by-laws of Canada, the Province of Ontario and the City of Hamilton, including but not limited to the Occupational Health and Safety Act,

and all applicable regulations thereunder. Further, without limiting any of the foregoing, I/we confirm that I/we have both a written occupational health and safety policy and program to implement that policy, and that all of our employees, subcontractors and any other persons performing the Work shall be appropriately trained, licensed and certified, as required to perform the Work.

**7. Fair Wage Policy and Schedule**

I/We agree to comply in all respects with the City of Hamilton's Fair Wage Policy and to be fully responsible for ensuring that all of my/our subcontractors also comply in all respects with said Fair Wage Policy.

**8. Execution**

If this Bid is accepted by the City and the Request for Tenders is awarded to me/us, I/we agree to provide and pay for the proof of insurance, WSIB clearance certificate, performance of contract security and a labour and material payment bond as required by the contract documents, my/our health & safety manual and any other document identified in the award letter as being required by the City prior to it being able to issue a purchase order, and to execute the Contract, in quadruplicate, all within 10 Business Days after the City has issued its award letter or within such longer time period as the City may specify.

**9. Bid Security**

I/We have submitted the Bid Security as specified in the Request for Tenders. The Bid Security shall be irrevocable for **90 CALENDAR DAYS** after the closing date and time of the Request for Tenders.

In the event of default or failure on my/our part to execute the Contract as required above and to provide the specified security required under the Request for Tenders and the Contract, I/we agree that the City may at its discretion do one or more of the following: declare the Bid Security forfeited, annul the award or terminate the Contract, accept the next lowest compliant Bid, advertise for new tenders, or carry out the Work in any manner deemed in the best interests of the City. In such a case, if required by the City, I/we shall pay the City the difference between the Base Bid Price and any greater sum that the City may be obligated to pay by reason of that default or failure, including the cost of any advertisement for new tenders.

**10. Time Open for Acceptance**

I/We agree and confirm that this Bid is irrevocable and is to continue open to acceptance by the City for a period of **90 CALENDAR DAYS** after the closing date and time of the Request for Tenders. The City may at any time within the above **90 CALENDAR DAY** period accept this Bid whether or not any other Bid has previously been accepted, upon notice of acceptance and award in writing to me/us, personally delivered or mailed to me/us by ordinary prepaid mail, to the address provided in the Bid submission, or delivered by fax to the fax number set forth in the Bid submission. Any notice mailed or faxed shall be deemed to have been received on the date mailed or faxed. Any notice personally delivered shall be deemed to have been received on the date the notice is personally delivered.

**11. No Collusion / Conflict of Interest**

I/We hereby declare that no person, firm or corporation other than me/us has any interest in this Bid or in the proposed Contract for which this Bid is made. I/We further declare that this Bid is made without any connection, comparison of figures or arrangements with, or knowledge of, any other person making a Bid for the same work and is in all respects fair and without collusion or fraud.

I/We confirm that we comply with Article 12 - Conflict of Interest, Lobbying and Collusion of the Instructions to Bidders and Article 4 – Joint Ventures of the Supplementary Instructions to Bidders.

I/We understand that, without limiting or restricting any other right or privilege of the City, the City may terminate the Contract where the bidder is in contravention with the City's Procurement Policy with respect to conflict of interest or vendor eligibility.

**12. Interpretation**

I/We confirm that we have received no oral information, instruction or advice from any officer, employee, agent or consultant of the City which changes the content of the Request for Tenders and all Addenda thereto.

I/We acknowledge and agree that we have not assumed that any information concerning our operations, business or personnel or any other information required to be provided by us when submitting our Bid is known to the City, regardless of whether such information may be actually previously known to the City or not. Further, we acknowledge and agree that all information to be

provided by us is to be complete and full and in such detail as required.

**13. Procurement Policy**

In submitting a Bid in response to the Request for Tenders, I/we agree and acknowledge that I/we have read and will be bound by the terms and conditions of the City's Procurement Policy. I/We understand that the City's Procurement Policy can be viewed on the City's website at: hamilton.ca/buying-selling-city/bids-tenders/procurement-policy-by-law.

**14. Ontarians with Disabilities Act, 2001 and Accessibility for Ontarians with Disabilities Act, 2005**

I/We confirm that I/we and all Subcontractors used on the Work for the City of Hamilton will comply with all applicable accessibility laws, regulations and by-laws of Canada, the
Province of Ontario and the City of Hamilton, including but not limited to the Ontarians with Disabilities Act, 2001 (ODA), the Accessibility for Ontarians with Disabilities Act, 2005 (AODA), Ontario Regulation 429/07 (Accessibility Standards for Customer Service) and Ontario Regulation 191/11 (Integrated Accessibility Standards), throughout the term of the Contract. Without limiting the generality of the foregoing, I/we shall provide to the City, prior to commencing Work, a Statement of Acknowledgement that I/we have read and understand the City's AODA Customer Service Standard Handbook (the "Handbook"), that I/we have provided the training required by the Handbook, and that I/we will comply with the requirements of the Handbook and applicable accessibility laws, regulations and by-laws. See City of Hamilton's AODA Customer Service Standard Handbook at: hamilton.ca/government-information/accessibility-services/accessibility-standards.

**15. Compliance with City of Hamilton By-laws**

I/We declare that I/we are in compliance with all municipal by-laws as they pertain to the City of Hamilton in respect of the operation of my/our business and in respect of the Work described in the Request for Tenders. I/We understand and agree that if this statement is untrue or incorrect, the City of Hamilton shall be entitled at its sole discretion to reject this Bid, or if such untruth or incorrectness comes to light after this Bid is accepted, to terminate or refuse to enter into, as applicable, any Contract and to pursue any other legal recourse the City deems appropriate, and that such untruth or incorrectness shall be a default under the Contract.

**16. Lump Sum Breakdown**

I/We understand and agree that after the opening of the Bids, if I/we are one of the two apparent low bidders, if requested by the City we are required to submit to the Tender Coordinator, within two Business Days of the closing date of the Request for Tenders, the document entitled Lump Sum Breakdown of Base Bid Price. The breakdown shall be given on the breakdown pages provided in the Request for Tenders. I/We acknowledge and agree that the City may refuse to accept any breakdown which contains prices considered to be unbalanced and may request me/us to adjust the breakdown to correct such unbalancing, and I/we agree to do so upon such request of the City.

**17. Provisional Items**

I/We understand and agree that, after the award of the Request for Tenders, the City reserves the right to delete from the Base Bid Price one or more of the items identified in the Schedule of Prices as Provisional Items, without penalty or compensation to the Successful Bidder, for credit at the price shown in the table. All prices are inclusive of all duties and taxes applicable, except for Value Added Taxes.

I/We understand that I/we are required to complete the table in the Schedule of Prices for each Provisional Item listed. I/We understand that failure to do so will result in the rejection of this Bid by the City.

I/We agree that the Unit Prices provided for each Provisional Item include all costs required for complete execution of the item of work, including the bidder's office staff, site supervisory staff, project management costs, clerical and other costs for documentation, materials, labour, equipment, delivery, handling, statutory charges, overhead and profit, other related charges, inclusive of all other duties and taxes applicable, and similar charges on account of such item of work. Unit Prices entered shall exclude all Value
Added Taxes.

I/We agree that if the quantity actually required for each item of work is more or less than estimated, the extended price for such item of work will be increased or decreased respectively using the same Unit Price or Lump Sum Price specified in the Schedule of Prices.

I/We agree that these Provisional Items are in addition to the requirements outlined in the Specifications. I/We understand that if I/we are awarded the Request for Tenders, I/we are not entitled to payment for any Provisional Item except for the extra or additional work carried out by me/us, as directed by the City and in accordance with the Contract and where payment was previously approved by the City.

**18. Alternatives**

I/We understand and agree that alternatives to specified equipment suppliers and/or equipment in the Request for Tenders will not be considered by the City prior to the award of the Request for Tenders.

☐ I/WE agree to be bound by the terms and conditions and have authority to bind the Bidder and submit this Bid on behalf of the Bidder.

**Conflict of Interest**
Except with the prior express written consent of the City, **prior to submitting this Bid**, vendors are required to notify the City in writing, of any potential conflict of interest that may arise prior to the award of any contract and fully disclose any details thereof. Failure on the part of a vendor to declare a conflict of interest to the City and to obtain the City's prior express written consent to waive the conflict of interest shall result in the vendor being ineligible to Bid and shall form a basis for rejection of a Bid submitted to the City.

Do you have a potential conflict of interest? ○ **Yes** ○ **No**

**Acknowledgement of Addenda**
The Bidder acknowledges and agrees that any Addenda below form part of the bid document.

Please check the box in the column "**I have reviewed this addendum"** below to acknowledge each of the Addenda.

| File Name | I have reviewed the below addendum and attachments (if applicable) | Pages |
|---|---|---|
| **There have not been any addenda issued for this bid.** | | |