University Hospital of Northern British Columbia (UHN) Histology Lab Renovation

SPECIFICATIONS

1475 Edmonton St, Prince George

NHA Project No. N662640003

Stantec Project No. 115625050

ISSUED FOR CONSTRUCTION

JUNE 09, 2026

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Invitation to Bid

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END OF SECTION

INVITATION TO BID

Tenders marked **"UHN Histology lab renovation – NHA project No. N662640003"** will be received electronically through bids & tenders, up to **2:00 pm local time on April 22, 2026.**

All Bidders must register with a Bidding System Vendor account and be registered as a Plan Taker for this Bid opportunity. This will allow you to download the Bid Call Documents, to receive Addenda email notifications, to submit a bid, and other features. We recommend becoming familiar with the online Bid Requirements before the closing date.

Questions related to this bid are to be submitted through the Bidding System only by "Submit a Question" button for this specific bid opportunity.

Northern Health will accept no responsibility for any Bidder not properly following the registration procedures outlined in this Advertisement. Bidders MUST register for the project in bid&tenders to receive notification of Addenda.

The work to be undertaken generally includes the following:

Objective of this project is to reduce staff exposure to hazardous chemicals - specifically formalin (formaldehyde), ethylbenzene, and toluene - within the Histology Laboratory. The upgrades must ensure compliance with WorkSafe BC standards and aim to keep exposure levels as low as reasonably achievable (ALARA). This will be achieved through improvements to existing ventilation systems, installation of specialized equipment, and enhancements to the general laboratory infrastructure.

- installation of seal safe system in the histopathology lab and in the operating room
- replacement of grossing stations in grossing rooms
- tissue processors and chemical recyclers ventilation

There will be an opportunity to view the facility during a VIRTUAL Site Tour to be held on **April 2, 2026**. Contractors to meet over MS TEAMS.

A Ten Percent (10%) Bid Bond must accompany the tender. A fifty Percent (50%) Labour and Materials Bond and a Fifty Percent (50%) Performance Bond must be provided by the selected Contractor within 10 days of award. Bonding is to be submitted electronically via bids&tender.

The successful Contractor will be required to enter into a CCDC2-2020 Stipulated Price Contract for the Work with reference to all CCDC2-2020 terms and conditions included.
The Owner reserves the right to reject any or all Bids or to accept the Bid deemed most favorable in the interest of the Owner.

Technical inquiries should be directed to:

Contact: Eleonore Leclerc

Phone: (604) 696 8000 Email: eleonore.leclerc@stantec.com

Part 1.1: DIVISION 00
Procurement and Contracting Requirements

For use with CCDC 2−2020 Stipulated Price Contract

00 11 13 - ADVERTISEMENT FOR BIDS

Reset All

1. BID CALL

.1Ă Northern Health Authority
will receive bids for this *Project* on or before 2pm, local time on April 22, 2026
(unless modified by addendum) at:

❒ ~~.1a *Physical Address Location*~~

❒ .1b https://northernhealth.bidsandtenders.ca/Module/Tenders/en

.2Ă The official bid closing time will be determined by the ~~[*reception desk clock*] [*online system*]~~
at the bid closing location.

.3Ă ☐ This bid call is by invitation only. The following Bidders have been invited to bid:

.3.1 Submit bids only in the name indicated in the letter of invitation to bid. Bids submitted in a name different to that indicated in the invitation, or from Bidders not invited to bid per 00 11 13 1.3, will be returned unopened, or if inadvertently opened, will be rejected and deemed as non−compliant.

.4Ă Bid Opening Process:

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.5Ă Unofficial bid results will be disclosed promptly to all Bidders. Such disclosure will not imply that the bids received are compliant or that a contract will be awarded to the lowest or any Bidder.

2. BID DOCUMENT AVAILABILITY

.1Ă Bid Documents are available in electronic form. It does not confer a license to use the Bid Documents for any other purpose. Bid Documents may be obtained from:

https://northernhealth.bidsandtenders.ca/Module/Tenders/en

~~.2Ă ☐ Bid Documents are available in hard copy form. It does not confer a license to use the Bid Documents for any other purpose. Hard copy Bid Documents may be obtained at :~~

~~*Include details such as contact person, information on deposits*~~

3. PROJECT DESCRIPTION

Include description and details of the Project, such as budget, schedule information, size, purpose, status

Objective of this project is to reduce staff exposure to hazardous chemicals - specifically formalin (formaldehyde), ethylbenzene, and toluene - within the Histology Laboratory. The upgrades must ensure compliance with WorkSafe BC standards and aim to keep exposure levels as low as reasonably achievable (ALARA). This will be achieved through improvements to existing ventilation systems, installation of specialized equipment, and enhancements to the general laboratory infrastructure.
- installation of seal safe system in the histopathology lab and in the operating room
- replacement of grossing stations in grossing rooms
- tissue processors and chemical recyclers ventilation

END OF SECTION

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00 21 13 INSTRUCTIONS TO BIDDERS

1. DOCUMENTS

1.1 DOCUMENTS

.1Ă Carefully examine the following information. Failure to follow these instructions may result in bid disqualification.

.2Ă Project information:

.1Ă Project ƒ Contract Name: UHN Histology lab renovation

.2Ă Project ƒ Contract No.: N662640003

.3Ă *Owner*: Northern Health Authority

.4Ă Project Address: 1475 Edmonton St, Prince George, BC V2M 1S2

.3Ă Examine the Bid Documents and promptly notify the person designated to receive inquiries of any perceived errors, omissions, conflicts or discrepancies in the Bid Documents.

1.2 BID DOCUMENTS

(a)ĂBCDC 2 − 2022, Part 1.1 Division 00 11 13 Advertisement for Bids;
(b)ĂBCDC 2 − 2022, Part 1.1 Division 00 21 13 Instructions to Bidders; 00 73 16 Insurance Requirements; 00 73 63 Contract Security Requirements;
(c)ĂBCDC 2 − 2022, Part 1.1 Division 00 41 13 Bid Form and Appendices;
(d)ĂCCDC 2 − 2020, Articles of Agreement;
(e)ĂCCDC 2 − 2020, General Conditions;
(f)ĂBCDC 2 − 2022, Part 1.2 Supplementary Conditions;
(g)ĂBCDC 2 − 2022, Part 1.3 Project Specific Amendments, if any;
(h)ĂGeneral Requirements;
(i)Ă Drawings and Specifications;
(j)Ă Appendices, if any;
(k)ĂAddenda.

1.3 CONTRACT DOCUMENTS

.1Ă Upon award of contract the Contract Documents consist only of (b) to (k) above. The *Owner* will prepare two copies of the Contract.

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2. PRE-BID INQUIRIES

.1 Direct inquiries relating to Bid Documents, only to the *Consultant/Owner* at:

Refer to the Invitation to Bid for instructions.

.2 Submit inquiries as early as possible in the bid period and not less than 5 Working Days before the bid closing time. Inquiries received after this time may not receive a response.

3. PRE-BID SITE VISIT

The optional virtual site tour will be on April 2, at 9:00 a.m, by means of Teams Conferencing.

A Virtual site tour will be held, April 2, at 9:00 a.m, for prospective bidders to review the project via drawings and Matterport footage.

No in-person site tour will be conducted to minimize disruptions to hospital operations and to provide more flexibility for both our team and the contractors.

Bidders will receive an invitation once they confirm their attendance through Bids and Tenders website. Bidders to send an email one day prior to eva.mencin@northernhealth.ca to confirm attendance.

Links to the Matterport footages that will be used during the presentation will be provided with the invitation.

Names of Bidders attending will be issued by addendum.

Issues arising from the pre−bid site visit will be addressed as required in an addendum to the Bid Documents. No meeting minutes will be issued. Bidders may not rely upon any information given verbally or otherwise at the pre−bid site visit and that is not confirmed by addendum.

~~Bidders visiting the Place of the Work must be accompanied at all times by a representative of the *Owner*.~~

~~Bidders visiting the Place of the Work must provide their own personal protective equipment.~~

❒ 2.3 *Owner* Requirements of Site Visit

Additional requirements

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4. PARTICULARS AFFECTING BID PRICE

4.1 MATERIALS

.1Ă Establish the Bid Price based on the use of materials specified in Drawings and Specifications.

.2Ă Proposed substitutions to materials specified will be considered during the bidding period only if full descriptive data are submitted in writing to the *Consultant/Owner* at least *5* Working Days before the bid closing date.

.3Ă Approved substitutions will be incorporated in the Drawings and Specifications by issuance of an Addendum.

4.2 CONDITIONS RELATED TO THE WORK

.1Ă Become familiar with the site and existing conditions prior to submitting a bid and make allowances for conditions related to the Work.

.2Ă Claims for an increase in Contract Price or Contract Time arising from observable conditions will be rejected by the *Owner*.

4.3 TAXES

.1Ă Include in bid price all taxes and customs duties in effect at the time of the bid closing, except for Value Added Taxes as defined in the CCDC standard form of contract.

5. ADDENDA

.1Ă Addenda may be issued to modify the Bid Documents in response to Bidder inquiries or as may be considered necessary.

.2Ă All addenda issued during the bid period will become part of the Bid Documents.

.3Ă No addenda will be issued later than 3 Working Days before the bid closing time, unless absolutely necessary.

.4Ă Each Bidder must ascertain before bid submission that it has received all addenda issued during the bid period and must indicate the addendum number(s) of all addenda received with their bid submission.

6. INTERPRETATION AND MODIFICATION OF BID DOCUMENTS

1.Ă If an inquiry requires an interpretation or modification of the Bid Documents, the response to that inquiry will be issued in the form of a written Addendum only, to ensure that all Bidders base their bids on the same information.

2.Ă Replies to inquiries or interpretations or modifications of the Bid Documents made by e−mail, verbally, or in any manner other than a written Addendum, will not form part of the Bid Documents and will not be binding.

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7. BID DEPOSITORY

❒ .1 This Project will *not* use BidCentral Online Bidding for Subcontractors ("BOBS"), a bid depository system.

☒ ~~.2 This Project will use BidCentral Online Bidding for Subcontractors ("BOBS"), a bid depository system.~~

❒ 2~~a. The following subcontractors must submit their bid through BOBS and provide bonding per the Rules of Procedure ("Rules"):~~

❒ 2b. The following subcontractors must submit their bid through BOBS and do not require bonding:

~~.1 The date and time for the BOBS closing will be not less than two (2) working days prior to General Contractor bid closing and up to 3:00 PM on the date specified, subject to the Rules.~~

~~.2 The Rules of Procedure for BOBS, in force at the bid closing time, will apply.~~

~~.3 Subcontractors listed must submit their bids through BOBS via the specified method as defined in BidCentral (https://www.bidcentral.ca/online-bidding-for-subcontractors/).~~

~~.4 Where stipulated in section 2a, BOBS requirements in the Project Documents, and as required under the Rules, the subcontractor must provide a bond. Such bond must conform to the requirements of the Rules.~~

~~.5 General Contractors must confirm their Intention to Bid no later than two (2) Working Days (to the hour) prior to the BOBS closing date and time as per the requirements in the Rules for BOBS.~~

~~.6 Notwithstanding the requirements for exclusion of work contained in the Rules, ensure all Work described in the Bid Documents is included in the Bid Price.~~

~~.7 Where required by 2a and when requested to do so the Bidder agrees to provide the *Owner* with proof of Subcontractor bonds within ten (10) Working Days of Contract award.~~

~~.8 Only General Contractor Bids which list Trade Contractor Bids submitted in accordance with the Rules of Procedure for BOBS for those sections or divisions specified, will be subject to a recommendation of acceptance from the Bid Calling Authority to the *Owner* and any others will be rejected.~~

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~~Bid Submission: PAPER SUBMISSIONS~~

~~8P. COMPLETION OF BID FORM & APPENDICES~~

~~.1 The Bidder must:~~

~~1.Ă Complete the bid on the Bid Form included with the Bid Documents in a non−erasable medium and execute in accordance with provisions of Clause 9 of the Instructions to Bidders, – EXECUTION OF THE BID.~~

~~2.Ă If required, state the number of weeks within which the Bidder will achieve *Ready−for−Takeover*.~~

~~3.Ă Initial erasures or corrections to entries on the Bid Form.~~

~~4.Ă Indicate receipt of Addenda.~~

~~5.Ă Complete all appendices as required by the *Owner*.~~

- ~~☐ ĂAppendix 'A' – List of Subcontractors~~
- ~~☐ ĂAppendix 'B' – Alternate Prices~~
- ~~☐ ĂAppendix 'C' – List of Unit Prices~~
- ~~☐ ĂAppendix 'D' – List of Cash Allowances~~

~~.2 The *Owner* must specify the specific subcontractors each Bidder must list in Appendix 'A' – LIST OF SUBCONTRACTORS. To the extent that the *Owner* does not list the subcontractors, there is no requirement for the Bidder to name the subcontractors.~~

~~.3 Where the Bid amount in writing is different than the numerical amount, the bid amount in writing will take precedence.~~

9P. EXECUTION OF THE BID

.1Ă Execute the Bid Form in one of the following ways:

.1Ă Limited Company: Include the company's full name and the name(s) and status of the authorized signing officer(s) in the spaces provided for that purpose. Affix the signature(s) of authorized officer(s) and date the Form; or

.2Ă Partnership: Print the partnership name and the name(s) of the person(s) signing in the spaces provided. Affix the signature of one or more of the authorized partners, who must sign in the presence of a witness who must also sign and date the Form; or

.3Ă Sole Proprietor: Print the business name and the name of the sole proprietor in the spaces provided. The sole proprietor must sign and date the Form in the presence of a witness who must also sign and date the Form.

10P. DELIVERY OF THE BID

.1Ă Enclose the properly completed and executed Bid Form in a properly addressed envelope.

.2Ă Ensure the name and address of the Bidder, the project name, (and project number where provided by the *Owner*) appear on the envelope face.

.3Ă Seal the envelope and deliver it to the submission location stated in the Invitation to Bid prior to the time and date specified for the closing of bids.

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.4Ă The *Owner* will immediately record the date and time on envelopes containing bids and on bid revisions received by fax and this information will take precedence over machine−initiated date and time information transmitted through a fax machine.

.5Ă Bids and other related documents received after the stated time and date of closing will not be considered by the *Owner*.

.6Ă The *Owner* is neither liable nor responsible for costs incurred by Bidders in the preparation, submission, or presentation of the bid. Bid documents become the property of the *Owner*.

11P. BID WITHDRAWAL ~~AND MODIFICATION~~

.1Ă If withdrawing a bid, Bidders must submit a signed letter to the *Owner* prior to closing.

.2Ă Modifications or withdrawals must be signed by an authorized signing officer.

.3Ă Bidders are warned that faxed or email modifications or withdrawals are submitted solely at their risk and will not be considered received until they have been received at the designated contact information, and date and time of the modification has been recorded by the bid authority.

.4Ă The *Owner* will assume no responsibility or liability for modifications or withdrawals that are, for any reason, delayed, illegible, unclear as to intent, ambiguous, contrary to these instructions, or otherwise improperly received.

.5Ă Email modifications or withdrawals to a bid must be submitted via a PDF document or an image file (I.e., jpeg, jpg, png) attached to the email and in the prescribed format identified in the procurement solicitation documents.

.6Ă For email modifications and withdrawals, the time received by the Bid Authority's servers will determine as to whether the bid modification was received by the closing time.

.7Ă For faxed modifications and withdrawals, the clock used for the official bid closing time will govern. The *Owner*'s handwritten date and time or time stamp from the clock used for the official bid closing will take precedence over facsimile machine generated time and date.

~~.8Ă Bid modifications:~~

~~.1Ă Modifications will be accepted prior to the time and date specified for the closing of bids, in a manner determined by the *Owner* using the bid amendment form included in Division 00 00 43 13 Appendix 'F' – BID MODIFICATION~~

~~.2Ă Only the Bidder's entries on the delivered Bid Form may be revised; the modification must state only the amount by which a bid figure is to be increased or decreased), or specific directions as to the exclusion or inclusion of particular words.~~

~~.3Ă Ensure all bid modifications to the original bid are clearly legible. State monetary modifications to the bid amount numerically and in writing.~~

~~.4Ă State all addendum numbers received, if different from what was indicated on the originally submitted Bid Form.~~

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~~.5Ă If changes are required to Appendices A, B, C, and D, new appendix forms must be submitted and revised in their entirety on new appendix submission forms. Where applicable, prices are completely new prices. These changes in price or in time are **not** a subtraction from or addition to already submitted on Appendices A, B, C, and D.~~

12P. BID SECURITY REQUIREMENTS

.1Ă Ensure the Bid Form is accompanied by a bid bond in the amount of ten percent (10%) of the Bid Price. Certified cheques and guaranteed letters of credit will not be accepted.

.2Ă Ensure the bid bond is issued on a CCDC 220 Bid Bond form

.3Ă If a successful Bidder declines to enter a *Contract* within the period set out in the Bid Form, or a further agreed period of time, the principal and surety will be required to pay to the *Owner* a sum equivalent to the difference between the principal's bid and the accepted bid or ten percent (10%) of the principal's bid, whichever is the lesser.

.4Ă Upon request, bid bonds of unsuccessful Bidders will be returned after the successful Bidder has entered into a contract with the *Owner* and provided the specified contract security, or earlier at the *Owner*'s discretion.

.5Ă The bid bond must name the *Owner* as specified in the bid document as the obligee and must be signed, sealed, and dated by both Bidder and surety.

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Bid Submission: ONLINE BIDDING SYSTEM SUBMISSIONS

8E. COMPLETION OF BID FORM

.1Ă All Bidders should familiarize themselves regarding online bidding requirements relating to system failure, functionality of the online system, Exclusion of Liability, Terms and Conditions for Online Bidding and Privacy Policy.

.2Ă Bidders must complete the bid on the Bid Form included in the Online Bidding System and execute in accordance with provisions of Clause 9E of the Instructions to Bidders − EXECUTION OF THE BID.

.3Ă If required, state the number of weeks within which the Bidder will achieve *Ready−for−Takeover*.

.4Ă If required, indicate receipt of Addenda.

9E. EXECUTION OF THE BID

.1Ă Execute the Bid Form by the method of the Bidder's identification and authentication as designated in the On−line Bidding System.

10E. DELIVERY OF THE BID

.1Ă All Bids must be submitted through the On−line Bidding System not later than the date and time specified for the On−line Bidding System closing. Bids submitted after On−line Bidding System closing time will not be allowed by the On−line Bidding System.

.2Ă The time as indicated on the On−line Bidding System will be the official time for the On−line Bidding System closing.

.3Ă The *Owner* is neither liable nor responsible for costs incurred by Bidders in the preparation, submission or presentation of the bid. Bidders will be required to accept on−line the Terms and Conditions of the On−line Bidding System in Clause 13.2 Terms and Conditions.

.4Ă Bid documents become the property of the *Owner.*

11E. BID MODIFICATION AND WITHDRAWAL

.1Ă Bidders must comply with procedures for electronic bid modification and withdrawal established by the online bidding system.

12E. BID SECURITY REQUIREMENTS

.1Ă Digitally Verified Bid Bonds must be submitted through the online bidding system. Digitally verified Bid Bonds must be provided by the Bidder's Surety representative through one of the ebond providers assessed by the Surety Association of Canada. Bid Bonds must include a clearly legible signature and seal. The attachment by the Bidder of the Bid Bond with the on−line creates the lawful act of validating the bond by the Bidder.

.2Ă Ensure the Bid Form is accompanied by a bid bond in the amount of ten percent (10%) of the Bid Price, Certified cheques and guaranteed letters of credit will **not** be accepted.

.3Ă Ensure the bid bond is issued on a CCDC 220 Bid Bond form or other form approved by the Surety Association of Canada and issued by a Surety acceptable to the *Owner.*

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.4Ă If a successful Bidder declines to enter a Contract within the period set out in the Bid Form, or a further agreed period of time, the principal and surety will be required to pay to the *Owner* a sum equivalent to the difference between the principal's bid and the accepted bid or ten percent (10%) of the principal's bid, whichever is the lesser.

.5Ă The bid bond must name the *Owner* as specified in the bid document as the oblige and must be signed, sealed, and dated by both Bidder and surety.

00 21 13 (con't) INSTRUCTION TO BIDDERS

13. BID ACCEPTANCE

.1Ă The lowest or any bid will not necessarily be accepted.

.2Ă The *Owner*, at its sole discretion, may accept or reject any or all of the Alternative Prices submitted in the Bid Documents. Alternative Prices will not be considered in determining the successful Bidder.

.3Ă Alternative Prices listed in the Bid Documents will remain open for acceptance by the *Owner* for the period stated in the Bid Documents, from the time and date specified for closing of bids.

.4Ă Bids which contain qualifying conditions or otherwise fail to conform to these Instructions to Bidders may, at the sole discretion of the *Owner*, be disqualified or rejected.

.5Ă The *Owner* retains the separate right to waive minor irregularities in the Bid Form if such irregularities have not provided the Bidder with a competitive advantage.

.6Ă In the event a single bid is received, the *Owner* may open the bid privately without reference to the Bidder. If the bid is opened and it is in excess of the *Owner*'s budget, the *Owner* reserves the right to re−issue the Bid Documents for new public re−bid without revisions being made to the Bid Documents and without disclosing the single Bid Price. The *Owner* reserves the right to accept or reject a single bid.

.7Ă The *Owner* has the right to enter into over−budget negotiations with the lowest compliant Bidder or a single Bidder, without cancellation of all bids or consideration to other Bidders, and to require that Bidder to negotiate with Subcontractors named on their Bid Form.

14. BID ACCEPTANCE PERIOD

.1Ă Bids will remain open to acceptance by the *Owner* and will be irrevocable until another Bidder enters into a contract with the *Owner* for performance of the Work or until expiry of the bid acceptance period stated in the Bid Form, whichever occurs first.

.2Ă After bid closing and before expiry of the bid acceptance period stated in the Bid Form, the *Owner* may request all Bidders to agree to an extension of the originally specified bid acceptance period. In such case the bid acceptance period will be extended subject to the Bidder, whose bid the *Owner* wishes to accept, having agreed in writing to the extension.

.3Ă Where the bidding for procurement of construction services for this project has a method where unofficial bid results are made available publicly after the bid closing time, and before expiry of the bid acceptance period stated in the Bid Form, the *Owner* may request all Bidders to agree to an extension of the originally specified bid acceptance period. In such case, the bid acceptance period will be extended, subject to the lowest compliant Bidder having agreed in writing to the extension.

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15. WORKSAFE BC LETTER

.1Ă After bid closing, upon request, the lowest compliant Bidder agrees to provide a WORKSAFE BC Letter of Good Standing within forty−eight (48) hours.

END OF SECTION

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00 41 13 BID FORM - STIPULATED PRICE

Project/Contract: UHN Histology lab renovation

Project/Contract No.: N662640003

From (Bidder): _____
company name

_____
street address or postal box number city/town

_____
province and postal code

Bidders Ph. _____ **Bidders Fax.** _____

Bidders Email _____

To (Owner): Project No. NHA N662640003 / SAL 115625050

We, the undersigned, having examined the Bid Documents for the above named project contract, including Addendum Number(s)_____, and being familiar with the site and existing conditions, hereby offer to perform the Work in accordance with the Bid Documents, for the stipulated bid price of:

$ _____
amount in writing in Canadian dollars, excluding Value Added Taxes.

$_____in Canadian dollars, excluding Value Added Taxes.
amount in figures

We, the undersigned, declare that:

a) Schedule:

- ❒ We agree to attain *Ready–for–Takeover* within (*Contractor* to fill in) _____ weeks after receiving notice of contract award and the contract time noted herein WILL NOT be taken into account by the *Owner* in awarding the contract. The date of contract award will be the date the letter of award is sent to the Bidder.

- ❒ We agree to attain *Ready–for–Takeover* within (*Contractor* to fill in) _____ weeks, taking into account the milestones and for schedule noted in Division 01 of these Project Specifications, and after receiving notice of contract award. The contract

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time noted herein MAY BE considered by the *Owner* in evaluating the bid and determining contract award. The date of contract award will be the date the letter of award is sent to the Bidder.

❒ We agree to attain *Ready–for–Takeover* within (*Owner* to fill in)_____weeks after receiving notice of contract award. This contract time is identified by the *Owner* based on the rational included in Part 1.3 Project Specific Amendments. The date of contract award will be the date the letter of award is sent to the Bidder.

b.Ă We have arrived at this bid without collusion with any competitor,

c.Ă This bid is open to acceptance by the *Owner* for a period of 90 days from the date of bid closing, and

d.Ă All bid form supplements called for by the Bid Documents form an integral part of this bid.

Signatures:
Signed and submitted by:

_____
legal company name

_____
name and title of authorized signing officer

_____
signature of authorized signing officer

_____
name of witness

_____
signature of witness

_____
name and title of authorized signing officer

_____
signature of authorized signing officer

_____
name of witness

_____
signature of witness

Dated this_____day of_____, 20_____.

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❒ Appendix 'A' – LIST OF SUBCONTRACTORS

Project/Contract: UHN Histology lab renovation

Project/Contract No.: N662640003

From (Bidder): _____
company name

The *Owner* has specified below the subcontractors are required to be named by the Bidder.

We, the above−named Bidder, intend to use for the above−named project the Subcontractors named below:

Item of Work	**Name of Subcontractor**
1.Ă [_____]	[_____]
2.Ă [_____]	[_____]
3.Ă [_____]	[_____]
4.Ă [_____]	[_____]
5.Ă [_____]	[_____]

The *Owner* cannot reject a bid on the basis of the subcontractor(s) named herein.

~~**BOBS Section/Division**~~ ~~***Closing via BOBS per Section 00 21 13 Clause 7.2***~~	~~**Name of Subcontractor**~~ ~~***Closing via BOBS per Section 00 21 13 Clause 7.2***~~
~~1.Ă [_____]~~	~~[_____]~~
~~2.Ă [_____]~~	~~[_____]~~
~~3.Ă [_____]~~	~~[_____]~~
~~4.Ă [_____]~~	~~[_____]~~
~~5.Ă [_____]~~	~~[_____]~~
~~6.Ă [_____]~~	~~[_____]~~
~~7.Ă [_____]~~	~~[_____]~~
~~8.Ă [_____]~~	~~[_____]~~
~~9.Ă [_____]~~	~~[_____]~~
~~10.Ă[_____]~~	~~[_____]~~

~~All parties should refer to the BCDC Guide.~~

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❒ Appendix 'B' – ALTERNATIVE PRICES

Project/Contract: UHN Histology lab renovation

Project/Contract No.: N662640003

From (Bidder): _____

company name

We, the above−named Bidder, offer the alternative prices requested below. The amount to be added to, or deducted from, our bid price (as entered in the Bid Form) is entered for each alternative requested. These prices do NOT include Value Added Taxes. If there is no change to the bid price for an alternative, we have so indicated. It is understood that:

a.Ă the *Owner* may accept any of the alternatives and corresponding alternative prices in any order or combination, including all or none,

b.Ă alternatives and alternative prices are open for acceptance by the *Owner* for the same period of time as the bid price, notwithstanding the award of the *Contract.*

c.Ă the *Work* of the *Contract* and the *Contract Price* will reflect the alternatives and alternative prices, if any, accepted by the *Owner* at the time of contract award, and

d.Ă acceptance of any alternatives will not affect the bid price contract completion time, unless we have specifically indicated an increase or decrease in time, in number of days, on account of a particular alternative.

e.Ă Acceptance of any alternative price will not affect the Listed Subcontractors on Appendix A unless it is noted below.

	Effect on Bid Price		
Description of Alternative	**Add**	**Deduct**	**Change to Listed Subcontractor** (if applicable)
Alternate Price No. 1			
	$_____	$_____	_____
Time (in Days)	_____	_____	

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Alternate Price No. 2

$_____ $_____

Time (in Days) _____ _____ _____

Alternate Price No. 3

$_____ $_____

Time (in Days) _____ _____ _____

Alternate Price No. 4

$_____ $_____

Time (in Days) _____ _____ _____

Alternate Price No. 5

$_____ $_____

Time (in Days) _____ _____ _____

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❒ Appendix 'C' – LIST OF UNIT PRICES

Project/Contract: UHN Histology lab renovation

Project/Contract No.: N662640003

From (Bidder): _____
company name

The following are our Unit Prices for the units of work listed hereunder. The Unit Prices listed apply to performing the units of work only during the Contract Time.

The below unit price(s) are intended for adjustment to the quantities, after contract award and as specified in the contract documents.

These prices do **NOT** include Value Added Taxes.

		Unit Price ($)	
Unit of Work		**Add per unit**	**Deduct per unit**
[	]	_____	_____
[	]	_____	_____
[	]	_____	_____
[	]	_____	_____
[	]	_____	_____
[	]	_____	_____
[	]	_____	_____
[	]	_____	_____
[	]	_____	_____
[	]	_____	_____
[	]	_____	_____

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❒ Appendix 'D' – LIST OF CASH ALLOWANCES

Project/Contract: UHN Histology lab renovation

Project/Contract No.: N662640003

From (Bidder): _____
company name

We, the above named Bidder, have provided the Cash Allowance(s) included in our bid price (as entered in the Stipulated Price Bid Form) as requested below. These prices do **NOT** include Value Added Taxes.

Description of Cash Allowance	**Amount $**
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]
[_____]	[_____]

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❒ Appendix 'E' – ITEMIZED PRICES

(To be submitted within two [2] working days of bid closing from the apparent successful Bidder, upon request from the Owner)

Project/Contract: UHN Histology lab renovation

Project/Contract No.: N662640003

From (Bidder): _____
company name

We, the above-named Bidder, provide the breakdown of items of *Work* included in our bid price (as entered in the Stipulated Price Bid Form) as requested below. It is understood that these itemized prices are provided for information purposes only and will not be used to modify the scope of the *Work* or adjust our bid price. These prices do **NOT** include Value Added Taxes.

Item of Work	**Itemized Price**

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❒ Appendix 'F' - BID MODIFICATION

(To be used where required)

Project/Contract: UHN Histology lab renovation

Project/Contract No.: N662640003

Owner: Project No. NHA N662640003 / SAL 115625050

From (Bidder): _____

Date: _____

Submit by:

☐ Fax _____

☐ Email _____

Bidders are to identify the project number and bid amendment in the email subject line

☐ Physical Address _____

_____

_____

WE HEREBY MODIFY OUR BID PRICE AS FOLLOWS:

	TO PREVIOUSLY SUBMITTED BID PRICE ADD	FROM PREVIOUSLY SUBMITTED BID PRICE SUBTRACT
MODIFICATION TO BID PRICE (in figures)	$ _____	$ _____
MODIFICATION TO BID PRICE (in writing)	ADD ƒ SUBTRACT	$ _____

These prices do **NOT** include Value Added Taxes.

Other amendments including issued addendum numbers are (or reference and include by attachment):

_____

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AMENDMENT TO SCHEDULE

If applicable, the amended change in time from the original bid is:

Add_____calendar daysfweeks; Subtract_____calendar daysfweeks.
*Bidders are to cross out which does **not** apply, days or weeks*

APPENDICES A, B, C AND D

If changes are required to Appendices A, B, C, and D, they must be submitted on new Appendix submission forms. Where applicable, these prices are completely new prices as per Division 00 21 13 Clause 11P Instructions to Bidders.

LEGAL NAME OF BIDDER: _____

ADDRESS: _____

TELEPHONE:_____ FAX:_____

EMAIL: _____

AUTHORIZED SIGNING OFFICER:

Name and Title: _____

Signature: _____

END OF SECTION

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00 73 16 INSURANCE REQUIREMENTS

1 − *OWNER* PROVIDED INSURANCE

.1 Refer to GC 11.1 − INSURANCE, GC 12.1 − INDEMNIFICATION and Supplementary Condition(s).

2 − CONTRACTOR PROVIDED INSURANCE

.1 Refer to GC 11.1 − Insurance, GC 12.1 − Indemnification and Supplementary Condition(s).

END OF SECTION

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00 73 63 CONTRACT SECURITY REQUIREMENTS

PERFORMANCE BONDS AND LABOUR AND MATERIAL PAYMENT BONDS

.1Ă The successful Bidder agrees to:

.1Ă Provide a Performance Bond and a Labour and Material Payment Bond each in the amount of fifty percent (50%) of the Contract Price.

.2Ă Provide these bonds within ten (10) Working Days of contract award. Maintain bonds in good standing until Contract fulfillment. Ensure requirements of GC 1 2.3 − WARRANTY are met and payment obligations arising under the Contract are made while bonds are still in place.

.3Ă Ensure the Performance Bond is issued on CCDC−221 Performance Bond form, and Labour and Material Performance Bond is issued on CCDC−222 Labour and Material Performance Bond form or other forms approved by the Surety Association of Canada and issued by a Surety acceptable to the *Owner.*

.4Ă Include bonding costs in the Bid Price.

.5Ă Ensure the oblige on the bonds is the *Owner.*

END OF SECTION

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PART 1.2 SUPPLEMENTARY CONDITIONS

For use with CCDC 2−2020 Stipulated Price Contract

ARTICLES

Add new:
Article A−9 TIME IS OF THE ESSENCE

"Time is of the essence in the performance of the Contract."

GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

PART 2 ADMINISTRATION OF THE CONTRACT

GC 2.3 REVIEW AND INSPECTION OF THE WORK

2.3.2 Add, in the first sentence "review," before the word "tests".

2.3.4Ă In the first sentence, replace "special" with "review," and add "review," before the third instance of "inspections".

Add new:
2.3.8 Should the *Consultant* be required to make more than one review of rejected work or should the *Consultant* perform additional reviews due to failure of the Work to comply with the application for status of completion made by the *Contractor*, the *Contractor* is required to compensate the *Owner* for such additional *Consultant* services including expenses incurred. Adjustment for such compensation should be made as outlined under PART 6 CHANGES IN THE WORK.

PART 3 EXECUTION OF THE WORK

GC 3.5 SUPERVISION

3.5.1 Add after the last sentence:
"The appointed *Contractor* representative shall not be changed without consultation with and written acceptance of the *Owner.* This acceptance shall not be unreasonably withheld."

GC 3.6 SUBCONTRACTORS AND SUPPLIERS

3.6.4Ă Add at the end of the sentence ", as outlined in GC 6.3 − CHANGE DIRECTIVE."

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PART 4 ALLOWANCES

GC 4.1 CASH ALLOWANCES

4.1.2Ă Add, after the first sentence "Unless noted otherwise, none of the work included in the drawings and specifications is intended to be paid for by the cash allowances. The cash allowances are for the *Owner's* use, at the *Owner's* sole discretion."

PART 5 PAYMENT

Amend the heading "**GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER**" to read "**GC 5.1 FINANCING INFORMATION REQUIRED**"

Delete paragraph 5.1.1 and 5.1.2 in their entirety and replace with:

5.1.1 The *Owner* and the *Contractor* shall provide each other with timely *Notice in Writing* of any material change in their financial ability to fulfill their respective obligations under the *Contract*.

GC 5.2 APPLICATIONS FOR PAYMENT

5.2.4 Add, after the first sentence:
"A secondary schedule, stating the anticipated monthly progress payments, is to be submitted upon request.**"**

Add new:
5.2.9 An application for payment shall be deemed received only if submitted complete with required supporting documentation as determined by the *Consultant***.**

GC 5.3 PAYMENT

5.3.1.1 Add another sentence:
"If, after a certificate of payment has been issued to the *Owner* (and prior to payment by the *Owner*), the *Consultant* determines on the basis of new information that the amount certified for payment is inappropriately high or low relative to the value of the work performed, then the *Consultant* shall issue a revised certificate of payment, and promptly advise the *Contractor* in writing giving reasons for the amendment."

Add new:
5.3.2 At the first application for payment following *Ready–for–Takeover*, the *Consultant* shall issue to the *Owner* and copy to the *Contractor*, a certificate for payment for an amount that deducts an amount equal to twice the value of any deficiencies as determined by the *Consultant*.

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Add new:

5.3.3 Partial payment may not be made for the completion or correction of any deficiencies shown on the comprehensive list of items to be completed or corrected prior to the date of the issuance of the final certificate of payment.

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

5.4.1 Ă Change *"*20 calendar days" to *"*10 days".

Add new:

5.4.7 At *Substantial Performance of the Work*, the *Consultant* shall issue a list itemizing the value of any items to be corrected or completed to the *Owner* and copy to the *Contractor*.

GC 5.5 FINAL PAYMENT

5.5.2 Change "calendar days" to "*Working Days*"

5.5.4 Change "5 calendar days" to "10 *Working Days*"

PART 6 CHANGES IN THE WORK

GC 6.2 CHANGE ORDER

Add new:

6.2.3 The following shall determine *Contractor* markup on *Change Orders* by percentage:

.1 To the cost of the *Work* performed by the *Contractor* directly, the *Contractor* may add a maximum of 20% markup for overhead and profit combined.

.2 To the cost of the *Work* performed by *Subcontractors* for the *Contractor*, before the *Subcontractor*'s markup, the *Contractor* may add a maximum of 10% markup for overhead and profit combined.

.3 On *Work* deleted from the *Contract*, not covered by unit prices, the credit to the *Owner* shall be the cost of the *Work* as set out in GC 6.3 − CHANGE DIRECTIVE, article 6.3.7.

.4 For a detailed list of what the *Contractor* may include in the cost of the *Work* before adding markups, refer to GC 6.3 CHANGE DIRECTIVE, article 6.3.7.

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GC 6.3 CHANGE DIRECTIVE

Add new:

6.3.14 The following shall determine *Contractor* markup on *Change Directives* by percentage:

.1 To the cost of the *Work* performed by the *Contractor* directly, the *Contractor* may add a maximum of 20% markup for overhead and profit combined.

.2 To the cost of the Work performed by Subcontractors for the *Contractor*, before the Subcontractor's markup, the *Contractor* may add a maximum of 10% markup for overhead and profit combined.

.3 On Work deleted from the Contract, not covered by unit prices, the credit to the Owner shall be the cost of the Work as set out in GC 6.3 – CHANGE DIRECTIVE, article 6.3.7.

GC 6.5 DELAYS

6.5.3.3 Add the word "local' after the word "adverse".

Add new:

6.5.6 The party making the claim shall submit to the *Consultant*, within 10 *Working Days*, an estimated quantum of the claim and of the *Contract Time* extension claimed, and the grounds upon which the claim is based complete with required supporting documentation as determined by the *Consultant*.

Add new:

6.5.7Ă Should the *Consultant*, in consultation with the *Contractor*, determine the *Contractor* is delayed in performance of the *Work*, or any part thereof, by the *Contractor's* inaction, or by delay or inaction of anyone employed or engaged by the *Contractor* directly or indirectly, and the *Contract Time* is compromised:

.1 Then the *Contracto*r shall accelerate the *Work* as required to meet the *Contract Time.*

.2 The *Consultant* will promptly give *Notice in Writing* of such determination to the *Owner* and the *Contractor*.

.3 The *Contractor* shall then promptly give the *Owner* and the *Consultant Notice in Writing* of specific changes to the construction scheduling and construction processes the *Contractor* will implement to accelerate the *Work*.

.4 The *Contractor* shall not be entitled to payment for costs to accelerate the *Work* to meet the *Contract Time*.

.5 If either party does not accept the *Consultant*'s determination, the disagreement shall be settled in accordance with Part 8 of the General Conditions – DISPUTE RESOLUTION. It being understood that by so doing neither party will jeopardize any claim the party may have to be reimbursed.

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GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

6.6.1 Delete: "Timely" and add "10 Working Days from the event or series of events giving rise to the claim"

PART 7 DEFAULT NOTICE

GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, STOP THE WORK, OR TERMINATE THE CONTRACT

7.1.5 In the first sentence, after "paragraph 7.1.1," replace "and" with "or".

PART 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.4 CONSTRUCTION SAFETY

Add to end of 9.4.1: "and be designated as the prime contractor"

PART 10 GOVERNING REGULATIONS

GC 10.2 LAWS, NOTICES, PERMITS, AND FEES

Add new:
10.2.8ĂThe *Contractor* shall provide to the *Consultant* copies of all inspection reports from the various authorities having jurisdiction within two *Working Days* of their receipt.

GC 10.4 WORKERS' COMPENSATION

Add new:
10.4.2 The *Contractor* is formally designated as the "prime contractor."

PART 12 OWNER TAKEOVER

GC 12.2 EARLY OCCUPANCY BY THE OWNER

Add new:
GC 12.2.5

The *Owner* may take possession of and use completed or partially completed portion of the *Work*, in addition to occupancy conditions included in the Contract, providing:

.1 Only as agreed by the Contractor, such agreement will not be unreasonably withheld.
.2 the portion of the *Work* is ready to be used for the purpose intended, to the satisfaction of the *Consultant* and authorities having jurisdiction; and
.3 the *Owner*'s possession and use do not interfere with the Contractor's *Work*; and
.4 the *Consultant* conducts a review prior to possession by the *Owner*; and
.5 any extra costs are borne by the *Owner*, subject to the provisions of GC 6.5 Delays.

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GC 12.3 WARRANTY

12.3.4 Add a second sentence "In effecting a correction of defects or deficiencies, the *Contractor* shall also bear all costs involved in removing, replacing, repairing, or restoring aspects of the *Work* that may be affected in the process of making the correction."

Add new:

12.3.7 Where a material, product or installation referenced in 12.3.1 covered by warranty fails, the stipulated warranty and warranty period shall be renewed for the specific work being replaced or repaired, with the exception of warranties referred to in GC 12.3.6. Such extended warranties referenced in 12.3.1, shall not exceed one year from the date of removing, replacing, repairing, or restoring.

Add new:

PART 14 MISCELLANEOUS

14.1 CONFIDENTIALITY

14.1.1 All information provided by or obtained from the *Owner* in any form in connection with the *Project*:

1. is the sole property of the *Owner* and must be treated as confidential;
2. is not to be used for any purpose other than the performance of the *Work*;
3. is not to be disclosed without prior written authorization from the *Owner*; and
4. must be returned to the *Owner* immediately upon request.

14.2 INFORMATION TECHNOLOGY RELATED THREATS

14.2.1 The *Contractor* shall notify the *Owner* and its mutual affiliates, as soon as reasonably possible, of any information technology related threat that may be transmitted electronically to the *Owner* or any of its affiliates which includes but is not limited to: viruses, rogue security software, trojan horses, spyware, computer worms, phishing, rootkits and any real or perceived electronic attack (the "IT Threat").

14.2.2 In the event the *Owner* becomes aware of an IT Threat, the *Owner* may as soon as reasonably possible, notify any organization that it reasonably believes could be exposed to the same IT Threat and include in such notification any relevant details for the purpose of avoiding or minimizing any negative impact.

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PART 1.3 PROJECT SPECIFIC AMENDMENTS

The Articles of Agreement Between Owner and Contractor, the General Conditions of the Stipulated Price Contract CCDC 2 – 2020, BCDC Division 00 and BCDC 2-2022 Supplementary Conditions together with the following alterations and additions shall apply in their entirety to the Contract.

AMENDMENTS TO DIVISION 00

PART 1.1 Division 00 21 13 – INSTRUCTIONS TO BIDDERS

Add:

4.2.3 Infection Control Guidelines - Contractors are required to comply with CSA Z317.13-22 or latest approved version, which may require specialized equipment & procedures. The following are guidelines only and not to be taken as complete instruction. Requirements will vary from project to project and it is the Contractor's responsibility to ensure they are fully aware of the requirements specific to this project. NH Infection Control Practitioners will instruct contractors as to the level of infection control measures required. Measures may include but are not limited to the following:

i) Dust control
   (1) may include hoarding from true ceiling to floor with 12 mil polyethylene, zippered doors.
   (2) hoarding may be required in ceiling space and vacuumed upon completion
   (3) room penetrations such as doors, windows, electrical outlets, intake and exhaust vents etc. may need to be sealed with plastic & duct/tuck tape (includes holes cut in walls as part of the project unless repaired within 8 hours).
   (4) water misting of work surfaces before cutting.
   (5) Construction workers to wear personal protective equipment, and to vacuum themselves with a HEPA filtered vacuum before leaving the work site, or wear cloth paper coveralls that are removed before leaving the work site.
   (6) Sticky walk-off mats at exit of hoarding, changed daily or more often if necessary
   (7) Immediate cleanup with HEPA filtered vacuum in the event hoarding tears/breaks
ii) Ventilation
   (1) area ventilation system disabled during construction/renovation
   (2) maintain negative pressure in construction zone
   (3) Exhaust air directly outside and away from any intake vents or to be filtered through HEPA filters before recirculating
iii) Debris Removal
   (1) Debris removal at each days end in a covered container or plastic garbage bag through designated route covered with moistened sheet before transporting
   (2) Container and wheels to be wiped down before re-entering facility
   (3) External chute if construction is not on ground floor
iv) Construction Clean
   (1) Wet mop and vacuum area with HEPA filtered vacuum upon completion
   (2) Wipe horizontal work surfaces with hospital approved disinfectant
v) Terminal Clean
   (1) To be performed by facility housekeeping staff upon completion of construction clean and PRIOR to hoarding being taken down

4.2.4 For greater clarity of CSA Z317.13-22 section 6.3.7 "Design and management professionals": The Design professional will be responsible for providing documentation demarcating the area and performance requirements required for infection control. The *Contractor* is required to design and provide the means and methods to meet the guidelines duly providing an IC plan and obtain acceptance from the MDT as per section 6.3.9.1.

4.2.5 Contractor shall comply with the infection control practices set out in the IPAC training program. Below is the link of the online course: https://www.csagroup.org/store/product/50000035/.

PART 1.1 Division 00 73 63 – CONTRACT SECURITY REQUIREMENTS

Replace entirely with the following:

PERFORMANCE BONDS AND LABOUR AND MATERIAL PAYMENT BONDS

.1 Refer to GC 11.1.13 of Part 1.3 Project Specific Amendments.

AMENDMENTS TO ARTICLES OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

ARTICLE A-5 PAYMENT

5.2.1 Replace “2%” with “0%”; Replace “4%” with “0%”.

AMENDMENTS TO GENERAL CONDITIONS

PART 3 EXECUTION OF THE WORK

GC 3.3.1 Temporary Wok

3.3.1 Add, after the first sentence "For further clarity, the *Contractor* acknowledges and agrees that the *Contract Price* is inclusive of all costs associated with the design, erection, operation, maintenance, and removal of *Temporary Work*, including any *Construction Equipment* required for the same. The *Contractor* is not entitled to any additional payment for any such *Temporary Work,* including any *Construction Equipment.*"

PART 5 PAYMENT

GC 5.2 APPLICATIONS FOR PAYMENT

Add:

5.2.10 The *Contractor* shall with each and every application for payment have an up-to-date red-lined as-built drawing available on site for *Consultant* review.

GC 5.3 PAYMENT

Delete: Section 5.3.1.2 in its entirety.

Add:

5.3.1.3 The *Owner* shall make payment to the *Contractor* on account as provided in Article A-5 of the Agreement – PAYMENT on or before 30 calendar days after the receipt by the *Owner* and the *Consultant* of the application for payment.

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

Add:

5.4.8 "An application for *Substantial Performance of the Work* shall be deemed complete only if submitted with required supporting documentation, including those requirements in GC 5.2.8, as determined by the *Consultant*, and including draft copies of *Operations and Maintenance Manuals* including table of contents, and approved shop drawings complete with *Operations and Maintenance Manuals* submissions."

Add new:

GC 5.8 WITHHOLDING OF PAYMENT

5.8.1 If because of climatic or other conditions reasonably beyond the control of the *Contractor*, there are items of work that cannot be performed, payment in full for that portion of the *Work* which has been performed as certified by the *Consultant* shall not be withheld or delayed by the *Owner* on account thereof, but the *Owner* may withhold, until the remaining portion of the *Work* is finished, only such an amount that the *Consultant* determines is sufficient and reasonable to cover the cost of performing such remaining work.

5.8.2 Upon the provision of *Notice in Writing* to the *Contractor*, and notwithstanding any other provisions of the *Contract Documents*, the *Owner* may withhold all or any portion of any payment to the extent necessary to protect the *Owner* from any actual or anticipated cost, damage, expense or loss arising from:

.1 the unsatisfactory progress of the *Contractor* in performing the *Work*, as determined by the *Consultant* acting reasonably and in good faith;

.2 the failure of the *Contractor* to pay any amounts properly due and payable by the *Contractor* to third parties arising from the performance of the *Work* in the aggregate amount of such amounts; and

.3 unsatisfied claims for costs, damages, expenses or losses caused by the *Contractor* to the *Work* or to the property of the *Owner*, the *Consultant*, other contractors, or to anyone employed at the *Place of the Work*, or in connection with the *Work*, including for greater certainty, wages, expenses or other amounts payable to any person employed for the performance of the *Work*, including *Subcontractors* and *Suppliers*.

5.8.3 The *Owner* may withhold any or all monies pursuant to GC 5.8.1 and 5.8.2 until such matters have been completed, remedied, discharged, cleared, satisfied or released. When the *Owner* is satisfied that it is no longer necessary to withhold payment from the *Contractor* for any or all of the matters listed in GC 5.8.2, the *Owner* shall release all or part of any amounts withheld except statutory holdback amounts.

PART 6 CHANGES IN THE WORK

GC 6.2 CHANGE ORDER

6.2.1 Replace "promptly present" with "present within 5 *Working Days*".
Add, after the last sentence "Failure to respond within the time limit deems the change in the *Work* to be at no cost to the *Owner*."

6.2.3 Replace “20%” with “15%”; replace “10%” with “7%”.

PART 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.4 – CONSTRUCTION SAFETY

9.4.1 Delete paragraph 9.4.1 in its entirety and substitute new paragraph 9.4.1:

9.4.1 The Contractor agrees to be the "Prime Contractor" for the purposes of all applicable occupational health and safety laws, including the *Workers Compensation Act* (British Columbia), and the Contractor is responsible for filing any documents necessary to comply with the *Workers Compensation Act* (British Columbia), including a Notice of Project. 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.

Add new paragraphs 9.4.6, 9.4.7 and 9.4.8:

“9.4.6 Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner*:

.1 a current Worksafe BC clearance letter;

.2 documentation of the Contractor’s in-house safety-related programs; and,

.3 a copy of the Notice of Project filed with WorkSafe BC naming itself as “Prime Contractor” under the Occupational Health and Safety Regulation pursuant to the *Workers Compensation Act* (BC).

9.4.7 The C*ontractor* shall indemnify and save harmless the *Owner*, its agents, officers, directors, employees, consultants, successors and assigns from and against the consequences of any and all safety infractions committed by the *Contractor* or *Subcontractors* under the *Workers Compensation Act* (BC) including the payment of legal fees and disbursements on a full indemnity basis.

9.4.8 In addition to the *Contractor's* obligations under this *Contract*, Owner may require *Contractor* to enter into the *Owner's* form of Prime Contractor Agreement."

PART 11 INSURANCE

GC 11.1 INSURANCE, replace entirely with the following:

GC 11.1 - INSURANCE

Without restricting the generality of GC 13.1—INDEMNIFICATION, insurance and coverage will be arranged and paid for as under-noted:

11.1.1 For the period when the *Owner’s* Commercial General Liability – Wrap up Insurance is not in force, the *Contractor* shall, without limiting its obligations or liabilities herein and at its own expense, provide and maintain the following insurance with insurers licensed in British Columbia:

(a) Commercial General Liability Insurance with a limit of not less than FIVE MILLION DOLLARS ($5,000,000), inclusive per occurrence against bodily injury and property damage, and the *Owner* is to be added as an additional insured and include a cross liability clause. This insurance shall be primary and not require the sharing of any loss by any insurer of the *Owner*.

11.1.2 **The *Contractor* shall, without limiting its obligations or liabilities herein and at its own expense, provide and maintain the following insurance with insurers licensed in British Columbia and in forms and amounts acceptable to the *Owner:***

(a) **Automobile Liability Insurance** in respect of each owned or leased vehicle if used directly or indirectly in the performance of the *Work*, subject to limits of not less than TWO MILLION DOLLARS ($2,000,000) inclusive per occurrence. This insurance shall be maintained continuously from commencement of the *Work* and kept in force until the *Project* has reached *Ready-for-Takeover* of the *Work.*

(b) Owned or Non-Owned Aircraft (including Unmanned Aircraft Vehicles) Liability Insurance if used directly or indirectly in the performance of the *Work*, subject to limits of not less than TWO MILLION DOLLARS ($2,000,000) inclusive per occurrence for bodily injury, death, and damage to property including loss of use thereof and including aircraft passenger hazard where applicable. The insurance will name the *Owner* as an additional insured and include a cross liability clause. This insurance shall be maintained continuously from commencement of the work involving aircraft (including unmanned aircraft vehicles) until such work is completed.

(c) Owned or Non-Owned Watercraft Liability Insurance if used directly or indirectly in the performance of the *Work*, subject to limits of not less than TWO MILLION DOLLARS ($2,000,000) inclusive per occurrence for bodily injury, death, and damage to property including loss of use thereof. The insurance will name the *Owne*r as an additional insured and include a cross liability clause. This insurance shall be maintained continuously from commencement of the work involving watercraft until such work is completed.

(d) Contractors Pollution Liability Insurance, where the *Contractor's* performance or the *Subcontractor's* performance of the *Work* is associated with hazardous materials clean up, removal and/or containment, transit, or disposal. This insurance must have a limit of liability not less than TWO MILLION DOLLARS ($2,000,000) inclusive per occurrence insuring against bodily injury, death, and damage to property including loss of use thereof.

Any insurance required under this clause 11.1.1 (d) must name the *Owner* as an additional insured, but only with respect to liability arising out of the *Contractor's* or the *Subcontractor's* performance of the work. Such insurance must include sudden and accidental, and gradual pollution events for third party liability including ongoing and completed operations and shall not be impaired by any, biological contaminants (without limitation, mould and bacteria), asbestos, or lead exclusions. Any 'insured vs. insured' exclusion shall not prejudice coverage for the *Owner* and shall not affect the *Owner's* ability to bring suit against the *Contractor* as a third party.

This insurance shall be maintained continuously from commencement of the work involving hazardous materials clean-up, removal and/or containment, transit and disposal until such work is completed and including a twenty-four (24) month extended reporting period if any such insurance is provided on a claims-made basis.

(e) Hot Roofing or Installation of Hot Membranes

If the project is a renovation involving hot roofing work or installation of hot membranes, the contractor will provide, maintain and pay for a liability policy insuring hot roofing or installation of hot membrane operations with a limit of not less than TWO MILLION DOLLARS ($2,000,000) inclusive per occurrence against bodily injury and property damage. This insurance will name the *Owner* as an additional insured and include a cross liability clause. This insurance will be treated as primary coverage and the *Owner's* Commercial General Liability - Wrap up Insurance will be treated as excess coverage.

Such insurance shall include, but not be limited to:

.01 Premises and Operations Liability;
.02 Products and Completed Operations;
.03 Owner's and Contractor's Protective Liability;
.04 Blanket Written Contractual Liability;
.05 Contingent Employer's Liability;
.06 Personal Injury Liability;
.07 Non-Owned Automobile Liability;
.08 Employees as Additional Insureds; and
.09 Broad Form Property Damage.

This insurance shall be maintained continuously from commencement of hot roofing or installation of hot membrane work until such work is completed.

11.1.3 Any insurance required under clauses 11.1.1 (a) and 11.1.2 (b), (c), (d) and (e) must be endorsed to provide the *Owner* with 30 days' advance written notice of cancellation.

11.1.4 As may be applicable, the *Contractor* must cause all *Subcontractors* to comply with the insurance requirements outlined in clauses 11.1.2 (a) (b), (c), (d) and (e).

11.1.5 The *Owner* shall, without limiting its obligations or liabilities herein and at its own expense, provide and maintain the following insurance and coverages:

(a) Commercial General Liability – Wrap Up Insurance with a limit of not less than TEN MILLION DOLLARS ($10,000,000) inclusive per occurrence, TWENTY MILLION DOLLARS ($20,000,000) general aggregate for third party bodily injury, death, and damage to property including loss of use thereof, product/completed operations liability with a limit of not less than TEN MILLION DOLLARS ($10,000,000) aggregate.

This insurance will cover the *Owner*, the *Contractor*, *Subcontractors*, *Consultant*, sub-consultants and anyone employed by them to perform a part or parts of the *Work* but excluding suppliers whose only function is to supply and/or transport products

to the project site, or security protection persons or organizations providing project site protection on or at the insured project. The insurance does not extend to any activities, works, jobs or undertakings of the insureds other than those directly related to the *Work* of this *Contract*.

The insurance will preclude subrogation claims by the insurer against anyone insured hereunder.

Such insurance shall include, but not be limited to:

.01 Premises and Operations Liability;
.02 Products and Completed Operations Liability (24 months);
.03 Blanket Written Contractual Liability;
.04 Cross Liability and/or Severability of Interests;
.05 Contingent Employer's Liability;
.06 Personal Injury Liability;
.07 Shoring, Blasting, Excavating, Underpinning, Demolition, Piledriving, Subsurface and Grading, as applicable;
.08 Limited Pollution Liability (TWO MILLION DOLLARS ($2,000,000))
.09 Broad Form Tenants Legal Liability (ONE MILLION DOLLARS ($1,000,000))
.10 Operation of Attached Machinery
.11 Forest Fire Fighting Expenses (ONE MILLION DOLLARS ($1,000,000))

There will be a deductible not exceeding FIFTY THOUSAND DOLLARS ($50,000) per occurrence except with respect to completed operations, to which a deductible not exceeding ONE HUNDRED THOUSAND DOLLARS ($100,000) per occurrence will apply.

This insurance will be maintained continuously from commencement of the *Work* and kept in force until the *Project* has reached at a minimum *Ready-for-Takeover* of the *Work*, plus with respect to completed operations coverage a further period of twenty-four (24) months.

(b) Course of Construction (Builders Risk) coverage, against "All Risks" of direct physical loss or damage including the peril of equipment breakdown, and will cover all materials, property, structures and equipment purchased for, entering into, or forming part of the *Work* while located anywhere within Canada and continental United States of America during construction, erection, installation and testing and commissioning, but such coverage may be subject to off-site storage and transit exposure sub-limits and shall not include coverage for the *Contractor's* and *Subcontractor's* equipment ofany description.

There will be a deductible not exceeding:

(1) TWENTY THOUSAND DOLLARS ($20,000) for each and every occurrence where the project value is TEN MILLION DOLLARS ($10,000,000) or less, or;
(2) FIFTY THOUSAND DOLLARS ($50,000) for each and every occurrence where the project value exceeds TEN MILLION ($10,000,000)

except for the following perils:

Earthquake with a deductible not exceeding FIVE PERCENT (5%) of the total project value at the time of the loss, subject to a minimum TWO HUNDRED FIFTY THOUSAND

DOLLARS ($250,000);
Water Damage perils (includes Flood and Sewer and Drain Back Up) with a deductible not exceeding ONE HUNDRED THOUSAND DOLLARS ($100,000);
Soft Costs with a one day waiting period for each month of the estimated project term subject to a minimum waiting period of 30 days will apply with respect to soft costs.

The coverage will include as a protected entity, the *Owner*, the *Contractor*, *Consultant* and each *Subcontractor* who is engaged in the *Project*.

The coverage will contain a waiver of the *Owner's* rights of subrogation against all protected entities except that rights of subrogation will be retained against architects, engineers and manufacturers (who are not employees of a protected entity) for liability in the event of loss caused by or resulting from any error in design or any other professional error or omission pertaining to the subject of this insurance.

The *Contractor* will, at its own expense, take precautions to prevent fires occurring in or about the *Work* and will observe, and comply with, all insurance policy warranties and all laws and regulations in force respecting fires.

This insurance will be maintained continuously from commencement of the *Work* and will be kept in force until the *Project* has reached *Ready-for-Takeover* of the *Work.*

11.1.6 The description of the *Owner* arranged insurance described herein is provided on a summary basis only and is not a statement of the actual policy terms and conditions. The *Owner* does not represent or warrant that the *Owner* arranged insurance contains insurance for any and all losses. It is the *Contractor's* responsibility to ascertain the exact nature and extent of coverage provided by the *Owner* arranged insurance, to review all policies pertaining thereto and to obtain any other insurance that it may be prudent for the *Contractor* to obtain.

11.1.7 The *Contractor* will also provide, maintain and pay for any other insurance that the *Contractor* is required by law to carry, or which the *Contractor* considers necessary.

11.1.8 The *Contractor* and/or its *Subcontractors*, the *Consultant* and sub-consultants as may be applicable, will be responsible for any deductible amounts under the policies of coverage and insurance except for the perils of flood and earthquake.

11.1.9 The *Owner* will, upon request, provide the *Contractor* with proof of insurance of those coverages and insurances required to be provided by the *Owner* prior to commencement of the *Work* and subsequent certified copy of policies within a reasonable time period thereafter.

11.1.10 The *Contractor* will provide the *Owner* with proof of insurance for those insurances required to be provided by the *Contractor* prior to the commencement of the *Work* in the form of a completed Certificate of Insurance and will also provide a certified copy of any required policies upon request.

11.1.11 The *Owner* will not be responsible for injury to the *Contractor's* employees or for loss or damage to the *Contractor's* or to the *Contractor's* employees' machinery, equipment, tools or supplies which may be temporarily used or stored in, on or about the project site during construction and which may, from time to time, or at the termination of this *Contract*, be removed from the project site. The *Contractor* hereby waives all rights of recourse against the *Owner* with regard to damage to the *Contractor's* property.

11.1.12 If the *Contractor* fails to provide, maintain and pay for insurance as required by this schedule, other than automobile liability insurance, the *Owner* may obtain and pay for the required insurance, the cost of which will be payable on demand by the *Owner*. The *Owner* may offset such amounts from any monies due to the *Contractor* if not paid within 15 days.

CONTRACT SECURITY

11.1.13 The *Contractor* shall prior to commencement of the *Work* furnish performance and labour and material payment bonds within fourteen (14) days of the date of this *Contract*. Each bond must be in a sum equal to 50% of the total *Contract Price*. The bonds must be issued on the latest CCDC-221 or CCDC-222 approved forms or other such forms approved by the Surety Association of Canada and issued by a surety company registered in the Province of British Columbia or another surety company acceptable to the *Owner*. The *Contractor* must maintain the bonds in good standing until the fulfilment of the *Contract*.

GC 13.1 INDEMNIFICATION, delete GC 13.1.1 and 13.1.2 and replace with the following:

GC 13.1 – INDEMNIFICATION

13.1.1 Without restricting the parties' obligation to indemnify as described in paragraphs 13.1.4 and 13.1.5, and excepting always losses caused or contributed to by the acts of the party for whom indemnification is sought, the *Owner* and the *Contractor* shall each indemnify and hold harmless the other from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings whether in respect to losses suffered by them or in respect to claims by third parties that arise out of, or are attributable in any respect to their involvement as parties to this *Contract*, provided such claims are:

.1 caused by:
(1) the acts or omissions of the party from whom indemnification is sought or anyone for whose acts or omissions that party is liable, or;
(2) a failure of the party to the *Contract* from whom indemnification is sought to fulfill its terms or conditions; and

.2 made by *Notice in Writing* within such periods as prescribed by the *Limitation Act* of the Province of British Columbia.

13.1.2 The obligation of either party to indemnify as set forth in paragraph 13.1.1 shall be limited as follows:

.1 In respect to losses suffered by the *Owner* and the *Contractor* for which Insurance is to be provided by either party pursuant to GC 11.1 - INSURANCE, the limit of:
(1) Commercial General Liability coverage – GC 11.1.1 (a);
(2) Commercial General Liability – Wrap Up Insurance – GC 11.1.5 (a); or
(3) Course of Construction (Builders Risk) – GC 11.1.5(b)
whichever is pertinent to the loss.

.2 In respect to losses suffered by the *Owner* and the *Contractor* for which insurance is not required to be provided by either party in accordance with GC 11.1 – INSURANCE, the greater of:
(1) the *Contract Price* as recorded in Article A-4 – CONTRACT PRICE or;
(2) TWO MILLION DOLLARS ($2,000,000),
but in no event shall the sum be greater than TWENTY MILLION DOLLARS ($20,000,000).

.3 In respect to indemnification by a party against the other with respect to losses suffered by them, such obligation shall be restricted to direct loss or damage, and neither party shall have any liability to the other for indirect, consequential, punitive or exemplary damages.

.4 In respect to indemnification respecting claims by third parties, the obligation to indemnify is without limit.

Divisions 1 - 10

Architectural

Part 1 General

1.1 PROJECT

.1 Project Name: University Hospital of Northern British Columbia (UHNBC) Histology lab renovation.

.2 Project Location: 1475 Edmonton St, Prince George

.3 Project Description: renovation to the space as indicated on Drawings.

1.2 CONTRACT DESCRIPTION

.1 Contract Type: Design Bid Build

1.3 CHANGE ORDER PRICING

.1 The Contractor is to include a full breakdown of material, labour, markup, tax, and impact to schedule for all pricing for change orders. Incomplete documentation will be rejected by the Consultant.

1.4 DESCRIPTION OF ALTERATIONS WORK

.1 Scope of demolition and removal work is shown on drawings and specified in Section 02 41 19 - Selective Demolition.

1.5 WORK BY OWNER

.1 Owner will supply and install the following:

- .1 non-fixed furniture
- .2 non-fixed fixtures
- .3 non-fixed equipment

.2 Owner will supply and Contractor will install the following: (backing provided by Contractor)

- .1 White Boards / Tack Boards
- .2 Monitor Mounts
- .3 Select Washroom Accessories, soap dispenser, paper towel dispensers

.3 The Owner will remove all medical equipment, computers and printers from construction areas prior to construction. Coordination between Owner and Contractor will be required.

1.6 OWNER OCCUPANCY

.1 Owner will occupy the existing building during the entire construction period. Contractor is responsible for the area under their control, including safety, security, and fire protection.

1.7 CONTRACTOR USE OF SITE AND PREMISES

.1 Coordinate use of premises under direction of Owner.

.2 Emergency Building Exits During Construction: Do not obstruct roadways, sidewalks, or other public ways without permit.

1.8 COMMUNICATIONS - REQUESTS FOR INFORMATION

.1 Written enquiries from the Contractor, commonly referred to as "Requests for Information" or "RFIs" shall be submitted electronically through the internet using standard internet web browser software.

1.9 HOURS OF WORK

1. After-hours work may be required for shut downs and work on transitions spaces adjacent to the elevators.

2. Most works can be carried out during Normal Hours (07:00 – 16:00, M-F).

3. Work on Level 0 is to be done to minimize disruption. Infection control measures are required, but access to this area should not be impeded for longer than absolutely necessary. It should be anticipated to be completed during evenings/weekends, with access left open during normal hours. Depending on scope of work, a containment cube may be a suitable solution in this location. No work is to happen in this area without prior coordination through Facilities

4. Maintenance and the NHA Project Manager, who would coordinate with any impacted departments.

5. All after hours work (anything outside of normal hours identified above), is to be coordinated and approved by site Facilities Management Staff and the NHA Project Manager.

6. Contractor shall provide minimum 4 weeks notification prior to Mechanical / Electrical Shutdowns. Shutdown request forms are to be submitted to the NHA Project Manager at this time to allow for adequate coordination. Final dates for shutdowns are at the discretion of FM staff and may be adjusted depending on staffing availability/workload.

7. Contractor to provide fire watch during Hot Work and Sprinkler Shut down. Contractor toapply for a Hot Work Permit through FM.

8. Noisy work is to be coordinated through Facilities Maintenance and the NHA PM prior to commencing.

9. There is to be no Contractor parking on site, even within the paid public parking areas. There is paid street parking through the City of PG surrounding the hospital that can be used and we recommend carpooling to limit the number of vehicles near site. Parking in grassed/gravel areas on NH property is not allowed and may result in removal of offending vehicles at the vehicle owner’s expense.

10. Any deliveries/offloading of materials/equipment is to be coordinated through Facilities

11. Maintenance or the NHA Project Manager. There is space near plant services, as well as at the loading dock that can be used, but access is to be coordinated whenneeded.

12. There is no additional laydown area beyond the project boundaries for storage of materials, etc.

13. Additionally, there is no space allocated on the UHNBC site for a dumpster, etc.

14. There is no smoking or vaping on NHA property.

15. Contractor access is coordinated through the NHA PM and site Facilities Maintenance staff.

16. Photo ID/Contractor Access badges will be coordinated at the project start up. Sign in/sign out of Contractor staff and sub contractors will be required each day.

17. Any incidents (safety, Infection Control, etc.) that occur on site are to be immediately reported to (in order), Site Facilities Maintenance contact (or after hours on call number) and NH Project Manager. Notification should be prompt, once all immediate safety concerns have been addressed to mitigate the impact. Additional notification may be required to Workplace Health and Safety, Infection Control, Worksafe BC, etc.

18. Contractor to submit a “Risk Reduction Measures Construction Report” to NHA for review and approval prior commencement of construction. Each separate area of work will require a separate submission if the procedures followed will vary. All decisions regarding what level of infection control requirements are needed are made as part of a collaborative approach through the Multi-Disciplinary Team (which includes NHA and Contractor participants) before work begins.

19. As outlined in the “Risk Reduction Measures Construction Report”: The Constructor’s on-site team shall include at least one person with demonstrated knowledge and experience in Infection Prevention at all times during construction. Workers not trained in infection prevention shall not work alone, shall work with or be supervised by trained personnel.

20. The Preliminary Schedule used for bidding purposes at time of award is not considered an approved schedule. Construction Schedules must be reviewed with and approved by NHA prior to mobilization. Ongoing coordination and collaboration with NHA will be required to ensure that sufficient time is allowed for the NHA portions of work on this project. This includes, but is not limited to: IMIT moves, department moves, relocation into temporary spaces, etc. it is recommended to allow for two weeks of coordination time of Northern Health resources and stakeholders. Often this can occur concurrently with other project activities. Please clearly indicate any responsibilities or coordination activities on the schedule to be completed by Northern Health to ensure that the project schedule can progress as planned.

21. All of this work is occurring within an active health care facility. Coordination is not intended to stop the project progress, but rather to ensure that NHA staff, patients and visitors are considered as well. D44

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 61 00 - Product Requirements.

1.2 ADMINISTRATIVE

.1 Contractor shall schedule and administer project meetings throughout the progress of the Work.

.2 Prepare agenda for meetings.

.3 Distribute written notice of each meeting four (4) days in advance of meeting date to Consultants and the Owner.

.4 Provide physical space for the meetings within the area of work.

.5 Make arrangements for and preside at meetings.

.6 Record the minutes. Include significant proceedings and decisions. Identify action required.

.7 Reproduce and distribute copies of minutes within three (3) days after each meeting and transmit to meeting participants, affected parties not in attendance, the Consultant and the Owner.

.8 Representatives of Contractor, Subcontractor and suppliers attending meetings shall be qualified and authorized to act on behalf of the party each represents.

1.3 MEETINGS

.1 PRECONSTRUCTION MEETING

.1 Within seven (7) days after award of contract, request a meeting of participants in the Work to discuss and resolve administrative procedures and responsibilities and scheduling.

.2 Representatives of the Owner, Consultant, other Consultants, Contractor, major subcontractors, field inspectors and supervisors shall be in attendance.

.3 Establish time and location of meeting and notify parties concerned minimum four (4) days before meeting.

.4 Agenda to include the following:

.1 Construction start-up review by Owner's Representative.

.2 Confirmation of authorized representative of the Owner, Consultant, other Consultants, and the Contractor Construction Safety Officer.

.3 Schedule of Work, progress scheduling (Section 01 32 00 - Construction Progress Documentation).

.4 Schedule of submission of shop drawings, samples, colour schedule (Section 01 33 00 - Submittal Procedures).

.5 Requirements for temporary facilities, offices, storage sheds, utilities, fences (Section 01 52 00 - Construction Facilities).

.6 Site security (Section 01 52 00 - Construction Facilities).

.7 Confirmation that affected utility services will be disconnected.

.8 Contemplated change notices, change orders, mark-up percentages, overtime, time extensions, procedures, approvals required, administrative requirements (GC).

.9 As-Built drawings (Section 01 33 00 - Submittal Procedures).

.10 Maintenance manuals (Section 01 33 00 - Submittal Procedures).

.11 Takeover procedures, acceptance, warranties (Section 01 77 00 - Closeout Procedures).

.12 Monthly progress claims, monthly submittals, administrative procedures, holdbacks (GC).

.13 Appointment of inspection and testing agencies or firms (Section 01 45 00 – Quality Control).

.14 Insurances, transcript of policies (GC).

.15 Review of certified professional related items.

.2 PROGRESS MEETINGS

.1 During course of Work and prior to completion, schedule progress meetings as directed by the Consultant.

.2 Contractor, major Subcontractors involved in Work, Owner's representative and Consultant to be in attendance.

.3 Notify parties minimum four (4) days prior to meetings.

.4 Record minutes of meetings and circulate to attending parties, affected parties not in attendance, and all Consultants within four (4) days after meeting.

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

.5 Review of off-site fabrication and materials delivery schedules including shop drawings submission review.

.6 Corrective measures and procedures to regain project schedule.

.7 Revisions to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules and expedite as required.

.10 Maintenance of quality standards.

.11 Review of constuction waste management procedures.

.12 Pending changes and substitutions.

.13 Review proposed changes for effect on construction schedule and on completion date.

.14 Materials delivered.

.15 Site Safety.

.16 Shut Down requests.

.17 Inspections called for.

.18 Witnesses required.

.19 Action required by.

.20 Pending action.

.21 Overdue action.

.22 Other business.

.23 List of outstanding claims.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Schedules, form, content, submission.

.2 Critical path scheduling.

.3 Progress photographs.

.4 Submittals schedule.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SCHEDULES

.1 Submit schedules as follows:

.1 Submittal Schedule for Shop Drawings and Product Data.

.2 Submittal Schedule for Samples.

.3 Submittal Schedule for timeliness of Owner-furnished Products.

.4 Product Delivery Schedule.

.5 Shutdown or closure activity.

.2 Schedule Format

.1 Prepare schedule in form of a horizontal Gantt bar chart.

.2 Provide a separate bar for each major item of work.

.3 Split horizontally for projected and actual performance.

.4 Provide horizontal time scale identifying last Working Day of each week.

.5 Format for listings: Chronological order of start of each item of work.

.6 Identification of listings: By systems description.

.3 Schedule Submission

.1 Submit initial format of schedules within fifteen (15) working days after award of Contract.

.2 Submit schedules in electronic format, forward through e-mail files.

.3 Consultant will review schedule and return review copy within ten (10) days after receipt.

.4 Resubmit finalized schedule within seven (7) days after return of review copy.

.5 Submit revised progress schedule with each application for payment.

.6 Distribute copies of revised schedule to:

.1 Job site office.

.2 Subcontractors.

.3 Other concerned parties.

.7 Instruct recipients to report to Contractor within ten (10) days, any problems anticipated by timetable shown in schedule.

1.4 CONSTRUCTION PROGRESS SCHEDULING

.1 Submit initial schedule in duplicate within fifteen (15) days after date established in Notice to Proceed.

.2 Revise and resubmit as required.

.3 Submit a revised construction schedule with each Application for Payment, identifying changes since previous version.

.4 Submit a computer generated horizontal bar chart with separate line for each major portion of Work or operation, identifying first work day of each week.

.5 Show complete sequence of construction by activity, identifying Work of separate stages and other logically grouped activities. Indicate the early and late start, early and late finish, float dates, and duration.

.6 Indicate estimated percentage of completion for each item of Work at each submission.

.7 Indicate submittal dates required for shop drawings, product data, samples, and product delivery dates, including those furnished by Owner and required by Allowances.

.8 Include dates for commencement and completion of each major element of construction as follows.

- .1 Demolition/Abatement.
- .2 Building Services.
- .3 Repair Work.
- .4 Structural Framing.
- .5 Special Subcontractor Work.
- .6 Equipment Installations.
- .7 Finishes.

.9 Indicate projected percentage of completion of each item as of first day of month.

.10 Indicate progress of each activity to date of submission schedule.

.11 Indicate changes occurring since previous submission of schedule:

- .1 Major changes in scope.
- .2 Activities modified since previous submission.
- .3 Revised projections of progress and completion.
- .4 Other identifiable changes.

.12 Provide a narrative report to define:

- .1 Problem areas, anticipated delays, and impact on schedule.
- .2 Corrective action recommended and its effect.
- .3 Effect of changes on schedules of other prime contractors.

1.5 CRITICAL PATH SCHEDULING

.1 Include complete sequence of construction activities.

.2 Include dates for commencement and completion of each major element of construction as follows.

.1 Demolition/Abatement.
.2 Building Services.
.3 Foundation Work.
.4 Structural Framing.
.5 Special Subcontractor Work.
.6 Equipment Installations.
.7 Finishes.

.3 Show projected percentage of completion of each item as of first day of month.

.4 Indicate progress of each activity to date of submission schedule.

.5 Show changes occurring since previous submission of schedule:

.1 Major changes in scope.
.2 Activities modified since previous submission.
.3 Revised projections of progress and completion.
.4 Other identifiable changes.

.6 Provide a narrative report to define:

.1 Problem areas, anticipated delays, and impact on schedule.
.2 Corrective action recommended and its effect.
.3 Effect of changes on schedules of other prime contractors.

1.6 PROGRESS PHOTOGRAPHS

.1 Digital Photography:

.1 Submit electronic copy of colour digital photography in *.jpg format.
.2 Identification: Name and number of project and date of exposure indicated.

.2 Number of Viewpoints: Locations of viewpoints determined by Construction Progress.

.3 Frequency: Weekly construction review.

1.7 SUBMITTALS SCHEDULE

.1 Include schedule for submitting shop drawings, product data, samples.

.2 Indicate dates for submitting, review time, resubmission time, and last date for meeting fabrication schedule.

.3 Include dates when delivery will be required for Owner-furnished products.

.4 Include dates when reviewed submittals will be required from Consultants.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Shop drawings and product data.

.2 Samples.

.3 Certificates and transcripts.

1.2 RELATED SECTIONS

.1 Other sections requesting submittals.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 ADMINISTRATIVE

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

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

.3 Present Shop Drawings, product data, samples and mock-ups in SI Metric units.

.4 Where items or information is not manufactured or produced in SI Metric units, converted values within the metric measurement tolerances are acceptable.

.5 Review submittals prior to submission to Consultant. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents.

.6 Submittals not stamped, signed, dated, identified as to specific project, and attesting to their being reviewed will be returned without being examined and shall be considered rejected.

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

.8 Verify field measurements and affected adjacent Work are coordinated.

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

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

.11 Submit 1 copy of shop drawings and samples to consultant for review. Keep one (1) reviewed copy of each submission on site.

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.3 Allow ten (10) days for review of each submission, or ten (10) days for review of large submission.

.4 Adjustments made on Shop Drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.5 Make changes in Shop Drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.

.6 Accompany submissions with duplicate transmittal letter, containing:

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

.7 Submissions shall include:

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

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to other parts of the Work.

.8 Submit electronic copy of Shop Drawings for each requirement requested in specification Sections and as Consultant may reasonably request. If electronic copy is not feasible, submit hard copies as necessary. Consultant will keep up to 2 copies for their records.

.9 Delete information not applicable to project.

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

.11 If upon review, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

1.5 SAMPLES

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

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

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

.4 Where colour, pattern or texture is criterion, submit full range of samples.

.5 Adjustments made on samples by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

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

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

1.6 MOCK-UP

.1 Erect mock-ups to Section 01 45 00.

1.7 CERTIFICATES AND TRANSCRIPTS

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

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

END OF SECTION

Part 1 General

1.1 GENERAL

.1 Comply with the minimum Preventive Measures for the specific classification as defined by the Northern Health Infection Prevention & Control Manual.

1.2 REFERENCES

.1 Health Canada Publication:

.1 Construction Related Nosocomial in Patients in Health Care Facilities.

.2 Canadian Standards Association:

.1 CAN/CSA-Z317.1-16, Special Requirements for Plumbing Installations in Health Care Facilities.

.2 CAN/CSA-Z317.2-19 Special Requirements for Heating, Ventilation and Air Conditioning (HVAC) Systems in Health Care Facilities.

.3 CAN/CSA-Z317.10-15, Handling of Waste Materials in Health Care Facilities and Veterinary Health Care Facilities.

.4 CAN/CSA-Z317.13-17, Infection Control during Construction, Renovation, and Maintenance of Health Care Facilities.

.3 Northern Health:

.1 Infection Control Manual IX0900 Construction Projects and IX1000 Construction and Renovation Guidelines.

1.3 CONSTRUCTION SAFETY MEASURES

.1 Observe and enforce construction safety measures required by Canadian Construction Safety Code, Worksafe BC, Occupational Health and Safety Act, Worker's Compensation Board and municipal statutes and authorities.

.2 In event of conflict between any provisions of above authorities the most stringent provision to apply.

.3 Submit to Consultant copies of all reports and stop work orders issued by local construction safety inspector.

.4 Job Superintendent: Each Contractor or employer shall appoint a person to be Job Superintendent on each project undertaken by that Contractor or employer.

.5 Job Superintendent’s Responsibility for Safety: The Job Superintendent is, throughout the job or project. Responsible for the safety and conduct on the job of the workers employed by the Contractor.

.6 Subcontractors’ Responsibility for Safety: Each Subcontractor working on a project shall appoint a person who shall be responsible for the safety and conduct on the project of every worker who is subject to that Subcontractor’s authority, and the Subcontractor shall forthwith file with the Job Superintendent the name of that person.

1.4 OVERLOADING

.1 Do not create unsafe conditions or permanent structural deformation by overloading any part of the Work.

1.5 INFECTION CONTROL AND PREVENTION

.1 Adhere to the requirements of CAN/CSA-Z317.13-17 during construction or renovation of Health Care facilities. Refer to tables in this section.

.2 Areas designated for construction and renovation shall follow the Guidelines of CSA-Z317.13-17. Coordinate all aspects of the construction work with the Owner's Representative (ICP).

1.6 DEFINITIONS

.1 "ICP' refers to the Owner's Infection Control Personnel who shall act as the Owner's Representative on site with respect to the Work of this section. The ICP shall have the authority to stop construction if breaches in prevention measures arise. Contractor shall not make any claim against the Owner arising from stop work orders issued as a result of breaches in prevention measures.

1.7 QUALITY ASSURANCE

.1 As applicable to the sequencing of construction and the Contractor's methods, the Contractor is required to comply with precautions required by the Owner's Representative (ICP) in conformance with the document "Construction Related Nosocomial Infections in Patients in Health Care Facilities" published by Health Canada and CAN/CSA-Z317.1, CAN/CSA-Z317.2 and CAN/CSA-Z317-10.

1.8 PRECONSTRUCTION PREVENTIVE MEASURES

.1 Consult with the ICP who shall coordinate all essential information related to infection prevention measure that may be required

.2 ICP shall identify patient population(s) that may be at risk and the prevention measures to ensure their safety and regularly provide this information to the Contractor.

.3 ICP and Contractor shall identify essential services (i.e. water supply, electricity, ventilation systems) that may be disrupted and measures to compensate for the disruption.

.4 Review and assess the integrity of the health care facility's exterior structure, the spatial separations and its ventilation and water supply for any infection control problems to the satisfaction of the ICP. Ensure that the air pressure, airflow and air exchange rates have been assessed by the HVAC personnel and that filtration systems are working appropriately. Any infection control problems identified shall be corrected prior the starting the construction activity.

.5 Ensure that the plumbing materials selected are durable and resistant to corrosion and bacterial growth to the satisfaction of the ICP. Items made of degreased stainless steel, natural un-pigmented polypropylene, polytetrafluoroethylene (PTEE), or polyvinyldenefluoride (PVDF) are examples of materials that are non-leaching and will not degrade the quality of water.

.6 As required, the ICP shall educate the Contractor on the infection prevention measures who shall then ensure that the construction workers receive the appropriate education.

1.9 DEMOLITION RESTRICTIONS

.1 Refer also to Section 02 41 19 – Selective Demolition for restrictions regarding timing of demolition, noisy operations, power equipment operation, removal of debris in-an-out of hours work etc.

1.10 HAZARDOUS DESIGNATED SUBSTANCES

.1 In the event that any asbestos containing material or any other hazardous material such as molds, lead or mercury is discovered during the course of carrying out the Work by the Contractor or the Subcontractors that is not identified in the hazardous material survey, immediately stop work, report the discovery, orally and in writing to the Owner and the Consultant.

.2 Remove and dispose of the hazardous material in accordance with applicable codes and regulations.

.3 The General Contractor is to retain the services of a certified hazardous materials abatement specialist to deal with hazardous materials encountered during construction.

.4 Refer to Section 02 81 00 for additional information.

1.11 PERFORMANCE OF THIS WORK

.1 Work of the Contract once commenced at the place of the Work shall be completed within the shortest possible time, consistent with requirements of the Contract Documents.

.2 Work shall be organized as much as possible prior to commencement at the place of the Work, and supplies of materials and products shall be secured and deliveries of same scheduled including, in part, the supply and delivery of specially manufactured items, all to favour expeditious performance of the Work at the place of the Work.

.3 Work shall not commence at the Hospital until Contractor has satisfied the Consultant that products and materials will be available at the time required for building into the work, and that unavailability of products and materials at the appropriate time will not prejudice expeditious performance of the Work.

1.12 PARKING

.1 The Contractor will be responsible for their own parking arrangements. As parking on site is limited its recommended that trades carpool when possible.

1.13 MAINTENANCE OF EXISTING BUILDING SERVICES

.1 Ensure existing building services are maintained continuously throughout the period of renovations. Keep any temporary interruptions to electrical power, water and other services to an absolute minimum.

.2 When interruptions or connections to existing services are required, i.e., electrical power, water, etc., refer to the Owners General Requirements in the appendix for shut down procedures. Contractor is to ensure all site impact notices are filled and signed off by the

owner prior to the start of work. Typically, it is required that the Work be done outside of normal working hours, the cost of such overtime incurred by the Contractor will be the Contractor's responsibility.

.3 All final connections to existing operational systems shall be carried out in the presence of the Owner's Operation staff.

.4 The Owner will cooperate in the shutdown of services as is necessary to allow connections to be made to existing services. However, if as a result of defective materials or workmanship or lack of contractor planning it is necessary for any shutdowns to be repeated, then the cost of the labour provided by the Owner, to repeat the shutdown and the later connection will be charged against the Contractor, and this cost will be deducted from the Contract Price.

1.14 EXISTING FACILITIES AND REGULATIONS

.1 The Owner shall have complete jurisdiction over the entry of the Contractor's staff and workmen to the existing buildings.

.2 Access within existing buildings to and between various areas of the Work shall be by Owner designated routes only. Access for workmen between existing floors shall be by use of designated existing stairs and service elevator, and on floors by use of designated interior corridors acceptable to the Owner. The stairs, service elevator and corridor routes to be used by the Contractor will be designated by the Owner's representative. Such access shall be kept to a minimum and must be approved by the Owner.

.3 Smoking is not permitted on the Hospital property.

.4 Ensure that responsible construction personnel are on hand to receive materials and equipment where delivered, the Hospital will not be responsible for receiving or storing construction materials and equipment.

.5 Receipt of prefabricated items too large for designated routes may be arranged for transport to the construction enclosures with the Owner in advance of receiving prefabricated items.

.6 Establish procedures to minimize tracking mud, dirt and waste construction materials onto Hospital property and driveways or onto municipal streets and roadways.

.7 In the event that overhead hoisting is necessary to complete the Work, such Work shall be to Worksafe BC requirements, and any occupied areas below must be properly cordoned-off and protected and the Contractor must obtain the approval of the Owner, prior to commencing this work.

.8 Provide a fireguard with fire extinguisher and take all necessary precautions whenever any open flames, work such as welding, burning, soldering is undertaken requires Hot Work Permit. Prior notice of such work is to be given to the Owner's representative in order that smoke detectors and the like can be temporarily deactivated by Hospital staff to prevent activation of the Fire Alarm System.

.9 Do not use any of the existing Hospital maintenance equipment, brooms, buckets, etc.

1.15 SPECIAL PROTECTION

.1 Take all necessary precautions to fully protect the existing buildings against damage during demolition, renovations and/or installation of the new work.

.2 Take all necessary precautions to adequately protect all existing surfaces outside of the designated renovation areas. All damage shall be made good by replacing damaged areas with exact duplicates of existing to the approval of the Consultant and the Owner.

.3 Provide protection against smoke propagation emanating from welding operations by use of temporary smoke barriers and/or temporary local ventilation of areas involved.

.4 Wherever possible seal off completely all work in existing areas to receive renovations. Install temporary insulated partitions to seal off the construction noise and dust. Remove all debris daily from these areas, as well as from all areas of the site, to maintain clean, safe and efficient site conditions. Control of dust is critical. Take all necessary precautions and schedule work to ensure existing areas being used are completely dust free at all times.

.5 Take all necessary precautions to fully protect the existing equipment, stores and furnishings against damage during renovations and installation of the Work. Provide temporary dust tight partitions and/or platforms as specified in Infection Prevention & Control Guidelines IX 0900 in appendix. Cover and protect existing stores, furnishings, cabinets, equipment, etc., by means acceptable to the Owner, whenever Work is to be carried on above or beside such existing items. Refer to Guidelines for dust containment included and referenced in this section.

.6 Make good, at no expense to the Owner, any damage or disruption caused to the existing building and its contents and to the existing utilities and services not called for as part of the Work of this contract. All repair work shall only be done after consultation with the Consultant, appropriate parties and authorities and to standards and codes of the authorities having jurisdiction.

.7 Particular care must be taken not to allow dust into the existing H.V.A.C. systems. Tape and seal all registers, grilles, return air plenums, open ductwork, etc., during demolition or installation, when dust or other air born contaminants are created. Provide additional temporary filters in any system if required to control dust or other potential contaminants. Failure to comply may result in contractor paying for duct cleaning and filter systems in ducts.

.8 Make good damage of any nature done to existing building and contents, except where required by Work to the satisfaction of the Consultant and at no additional cost to the Owner.

.9 Making good shall mean restoration to at least the original condition in terms of strength, safety, workmanship and appearance.

.10 The Owner reserves the right to provide their own personnel to repair, mop-up, clean down areas resulting and effected by the Contractor’s operations where required to maintain hospital operations. All costs incurred will be charged against the Contractor and this cost will be deducted from the contract sum.

.11 The Owner reserves the right to replace service, or repair items damaged by the Contractor where required to maintain Hospital operations. All costs incurred will be charged against the Contractor and this cost will be deducted from the contract sum.

.12 Where material or equipment is being transported within the existing buildings on carts or pallets, such carts or pallets shall have rubber tires. All items transported within existing buildings shall be covered.

1.16 DISPOSAL AND RECYLING CONTAINERSIBINS

.1 During renovations the Contractor shall be allowed to periodically bring disposal container/bins to the site to be immediately filled up and immediately removed from the site. Contractor shall coordinate delivery/removal times with the Owner.

.2 Use of the Hospital's disposal containers/bins is not permitted.

.3 The Contractor shall reinstate lawn and plantings damaged by disposal containers/bins and chutes to match original condition at no extra cost to the Hospital.

.4 Disposal container/bin shall be "closed top" type to prevent waste materials from being wind-blown.

.5 Demolition and construction waste materials are to be removed via the service elevator assigned by the Owner. The use of refuse chutes will not be permitted.

1.17 DUST AND DEBRIS

.1 Clean and dust free conditions are imperative so that occupied areas of the Hospital can function continuously. It shall be the Contractor's responsibility to ensure that occupied areas affected by this project remain clean and dust free at all times. If the Contractor fails to maintain clean and dust free conditions, it shall be notified verbally and in writing by the Consultant. The Owner shall then retain the services of a professional cleaning/maintenance company to fine clean the areas in question and the cleaning/maintenance company shall invoice the Contractor directly.

.2 All exterior areas to and from and around the disposal containers/bins shall be kept minimum broom clean by the Contractor.

.3 Ensure that periodic removal, disposal and clean-up of debris by Subcontractors is maintained.

.4 Leave all areas of construction and renovations in a clean and safe condition at the end of each work day.

.5 Special care shall be taken to ensure that dust and rubble is not allowed to escape from materials of demolition when they are transported through occupied areas of the Hospital in closed top containers.

.6 All stud cavities are to be cleaned prior to insulating and boarding.

.7 All ceiling spaces are to be cleaned prior to the installation of finished ceilings.

1.18 FIRE TRUCK I AMBULANCE I PUBLIC TRANSIT ACCESS

.1 Maintain access for fire trucks and ambulances to existing buildings at all times during the Work.

.2 Keep fire truck and ambulance access route free of encumbrances at all times during construction. Coordinate any work within fire truck access routes with the Owner and the

local fire department and make arrangements to determine specific dates and periods for such construction. Any such work shall be expedited to minimize the time when access for fire trucks and ambulances may be limited or obstructed.

.3 Do not encumber any fire truck or ambulance access with storage, materials, temporary offices and the like, at any time during the Contract.

.4 Maintain public transit access to site. Relocation of bus stop will be required. Coordination with the Owner and City of Prince George will be required.

1.19 FIRE SAFETY REQUIREMENTS

.1 Communicate with the Owner to receive instructions on fire regulations. The Contractor and his subcontractors will be required to comply with the Owner's fire regulations.

.2 Keep all existing entrances and exits clear at all times, comply with all fire safety requirements of existing facilities during the period of construction, and any other regulations pertaining to fire protection during new construction and renovations.

.3 Provide fire extinguishers as required by codes. The Owner's extinguishers will not be considered as part of the required complement of extinguishers for compliance of fire regulations within the job site.

.4 Comply with all fire safety regulations and procedures required by British Columbia Building Code, Insurance Company and municipal statutes and authorities.

.5 Provide ULC approved fire extinguishers and other firefighting services and equipment.

.6 Maintain clear emergency exit paths from each zone for personnel at all times.

.7 Exits with self-closing devices providing security are not to be secured in an open position at any time.

.8 Use only fire resistant tarpaulins and similar protective covering on site.

.9 Ensure that volatile waste is stored in closed containers and removed from premises daily.

.10 Construction activities must not obstruct access roadways designated for fire department equipment.

.11 Provide multipurpose 10-pound fire extinguishers at each site where flammable work is underway, for the duration of the work.

.12 Notify facility in writing prior to any smoke generating work activity commencing to allow for fire alarm disengagement. Notify facility in writing when work is complete. Refer to Owners General Requirements.

1.20 CUTTING OPENINGS IN EXISTING BUILDINGS

.1 All cutting of all openings in existing walls, partitions, floors and ceilings within the existing building shall be done by the Contractor. See also Section 02 41 19 – Selective Demolition.

.2 All required holes in existing concrete for services shall be core-drilled. Monitor the work below such concrete floor and control the flow of water and slurry to avoid damage the hospital's furnishings and equipment.

.3 All new larger openings in existing concrete shall be saw-cut. The saw cuts shall not overrun the corners of the openings. Coredrill a hole at each corner of new rectangular openings so that the concrete can be removed without saw-cut overruns.

.4 The location of all holes or openings to be core-drilled or saw-cut in existing concrete shall be approved by the Consultant before such work is commenced. The required size and spacing for such holes or openings shall also be approved by the Consultant before proceeding.

.5 Take care not to remove more existing concrete than that required. Excessive removal of concrete may damage the structure. No beams or columns are to be cut or damaged in any way. Before cutting or coring any holes, the Contractor shall check that no beam or column will be encountered, coordinate with structural.

.6 Alternative methods of hole cutting may be submitted for approval to the Consultant. Minimum noise, minimum damage to structure and fire safety are prime considerations.

.7 Jackhammering will not be permitted.

.8 Before saw cutting or core drilling in existing concrete slabs or wall establish the location of embedded conduit runs by GPR or other method approved by the Consultant. Where concrete saw cutting or core drilling is required take all necessary precautions to prevent the passage of water to adjoining areas.

.9 Schedule the work with the Owner's representative before commencing operations and advise regarding the impact of the work on the departments on the floor below.

1.21 NOISE AND VIBRATION

.1 Comply with the requirements of the Owner regarding noise abatement and take all necessary steps to ensure the generation and transmission of noise and vibration due to this work is kept to a minimum. Any such noise or vibration which is found to be objectionable shall be corrected at no additional cost and to the satisfaction of the Owner.

.2 Excessively noisy activities of construction that could affect the normal operation of the hospital or patients shall be scheduled in advance with the Owner's representative.

.3 The Owner reserves the right to stop or reschedule such work for a reasonable period of time to facilitate Hospital operations without cost to the Owner.

.4 Comply also with the limitations of the City Noise Abatement by-laws and/or restrictions.

.5 Construction methods shall be maintained at a low level of construction noise. Sound enclosures, sound baffles, muffler-equipped equipment and vibration platforms shall be employed to keep all equipment as quiet as practicable and the noise emission as low as possible. The vibration-free platforms shall be used on all equipment which will cause vibration to penetrate into the existing building causing malfunctions of existing equipment. In cases where the vibration platforms are not efficient and cause the existing equipment to be disturbed, the equipment causing the vibration shall not be used or shall be used at times agreed to with the Owner when their equipment is not in use.

.6 If any noisy operations may cause undue disturbance to the Owner's daily operations in existing facilities, such operation must be stopped immediately and work re-scheduled. Contractor shall be prepared to undertake such work off-hours so as not to cause any interruptions to existing facilities. Such re-schedule of work shall be at no cost to the Owner.

1.22 DAMAGE DOCUMENTATION OF EXISTING WORK

.1 Prior to commencing active demolition or other work on the site, Contractor shall examine and photographically document existing work and items which are to remain or be re- used in the finished work and shall document damage to such work and items in writing to the Consultant. Items shall include floors, walls, ceilings and equipment on the designated access route to the construction enclosures.

.2 The Contractor's prepared documentation shall be reviewed by the Contractor with the Owner and Consultant prior to proceeding further with the Work.

.3 The Contractor shall furnish the Owner and Consultant with a copy of the above- mentioned documentation.

1.23 FUMES, FLAME AND VOLATILE SUBSTANCES USE

.1 All flammable liquids and volatile substances must be handled and stored in approved containers away from the existing buildings. Paint materials shall be stored and mixed only in approved locations as directed by the Owner. All oily waste and rags after use must be placed in approved safety containers and removed from the existing buildings at the end of each working day.

.2 Provide and maintain a fire extinguisher in the Contractor's designated site storage area.

.3 Take all precautions necessary to ensure that dust and fumes resulting from construction operations or originating from within construction enclosures are prevented from entering any portion of the new and existing air supply or exhaust system. Precautions shall, in part, include, providing temporary additional air filters, the sealing off of return air grilles, and sealing off of open ends of supply and exhaust ducts which are left open for any reason whatsoever. Also refer to Infection Prevention & Control Guidelines.

1.24 SEISMIC RESTRAINT

.1 The hospital is a post-disaster structure and all owner supplied contractor installed/ owner supplied vendor installed/ vendor supplied vendor installed medical equipment is to be seismically restrained. Refer to equipment list. Owner will provide equipment cut sheets during construction. Ensure 19mm plywood backing is provided at these locations.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Laws, notices, permits and fees.

.2 Discovery of hazardous materials.

1.2 RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 LAWS, NOTICES, PERMITS AND FEES

.1 The laws of the Place of the Work shall govern the Work.

.2 The Owner shall obtain and pay for permanent easements and rights of servitude. The Subcontractor shall be responsible for the building permit, other permits, licenses or certificates necessary for the performance of the Work which were in force at the date of executing the Agreement.

.3 Give the required notices and comply with the laws, ordinances, rules, regulations or codes which are or become in force during the performance of the Work and which relate to the Work, to the preservation of the public health and to construction safety.

.4 If the Subcontractor knowingly performs or allows work to be performed that is contrary to any laws, ordinances, rules, regulations or codes, the Subcontractor is responsible for and shall correct the violations thereof; and shall bear the costs, expenses and damages attributable to the failure to comply with the provisions of such laws, ordinances, rules, regulations or codes. Determine detailed requirements of authorities having jurisdiction.

.6 Pay construction damage deposits levied by municipality in connection with the issuance of a building permit.

1.4 HAZARDOUS MATERIAL DISCOVERY

.1 Asbestos: If material resembling asbestos is encountered in course of demolition work, immediately stop work and notify Consultant.

.2 All hazardous materials encountered and identified that will be distributed within the scope of this project will be abated. The General contractor will retain the services of a hazardous materials abatement contractor for this work.

.3 All abatement work is to follow all regulatory and Worksafe BC regulations.

1.5 PERSONNEL SMOKING

.1 Comply with regulatory and hospital imposed smoking restrictions during execution of the Work within or out-of-doors to the premises.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 References and standards.

.2 Standards producing industry organizations and their addresses.

1.2 RELATED SECTIONS

.1 Section 01 61 00 - Product Requirements.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

.1 For Products or quality specified by association, trade, or other references or consensus standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

.2 Conform to reference standard by date specified in the individual specification sections except where a specific date is established or required by code.

.3 Obtain copies of standards where required by product specification sections.

.4 Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of the Consultant shall be altered from the Contract Documents by mention or inference otherwise, in any reference document.

1.4 STANDARDS PRODUCING INDUSTRY ORGANIZATIONS

.1 The following associations and organizations are cited in specification sections. Acronym, name, address, and Internet URL: addresses are as follows.

.2 Prominent Canadian Organizations:

.1 ACEC - Association of Consulting Engineers of Canada, 130 Albert Street, Suite 616, Ottawa, ON K1P 5G4; URL: http://www.acec.ca

.2 AWMAC - Architectural Woodwork Manufacturers Association of Canada, 516-4 Street West, High River, AB T1V 1B6; URL: http://www.awmac.com

.3 Canada Green Building Council, 330 - 55 rue Murray Street, Ottawa, ON K1N 5M3; Tel: 613-241-1184, Fax: 613-241-5750; URL: http://www.cagbc.org

.4 CCA - Canadian Construction Association, 75 Albert St., Suite 400, Ottawa, ON K1P 5E7; URL: http://www.cca-acc.com

.5 CCDC - Canadian Construction Documents Committee, Refer to ACEC, CCA, CSC or RAIC; URL: http://www.CCDC.org

.6 CFFM - Canadian Forces Fire Marshal, 101 Colonel By Drive, Ottawa, ON K1A 0K2; URL: http://www.dnd.ca/admie/dgcps/CFFMe.htm

.7 CGA - Canadian Gas Association, 20 Eglinton Avenue West, Suite 1305, Toronto, ON M4R 1K8; URL: http://www.cga.ca

.8 CGSB - Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, QC K1A 0S5; URL: http://w3.pwgsc.gc.ca/cgsb

.9 CISC - Canadian Institute of Steel Construction, 201 Consumers Road, Suite 300, Willowdale, ON M2J 4G8; URL: http://www.cisc-icca.ca

.10 CLA - Canadian Lumbermen's Association, 27 Goulburn Avenue, Ottawa, ON K1N 8C7; URL: http://www.cla-ca.ca

.11 CNLA - Canadian Nursery Landscape Association, RR #4, Stn. Main, 7856 Fifth Street, Milton, ON L9T 2X8; URL: http://www.canadanursery.com

.12 CRCA - Canadian Roofing Contractors Association, 155 Queen Street, Suite 1300, Ottawa, ON K1P 6L1; URL: http://www.roofingcanada.com

.13 CSA - Canadian Standards Association International, 178 Rexdale Blvd., Toronto, ON M9W 1R3; URL: http://www.csa-international.org

.14 CSC - Construction Specifications Canada, 120 Carlton Street, Suite 312, Toronto, ON M5A 4K2; URL: http://www.csc-dcc.ca

.15 CSDMA - Canadian Steel Door Manufacturers Association, One Yonge Street, Suite 1801, Toronto, ON M5E 1W7; URL: http://www.csdma.org

.16 CSPI - Corrugated Steel Pipe Institute, 652 Bishop Street N, Unit 2A, Cambridge, ON N3H 4V6; URL: http://www.cspi.ca

.17 CSSBI - Canadian Sheet Steel Building Institute, 652 Bishop St. N., Unit 2A, Cambridge, ON N3H 4V6; URL: http://www.cssbi.ca

.18 CUFCA - Canadian Urethane Foam Contractor's Association, Box 3214, Winnipeg, MB R3C 4E7; URL: http://www.cufca.ca

.19 CWC - Canadian Wood Council, 1400 Blair Place, Suite 210, Ottawa, ON K1J 9B8; URL: http://www.cwc.ca

.20 EC - Environment Canada, Conservation and Protection, Inquiry Centre, 351 St. Joseph Blvd, Hull, QC KIA 0H3; URL: http://www.ec.gc.ca

.21 EFC - Electro Federation of Canada, 5800 Explorer Drive, Suite 200, Mississauga, ON L4W 5K9; URL: http://www.electrofed.com

.22 MPI - The Master Painters Institute, 4090 Graveley Street, Burnaby, BC V5C 3T6; URL: http://www.paintinfo.com

.23 NABA - National Air Barrier Association, PO Box 2747, Winnipeg, MB R3C 4E7; URL: http://www.naba.ca

.24 NLGA - National Lumber Grades Authority, 406-First Capital Place, 960 Quayside Drive, New Westminster, BC V3M 6G2; URL: http://www.nlga.org

.25 NRC - National Research Council, Building M-58, 1200 Montreal Road, Ottawa, ON K1A 0R6; URL: http://www.nrc.gc.ca

.26 QPL - Qualification Program List, c/o Canadian General Standards Board, Place du Portage, Phase III, 6B1, 11 Laurier Street, Hull, QC K1A 1G6; URL: http://www.pwgsc.gc.ca/cgsb

.27 RAIC - Royal Architectural Institute of Canada, 55 Murray Street, Suite 330, Ottawa, ON K1N 5M3; URL: http://www.raic.org

.28 SCC - Standards Council of Canada, 270 Albert Street, Suite 2000, Ottawa, ON K1P 6N7; URL: http://www.scc.ca

.29 TTMAC - Terrazzo, Tile and Marble Association of Canada, 30 Capston Gate, Unit 5 Concord, ON L4K 3E8; URL: http://www.ttmac.com

.30 ULC - Underwriters' Laboratories of Canada, 7 Crouse Road, Toronto, ON M1R 3A9; URL: http://www.ulc.ca

.3 Commonly Referenced USA Organizations:

.1 AA - Aluminum Association, 900 19th Street N.W., Washington, DC 20006; URL: http://www.aluminum.org

.2 AASHTO - American Association of State Highway and Transportation Officials, 444 N Capitol Street N.W., Suite 249, Washington, DC 20001; URL: http://www.aashto.org

.3 AHA - American Hardboard Association, 1210W Northwest Hwy, Palatine, IL 60067; URL: http://www.hardboard.org

.4 AITC - American Institute of Timber Construction, 7012 S. Revere Parkway, Suite 140, Englewood, CO 80112; URL: http://www.aitc-glulam.org

.5 AMCA - Air Movement and Control Association Inc., 30 West University Drive, Arlington Heights, IL 60004-1893; URL: http://www.amca.org

.6 ANSI - American National Standards Institute, 25 West 43rd Street, 4th Floor, New York, NY 10036; URL: http://www.ansi.org

.7 APA - The Engineered Wood Association, P.O. Box 11700, Tacoma, WA 98411-0700; URL: http://www.apawood.org

.8 API - American Petroleum Institute, 1220 L St. Northwest, Washington, DC 20005-4070; URL: http://www.api.org

.9 ARI - Air Conditioning and Refrigeration Institute, 4100 N Fairfax Drive, Suite 200, Arlington, VA 22203; URL: http://www.ari.org

.10 ASHRAE - American Society of Heating, Refrigeration and Air-Conditioning Engineers, 1791 Tullie Circle NE, Atlanta, GA 30329; URL: http://www.ashrae.org

.11 ASME - American Society of Mechanical Engineers, ASME Headquarters, 3 Park Avenue, New York, NY 10016-5990; URL: http://www.asme.org

.12 ASTM International, 100 Barr Harbor Drive West, Conshohocken, PA 19428-2959; URL: http://www.astm.org

.13 AWCI - Association of the Wall and Ceiling Industries International, 803 West Broad Street, Suite 600, Falls Church, UA 22046; URL: http://www.awci.org

.14 AWPA - American Wire Producer's Association, 801 N Fairfax Street, Suite 211, Alexandria, VA 22314-1757; URL: http://www.awpa.org

.15 AWPA - American Wood Preservers' Association, P.O. Box 5690, Granbury TX 76049-0690; URL: http://www.awpa.com

.16 AWS - American Welding Society, 550 N.W. LeJeune Road, Miami, FL 33126; URL: http://www.amweld.org

.17 AWWA - American Water Works Association, 6666 W. Quincy Avenue, Denver, CO 80235; URL: http://www.awwa.org

.18 EIMA - EIFS Industry Manufacturer's Association, 3000 Corporate Center Drive, Suite 270, Morrow, GA 30260; URL: http://www.eima.com

.19 ISAP - International Society for Asphalt Paving, 400 Selby Avenue, Suite 1, St. Paul, MN 55102; URL: http://www.asphalt.org

.20 IEEE - Institute of Electrical and Electronics Engineers, IEE Corporate Office, 3 Park Avenue, 17th Floor, New York, NY 10016-5997; URL: http://www.ieee.org

.21 MSS - Manufacturers Standardization Society of the Valve and Fittings Industry, 127 Park Street, N.E., Vienna, VA 22180-4602; URL: http://www.mss-hq.com

.22 NAAMM - National Association of Architectural Metal Manufacturers, 8 South Michigan Avenue, Suite 1000, Chicago, IL 60603; URL: http://www.naamm.org

.23 NEMA - National Electrical Manufacturers Association, 1300 N 17th Street, Suite 1847, Rosslyn, VA 22209; URL: http://www.nema.org

.24 NFPA - National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101Quincy, MA 02269-9101; URL: http://www.nfpa.org

.25 NFSA - National Fire Sprinkler Association, P.O. Box 1000, Patterson, NY 12563; URL: http://www.nfsa.org

.26 NHLA - National Hardwood Lumber Association, 6830 Raleigh-La Grange Road, Memphis, TN 38184-0518; URL: http://www.natlhardwood.org

.27 NSPE - National Society of Professional Engineers, 1420 King Street, Alexandria, VA 22314-2794; URL: http://www.nspe.org

.28 PCI - Prestressed Concrete Institute, 209 W. Jackson Blvd., Suite 500, Chicago, IL 60606-6938; URL: http://www.pci.org

.29 PEI - Porcelain Enamel Institute, PO Box 920220, Norcross, GA 30010; URL: http://www.porecelainenamel.com

.30 SSPC - The Society for Protective Coatings, 40 24th Street, 6th Floor, Pittsburgh, PA 15222-4656; URL: http://www.sspc.org

.31 TPI - Truss Plate Institute, 583 D'Onofrio Drive, Suite 200, Madison, WI 53719; URL: http://www.tpinst.org

.32 UL - Underwriters' Laboratories, 333 Pfingsten Road, Northbrook, IL 60062-2096; URL: http://www.ul.com

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2 REFERENCES

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

1.3 QUALITY ASSURANCE

.1 Provide testing organization services as specified in Section 01 45 00.

.2 Testing organization: Current member in good standing of their respective professional or industry organization and certified to perform specified services.

.3 Comply with applicable procedures and standards of the certification sponsoring association.

.4 Perform services under direction of supervisor qualified under certification requirements of sponsoring association.

.5 Qualifications:

.1 Provide adequate workforce training through meetings and demonstrations.

.2 Provide a designated experienced person on site with de-construction experience throughout the project for consultation and supervision purposes.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

.3 Mock-up criteria.

.4 Mill tests.

.5 Written and electronic submitted reports.

.6 Equipment and system adjustments and balance.

1.2 RELATED SECTIONS

.1 Section 01 43 00 - Quality Assurance.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

.1 ISO/IEC 17025:2017 - General Requirements for the Competence of Testing and Calibration Laboratories.

.2 SCC (Standards Council of Canada).

1.4 INSPECTION BY AUTHORITY

.1 Allow Authorities Having Jurisdiction access to Work. If part of the Work is in preparation at locations other than the Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection whenever portions of the Work are designated for special tests, inspections or approvals, either when described in the Contract Documents or when required by law in the Place of the Work.

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

1.5 REVIEW BY CONSULTANT

.1 Consultant may order any part of the Work to be reviewed or inspected if the Work is suspected to be not in accordance with Contract Documents.

.2 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.

.3 If such Work is found in accordance with Contract Documents, Owner will pay cost of review and replacement.

1.6 INDEPENDENT INSPECTION AGENCIES

.1 Independent Inspection and Testing Agencies will be engaged by the Contractor or his subtrades for purpose of inspecting and testing portions of Work. Cost of such services will be borne by respective Contractor or Subtrade.

.2 Testing Organizations: Listed by SCC within info.palcan@scc.ca listings.

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

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

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

1.7 ACCESS TO WORK

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

.2 Cooperate to provide reasonable access and facilities for such access.

1.8 PROCEDURES

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

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

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

1.9 REJECTED WORK

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

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

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

1.10 REPORTS

.1 Submit one (1) electronic copy of signed inspection and test reports to Consultant.

.2 Provide signed paper copies to Subcontractor of work being inspected or tested.

1.11 TESTS AND MIX DESIGNS

.1 Furnish test results and mix designs as may be requested.

.2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of the Place of Work, shall be appraised by Consultant and may be authorized as recoverable.

1.12 MOCK-UP

.1 Prepare mock-up for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.

.2 Construct in all locations acceptable to Consultant.

.3 Prepare mock-ups for Consultant's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.

.4 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 If requested, Contractors will assist in preparing a schedule fixing dates for preparation.

.6 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed.

1.13 MILL TESTS

.1 Submit mill test certificates as required of specification Sections.

1.14 EQUIPMENT AND SYSTEMS

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Temporary utilities.

1.2 RELATED SECTIONS

.1 Section 01 45 00 – Quality Control.

.2 Section 01 52 00 - Construction Facilities.

1.3 INSTALLATION AND REMOVAL

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

.2 Salvage and assist in recycling products for potential reuse.

.3 Remove from site all such work after use.

.4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.4 WATER SUPPLY

.1 A metered connection to the hospital water system will be permitted for this work.

1.5 TEMPORARY HEATING AND VENTILATION

.1 Provide temporary heating required during construction period, including attendance, maintenance and fuel.

.2 Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.

.3 Provide temporary heat and ventilation in enclosed areas as required to:

- .1 Facilitate progress of Work.
- .2 Protect Work and products against dampness and cold.
- .3 Prevent moisture condensation on surfaces.
- .4 Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for safe working environment.

.4 Maintain temperatures of minimum 10 degrees C in areas where construction is in progress.

.5 Ventilating:

- .1 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
- .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
- .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
- .4 Ventilate storage spaces containing hazardous or volatile materials.
- .5 Ventilate temporary sanitary facilities.

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

.6 Permanent heating system of building, may be used when available. Be responsible for damage to heating system if use is permitted.

.7 On completion of Work for which permanent heating system is used, replace filters and clean.

.8 Ensure date of Substantial Performance of the Work and Warranties for heating system do not commence until entire system is in as near original condition as possible and is certified by Consultant.

.9 Pay costs for maintaining temporary heat, when using permanent heating system.

.10 Maintain strict supervision of operation of temporary heating and ventilating equipment to:

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

.11 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

1.6 TEMPORARY POWER AND LIGHT

.1 A metered connection to the hospital electrical system will be permitted for temporary lighting and operating of power tools, to a maximum supply of 230 volt, 30 amp.

.2 Contractor to pay for electrical consumption. Rate for electrical usage to be at Owner's actual cost.

.3 Arrange for connection with appropriate utility company. Pay all costs for installation, maintenance and removal.

.4 Provide and pay for temporary power for electric cranes and other equipment requiring temporary power in excess of above noted requirements.

.5 Provide and maintain temporary lighting throughout project. Ensure level of illumination is not less than 162 lx.

.6 Electrical power and lighting systems installed under this Contract may be used for construction requirements only with prior approval of Consultant provided that guarantees are not affected. Make good damage to electrical system caused by use under this Contract. Replace lamps which have been used for more than three (3) months.

1.7 TEMPORARY COMMUNICATION FACILITIES

.1 Provide and pay for temporary telephone, fax, data and high-speed internet hook up, and computer equipment necessary for own use and use of Consultant. Computer shall have email capability and have the ability to create/read word documents, spreadsheets and documents in .pdf format.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Construction aids.

.2 Office and sheds.

.3 Parking.

.4 Project identification.

1.2 RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

.1 CAN/CSA-Z321-96 (R2006) - Signs and Symbols for the Workplace.

1.4 INSTALLATION AND REMOVAL

.1 Provide construction facilities to execute work expeditiously.

.2 Remove from site all such work after use.

1.5 SCAFFOLDING

.1 Provide and maintain scaffolding, ramps, ladders, platforms and temporary stairs, as required to complete the project.

1.6 HOISTING

.1 Provide, operate and maintain hoists or cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.

.2 Qualified operator shall operate hoists and cranes.

1.7 USE OF THE WORK

.1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with Products.

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

1.8 CONSTRUCTION PARKING

.1 Parking is limited at the hospital site coordinate ride share and parking requirements with site.

.2 Provide and maintain adequate access to project site.

.3 Clean areas used by Contractor's equipment.

1.9 SECURITY

.1 Contractor is required to maintain site security to protect site staff and public at all times.

1.10 HOARDING

.1 Construct & Install Temporary Hoarding as required to the construction area. Provide a locked door access through the Hoarding. Provide fire rated hoarding as required and indicated on Drawings.

.2 Supply and erect hoarding at job site to locations indicated on drawings. Hoarding shall be consisting of wood uprights set firmly in the ground, faced with new 12.5 mm Fir, Pine or Poplar plywood, rough sheathing grade plywood, factory pre-treated, pre-stained green with wood preservative on both sides. Maintain in good condition during construction. When hoarding is no longer required, it shall be removed from the site. Demolished material shall become property of Contractor.

.3 Contractor shall consider suitable material to provide required hoardings based on requirements of the project within contract price. Comply with infection Control Manual IX0900 Construction Projects and IX1000 Construction and Renovation Guidelines. Refer to appendix for documents.

.4 Contractor is responsible to Maintain Security of Construction Site.

1.11 OFFICES

.1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing layout table.

.2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

.3 Subcontractors may provide their own offices as necessary. Direct location of these offices.

1.12 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

.2 Locate materials not required to be stored in weatherproof sheds on site in a manner to cause least interference with work activities.

1.13 SANITARY FACILITIES

.1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances.

.2 Existing washroom facilities may be used upon approval from the hospital.

.3 Post notices and take such precautions as required by local health authorities.

.4 When permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building.

.5 New permanent facilities may be used on approval of Consultant.

.6 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Product quality, availability, storage, handling, protection, and transportation.

.2 Product substitution procedures.

.3 Manufacturer's instructions.

.4 Quality of Work, coordination, and fastenings.

.5 Existing facilities.

1.2 RELATED SECTIONS

.1 Section 01 42 00 - References:

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 TERMINOLOGY

.1 New: Produced from new materials.

.2 Renewed: Produced or rejuvenated from an existing material to like-new condition to serve a new or existing service.

.3 Defective: A condition determined exclusively by the Consultant.

1.4 PRODUCT QUALITY

.1 Products, materials, equipment, parts, or assemblies (referred to as Products) incorporated in Work: New, not damaged or defective, of best quality (compatible with specification requirements) for purpose intended. If requested, provide evidence as to type, source and quality of Products provided.

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

.3 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Consultant.

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

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

1.5 AVAILABILITY

.1 Immediately upon signing Contract, review Product delivery requirements and anticipate foreseeable supply delays for any items.

.2 If delays in supply of Products are foreseeable, notify Consultant of such, in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of Work.

.3 In event of failure to notify Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, Consultant reserves right to substitute more readily available Products of similar character, at no increase in Contract Price or Contract Time.

1.6 STORAGE AND PROTECTION

.1 Store and protect Products in accordance with manufacturers' written instructions.

.2 Store with seals and labels intact and legible.

.3 Store sensitive Products in weather tight, climate controlled, enclosures in an environment favourable to Product.

.4 For exterior storage of fabricated Products, place on sloped supports above ground.

.5 Cover Products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of Products.

.6 Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

.7 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.

.8 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.

.9 The Contractor shall provide at their own cost all necessary off-site storage required for all material and equipment until it is required to be installed in accordance with the Project Construction Schedule. All equipment to be stored shall be placed indoors in a dry atmosphere.

1.7 TRANSPORTATION AND HANDLING

.1 Transport and handle Products in accordance with manufacturer's written instructions.

.2 Promptly inspect shipments to ensure that Products comply with requirements, quantities are correct, and Products are undamaged.

.3 Provide equipment and personnel to handle Products by methods to prevent soiling, disfigurement, or damage.

1.8 EXISTING UTILITIES

.1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work.

.2 Protect, relocate, or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

1.9 MANUFACTURER'S WRITTEN INSTRUCTIONS

.1 Unless otherwise indicated in specifications, install or erect Products to manufacturer's written instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.

.2 Notify Consultant in writing, of conflicts between specifications and manufacturer's instructions, so that Consultant may establish course of action.

.3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes Consultant to require removal and re-installation at no increase in Contract Price or Contract Time.

1.10 QUALITY OF WORK

.1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Consultant if required Work is such as to make it impractical to produce required results.

.2 Do not employ anyone unskilled in their required duties. Owner reserves right to require dismissal from site any workers deemed incompetent or careless.

.3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Consultant, whose decision is final.

1.11 COORDINATION

.1 Ensure cooperation of workers in laying out Work. Maintain efficient and continuous supervision.

.2 Be responsible for coordination and placement of openings, sleeves, and accessories.

1.12 CONCEALMENT

.1 In finished areas, conceal pipes, ducts and wiring in floors, walls, and ceilings, except where indicated otherwise.

.2 Before installation, inform Consultant if there is interference. Install as directed by Consultant.

1.13 REMEDIAL WORK

.1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Coordinate adjacent affected Work as required.

.2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.14 LOCATION OF FIXTURES

.1 Consider location of fixtures, outlets, and mechanical and electrical items indicated as approximate.

.2 Inform Consultant of conflicting installation. Install as directed.

1.15 FASTENINGS

.1 Provide metal fastenings and accessories in same texture, colour, and finish as adjacent materials, unless indicated otherwise.

.2 Prevent electrolytic action between dissimilar metals and materials.

.3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.

.4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

.5 Keep exposed fastenings to a minimum, space evenly and install neatly.

.6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.16 FASTENINGS - EQUIPMENT

.1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use Type 304 or 316 stainless steel for exterior areas.

.3 Bolts may not project more than one diameter beyond nuts.

.4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.17 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of any part of the Project.

.2 Do not cut, drill, or sleeve any load bearing structural member, unless specifically indicated, without written approval of Consultant.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Substitutions.

1.2 RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SUBSTITUTIONS

.1 Instructions to Bidders 3.1.2 specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.

.2 Substitutions will be considered when a Product becomes unavailable through no fault of the Contractor.

.3 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

.4 A request constitutes a representation that the Bidder:

.1 Has investigated proposed Product and determined that it meets or exceeds the quality level of the specified Product.

.2 Will provide the same warranty for the Substitution as for the specified Product.

.3 Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.

.4 Waives claims for additional costs or time extension which may subsequently become apparent.

.5 Will reimburse Owner and Consultant for review or redesign services associated with re-approval by authorities.

.5 Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

.6 Substitution Submittal Procedure:

.1 Submit electronic copy of request for Substitution for consideration. Limit each request to one (1) proposed Substitution.

.2 Submit shop drawings, product data, and certified test results attesting to the proposed Product equivalence. Burden of proof is on proposer.

.3 The Consultant will notify Contractor in writing of decision to accept or reject request.

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Recording of subsurface conditions found.

.2 Survey services to determine measurement inverts for the Work.

.3 Requirements and limitations for cutting and patching the Work.

1.2 RELATED SECTIONS

.1 requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

.1 Owner's identification of existing survey control points and property limits.

1.4 SUBMITTALS

.1 Submit name and address of Surveyor to Consultant.

.2 On request of Consultant, submit documentation to verify accuracy of field engineering work.

.3 Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

1.5 CONTROL OF THE WORK

.1 Prior to commencing the Work, the Contractor shall verify, at the Place of the Work, all relevant measurements and levels necessary for the proper completion 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 in the Contract Documents, the Contractor shall immediately notify the Consultant in writing and obtain Supplemental Instructions from the Consultant before proceeding with any part of the affected work.

1.6 EXAMINATION

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

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

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

1.7 PREPARATION

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

.2 Provide protection from elements for areas which may be exposed by uncovering work; maintain excavations free of water.

1.8 EXISTING SERVICES

.1 Before commencing work, establish location and extent of service lines in area of Work and notify Consultant of findings.

1.9 LOCATION OF EQUIPMENT AND FIXTURES

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

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

.3 Inform Consultant of impending installation and obtain approval for actual location.

.4 Submit field drawings to indicate relative position of various services and equipment when required by Consultant.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Submittal requirements associated with connecting to new and existing facilities.

.2 Execution requirements for all Work.

1.2 RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SUBMITTALS - ATTACHING TO EXISTING WORK

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

- .1 Structural integrity of any element of Project.
- .2 Integrity of weather-exposed or moisture-resistant elements.
- .3 Efficiency, maintenance, or safety of any operational element.
- .4 Visual qualities of sight-exposed elements.
- .5 Work of Owner or separate contractor.

.2 Include in request:

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

1.4 TOLERANCES

.1 Monitor fabrication and installation tolerance control of Products to produce acceptable Work.

.2 Do not permit tolerances to accumulate beyond effective or practical limits.

.3 Comply with manufacturers' tolerances. In case of conflict between manufacturers' tolerances and Contract Documents, request clarification from Contractor before proceeding.

.4 Adjust Products to appropriate dimensions; position and confirm tolerance acceptability, before permanently securing Products in place.

1.5 EXECUTION

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

.2 Perform all required excavation and fill to complete the Work.

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

.4 Uncover Work to install ill-timed Work.

.5 Remove and replace defective or non-conforming Work.

.6 Remove samples of installed Work for testing, if not designated in the respective Section as remaining as part of the Work.

.7 Provide openings in non-structural elements of Work for penetrations of mechanical electrical and associated Work. Limit opening dimensions to minimal sizes required, and performed in a neat and clean fashion.

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

.9 Employ qualified workers to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.

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

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

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

.13 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, for full thickness of the constructed element.

.14 Re-finish surfaces to match adjacent finishes: For continuous surfaces re-finish to nearest intersection; for an assembly, re-finish entire unit.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Requirements and limitations for cutting and patching of Work.

1.2 RELATED SECTIONS

.1 Section 01 61 00 - Product Requirements.

.2 Section 07 84 00 - Firestopping.

.3 Individual Product Specification Sections:

.1 Cutting and patching incidental to work of the section.
.2 Advance notification to other sections of openings required in Work of those sections.
.3 Limitations on cutting structural members.

1.3 SUBMITTALS

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

.1 Structural integrity of any element of Project.
.2 Integrity of weather exposed or moisture resistant element.
.3 Efficiency, maintenance, or safety of any operational element.
.4 Visual qualities of sight exposed elements.
.5 Work of Owner or separate contractor.

.2 Include in request:

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

Part 2 Products

2.1 MATERIALS

.1 Primary Products: Those required for original installation.

Part 3 Execution

3.1 EXAMINATION

.1 Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

.2 After uncovering existing Work, assess conditions affecting performance of work.

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

3.2 PREPARATION

.1 Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

.2 Provide protection from elements for areas which may be exposed by uncovering work.

.3 Maintain excavations free of water.

3.3 CUTTING

.1 Execute cutting and fitting including excavation and fill to complete the Work.

.2 Uncover work to install improperly sequenced work.

.3 Remove and replace defective or non-conforming work.

.4 Remove samples of installed work for testing when requested.

.5 Provide openings in the Work for penetration of mechanical and electrical work.

.6 Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

.7 Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

3.4 PATCHING

.1 Execute patching to complement adjacent Work.

.2 Fit Products together to integrate with other Work.

.3 Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.

.4 Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.

.5 Restore work with new Products in accordance with requirements of Contract Documents.

.6 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.7 At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material to Section 07 84 00, to full thickness of the penetrated element.

.8 Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Cleaning prior to acceptance.

1.2 RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

Part 2 Products

2.1 CLEANING MATERIALS

.1 Cleaning Agents and Materials: Low VOC content.

Part 3 Execution

3.1 PROGRESSIVE CLEANING

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Consultant.

.3 Clear snow and ice from area of construction. Remove from site as necessary

.4 Remove waste material and debris from site and deposit in waste container at end of each working day.

.5 Dispose of waste materials and debris off site.

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

.7 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.8 Provide adequate ventilation during use of volatile or noxious substances. Use of enclosure ventilation systems is not permitted for this purpose.

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

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

3.2 CLEANING PRIOR TO ACCEPTANCE

.1 Prior to applying for Substantial Performance of the Work, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris and leave Work clean and suitable for occupancy.

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

.4 Remove waste materials from site at regularly scheduled times. Do not burn waste materials on site. Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.6 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.7 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors.

.8 Clean lighting reflectors, lenses, and other lighting surfaces.

.9 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.10 Clean and polish surface finishes, as recommended by manufacturer.

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

.12 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.13 Remove dirt and other disfiguration from exterior surfaces.

.14 Clean and sweep roofs, gutters, areaways, and sunken wells.

.15 Sweep and wash clean paved areas.

.16 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

.17 Clean roof surfaces, down-spouts, and drainage components.

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

.19 Remove snow and ice from access to facilities.

3.3 FINAL PRODUCT CLEANING

.1 Execute final cleaning prior to final project assessment.

.2 Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum and wash flooring surfaces.

.3 Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

.4 Replace filters of operating equipment.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Adjusting products and equipment required by all specifications sections for this Project.

1.2 RELATED SECTIONS

.1 Section 01 74 00 - Cleaning and Waste Processing.

.2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 PURPOSE

.1 Perform testing adjusting and balancing of operating systems.

.2 Prior to start of balancing, ensure systems are:

.1 Piped, ducted, wired and wireless services and systems, including components and equipment forming part thereof.

.2 Manually and mechanically operated, including components and equipment forming any part.

.3 Testing, adjusting and balancing will not be started until after all static checks have been completed for the system being balanced and signed off on the commissioning report forms.

.4 Contractor to ensure systems are operated at designated times, under conditions required for proper testing, adjusting, and balancing.

.5 Report any deficiencies or defects which may affect the balancing or noted during testing, adjusting and balancing, which cannot be promptly corrected.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 PREPARATION

.1 Prepare each system and item of equipment for testing, adjusting and balancing.

.2 Verify that each system and equipment installation is complete and in functional operation.

.3 Verify appropriate ambient conditions.

3.2 TESTING

.1 Tests will be conducted to confirm compliance with requirements of Contract Documents. Take corrective action as necessary.

3.3 ADJUSTING

.1 Adjust operating Products and equipment to ensure smooth and unhindered operation.

.2 Provide equipment required to ensure proper, efficient and safe operation of all equipment including belts and sheaves.

3.4 BALANCING

.1 Cooperate with and assist the balancing agent to ensure that the various parts of system are in a proper state of equilibrium.

END OF SECTION

PART 1 GENERAL

1.1 OPERATING AND MAINTENANCE MANUALS

.1 Submit to the Consultant one (1) copy of maintenance, operating and instruction manuals.

.2 Separately bound manuals are to be prepared for the following trade work:

1) Building: Architectural elements, fixtures, finishes, casework, hardware, specialties, etc.

2) Mechanical: Heating ventilating, air conditioning, etc.

3) Plumbing: Plumbing, fire sprinklers, etc.

4) Electrical: Power, lighting, fire alarm system, data, communications, security, etc.

.3 Provide maintenance manuals in hard and electronic format as specified hereafter, giving full operating and maintenance instructions for each system and major piece of equipment, as well as, maintenance instructions for building elements, fixtures and finishes.

.4 Manuals are to contain pertinent maintenance operational and installation instruction information on equipment, materials cleaning and lubrication schedules, filters, overhaul, replacement, adjustment schedules, and emergency procedures as applicable. Instructions in manuals shall be in simple language so as to guide the Owner in the proper operation and maintenance of building material, components, equipment and systems.

.5 Include all items covered by Change Orders.

.6 Update the manuals periodically during the installation and commissioning phase of the Work so that the manuals are final by the scheduled turnover date.

.7 Include equipment supplied by the Owner and pre-tendered equipment.

.8 Binders:

1) Binders shall be ACCO Canadian Co. Ltd. or approved substitution as follows:

2) ACCO Inview D-Ring Binders – color Black
1 inch – 41805-0
2 inch - 41807

3) ACCO expanding bar-lock catalogue binder - color Black
3 to 5.5 inches – 05436-0

.9 Pages:

1) Descriptions and lists are to be neatly typed or printed on 216 mm x 280 mm heavy bond paper. Duplicate pages shall be made by electrostatic dry copier.

2) The maximum paper size for schedules and diagrams is 280 mm x 432 mm. Larger paper sizes will be accepted for diagrams only if a mylar sepia is provided for each sheet.

3) Alphabetical index tab separators are to be used in each manual to identify each information “Section”.

.10 Manual contents shall be organized into applicable categories of Work, parallel to specifications divisions and sections.

.11 Architectural manuals shall include in general, but shall not necessarily be limited to, the following:

1) List of all Subcontractors, manufacturers, suppliers, complete with addresses and telephone and facsimile numbers.

2) Copy of hardware schedule and paint schedules, complete with the actual manufacturer, supplier and identification names and numbers.

3) All manufacturer’s equipment, materials, products, data, details, identification, list, schedules of maintenance, operational and installation instruction information as required in accordance with the various sections of the specification.

4) All extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specification, with the following information:

.1 Name and address of subject.
.2 Commencement date (Substantial Performance of the Work) of guarantees and warranties.
.3 Duration and expiry date of guarantees and warranties.
.4 Signature and seal of the Contractor, installer, manufacturer and/or supplier as applicable.

5) Complete set of all final reviewed shop drawings.

6) Certificates of Inspection.

7) Test reports and certificates as applicable.

8) Confirmation letters of all extra, reserve, replacement materials as required in accordance with various sections of the specification has been properly handed over and received by the Owner in good order.

9) Confirmation letters of all portable units, equipment, materials such as fire extinguishers, special tools, keys for all equipment and/or panels, elevator pads/accessories, keys to millwork, casework, has been properly handed over and received by the Owner in good order.

10) Submit to the Consultant one (1) copy of plumbing/mechanical and electrical manuals in accordance with this section and to detailed requirements specifically set out in the various sections of the specification as applicable.

1.2 ELECTRONIC COPIES OF MANUALS

.1 In addition to the printed copies, submit electronic copies of all operating and maintenance data.

.2 Submit data on “read only” CDs. Provide one (1) copy of each CD for the Owner and 1 copy to the Consultant.

.3 Do not provide separate CDs for each major section. Use more than one CD only if the volume of data exceeds the capacity of a single CD. Professionally label each CD and CD jewel case, including the name of the Owner, project and CD title.

.4 Organize electronic data using directories and sub-directories. Prior to assembling the electronic data, submit to the Consultant a detailed list of the proposed directory/sub-directory structure including proposed files names. File names to be easily recognizable without the need to open the document to know what information the file contains. Directory structure and file naming is subject to the approval of the Consultant.

.5 Provide information in Portable Document Format (PDF). Break down large files into sections and use bookmark structure for easy navigation.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Inspections and declarations.

.2 Closeout submittals

.3 Operation and maintenance manual format.

.4 Contents each volume.

.5 Recording actual site conditions.

.6 Record (as-built) documents and samples.

.7 Record documents.

.8 Final survey.

.9 Warranties and bonds.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 79 00 - Demonstration and Training.

.4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSPECTIONS AND DECLARATIONS

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

.1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Consultant's Inspection.

.2 Consultant's Inspection: Consultant and Contractor will perform inspection of Work to identify defects or deficiencies. Correct defective and deficient Work accordingly.

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

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

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

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

.4 Certificates required by authorities having jurisdiction have been submitted.

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

.6 Work is complete and ready for Final Inspection.

.4 Final Inspection: When items noted above are completed, request final inspection of Work by Owner, Consultant and Contractor. If Work is deemed incomplete by Consultant, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Consultant considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial Performance of the Work.

.6 Commencement of Warranty Periods: the date of Substantial Performance of the Work shall be the date for commencement of the warranty period.

.7 Commencement of Lien Periods: the date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.

.8 Final Payment: When Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.

.9 Payment of Hold-back: After issuance of certificate of Substantial Performance of the Work, submit an application for payment of hold-back amount.

1.4 CLOSEOUT SUBMITTALS

.1 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 maintenance manuals;

.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 municipal, governmental, and utility authorities having jurisdiction in the Place of the Work.

.2 Where the Contractor is unable to deliver the documents and materials described in paragraph 5.4.4, 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.

1.5 OPERATION AND MAINTENANCE MANUAL SUBMITTALS

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

.2 Copy will be returned after final inspection with Consultant's comments.

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

.4 Two (2) weeks prior to Substantial Performance of the Work, submit to the Consultant, two (2) final copies of operating and maintenance manuals in Canadian English.

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

.6 If requested, furnish evidence as to type, source and quality of products provided.

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

.8 Pay costs of transportation.

1.6 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder by discipline: list title of project and identify subject matter of contents.

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

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Provide manufacturer's product data, including stamped shop drawings, colour selections, cleaning and care documentation, etc.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.7 CONTENTS - EACH VOLUME

.1 Table of Contents: Provide:

.1 Title of project.

.2 Date of submission.

.3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

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

.2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

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

.5 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate.

.6 Training: Refer to Section 01 79 00.

1.8 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and within the Project Manual, provided by Consultant.

.2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.

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

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

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

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

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

.2 Changes made by Addenda and change orders.

.6 Other Documents: Maintain manufacturer's certifications, inspection certifications and field test records required by individual specifications sections.

1.9 RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Consultant, one (1) record copy of:

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

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

.3 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.

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

.5 Keep as-built documents and samples available for inspection by Consultant.

.6 Submit to Consultant for inclusion in electronic documents.

1.10 WARRANTIES AND BONDS

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

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

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

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

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittals.

1.11 RECORDSIDAILY REPORTSIDAILY LOGS

.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 office in accordance with the requirements of law, but in any event for not less than 6 years from Substantial Performance of the Work or until all claims have been settled. During this time, the Contractor shall allow Owner and Consultant 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 Subcontractors and Suppliers to incorporate them into every level of contract thereunder for any part of the Work.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Equipment and systems.

.2 Materials and finishes.

.3 Spare parts.

.4 Maintenance manuals.

.5 Special tools.

.6 Storage, handling and protection.

1.2 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

.2 Section 01 78 30 – Spare Parts Maintenance Materials.

1.3 EQUIPMENT AND SYSTEMS

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

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

.3 Include installed colour coded wiring diagrams.

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

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

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

.14 Include test and balancing reports as specified in Section 01 45 00 and 01 75 19.

.15 Additional requirements: As specified in individual specification sections.

Part 2 Products

2.1 MATERIALS AND FINISHES

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

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

.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Building Envelope: include copies of drawings of building envelope components, illustrating the interface with similar or dissimilar items to provide an effective air, vapour and thermal barrier between indoor and outdoor environments. Include an outline of requirements for regular inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.

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

2.2 SPARE PARTS

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

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

.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

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

2.3 MAINTENANCE MATERIALS

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

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

.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

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

2.4 SPECIAL TOOLS

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

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

.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

Part 3 Execution

3.1 DELIVER TO SITE

.1 Deliver to site; place and store. Turn maintenance materials over to Owner in one transaction.

3.2 STORAGE, HANDLING AND PROTECTION

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

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

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

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

.5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 77 00 – Contract Closeout Procedures

.2 Divisions 2 through 28 of the Project Manual for individual products or systems as specified in individual sections and not otherwise listed in this section.

1.2 SOURCE OF SUPPLY

.1 Provide spare parts manufactured by original equipment manufacturer.

.2 Provide maintenance materials identical to those installed.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver required items to the Place of the Work and store in temporary locations determined by Contractor or permanent locations designated by Owner.

.2 Deliver and store items in original factory packaging or other securely packaged form.

.3 Identify, on carton or package, name of item, colour or part number, as applicable. Identify equipment, system, area, room no., etc. for which each item is intended.

.4 Maintain an inventory list of all items delivered. For each item, record description of item, quantity, and location where stored.

.5 Stored items shall remain in Contractor's care, custody, and control until Substantial Performance of the Work. Protect stored items against theft or damage.

.6 Handle items as necessary, until stored in permanent locations designated by Owner.

1.4 ACCEPTANCE

.1 Prior to requesting inspection for Substantial Performance, do the following:

.1 Review Contract Documents and compare with inventory list to verify that all required items have been delivered.
.2 Verify that items listed on inventory list are in their designated storage locations.
.3 Inspect items to verify that they meet specified requirements and are in serviceable condition.
.4 Arrange for delivery of any missing items.
.5 Arrange for replacement of items not meeting specified requirements or not in serviceable condition.
.6 Provide Owner with copy of inventory list indicating status of all required items.

.2 Review inventory list with Owner for Substantial Performance.

1.5 SCHEDULE

.1 Provide spare parts and maintenance materials specified in the following Sections. Maintenance materials shall be whole pieces, boxed and packaged in original wrapping or wrapped and identified for material and location within the building:

Section Number (Regardless of Trade Package)	Material	Quantity
08 71 00	Door Hardware	Turn over all spare parts and misc. adjustment tools as required.
09 51 13	Acoustic Panel Ceilings	1% of total installation with minimum 3 boxes of acoustic tile. Provide 5 wood ceiling tiles for repairs.
09 65 16	Resilient Flooring: Sheet Vinyl	2% of total installation with a minimum of 10m^2 of each colour and type. 7.62m (25') of rubber base min. of each colour (Not short scraps)
09 91 00	Painting	Minimum of 4-4 L containers of field colours and 4-1 L containers of each accent colour, and all remnants.
10 26 13	Wall Protection	3 sheets of each panel colour and type including weld materials. Including spare parts for hand rail and bumper rails.

.2 Mechanical spare parts and maintenance materials as specified in Division 22.

.3 Electrical spare parts and maintenance materials as specified in Division 26 and 27.

.4 Other Sections that may specify spare parts and maintenance materials.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 73 00 –Execution

.3 Section 01 77 00 –Closeout Procedures

1.2 DESIGNATION OF PROJECT RECORD DOCUMENTS

.1 Designate one copy of the following documents to be retained as project record documents:

- .1 One copy of Project Manuals (specifications).
- .2 One complete set of Drawings.
- .3 One set of all Addenda issued.
- .4 One set of approved Change Orders and Supplementary Instructions.

.2 Subtrades shall report to the Contractor all required information for recording of information on Project Record Drawings.

.3 Record Documents shall consist of Division 1 to 28 of the Project Manual and all Drawings issued for construction and as modified.

1.3 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Provide red-line drawings to the Owner with the exception of both Mechanical and Electrical Subcontractors.

.2 Mechanical and Electrical Subcontractors shall record their information on red-line drawings and return to Contractor for final coordination.

.3 Use coloured erasable pencils to record information.

.4 Subcontractors shall report to Contractor all changes and variations from Contract Drawings concurrently with construction process. Do not conceal any work until required information is recorded.

.5 Subcontractor shall provide sufficient information so that Contractor can legibly mark project record drawings to record actual construction including, but not limited to the following:

- .1 Measured locations of internal utilities and appurtenances concealed in construction. Reference to visible and accessible features of construction.
- .2 Field changes of dimension and detail.
- .3 Changes to equipment layout and services.
- .4 Deviations in piping, duct runs, wiring, and utility connections.
- .5 **Actual locations** of mechanical and electrical equipment, plumbing lines, electrical, data and communications lines **referenced to fixed structural elements** for items that are schematically indicated in Contract Documents.
- .6 Clearly identify locations of fire dampers, major control lines, access doors, tagged valves, and actual final room names or numbers.
- .7 Changes in construction materials or locations required by on-site conditions and to make components of the Work come together.

.8 Changes required by Addenda, Bid Revisions, Change Orders, Work Orders and Construction Communications.
.9 Other information identified in specific sections of the Specifications.

.6 Contractor shall maintain Record Documents at the site office and make available for review during all site meetings.

.7 Subcontractor shall make recordings immediately after the respective Work is completed and not less than once a week. Each recording shall be dated.

.8 Changes to specification sections shall be legibly noted in the margins of the document or by stapling a sheet of white paper to the margin and referencing the affected article(s). Use of adhesive tape or self-sticking removable notes will not be acceptable for this purpose.

.9 The Contractor shall provide a paper or electronic copy (PDF) of the as-built drawings to the consultant for the preparation of the final record documents..

.10 The Consultant's review of Record Documents is not a verification of the accuracy of the record drawings. Responsibility for accuracy lies solely with the Contractor:

.1 Where subsequent reviews or modifications to the Work occur during the Warranty Period indicate that the Record Drawings contain inaccuracies, the Owner reserves the right to verify or survey as-built conditions by an independent agency.
.2 Where inaccuracies are contained within the Record Drawings, the Contractor will be responsible for costs of independent survey agency and costs related to revisions to the Record Drawings.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Procedures for demonstration and instruction of Products, equipment and systems to Owner's personnel.

.2 Seminars and demonstrations.

1.2 RELATED SECTIONS

.1 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two (2) weeks prior to date of final inspection.

.2 Owner will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.

1.4 COMPONENT DEMONSTRATION

.1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.

.2 Instruct Owner's personnel and provide written report that demonstration and instructions have been completed.

1.5 SUBMITTALS

.1 Submit schedule of time and date for demonstration of each item of equipment and each system two (2) weeks prior to designated dates, for Consultant's approval.

.2 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

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

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

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 PREPARATION

.1 Verify that suitable conditions for demonstration and instructions are available.

.2 Verify that designated personnel are present.

.3 Prepare agendas and outlines.

.4 Establish seminar organization.

.5 Explain component design and operational philosophy and strategy.

.6 Develop equipment presentations.

.7 Present system demonstrations.

.8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 PREPARATION OF AGENDAS AND OUTLINES

.1 Prepare agendas and outlines including the following:

.1 Equipment and systems to be included in seminar presentations.

.2 Name of companies and representatives presenting at seminars.

.3 Outline of each seminar's content.

.4 Time and date allocated to each system and item of equipment.

.5 Provide separate agenda for each system

3.3 SEMINAR ORGANIZATION

.1 Coordinate content and presentations for seminars.

.2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.

.3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.

.4 Coordinate proposed dates for seminars with Owner and select mutually agreeable dates.

3.4 EXPLANATION OF DESIGN STRATEGY

.1 Explain design philosophy of each system. Include following information:

.1 An overview of how system is intended to operate.

.2 Description of design parameters, constraints and operational requirements.

.3 Description of system operation strategies.

.4 Information to help in identifying and troubleshooting system problems.

3.5 DEMONSTRATION AND INSTRUCTIONS

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

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

.3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.

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

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

.6 Video record the demonstration and provide copy to Owner.

END OF SECTION

1.0 PART 1 – GENERAL

1.1 GENERAL

.1 Commissioning Authority:

.1 An independent firm (CES Engineering Ltd) specializing in building systems commissioning type of work has been retained by the Owner (Interior Health) to act as the project Commissioning Authority (CA). This firm will be responsible to manage and administrate the commissioning process on this project.

.2 The CA directs and coordinates the commissioning activities and the reports to the Owner and Architect and Design Engineers (A/E). All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

.2 Commissioning Definition:

.1 Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting the owner's project requirements, design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

.3 Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

.1 Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.

.2 Verify and document proper performance of equipment and systems.

.3 Verify that O&M documentation left on site is complete and

.4 Verify that the Owner's operating personnel are adequately trained.

.4 The commissioning process does not take away from or reduce the responsibility of the installing contractors to provide a finished and fully functioning product.

.5 Abbreviations:

.1 The following are common abbreviations used in the Commissioning Specifications and in the Commissioning Plan. Definitions are found in subsequent paragraphs.

OW:	Owner/Owner's Representative	PM:	Project Manager (of the Owner)
CA:	Commissioning Authority	GC:	General Contractor (prime)
Cx:	Commissioning	MC:	Mechanical Contractor
Cx Plan:	Commissioning Plan Document	CC:	Controls Contractor
PC:	Pre-functional Checklist	TAB:	Test and Balance Contractor
FT:	Functional Performance Test	EC:	Electrical Contractor
A/E:	Architect and Design Engineers	Subs:	Subcontractors

1.2 CODES, REFERENCES AND STANDARDS

.1 Commissioning Standards:

.1 The administration of the commissioning process is based on the CSA Z8001-13 Commissioning of Healthcare Facilities.

.2 Comply with applicable Municipal, Provincial, and National Codes, Standards and bylaws, including Federal Environmental Health standards as specified in other sections.

1.3 RELATED WORK

.1 Specific commissioning requirements are given in the following sections of these specifications or are directly related to the commissioning process. All of the following sections apply to the Work of this section.

.1 01 91 14 – Commissioning Plan

.2 01 91 15 – Commissioning Training

.3 21 05 93 – Testing and Adjusting for Fire Protection Systems

.4 21 08 00 – Commissioning for Fire Suppression Systems

.5 22 05 93 – Testing and Adjusting for Plumbing Systems

.6 22 08 00 – Commissioning of Plumbing Systems

.7 23 05 93 – Testing, Adjusting and Balancing for HVAC Systems: Alerts balancer of Cx responsibilities in 01 91 13 and 23 08 00.

.8 25 05 10 – Building Automation System: Alerts the BAS contractor of Cx responsibilities in 01 91 13 and 23 08 00.

.9 23 08 00 – Commissioning of HVAC Systems

.10 26 05 03 – Commissioning of Electrical

1.4 SYSTEMS TO BE COMMISSIONED

.1 Mechanical Systems

.1 Division 21: Fire Suppression

.2 Division 22: Plumbing

.3 Division 23: Heating Ventilation and Air Conditioning (HVAC)

.4 Division 25: Integrated Automation

.2 Electrical Systems

.1 Division 26: Electrical

.3 Communication Systems

.1 Division 27: Communication System

.4 Electronic Safety and Security

.1 Division 28: Electronic Safety and Security

1.5 COMMISSIONING TEAM:

.1 The members of the commissioning team consist of the Commissioning Authority (CA), the Project Manager (PM), the designated representative of the Owner's firm (OW), the General Contractor (GC), the architect and design engineers (A/E), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB Contractor, the Controls Contractor (CC), any other installing subcontractors (Subs) or suppliers of equipment. The Owner's building or plant operator/engineer is also a member of the commissioning team.

.2 The commissioning team for this project includes the following members:

.1 Owner/Owner's Project Manager (OW/PM): Interior Health Authority
.2 Commissioning Authority (CA): CES Engineering Ltd
.3 Architect (A): Stantec Architecture Ltd.
.4 Mechanical Consultant (ME): Stantec Consulting Ltd.
.5 Electrical Consultant (EE): Stantec Consulting Ltd.
.6 Structural Consultant (SE): Stantec Consulting Ltd.
.7 General Contractor (GC)
.8 Mechanical Contractor (MC)
.9 Sheet Metal Contractor
.10 Fire Protection Contractor
.11 Controls Contractor (CC)
.12 Testing and Balancing Agency (TAB)
.13 Division(s) 20 - 25 Specialty Equipment Vendor Specialists
.14 Electrical Contractor (EC)
.15 Division 26 Specialty Equipment Vendor Specialists

1.6 COMMISSIONING PROCESS OVERVIEW

.1 Commissioning Plan:

.1 The Commissioning Plan provides guidance in the execution of the commissioning process. The CA will develop the draft Commissioning Plan in early construction and circulate to the project team for review. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The Specifications will take precedence over the Commissioning Plan.

.2 Commissioning Process: The following provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

.1 Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
.2 Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
.3 Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.

.4 The CA works with the MC, EC and the Subs in developing startup plans and startup documentation formats, including providing the MC, EC and the Subs with pre-functional checklists to be completed, during the startup process.

.5 In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with Pre-functional checklists being completed before functional testing.

.6 The MC, EC and the Subs, under GC direction, execute and document the Pre-functional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment.

.7 The CA develops specific equipment and system functional performance test procedures. The MC, CC and the Subs review the procedures.

.8 The procedures are executed by the MC, EC and the Subs, under the direction of, and documented by the CA.

.9 Items of non-compliance in material, installation or setup are corrected at the MC, EC and the Sub's expense and the system retested.

.10 The CA reviews the O&M documentation for completeness.

.11 Commissioning shall be completed before Substantial Completion.

.12 The CA reviews, pre-approves and coordinates the training provided by the MC, EC and the Subs and verifies that is was completed.

.13 Deferred testing is conducted, as specified or required.

1.7 RESPONSIBILITIES

.1 Overview

.1 The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the mechanical contractor, TAB and controls contractor are in *Section 23 08 00* and those of the electrical contractor in *Section 26 05 03*.

.2 It is noted that the commissioning services for the Project Manager, General Contractor, Architect, HVAC mechanical and electrical Consultants / engineers, and Commissioning authority are not provided by the contractors in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.

.2 All Parties

.1 Follow the Commissioning Plan.

.2 Attend commissioning scoping meeting and additional meetings, as necessary.

.3 Architect (of A/E)

.1 Construction and Acceptance Phase

.1 Attend the commissioning scoping meeting and selected commissioning team meetings.

.2 Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual review, etc., as contracted.

.3 Provide any design narrative documentation requested by the CA.

.4 Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents

.2 Warranty Period

.1 Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

.4 Mechanical and Electrical Consultants (of the A/E)

.1 Construction and Acceptance Phase

.1 Perform normal submittal reviews, construction observation, O&M manual review etc., as contracted. One site observation should be completed just prior to system startup.

.2 Provide any design narrative and sequences documentation requested by the CA. The Consultants shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

.3 Attend commissioning scoping meetings and other selected commissioning team meetings as required or via conference call.

.4 Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents

.5 Provide a design overview presentation if requested at one of the training sessions for the Owner's personnel.

.6 Witness testing of selected pieces of equipment and systems

.2 Warranty Period

.1 Participate, as required, in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

.5 Commissioning Authority (CA)

.1 The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems. The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General Contractor.

.2 Construction and Acceptance Phase

.1 Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

.2 Coordinate the commissioning work with the GC, ensure that commissioning activities are being scheduled into the master schedule.

.3 Revise, as necessary, *Commissioning Plan.*

.4 Plan and conduct a commissioning scoping meeting and other commissioning meetings.

.5 Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.

.6 Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

.7 Review normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with, or upon completion of, the A/E reviews.

.8 Write and distribute pre-functional tests and checklists.

.9 Develop an enhanced start-up and initial systems checkout plan with Subs.

.10 Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

.11 Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Notify owners project manager of any deficiencies in results or procedures.

.12 Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Notify owner's project manager of any deficiencies in results or procedures.

.13 Approve pre-functional tests and checklist completion by reviewing pre-functional checklist reports and by selected site observation and spot checking.

.14 Approve systems startup by reviewing start-up reports and by selected site observation.

.15 Review TAB execution plan.

.16 Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.

.17 Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.

.18 With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing. Submit to GC for review, and for approval if required.

.19 Analyze any functional performance trend logs and monitoring data to verify performance.

.20 Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.

.21 Maintain a master deficiency and resolution log and a separate testing record. Provide the GC with written progress reports and test results with recommended actions.

.22 Witness performance testing of fire / smoke dampers and other fire alarm systems by others and other owner contracted tests or tests by manufacturer's personnel over which the CA may not have direct control. Document these tests and include this documentation in the Commissioning Report.

.23 Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.

.24 Oversee and approve the training of the Owner's operating personnel.

.25 Review and approve the preparation of the O&M manuals.

.26 Provide a final Commissioning Report (as described in this section).

.27 Prepare a standard trend logging package of primary parameters that will provide the operations staff clear indications of system function in order to identify proper system operation and trouble shoot problems. The CA shall also provide any needed information on interpreting the trends.

.3 Warranty Period

.1 Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

.2 Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

.6 Owner/Owner's Representative (OW)

.1 Construction and Acceptance Phase

.1 Review and approve the final Commissioning Plan—Construction Phase.

.2 Attend a commissioning scoping meeting and other commissioning team meetings.

.3 Perform the normal review of Contractor submittals.

.4 When necessary, observe and witness pre-functional checklists, startup and functional testing of selected equipment.

.5 Assist the GC in coordinating the training of owner personnel.

.2 Warranty Period

.1 Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

.7 Project Manager (PM)

.1 Construction and Acceptance Phase

.1 Manage the contract of the A/E and of the GC.

.2 Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the *Commissioning Plan*.

.3 Provide final approval for the completion of the commissioning work.

.2 Warranty Period

.1 Ensure that any seasonal or deferred testing and any deficiency issues are addressed.

.8 General Contractor (GC)

.1 Construction and Acceptance Phase

.1 Facilitate the coordination of the commissioning work by the CA and ensure that commissioning activities are being scheduled into the master schedule.

.2 Include the cost of participating in the commissioning process as outlined in the specifications in the total contract price.

.3 Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.

.4 In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.

.5 Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.

.6 A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process

.7 Coordinate the training of owner personnel.

.8 Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

.2 Warranty Period

.1 Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.

.2 Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

.9 Equipment Suppliers

.1 Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.

.2 Assist in equipment testing per agreements with Subs.

.3 Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone datalogging equipment that may be used by the CA.

.4 Through the contractors they supply products to, analyze specified products and verify that the Consultant has specified the newest most updated equipment reasonable for this project’s scope and budget.

.5 Provide information requested by CA regarding equipment sequence of operation and testing procedures.

.6 Review test procedures for equipment installed by factory representatives.

1.8 DEFINITIONS

.1 Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.

.2 Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

.3 Architect / Engineer (A/E): The prime consultant (architect – Stantec Architecture Ltd.) and sub-consultants who comprise the design team, generally the HVAC mechanical Consultant/engineer and the electrical Consultant/engineer.

.4 Basis of Design: The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.

.5 Commissioning Authority (CA): An independent agent, not otherwise associated with the A/E team members or the Contractor. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role like the GC. The CA is part of the Owner's team and reports directly to the OW/PM.

.6 Commissioning Plan: An overall plan, developed before or after bidding, that provides the structure, schedule and coordination planning for the commissioning process.

.7 Contract Documents: The documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, *Cx Plan*, etc.).

.8 Contractor: The contractor in general or authorized representative.

.9 Control system: The central building energy management control system.

.10 General Contractor (GC): The General Contractor is responsible for providing all of the material, labor, equipment and services necessary for the construction of the project. The general contractor hires specialized subcontractors to perform all or portions of the construction work.

.11 Datalogging: Monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

.12 Deferred Functional Tests: FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.

.13 Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).

.14 Design Intent: A dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

.15 Design Narrative or Design Documentation: Sections of either the Design Intent or Basis of Design.

.16 Factory Testing: Testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

.17 Functional Performance Test (FT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after pre-functional checklists and startup are complete.

.18 Indirect Indicators: Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

.19 Manual Test: Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

.20 Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

.21 Non-Compliance: See Deficiency.

.22 Non-Conformance: See Deficiency.

.23 Over-written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."

.24 Owner-Contracted Tests: Tests paid for by the Owner outside the GC's contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

.25 Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.

.26 Pre-functional Checklist (PC): A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Pre-functional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word pre-functional refers to before functional testing. Pre-functional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning

process, contractors typically perform some, if not many, of the pre-functional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the pre-functional check-listing, except for larger or more critical pieces of equipment and some spot checking.

.27 Project Manager (PM): The contracting and managing authority for the owner over the design and/or construction of the project.

.28 Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to this Section, Part 3.6, F for details.

.29 Seasonal Performance Tests: FT that are deferred until the system(s) will experience conditions closer to their design conditions.

.30 Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

.31 Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

.32 Specifications: The construction specifications of the Contract Documents.

.33 Startup: The initial starting or activating of dynamic equipment, including executing pre-functional checklists.

.34 Subs: The subcontractors to the GC who provide and install building components and systems.

.35 Test Procedures: The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

.36 Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents.

.37 Trending: Monitoring using the building control system.

.38 Vendor: Supplier of equipment.

.39 Warranty Period: Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

2.0 PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

.1 All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division(s) 20 - 25 shall ultimately be responsible for all standard testing equipment for the Fire Protection, Plumbing, Mechanical (HVAC) and controls systems in this Division, except for equipment specific to and used by TAB in their commissioning responsibilities. Two-way radios shall be provided by the control contractor (CC).

.2 Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site.

.3 All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

3.0 PART 3 - EXECUTION

3.1 MEETINGS

.1 Scoping Meeting

.1 Within 90 days of commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to revise the Draft Commissioning Plan to its "final" version, which will also be distributed to all parties.

.2 Miscellaneous Meetings

.1 Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs. Within final 3 months of construction these meetings may be held as frequently as one per week.

3.2 REPORTING

.1 The CA will provide regular reports to the PM and GC, with increasing frequency as construction and commissioning progresses.

.2 The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, field reviews, progress reports, etc.

.3 Field Reviews will be conducted and used to validate construction progress, equipment start-up progress and O&M requirements for the building systems. The CA shall complete Field Reviews at regular intervals throughout construction, and issue to PM and GC through appropriate channels.

.4 Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

.5 A Final Commissioning Report will be compiled by the CA and submitted to the Owner/PM, which will include all acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc.

3.3 SUBMITTALS

.1 The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning authority. All documentation requested by the CA shall also be included by the Subs in their O&M manual contributions.

.2 The CA will review submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning authority will notify the GC, PM or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.

.3 The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

.4 These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them.

3.4 SCHEDULING

.1 Provide detailed Commissioning Schedule part of the construction schedule, following the same requirements of Section 01 32 00.

.2 The CA will work with the GC according to established protocols to define a schedule for commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process. The schedule shall include all necessary time-points and milestones, testing, documentation, training and commissioning activities.

.3 The CA will provide the format for the initial schedule of primary commissioning events at the commissioning scoping meeting. The *Commissioning Plan* provides the format for this schedule.

.4 A detailed commissioning schedule in day-by-day format shall be provided by the Contractor for pre-functional testing of all individual components, equipment and subsystems; and functional and integration testing of each completed system. This schedule shall include a detailed training schedule to demonstrate that there will be no conflicts with testing.

.5 The schedule of commissioning activities shall be produced in a Gantt chart format to a scale that will ensure legibility. This Gantt chart will show sequences of testing equipment and systems, interrelationship between tests, duration of tests and training periods. As construction progresses more detailed schedules are developed by the contractors.

.6 The commissioning schedule shall include the following milestones (as appropriate):

- .1 Introductory commissioning meeting chaired by the Commissioning Authority: 90 days after general contractor award of contract.
- .2 Inspection and Testing of ORs, ICUs, PACUs, Pharmacy and Special Service Areas
  - .1 Pre-finishing inspection of architectural features, caulking and sealing
  - .2 Pre-finishing room pressure test to determine the leakage rate of the room shell prior to closing in the room.
- .3 Start-up and Pre-Functional Checks
- .4 Building Clean – Ventilation Activation dates for all major functional areas
- .5 Testing and Balancing (TAB) of Air and Water Systems
- .6 BAS / BMS Checkout
- .7 Functional Performance Testing
- .8 Integration Testing
- .9 O&M Manual and As-Builts Submissions
- .10 Owner Training
- .11 Occupancy (Life Safety)
- .12 Substantial Completion
- .13 Start of Contractor Warranty Period
- .14 Deferred / Seasonal Testing

.7 The CA will monitor progress of commissioning against this schedule.

3.5 START-UP, PRE-FUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

.1 Application

.1 The following procedures apply to all equipment to be commissioned, according to *Paragraph 1.4, Systems to be Commissioned*. Some systems that are not comprised so much of actual dynamic machinery, e.g., architectural systems, electrical distribution panels, may have very simplified PCs and startup.

.2 General

.1 Pre-functional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout. No sampling strategies are used. The pre-functional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

.3 Pre-finishing inspection and testing of Critical Rooms (CSA Z8001 Annex J & K)

.1 The GC shall facilitate A/E and CA inspections of ORs, ICUs, PACUs, Pharmacy and Special Service Areas following drywall installation but prior to final finishes.

.2 GC shall provide all necessary equipment such as blower door assemblies, and pressure and airflow monitoring equipment required to obtain leakage rate of the room shells prior to closing in the rooms.

.3 Perform remedial actions to caulking and sealing as required to ensure that architectural features of the room that affect air seals and air flow are built in accordance with the room design such that the room will meet relative pressurization requirements of the design, CAN/CSA-Z317.2, The National Association of Pharmacy Regulatory Authorities (NAPRA) Model Standards (Sterile Preparations) and / or other accreditation guidelines and standards for the type of area being tested.

.4 Start-up and Initial Checkout Plan.

.1 The CA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that the contractor provides written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for pre-functional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms.

.2 The CA obtains manufacturer installation, startup and checkout data, including actual field checkout sheets used by the field technicians from the contractor (through an RFI) or shop drawings.

.3 The CA copies all pages with important instructional data and procedures from the startup and checkout manuals not covered in manufacturer field checkout sheets and adds a signature line in the column by each procedure.

.4 The copied pages, along with the pre-functional checklist provided by the CA and the manufacturer field checkout sheets become the “Startup and Checkout Plan.”

.5 For systems that may not have adequate manufacturer startup and checkout procedures, particularly for components being integrated with other equipment, the Sub should provide the added necessary detail and documenting format to the CA for approval, prior to execution.

.6 The CA transmits the full Startup Plan to the GC, who designates which trade or contractor is responsible to fill out each line item on the Pre-functional Checklist from the CA. The GC then transmits the full start-up plan to the Subs for their review and use. (This usually means that the Pre-functional Checklist, alone, will go to more than one Sub, while the full plan will go to the primary installing contractor.)

3.6 EXECUTION OF PRE-FUNCTIONAL CHECKLISTS AND STARTUP

.1 Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the GC and CA. The performance of the Pre-functional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off Pre-functional checklists, signatures may be required of other Subs forverification of completion of their work.

.2 The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and Pre-functional tests and checklists. The CA may review pre-functional checklists in progress, as necessary.

.3 The site technician performing the line item task initials and dates on the Pre-functional and manufacturer field checkout sheets, as they are completed. Only individuals that have direct knowledge and witnessed that a line item task on the Pre-functional checklist was performed shall initial or check that item off. It is not acceptable for supervisors to fill out these forms unless they have directly witnessed the specific task.

3.7 DEFICIENCIES, NON-CONFORMANCE AND APPROVAL IN CHECKLISTS AND STARTUP

.1 The Subs shall clearly list any outstanding items of the initial start-up and Pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet.

.2 The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.

.3 The CA reviews the report and tracks issues and non-compliances in the Commissioning Issues Log, for follow-up by the Sub or GC. The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CA will involve the GC and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and response to the related Issues Log item. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system to the Owner.

.4 Items left incomplete, which later cause deficiencies or delays during functional testing may result in back charges to the responsible party. Refer to Part 3.11 herein fordetails.

3.8 PHASED COMMISSIONING

.1 The project may require startup and initial checkout to be executed in phases. This phasing will be planned and scheduled in a coordination meeting of the CA, GC, Mechanical, Electrical, TAB and controls contactors. Results will be added to the master and commissioning schedule.

3.9 FUNCTIONAL PERFORMANCE TESTING

.1 This sub-section applies to all commissioning functional testing for all divisions.

.2 The general list of equipment to be commissioned is found in Paragraph 1.7. The specific equipment and modes to be tested are found in Sections 21 08 00, 22 08 00, *23 08 00* and *26 05 03*. If specific testing requirements were not included in the bid documents and original specifications, they should be developed for this project for each piece of commissioned equipment.

.3 The parties responsible to execute each test are listed with each test in Sections 21 08 00, 22 08 00, *23 08 00* and *26 05 03*.

.4 Objectives and Scope

.1 The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing includes validation of completed systems in all modes of operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

.2 In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low pressure, no flow, equipment failure, etc. shall also be tested. Specific modes required in this project are given in Sections 21 08 00, 22 08 00, *23 08 00* and *26 05 03*.

.3 The CA shall witness at a minimum, contractor functional testing for each piece of primary equipment, unless there are multiple units, in which case a sampling strategy may be used. In no case will the number of units witnessed be less than 20% of the total number of identical or very similar units. Sampling strategy is discussed further in section 3.8.3 below.

.5 Development of Test Procedures

.1 Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in *Sections* 21 08 00, 22 08 00, *23 08 00* and *26 05 03* the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. CA obtains clarification, as needed, from contractors and the A/E regarding sequences and operation to develop these tests. Each Sub or vendor responsible to execute a test, shall aid the CA in developing the procedures (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the primary equipment test procedures to the Subs (via the GC) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested.

.2 The CA shall review owner-contracted, factory testing or required owner acceptance tests which the CA is not responsible to oversee, including documentation format, and

shall determine what further testing or format changes may be required to comply with the *Specifications*. Redundancy of testing shall be minimized.

.3 The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

.6 Test Methods.

.1 Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. Sections 21 08 00, 22 08 00, *23 08 00* and 26 05 03 specify which methods shall be used for each test. The CA follows the Specifications when given and uses judgement where needed to determine which method is most appropriate. The CA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the Owner. This may require a change order and adjustment in charge to the Owner. The CA will determine which method is most appropriate for tests that do not have a method specified.

.1 Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.

.2 Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value, or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

.3 Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended; over using the sensor to act as the signal generator via simulated conditions or overwritten values.

.4 Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 12.78ºC (55F), when the outside air temperature is above 12.78ºC (55F), temporarily change the lockout setpoint to be approximately 1.2ºC (2F) above the current outside air temperature.

.5 Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during Pre-functional testing.

.6 Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

.7 Sampling: Not all pieces of identical equipment receive in-depth testing; multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in Pre-functional checklist execution.

.1 A common sampling strategy referenced in the *Specifications* as the "xx% Sampling—yy% Failure Rule" is defined by the following example.

.1 xx = the percent of the group of identical equipment to be included in each sample.

.2 yy = the percent of the sample that if failing, will require another sample to be tested.

.2 The example below describes a 20% Sampling—10% Failure Rule.

.1 Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."

.2 If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample)

.3 If 10% of the units in the second sample fail, test all remaining units in the whole group.

.4 If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

3.10 EXECUTION OF FUNCTIONAL PERFORMANCE TESTS

.1 Coordination and Scheduling.

.1 The Subs shall provide sufficient notice to the CA regarding their completion schedule for the Pre-functional checklists and startup of all equipment and systems. The CA will schedule functional tests through the GC and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

.2 In general, functional testing is conducted after Pre-functional testing and startup has been satisfactorily completed. For any given system, prior to performing functional testing, the CA waits until the Pre-functional checklist has been submitted with the necessary signatures, confirming that the system is ready for functional testing.

.3 The control system is sufficiently tested by the installing contractor before it is used for TAB or to verify performance of other components or systems. The air balancing and

water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interfaces, integration and/or coordinated responses between systems is tested.

.2 Problem Solving

.1 The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the contractors, Subs and A/E.

.3 Owner Engagement:

.1 The Owner's facilities operating staff are encouraged to attend and participate in the testing process. The CA will notify the Owner/PM, who will then notify the facility staff when the commissioning events will occur.

3.11 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

.1 Documentation

.1 The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the GC for review and approval and to the Subs for review. The CA will include the filled out forms in the System Manual.

.2 Non-Conformance

.1 The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the GC on a standard non-compliance form.

.2 Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

.3 Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the GC.

.4 As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.

.5 When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:

.1 The CA documents the deficiency and the Sub's response and intentions; and then they go on to another test or sequence. After the day's work, the CA submits the non-compliance reports to the GC for signature, if required. A copy is provided to the Sub and CA. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.

.2 The CA reschedules the test (through the GC) and the test is repeated.

.6 If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

.1 The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the GC and to the Sub representative assumed to be responsible

.2 Resolutions are made at the lowest management level possible (preferably between CA or GC and the Sub). Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.

.3 The CA documents the resolution process.

.4 Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved

.7 Cost of Retesting

.1 The cost for the Sub to retest a Pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.

.8 For a deficiency identified, not related to any Pre-functional checklist or start-up fault, the following shall apply:

.1 The CA and GC will direct the retesting of the equipment once at no "charge" to the contractors for their time. However, the CA's and GC's time for a second retest will be charged to the contractors, who may choose to recover costs from the responsible Sub.

.2 Refer to the Sampling Section for requirements for testing and retesting identical equipment.

.9 The Contractor shall respond in writing to the CA and GC at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

.10 The CA retains the original non-conformance forms until the end of the project.

.11 Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

.12 Failure Due to Manufacturer Defect:

.1 If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the GC or PM. In such case, the Contractor shall provide the Owner with the following:

.1 Within one week of notification from the GC or PM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the GC or PM within two weeks of the original notice.

.2 Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

.3 The GC or PM will determine whether a replacement of all identical units or a repair is acceptable.

.4 Two examples of the proposed solution will be installed by the Contractor and the GC will be allowed to test the installations for up to one week, upon which the GC or PM will decide whether to accept the solution.

.5 Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

.3 Approval

.1 The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the Owner, if necessary. The CA recommends acceptance of each test to the Owner using a standard form.

3.12 OPERATION AND MAINTENANCE (O&M) DOCUMENTATION

.1 Standard O&M Manuals:

.1 Specific content and format requirements for the standard O&M manuals are detailed in Sections *01 33 00, 21 05 00, 22 05 00, 23 05 00* and *26 05 00*. Special requirements for the controls contractor and TAB contractor are found Section *23 08 00*.

.2 CA Review and Approval:

.1 Prior to substantial completion, the CA shall review the O&M manuals to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the GC, PM or A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the GC, PM or A/E.

.3 Warranty:

.1 A complete inventory of warranty items shall be provided by the Contractor. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E’s review of the O&M manuals according to the A/E’s contract.

.4 "As-built" Drawings and Specifications:

.1 These are generally produced by the consultant from the project record documents maintained on the site and kept up-to-date with all changes as they occur and marked thereon by the Contractor. Accuracy will be verified by the Consultant before preparation of the "As-builts" and by the Commissioning Authority after submission by the Consultant. They shall be completed in time to be used for owner’s training and demonstration sessions. For specific information regarding As-Builts refer to

specification sections Architectural Section 01 33 00, Mechanical Section 23 05 00, Electrical Section 26 05 00.

.5 Commissioning Records in O&M Manuals:

.1 Contractors shall include copies of all test reports and completed checklists in the O&M Manuals.

.2 The CA will compile a final Commissioning Report summarizing the results of the overall commissioning process under a separate cover. Refer to the Commissioning Plan for details.

3.13 DEMONSTRATION AND TRAINING OF OWNER PERSONNEL

.1 Detailed information regarding contents, duration and instructors for any particular building system is included in Specification *Section 01 91 15 – Commissioning – Training*.

.2 The Training Plans are produced conjointly by the Contractor and the Commissioning Authority to meet project-specific requirements and they include details provided by the Facility Property Manager relating to numbers and prerequisite qualifications and skills of trainees, type of training (i.e. observation, hands-on, classroom), etc.

.3 The CA coordinates and schedules, with the GC, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CA advises the OW on the adequacy of the training provided based on these pre-determined success criteria.

.4 Sample Training Agenda is included in Specification *Section 01 91 15 – Commissioning – Training*.

.5 The Commissioning Schedule shall indicate proposed training dates for specific systems.

3.14 ACTIVITIES DURING THE WARRANTY PERIOD

.1 While all Functional Performance Testing must be completed before Substantial Completion, it is anticipated that certain commissioning activities will be necessary during the Warranty Period.

.2 The CA shall remain at the service of the owner to address any commissioning related issues throughout the first year of operation. This may include coordination of deferred testing, deficiency resolution/follow-up, and addressing specific occupant or owner concerns. Near the end of the warranty period, the CA shall perform a commissioning review of commissioning related issues and their resolution during the first year of operation.

.3 Occupant concerns (Including temperature, thermal comfort, IAQ, and others) for the project shall be communicated through the building operation and maintenance department via the appropriate channels. These concerns shall then be relayed directly by the PM to the project team, including the CA, Contractor, Subs, and consultants. An investigation process to address concerns shall be led by the CA and responsible contractors. Subsequent action may include additional testing, deficiency resolution, and tuning of the systems with the contractor team and equipment manufacturers, under supervision and direction of CA. Upon resolution of the issue, the occupants are informed through the appropriate channels.

3.15 DEFERRED TESTING

.1 Unforeseen Deferred Tests.

.1 If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

.2 Seasonal Testing:

.1 During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

3.16 WRITTEN WORK PRODUCTS

.1 The commissioning process generates a number of written work products described in various parts of the specifications. The following lists all the formal written work products and describes who is responsible to create them. In summary, the written products are:

Product		Developed By
.1	Commissioning Plan	CA
.2	Meeting Minutes	CA
.3	Commissioning Schedules	CA with GC and Subs
.4	Equipment documentation submittals	Subs
.5	Sequence clarifications	Subs and A/E as needed
.6	Pre-functional Checklists	CA and Subs
.7	Startup and initial checkout plan	Subs and CA
.8	TAB Plan	TAB
.9	Field Reviews	CA
.10	Room Leakage Test Reports	GC
.11	Pre-functional Checklists filled out	Subs
.12	Final TAB Report	TAB
.13	Issues Log (deficiencies)	CA
.14	Commissioning Progress Reports	CA
.15	Functional Test forms	CA
.16	Filled out Functional Tests	CA
.17	O&M Manuals	Subs
.18	Overall training plan	CA and GC
.19	Final Commissioning Report	CA

END OF SECTION

1.0 PART 1 – GENERAL

1.1 SUMMARY

.1 Refer to the Commissioning Plan prepared by the CA will be issued during submittals stage of the project to outline to the project specific commissioning program including draft checklists and test plans.

.2 The Commissioning Plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the “final” plan, though it will continue to evolve and expand as the project progresses. The Specifications will take precedence over the Commissioning Plan.

.3 Contractors shall be familiar with all parts of the Commissioning Plan, as well as associated Sections 01 91 13 Commissioning – General Requirements, 01 91 15 Commissioning – Training and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

2.0 PART 2 – PRODUCTS

.1 Not used.

3.0 PART 3 – EXECUTION

.1 Not used.

END OF SECTION

1.0 PART 1 – GENERAL

1.1 DESCRIPTION

.1 The building systems demonstration and training for Owners Operating Personnel shall be coordinated by the Commissioning Authority. The demonstration and training shall include all components as identified in this section and elsewhere in the specifications.

.2 Training Objectives: Training shall be in sufficient detail and of sufficient duration to meet the following objectives:

- .1 Safe, reliable and energy-efficient operation of all systems in all normal, all emergency and catastrophic (internal and external) modes and under all conditions.
- .2 Effective ongoing inspection and measurement of system performance.
- .3 Proper preventive maintenance, diagnosis and troubleshooting.
- .4 Service and repair of all systems, equipment and components.
- .5 Ability to update documentation and input on future building modifications.
- .6 Ability to operate equipment and systems under emergency conditions without assistance or until appropriate qualified assistance arrives.

.3 For training of O & M personnel to be effective, it is to be implemented during the later stages of construction, to allow for familiarization with the facility and the installed systems.

.4 Co-ordination and Monitoring:

- .1 Contractors shall co-ordinate and implement all training
- .2 The Owner shall co-ordinate all participants to attend training
- .3 The Commissioning Authority shall track successful completion of all training to ensure that it has been delivered to the Owner's satisfaction.

.5 Long Term Ongoing Training: "Long-term" ongoing training is not included in commissioning activities. However, training courses and training materials must be designed to permit long term ongoing training well into the future.

1.2 RESPONSIBILITIES

.1 The Commissioning Authority shall:

- .1 In conjunction with the Owner ensure all designated O & M personnel will be available for training during later stages of construction for purposes of familiarization with the facility and all installed systems,
- .2 Review the quality of the Contractor's training and training materials meets all requirements of the project.

.2 The Contractor shall:

- .1 Have overall responsibility to provide, coordinate, document, and record all training, and shall provide all training materials, training and classroom times. Note that the owner reserves the right to video record training sessions.
- .2 Contractor's personnel, professional trainers, manufacturer's resources for training purposes and be responsible for:
  - .1 Direction of all training
  - .2 Implementation of all training activities
  - .3 Coordination among instructors

.4 Quality of training and training materials.

.3 Trainees shall include O & M personnel selected for operating and maintaining the project, the Facility Manager, building operators, maintenance staff, security staff, service contractors, and technical specialists (as applicable).

1.3 INSTRUCTORS

.1 Instructors shall include the following:

.1 Design Consultant:

.1 To provide instruction on the Design Philosophy, Design Criteria, Design Intent, and Description of all Systems.

.2 Contractor:

.1 To provide instruction on the operation of specific systems, equipment or components, including start up, operation, shut down, features of controls, such as reasons for, results of, implications on associated systems of, adjustment of set points of control and limit safety devices.

.3 Factory trained and certified manufacturer's maintenance specialist personnel:

.1 to provide instruction on start-up, operation, care, maintenance, shut down of equipment for which they have certified installation, started up and carried out PV tests.

.4 Professional trainers:

.1 Where the Contractor is not deemed to be able to deliver the quality or level or training required.

1.4 ORGANIZATION

.1 Training of O & M personnel shall consist of three main parts:

.1 Classroom sessions: shall be provided as necessary, with instruction regarding functional requirements, system philosophy, system operation and use of the Building Management Manual and all other commissioning documentation.

.2 Familiarization sessions organized for all systems during construction and installation stage and equipment commissioning. This may include review of installation, layout of equipment, systems and components, start-up and testing of the work, access to approved shop drawings, equipment operating and maintenance data. On- site observations may include still-photo records as deemed necessary by the O&M personnel – particularly of concealed elements.

.3 Hands on training: shall be provided on all systems, components and equipment and explanations of all commissioning procedures shall be provided.

1.5 CONTENT

.1 Training requirements for building systems are included in table format in this appendix and in the relevant commissioning specifications of various divisions.

.2 Training shall include:

.1 Review of the facility

.2 Functional requirements

.3 System philosophy – Design Criteria, design Intents, why the system was designed in this way, why certain settings are important and should not be changed without proper authority, limitations of each system, including emergency procedures
.4 Review of system layout and equipment, components and controls
.5 Use the printed installation, operation and maintenance instruction material included in the O&M manuals
.6 Discussion of warranties and guarantees.
.7 System operating sequences, including interaction between systems forming part of integrated systems, step by step directions for starting up and shutting down all systems, closing and opening valves, dampers and switches, adjusting control settings, turning motors on and off, and emergency procedures
.8 Features of controls, monitoring, and procedures for performance verification
.9 Reasons for, results of and implications on associated systems of adjustment of setpoints of control, limit and safety devices; interaction among systems during integrated operation
.10 Maintenance and servicing of systems, equipment and components
.11 Troubleshooting diagnosis – symptoms, signs, causes and corrective measures. For some equipment, this need only be a general knowledge, but should be enough to allow the operator to describe the problem adequately and to take emergency measures until qualified help arrives
.12 Review of O & M documentation

.3 Instructional Materials: All instructional material shall be produced in a digital electronic form that will permit future training for replacement O & M personnel to the same degree of detail and depth as supplied by initial training.
.4 Training materials shall include at least the following:
.1 “As Built” Contract Documents
.2 Operation and Maintenance (O&M) Manual – Copies of the O&M Manual shall be made available to O & M personnel prior to the familiarization sessions for retention throughout the training period for purposes of self-study.
.3 TAB, Commissioning Reports
.5 Instructional material shall be supplemented as necessary by:
.1 Manufacturers training videos. These should be screened by the Commissioning Authority and reviewed by the Consultant at least six months prior to pre start up inspections before being included as part of the training material.
.2 Equipment models
.6 Instructors shall be responsible for the content and quality of training materials for all training sessions under their jurisdiction.

1.6 TRAINING PLANS

.1 A training Plan developed by the Contractor for each discipline based upon project requirements..

.2 Submit the training Plan to the Commissioning Authority for review and comment at least 12 weeks prior to the proposed training dates. Update and resubmit as required.

.3 Include an agenda and a course outline summarizing the content and duration of training.

.4 Co-ordinate the date(s) of the training session (s) with the Owner. Owner to provide the lists of participants.

.5 Contractor to organize the location and circulate calendar invites for each session.

.6 Prepare a summary of the training sessions. Indicate dates, subject matter, and all personnel present for training. After training, submit the training summary to the Commissioning Authority.

.7 Record the time, date and subject matter of training sessions as they occur. Indicate all those who are present at each training session.

1.7 DELIVERY OF TRAINING

.1 Training shall normally be provided during regular working hours prior to take over of the project.

.2 Adequate time for training is to be included in Construction and Completion Schedule.

.3 Each training session should not be longer than three hours and provided between the hours of 08:30 – 11:30 and 13:00 – 16:00.

.4 Training is to be hands on, on site, classroom, oral, written and audio/visual.

.5 All training is to be completed prior to acceptance of facility.

.6 Training should include demonstrations by the trained O & M personnel so as to show confidence in, and depth of understanding of, all systems and equipment, and to demonstrate completeness of training.

.7 Upon completion of these demonstrations, the contractors responsible for all training shall provide a written report signed by Instructors and witnessed by Consultant and/or Commissioning Authority. This report shall be submitted to the Commissioning Authority.

.8 The owner reserves the right to video record any or all training sessions. Video recording services will be professional quality and include copies of the session to be handed over to the owner for future use. Procurement of video production to be as directed by the owner (carried by the owner or other).

1.8 TRAINING ACTIVITIES:

.1 See the following typical training agenda provided as an appendix to this section.

.2 This is a broad scope outline summary for the Contractors information and incorporation into the project training plan.

1.9 TRAINING DURATIONS

.1 At a minimum, the training shall be provided as follows:

System	Duration
Mechanical System Design	2 hours (by consultant)
Fire Suppression Systems	4 hours (min 30 mins per department) + 30 mins for plant services
Plumbing Systems	8 hours (min one hour per department) + one hour for plant services
Mechanical Systems	16 hours (min 2 hours for each department (due to phasing) and 2 hours min for plant changes
BAS Controls	4 hours – initial training 3 x 4 hours – follow up sessions
Venturi Valves and Critical Pressure Controls	8 hours (Compounding Pharmacy and Scope Processing)
Electrical and Communication System Design	2 hours (by consultant)
Electrical Distribution	4 hours
Communication Systems	8 hours
Fire Alarm System	8 hours
Lighting and Control System	4 hours – initial training 2 x 4 hours – follow up sessions

2.0 TRAINING AGENDA - TYPICAL

SYSTEM XX				
Systems and Goals	**Instructor**	**Content (approximately 30% Theory, 70% practical)**	**Duration**	**Instruction Materials and Tools**
Design Philosophy 1. General overview of design concepts 2. Awareness of interaction of mechanical systems	Engineer and/or Commissioning Authority (CA)	1. Explanation of mechanical and related electrical systems, their interaction 2. Site visit in early stages of project 3. Classroom sessions during commissioning stage	X hours	1. Schematic of layouts & controls 2. Installed system, equipment 3. Design Criteria, Design Intents
System A 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions	X hours	1. " As built" drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration
System B 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions	X hours	1. " As built" drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration

Part 1 General

1.1 SECTION INCLUDES

.1 Alteration project procedures.

.2 Removal of designated building equipment and fixtures.

.3 Removal of designated construction.

.4 Disposal of materials.

.5 Storage of designated materials.

.6 Identification of existing building services.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 13 – Special Project Procedures.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 Comply with Northern Health Infection Control Policies.

.3 Canada Communicable Disease Report: Construction-related nosocomial infections in patients in health care facilities.

.4 APIC: Infection control tool kit series: construction and renovation.

.5 CSA Standard: CAN/CSA Z317.13-17, "Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities".

1.4 ALTERATION PROJECT PROCEDURES

.1 Materials: As specified in Product sections; match existing Products and work for patching and extending work.

.2 Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

.3 Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring Products and finishes to original condition.

.4 Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

.5 Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

.6 When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Consultant for review.

.7 Where a change of plane of 6 mm or more occurs, submit recommendation for providing a smooth transition; to Consultant for review.

.8 Patch or replace portions of existing surfaces which are damaged, lifted, discoloured, or showing other imperfections.

.9 Finish surfaces as specified in individual Product sections.

1.5 SUBMITTALS FOR CLOSEOUT

.1 Project Record Documents: Accurately record actual locations of capped utilities and subsurface obstructions.

1.6 REGULATORY REQUIREMENTS

.1 Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

.2 Obtain required permits from authorities.

.3 Do not close or obstruct egress width to any building or site exit.

.4 Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

.5 Conform to procedures applicable when hazardous or contaminated materials are discovered.

1.7 SEQUENCING

.1 Sequence activities in the order determined by the Contractor.

1.8 SCHEDULING

.1 Schedule Work to coincide with new construction.

.2 Describe demolition removal procedures and schedule.

1.9 PROJECT CONDITIONS

.1 Conduct demolition to minimize interference with adjacent and occupied building areas.

.2 Cease operations immediately if structure appears to be in danger and notify Consultant. Do not resume operations until directed.

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 PREPARATION

.1 Comply with Northern Health Infection Control Policies.

.2 Provide, erect, and maintain temporary barriers at locations indicated.

.3 Erect and maintain weatherproof closures for exterior openings.

.4 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued Owner occupancy.

.5 Protect existing materials, furnishings, and equipment which are not to be demolished.

.6 Prevent movement of structure; provide bracing and shoring.

.7 Notify affected utility companies before starting work and comply with their requirements.

.8 Mark location and termination of utilities.

.9 Provide appropriate temporary signage including signage for exit or building egress.

3.2 DEMOLITION

.1 Comply with Interior Health Infection Control Policies.

.2 Disconnect remove and identify designated utilities within demolition areas.

.3 Demolish in an orderly and careful manner. Protect existing supporting structural members.

.4 Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

.5 Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

.6 Remove temporary Work.

END OF SECTION

Part 1 – General

1.1 DOCUMENTS

.1 This section of the specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SECTION INCLUDES

.1 Removal, clean up, transport and disposal of all asbestos containing materials and other hazardous materials identified in way of the work in accordance with applicable regulatory requirements.

1.3 RELATED SECTIONS OR REPORTS

.1 Section 01 35 13 Special Project Procedures

1.4 PERMITS

.1 Ensure that through the requirements for renovations or demolition, all electrical disconnection, capping or isolation of the appropriate services and utilities is complete should these services be affected by the removal.

1.5 STANDARDS

.1 Conform to and perform work in accordance with the B.C. Worker's Compensation Board.

.2 Conform to and perform work in accordance with M.S.D.S. sheets for all regulated products in use on the project.

.3 Conform to and perform work in accordance with CSA Z-190 standard for respirator fittesting.

.4 Conform to and perform work in accordance with WCB WHMIS core manual.

.5 Conform to and perform work in accordance with current WCB Occupational Health & Safety Regulations.

.6 Conform to and perform work in accordance with current WCB publication regarding work with asbestos.

.7 Conform to and perform work in accordance with Latest edition of the BC Building Code.

.8 Conform to and perform work in accordance with all applicable electrical codes.

.9 Conform to and perform work in accordance with WCB manual of First Aid requirements.

.10 Conform to and perform work in accordance with WCB Notice of Project.

.11 Conform to and perform work in accordance with WCB publication - "Confined Space Entry - A Manual of Standard Practice" (Latest Edition).

.12 Conform to CSA Z 317.17 -12 Infection Control during the Construction, Renovation and Maintenance of Health Care Facilities

.13 Conform to and perform work in accordance with CSA S350-M1980, Code of Practice for Safety in Demolition of Structures

1.6 PROCEDURES AND REQUIREMENTS

.1 The Hazardous Materials (hazmat) Contractor will be a subcontractor to the Prime Contractor for the purposes of this Specification unless otherwise determined in contract documents.

.2 Asbestos removal for this project will be conducted under moderate risk work conditions as defined by the Work Safe B.C. publication "Safe Work Practices for Handling Asbestos".

.3 The HazMat Contractor and the Prime Contractor must submit, upon award, a copy of his exposure control plans and site-specific written work procedures including methods of hazardous materials removal or procedures to work on or around hazardous materials specifically as they relate to this project.

Part 2 – Description of Work

2.1 ASBESTOS ABATEMENT GENERAL

1 The work specified herein shall be the removal of known hazardous materials by competent persons trained, knowledgeable and qualified in the handling, transport and disposal of the hazardous materials using moderate and high-risk work procedures. Any worker deemed by the Industrial Hygiene Consultant to be inadequately trained to perform these duties will be removed from the project.

.2 Any scaffolds and/or platforms used to access and/or support asbestos workers and to remove the asbestos-containing materials shall be constructed or used in accordance with Occupational Health & Safety regulations.

.3 All necessary documentation shall be the responsibility of the HazMat and Prime Contractors.

.4 The health and safety of all contract employees in the areas affected during hazmat removal shall be the responsibility of the HazMat Contractor and the Prime Contractor and should the HazMat Contractor require the assistance of any other trade during the hazmat work, he will provide all necessary equipment, labour and training required to affect the work.

.5 The HazMat Contractor will assume total responsibility for the erection, maintenance, signs and integrity of all enclosures and barriers related to the hazmat work.

.6 The HazMat Contractor will provide all necessary labour, materials, insurance, permits and equipment necessary to carry out the work in accordance with all applicable regulations and this documentation.

.7 The HazMat Contractor will provide all necessary labour to secure the required utilities for all asbestos work.

2.2 SCOPE OF WORK

.1 The scope of work covers the complete removal, cleanup, transport and disposal at a licensed landfill of all asbestos, lead and PCB containing materials and equipment in way of the work as defined in the project Architectural, Mechanical, Structural and Electrical Specifications and Drawings.

.2 HazMat removal for this project will be conducted under Moderate work conditions as defined by the Work Safe B.C. for Asbestos, Lead, Silica and PCBs.

.3 Conditions of Work:

1. All work at Prince George Hospital site must conform to CSA Z317.17-12 Standards and

WorkSafeBC Occupational Health and Safety Regulations and Guidelines.

2. Viewing Windows must be installed within each enclosure to provide unrestricted access for use by the Fire Department, Night Watchman, Supervisors and Consultants. The viewing window will be a minimum of two feet by two feet in size.
3. The waste bins will be in the loading dock or other approved location.

Part 3 – Waste Handling and Disposal

.1 Disposal of all hazardous wastes will be conducted in accordance with the B.C. Ministry of Environment regulations pertaining to hazardous waste.

.2 The contractor will have a Transportation or Dangerous Goods certified person prepare a waste manifest form prior to the disposal of any asbestos-containing waste materials from the site.

.3 All waste bins used for material transportation will be lockable. The contractor will ensure that the waste bin is always locked when there is no employee watching the bin. Hazardous wastes will be moved only after 07:00 p.m. or as agreed to by the owner.

.4 The waste level in the bins is not to go above one foot from the top of the bin before transport.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Furnishing of all labour, materials, services and equipment necessary for:

.1 Finishing slabs-on-grade and monolithic suspended floor slabs.

.2 Concrete topping, sealers, patching and levelling compounds.

.3 Floor finishing and tolerances.

1.2 RELATED SECTIONS

.1 Section 01 74 00 – Cleaning and Waste Processing

.2 Section 07 92 00 - Joint Sealants.

.3 Section 09 91 00 - Painting.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 CAN/CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction / Methods of Test for Concrete.

.3 CAN/CGSB-25.20, Surface Sealers for Floors.

.4 ACI 302.1R, Guide for Concrete Floor and Slab Construction.

.5 ASTM E1155M, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

1.4 SUBMITTALS

.1 Section 01 33 00: Submittal procedures.

.2 Product Data: Provide data on concrete hardener, sealer, and slip resistant finish compatibilities, and limitations.

1.5 MAINTENANCE DATA

.1 Section 01 33 00: Submittal procedures.

.2 Maintenance Data: Provide data on maintenance renewal of applied coatings.

1.6 QUALITY ASSURANCE

.1 Perform Work in accordance with CAN/CSA A23.1/A23.2.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in manufacturer's packaging including application instructions.

1.8 COORDINATION

.1 Coordinate floor finishing with concrete floor placement and concrete floor curing.

.2 Coordinate exposed architectural concrete finishing with concrete formwork and concrete placement.

1.9 WASTE MANGEMENT AND DISPOSAL

.1

.1 Comply with Section 01 74 00 - Cleaning and Waste Processing

Part 2 Products

2.1 CONCRETE TOPPING

.1 Portland cement based, self-leveling, self-drying topping.

.2 Acceptable materials;

.1 Sika EmeriCrete Topping

.2 Target Bonded Topping Mix

.3 Ardex K 301 Self-Leveling Concrete Topping; Ardex K 500 self leveling cementitious topping; or Ardex SD-T fast track self leveling, self drying concrete topping.

.4 Or approved substitution.

2.2 BONDING AGENTS

.1 Portland cement/ epoxy-based bonding agent: Formulated for bonding new concrete to cured concrete.

.2 Acceptable materials;

Ardex Bonding and Anti-corrosion agent

.2 Grace Daraweld C

.3 Target Polymer Bonding Agent

.4 Sternson Surfacrete Concentrate Bond Agent

.5 Steels Multipurpose Acrylic

.6 Or approved substitution.

2.3 LEVELING COMPOUND:

.1 Self-drying, cement-based, polymer modified, trowel-grade underlayment.

.2 Acceptable materials:

.1 Mapei Plani/Patch

.2 Ardex Feather Finish, Ardex Fortifinish high strength, Ardex SD-P trowelabe and rampable.

.3 Starpatch Super Fine Skim Coat Mortar

.4 Or approved substitution.

2.4 SURFACE SEALER

.1 Surface sealer: acrylic polymer water emulsion type, clear, to CAN/CGSB-25.20, Type 2 or ASTM-C309, Type 1.

.1 Acceptable material:

.1 CPD Acrylic Floor Sealer (Water Emulsion)

.2 W.R. Meadows Sealtight Vocomp-20

.3 Sika Florseal WB 25.

.4 Sonneborne Kure-N-Seal WB

2.5 FLOOR HARDENER

.1 Non-metallic hardener (plain): premixed, dry shake surface hardener.
- .1 Acceptable material: Sternson Diamag 7; Target Non-Metallic; CPD Floor Hardener Pre-Mix (Standard); Master Builders Mastercron; Sonneborn Harcol Redi-Mix.

.2 Non-metallic hardener (coloured): premixed, dry shake surface hardener, colour selected by Consultant.
- .1 Acceptable material: Sternson Colorplete; Master Builders Colorcron; Sonneborn Harcol Redi-Mix.

2.6 MIXING

.1 Site mix materials in accordance with manufacturer's written instructions.

2.7 SUBSTITUTIONS

.1 Specified manufacturer's products stated herein establish minimum acceptable standards for work of this Section.

.2 Other manufacturers offering products meeting or exceeding specified products and requirements may be considered.

.3 Requests for substitutions will be considered.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify site conditions.

.2 Verify that floor surfaces are acceptable to receive the work of this section.

3.2 PREPARATION

.1 Prior to finishing concrete floors, confirm with the manufacturers of all finished flooring to be used on the project, the specific floor finish, (rough or smooth) required for the application of the finished flooring.

.2 Prior to application of levelling compounds and curing compounds, confirm compatibility of products with finished flooring manufacturers.

.3 Examine surfaces to receive curing compounds, patching and levelling compounds and report any defects which may affect the performance of the work of this section.

.4 Beginning of installation means acceptance of existing conditions.

.5 Prepare and clean substrates in accordance with manufacturer's directions for application of curing compounds, patching and levelling compounds.

.6 Concrete surfaces shall have been cured for time periods stipulated by manufacturers for installation of their products.

3.3 FLOOR SLAB FINISHING

.1 Finish concrete floor surfaces in accordance with CSA-23.1, Section 22 - Treatment of Unformed Surfaces, for Class 'A' floor finish.

.2 Steel Trowel Finish: In accordance with CSA-23.1, Section 22 and as follows:

.1 Thoroughly float surface with disc power floating machine until compacted. Continue floating until sufficient mortar rises to surface and fills all voids.

.2 When floor surface has hardened sufficiently and no fines are brought to the surface, trowel floor with steel trowel to smooth surface free from pinholes and imperfections.

.3 Ensure trowel disc lines are removed and provide a smooth hard burnished finish.

.4 Schedule:

.1 Concrete floors to receive resilient flooring.

.3 Tool all control joints and construction joints. Coordinate tooling with concrete finishing. Re-tool joints at completion of finishing as required to give full size joint and provide sound substrate suitable for sealant application.

3.4 FLOOR TOLERANCES

.1 Concrete tolerance for horizontal surfaces in accordance with CSA-A23.1/A23.2. Use F-number method to verify flatness within 48 hours after slab installation.

.2 Finish concrete to achieve the following tolerances:

.1 Under Resilient Finishes: F_F 32 and F_L 25.

.3 Correct the slab surface if the actual F_F or F_L number for the floor installation measures less than required.

.4 Correct defects in the defined traffic floor by grinding or removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.5 CORRECTION OF FLOOR TOLERANCES

.1 Where floor tolerances are not within the specified limits, grind or fill the floor to bring the surface to within the requirements.

.2 Where grinding is required, grind floors as soon as possible, preferably within three days but not until the concrete is sufficiently strong to prevent dislodging coarse aggregate particles.

.3 Where filling is required, the concrete surface shall be prepared by mechanical roughening or hydromilling to remove all surface film and laitence.

.4 Apply levelling compound as specified in accordance with manufacturer's printed instructions.

3.6 LEVELLING COMPOUND AND FLOOR DRAINS

.1 Apply levelling compound in accordance with manufacturer's instructions, where required to bring floor tolerances to within limits specified. Grind down subfloor ridges and bumps.

.2 Clean floor and apply filler to leave smooth, flat, hard surface in conformance with manufacturer's written recommendations. Prohibit traffic until fully cured.

.3 Unless otherwise detailed or specified, at junctions of flooring with differing finish levels provide a smooth transition using levelling compound as specified applied in accordance with manufacturer's printed instructions. Feather out levelling compound for a distance of 3 m (10 ft.).

.4 Flood test concrete floor surfaces incorporating floor drains to ensure that positive drainage has been provided in the floor area.

3.7 APPLICATION: CURING COMPOUND

.1 Apply curing and sealing compound in accordance with the manufacturer's instructions to all areas not scheduled to receive further floor finish. Apply at the rate of not less than 10 m2/litre for smooth steel troweled surfaces and 5 to 7.5 m2/litre for float or broom finished surfaces.

.2 Do not apply concrete curing compound to floors designated to receive resilient flooring, liquid applied finishes or ceramic tile.

3.8 APPLICATION: SURFACE SEALERS

.1 Ensure compatibility of floor treatment materials with adhesives of finished flooring materials and other bonded toppings or coatings prior to application.

.2 Apply floor treatment in accordance with manufacturer's written instructions.

.3 Clean overspray. Clean sealant from adjacent surfaces.

3.9 APPLICATION: FLOOR HARDENERS

.1 Apply hardener in accordance with manufacturer's written instructions.

.2 Apply floor hardener aggregate at rate of 0.75 - 1.0 lbs/ft² 3.66 - 4.88 kg/m² for a "light duty" hardened surface.

.3 Apply floor hardener aggregate at rate of 1.0 - 1.25 lbs/ft² 4.88 - 6.1 kg/m² for a "medium duty" hardened surface.

.4 Protect finished installation until floor treatment has cured.

3.10 BONDING AGENT

.1 Apply bonding agent to all concrete when new concrete will be applied against it under the following conditions:

.1 Patching

.2 At construction joints.

3.11 DEFECTIVE CONCRETE

.1 Repair honeycombing, rock pockets, chips, spalls and stains in exposed concrete surfaces. Remove fins and other protrusions in concrete surfaces by chipping, not grinding.

.2 Patch honeycombing, rock pockets, chips and spalls to match surrounding sound concrete surfaces, textures and colour.

.3 Remove stains from concrete surfaces.

3.12 PROTECTION

.1 At all times during the work protect architectural members as required with polyethylene sheets or the like from staining or becoming coated with leakage, due to continuing concreting operations. Protect concrete from staining due to rusting of reinforcing steel.

3.13 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 As work proceeds and on completion deposit all recyclable packing materials and containers in appropriate recycling containers.

.3 Rubbish and debris resulting from work of this section shall be collected regularly, and removed from the project site and disposed of in accordance with Section 01 74 00 - Cleaning and Waste Processing.

.4 Repair, remove and clean all drips or smears resulting from the work of this section on exposed, finished surfaces or surfaces to be subsequently finished.

.5 Clean adjacent soiled surfaces.

3.14 SCHEDULES

.1 Refer to Room Finish Schedule for Areas with resilient flooring and seamless flooring.

.2 Infill trenches where new underslab piping is intalled for new shower drains.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Furnishing of all labour, materials, services and equipment necessary for the design, supply and installation of shop fabricated miscellaneous metal items.

1.2 RELATED SECTIONS

.1 Section 06 41 11 - Architectural Cabinetwork.

.2 Section 09 91 10 - Painting.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

.3 ASTM A153/A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.4 ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.5 ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

.6 ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

.7 CAN/CGSB-1.181 - Ready-Mixed, Organic Zinc-Rich Coating.

.8 CAN/CSA-G40.20-04/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.9 CAN/CSA-G164 - Hot Dip Galvanizing of Irregularly Shaped Articles.

.10 CSA/CAN-B44 - Safety Code for Elevators: Elevator access ladders.

.11 CSA W48 - Filler Metals and Allied Materials for Metal Arc Welding

.12 CSA W59 - Welded Steel Construction (Metal Arc Welding).

.13 SSPC (The Society for Protective Coatings) (formerly SSPC - Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

.3 Indicate welded connections using standard welding symbols. Indicate net weld lengths.

1.5 QUALITY ASSURANCE

.1 Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the Province of British Columbia.

.2 Welded Steel Construction: CSA W59.

.3 Structural Design and Inspection:

.1 Provide and pay for the services of professional engineer registered in the Province of British Columbia who specializes in the restraint of building elements to:

.1 design the components of the work of this Section requiring structural performance,

.2 be responsible for determining sizes, joint spacing to allow for thermal and seismic movement and loading of components in accordance with all applicable codes and regulations,

.3 be responsible for production and review of shop drawings,

.4 inspect the work of this Section during fabrication and erection,

.5 stamp and sign each shop drawing,

.6 provide site administration and inspection of this part of the Work.

Part 2 Products

2.1 MATERIALS - STEEL

.1 Steel Sections and Plates: CAN/CSA-G40.20/G40.21.

.2 Steel Pipe: ASTM A53/A53M, Grade A Schedule 40, standard weight, black finish.

.3 Steel Tubing: ASTM A500, Grade B, black finish.

.4 Bolts, Nuts, and Washers: ASTM A307, galvanized to CSA G164 for galvanized components.

.5 Welding Materials: Type required for materials being welded.

.6 Welding Filler Material: CSA W48.

.7 Shop and Touch-Up Primer: SPCC 15 Type I red oxide.

2.2 MATERIALS - ALUMINUM

.1 Extruded Aluminum: ASTM B221/B221M alloy, 6063, Temper T5.

.2 Sheet Aluminum: ASTM B209/B209M, Alloy 6063, Temper T5.

.3 Aluminum-Alloy Drawn Seamless Tubes: ASTM B210, Alloy 6063, Temper T6.

.4 Aluminum-Alloy Bars: ASTM B211, Alloy 6063, Temper T6.

.5 Bolts, Nuts, and Washers: Stainless steel.

.6 Welding Materials: Type required for materials being welded.

2.3 FABRICATION

.1 Fit and shop assemble items in largest practical sections, for delivery to site.

.2 Fabricate items with joints tightly fitted and secured.

.3 Continuously seal joined members by continuous welds.

.4 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

.5 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

.6 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATION TOLERANCES

.1 Squareness: 3 mm maximum difference in diagonal measurements.

.2 Maximum Offset Between Faces: 1.5 mm.

.3 Maximum Misalignment of Adjacent Members: 1.5 mm.

.4 Maximum Bow: 3 mm in 1.2 m.

.5 Maximum Deviation from Plane: 1.5 mm in 1.2 m.

2.5 FINISHES - STEEL

.1 Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

.2 Exterior Exposed Steel: prepare to SSPC-SP-6, Commercial Blast. All other steel to be prepared to SSPC-SP3, Power Tool Cleaning.

.3 Do not prime surfaces in direct contact with concrete or where field welding is required.

.4 Prime paint items with one coat.

2.6 FINISHES - ALUMINUM

.1 Finish coatings to conform to AAMA 603 AAMA 605.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that field conditions are acceptable and are ready to receive work.

.3 Verify dimensions, tolerances, and method of attachment with other work.

3.2 SITE PREPARATION

.1 Clean and strip primed steel items to bare metal where site welding is required.

.2 Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

.1 Install items plumb and level, accurately fitted, free from distortion or defects.

.2 Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

.3 Field weld components indicated on shop drawings.

.4 Perform field welding to CSA requirements.

.5 Obtain approval prior to site cutting or making adjustments not scheduled.

.6 After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

.7 Install ceiling grid equipment support system in accordance with manufacturer's written instructions.

.1 Rails shall be true, plumb and level to the tolerances indicated when maximum loading conditions are applied due to equipment operation.

3.4 ERECTION TOLERANCES

.1 Maximum Variation from Plumb: 6 mm per story, non-cumulative.

.2 Maximum Offset from True Alignment: 6 mm.

.3 Maximum Out-of-Position: 6 mm.

3.5 COATINGSIDISSIMILAR METALS

.1 Aluminum surfaces to be placed in contact with masonry or concrete shall, before shipment from the fabricating plant, be given a heavy coat of an alkali resistant bituminous paint. The paint shall be applied without the addition of any thinner in strict accordance with the paint manufacturer's instructions.

.2 Where aluminum work is fastened to steel supporting members or other dissimilar metal parts, the aluminum shall be kept from direct contact with such parts by a heavy shop coat of alkali resistant bituminous paint. The paint shall be applied without the addition of any thinner, in strict accordance with the paint manufacturer's instructions. Such paint shall be allowed to dry before assembly of parts.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Concealed blocking for support of toilet and bath accessories, wall cabinets, equipment, and other wall mounted apparatus.

.2 Telephone and electrical panel back boards.

.3 Roof curbs for mechanical equipment as per RCABC design guidelines.

1.2 RELATED SECTIONS

.1 Section 06 41 11 – Architectural Cabinetwork.

.2 Section 07 52 11 – SBS Modified Bitumen Membrane Roofing (Patch Work)

.3 Section 09 21 16 – Non-Structural Metal Stud Framing.

.4 Section 07 62 00 - Sheet Metal Flashing and Trim

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 CSA B111 - Wire Nails, Spikes and Staples.

.3 CSA O141 - Softwood Lumber.

.4 CSA O151 - Canadian Softwood Plywood.

.5 CSA O80 Series-97 - CSA Standards for Wood Preservation.

.6 National Lumber Grades Authority (NLGA) - Standard Grading Rules for Canadian Lumber.

Part 2 Products

2.1 FRAMING AND STRUCTURAL MEMBERS

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less to following standards:

.1 CAN/CSA-O141 - Softwood Lumber.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Glued end-jointed (finger-jointed) lumber is not acceptable.

.3 Structural Composite Lumber (SCL): to ASTM D5456.

.4 Framing and board lumber: to National Building Code (NBC), except as follows:

.1 Framing and board lumber: S-P-F species, NLGA No.2 grade or better.

.5 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:

.1 Board sizes: SPF species, “Standard” or better grade.

.2 Dimension sizes: SPF species, “Standard” light framing or better grade.

.6 Do not use products containing added urea formaldehyde in the Facility.

2.2 ACCESSORIES

.1 Fasteners and Anchors:

.1 Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.

.2 Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

2.3 FASTENER FINISHES

.1 Galvanizing: to CSA G164, use galvanized finished fasteners for exterior work and pressure-preservative treated lumber.

2.4 PRESSURE PRESERVATIVE TREATED WOOD

.1 Sustainable requirements: only wood materials located outside of building air barrier assembly may be pressure preservative treated.

.2 Provide lumber and plywood materials pressure preservative treated for following:

.1 Roof curbs, fascia backing, sleepers.

.2 Furring, blocking on exterior of building.

.3 Other materials indicated on Drawings.

.3 Preservative: to CSA O80 Series, water-borne, alkaline copper quaternary (ACQ).

.4 Treat material to CSA O80 Series using ACQ preservative to obtain minimum net retention for exposures as follows:

.1 UC3.2 - material above grade.

.2 UC4.1 - material below grade or in contact with ground.

.5 Identify each piece of treated material with a tag or ink mark bearing Canadian Wood Preservers' Bureau quality mark.

.6 Following water-borne preservative treatment, dry material to maximum moisture content of 19% (S-dry)% or less.

.7 Field treatment: comply with AWPA M4 and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2. Apply surface applied wood preservative to heartwood exposed from trimming, cutting, or boring.

.8 Remove chemical deposits on treated wood to receive applied finish.

Part 3 Execution

3.1 INSTALLATION

.1 Comply with requirements of BCBC, supplemented by following paragraphs.

.2 Refer to Structural Drawings for additional requirements.

.3 Install members true to line, levels, and elevations. Space uniformly.

.4 Construct continuous members from pieces of longest practical length.

.5 Install spanning members with "crown-edge" up.

.6 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where

materials are left exposed. Sanding is acceptable only in locations where defacement will not be evident after finishing.

.7 Install blocking at locations indicated to support washroom accessories. For landscape work, obtain the Design Consultant's acceptance of rough grades prior to construction.

.8 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, electrical equipment mounting boards, and other work as required.

.9 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.10 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

3.2 Erection

.1 Frame, anchor, fasten, tie, and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

.3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

.4 Use fastenings of following types, except where specific type is indicated or specified:

.1 To hollow masonry, plaster, and panel surfaces use toggle bolt.

.2 To solid masonry and concrete use expansion shield with lag screw, lead plug with wood screw.

.3 To structural steel use bolts through drilled holes, welded stud-bolts, power driven self-drilling screws, welded stud-bolts, or explosive actuated stud-bolts.

.5 Furring and blocking:

.1 Install furring and blocking as required to space-out and support casework, cabinets, surface applied fixtures and equipment, wall and ceiling finishes, and other work as indicated.

.2 Align and plumb faces of furring and blocking to tolerance of 1:600.

.6 Nailing strips, grounds and rough bucks:

.1 Install rough bucks, nailers, and linings to rough openings as required to provide backing for frames and other work.

.2 Except where indicated otherwise, use material at least 38 mm thick.

.7 Curbs, Nailers:

.1 Install curbs, and other wood supports as required and secure using galvanized fasteners.

.2 Secure roof curbs, nailers with 10 mm diameter galvanized bolts where indicated, galvanized nails elsewhere. Space bolts within 300 mm from ends of members and uniformly spaces at maximum 1 200 mm on centre between. Countersink bolts where necessary to provide clearance for other work.

.3 On roof deck provide strips of roofing vapour barrier sheet under curbs, nailers, and sleepers installed directly onto roof deck. Extend vapour barrier sheet minimum 300 mm onto roof deck both sides of curbs or sleeper to allow for overlap and sealing to roofing vapour barrier. Apply as continuous strips, with 200 mm overlap at joints, and seal joints with mastic. Use same material used for roofing vapour barrier. Coordinate with roofing Subcontractor.

.8 Electrical equipment backboards: Install 19 mm fire rated fir plywood boards. On all walls in telephone and data rooms receiving wiring and equipment; minimum 1220 mm x 2440 mm panels on periphery walls over 300 mm wide, mounted 300 mm off of finished floor.

3.3 HANDLING AND USE OF TREATED TIMBER

.1 Handle and use treated material in a manner which will avoid damage or field fabrication, causing alteration in original treatment.

.2 Treat in field, cuts and damages to surface of treated material with an appropriate, clear preservative as described in CSA O80. Ensure that damaged areas such as abrasions nail and spike holes, are thoroughly saturated with field treatment solutions in accordance with CSA O80.

3.4 WORKMANSHIP

.1 Construct all work to details, using adequate fastening methods to ensure solid durable finished work suitable for purpose intended.

.2 Do all nailing and fastening neatly, evenly, and thoroughly.

.3 Install all members true to line, levels, and elevations. Set plumb and space uniformly.

.4 Use timbers of longest possible length to minimize joints.

3.5 SCHEDULE

.1 Install solid wood backing for support of all millwork cabinets.

.2 Install wood curbs and blocking to equipment curbs.

.3 Install concealed 19mm plywood backing for all wall mounted accessories.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Fire-stopping and fire-safing materials and accessories.

.2 Only tested firestop systems shall be used in specific locations as follows:

.1 Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

.2 Safing slot gaps between edge of floor slabs and curtain walls.

.3 Openings between structurally separate sections of wall or floors.

.4 Gaps between the top of walls and ceilings or roof assemblies.

.5 Expansion joints in walls and floors.

.6 Openings and penetrations in fire-rated partitions or walls containing fire doors.

.7 Openings around structural members which penetrate floors or walls.

.8 Alternative Solutions containing the manufacturer's firestop custom detail shall be used when no listed firestop system is available for an application in specific locations including, but not limited to the following:

.3 Perimeter joints between rated concrete floor and non-rated curtain wall system.

1.2 RELATED SECTIONS

.1 Section 09 21 16 - Gypsum Board Assemblies

.2 Section 23 33 00 – Air Duct Accessories

.3 Section 26 05 21 – Wiring and Cables

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

.3 ASTM E119 - Method for Fire Tests of Building Construction and Materials.

.4 ASTM E814 - Test Method of Fire Tests of Through-Penetration Fire Stops.

.5 ASTM E1966 - Test Method for Fire-Resistive Joint Systems

.6 CAN/ULC S101 - Fire Endurance Tests of Building Construction and Materials.

.7 CAN/ULC S102 - Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.8 CAN/ULC S115 - Fire Tests of Firestop Systems.

.9 British Columbia Building Code.

.10 NFPA - Life Safety Code.

.11 Canadian Electrical Code.

1.4 DEFINITIONS

.1 Firestopping (Firesafing): Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke and hot gases through penetrations in, or construction joints between, fire-rated wall and floor assemblies.

.2 Listed Firestop System: A specific construction consisting of materials, any penetrating items and their means of support, that has met the requirements of an F, FT, FH and/or FTH rating when tested in accordance with CAN/ULC-S115 - Standard Method of Fire Tests of Firestop Systems.

1.5 SYSTEM DESCRIPTION

.1 Listed Firestop System to achieve a fire rating as noted on Drawings.

.2 Surface Burning: CAN/ULC S102 with a flame spread/smoke developed rating of 5/40.

.3 Firestop all interruptions to fire rated assemblies, materials, and components.

1.6 SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of listed firestop systems to be used and manufacturer's installation instructions.

.3 Alternative Solutions: Manufacturer's firestop custom details for each custom application including both project name and subcontractor's name who will install the firestop solution as described in the detail drawing. This alternative solution must be reviewed by a professional Engineer registered in British Columbia who shall take responsibility for the design under seal.

.4 Submit material safety data sheets provided with product delivered to job-site.

.5 VOC Content Limitations: For firestop system products, submit documentation in accordance with Article 1.12.

.6 Shop Drawings: Provide shop drawings for products cast in concrete.

1.7 INSTALLER QUALIFICATIONS

.1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacture's products per specified requirements.

1.8 QUALITY ASSURANCE

.1 A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details. Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.

.2 Listed Firestop System installation must meet requirements of CAN/ULC-S115 tested assemblies that provide an F rating or FT rating as shown in 2.3.15 below.

.3 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

.4 Listed Firestop Systems do not re-establish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

.5 Alternative Solutions described in 1.6 - Submittals, Paragraph .3 shall be submitted to local authorities having jurisdiction for their review and approval prior to installation. Firestop custom details must follow current requirements set forth by the International Firestop Council.

1.9 REGULATORY REQUIREMENTS

.1 Conform to ULC for fire resistance ratings and surface burning characteristics.

1.10 COORDINATION MEETING

.1 All subtrades penetrating rated fire separations or providing joints between rated fire separations (regardless if firestopping or not) shall meet with firestop manufacturer prior to firestop installation to coordinate construction practices to best meet the requirements of the proposed listed firestop systems.

1.11 PROJECT CONDITIONS

.1 Do not use materials that contain flammable solvents.

.2 Scheduling:

.1 Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.

.2 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

.3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

.4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

.5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

Part 2 Products

2.1 FIRESTOPPING, GENERAL

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

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

.3 Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.2 MANUFACTURERS

.1 Acceptable Products/Materials: Subject to compliance with through penetration firestop systems and joint systems tested in accordance with CAN/ULC-S115, provide products of the following manufacturers as identified below:

.1 Hilti (Canada) Corporation, Mississauga, Ontario, 1-800-363-4458 www.ca.hilti.com, or approved alternate.

.2 Acceptable Materials/Products are listed in article 2.3 - Materials are based on products manufactured by Hilti (Canada) Corporation. Alternate manufacturers and products may be accepted.

.3 Other manufacturers offering products meeting or exceeding specified products and requirements may be considered.

.4 3M is an approved manufacturer.

.2 Substitutions: Refer to Section 01 62 50.

2.3 MATERIALS

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

.1 Fire stop system rating: 1 hour and 2 hours.

.2 Service penetration assemblies: systems tested to CAN-ULC-S115.

.3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.

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

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

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

.9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify openings are ready to receive the work of this section.

3.2 PREPARATION

.1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

.1 Verify penetrations are properly sized and in suitable condition for application of materials.

.2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

.3 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

.4 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

.5 Do not proceed until unsatisfactory conditions have been corrected.

3.3 COORDINATION

.1 Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

.2 Responsible trade is to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interference.

3.4 INSTALLATION

.1 Install firestop materials in accordance with Directory affiliated with listed firestop system.

.2 Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

.3 Consult with Mechanical Consultant, Contractor, and damper manufacturer prior to installation of any firestop solutions that might hamper the performance of fire dampers as it pertains to ductwork.

.4 Protect materials from damage on surfaces subjected to traffic.

3.5 FIELD QUALITY CONTROL

.1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

.2 Keep areas of work accessible until inspection by applicable code authorities.

.3 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

.4 Install a warning card that is clearly visible adjacent to all large and medium openings that may be re-penetrated. This card should contain the following information:

.1 Warning that the opening has being fire stop protected

.2 Indicate the fire stop system used

.3 F rating or FT rating

.4 Fire stop product(s) used

.5 Person to contact and phone number in case of modification or new penetration of fire stop system.

.5 Manufacturer's Field Service: During initial installation, firestop manufacture shall be present to assure proper installation of products.

3.6 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Remove equipment, materials and debris, leaving area in undamaged, clean condition.

.3 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.7 PROTECTION OF FINISHED WORK

.1 Protect adjacent surfaces from damage by material installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Preparing substrate surfaces.

.2 Sealant and joint backing.

1.2 RELATED SECTIONS

.1 Section 07 52 11 - SBS Modified Bitumen Membrane Roofing (Patch Work)

.2 Section 08 11 13 - Standard Metal Doors and Frames

.3 Section 09 21 16 - Gypsum Board Assemblies

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM C834 - Latex Sealants.

.3 ASTM C919 - Use of Sealants in Acoustical Applications.

.4 ASTM C920 - Elastomeric Joint Sealants.

.5 ASTM C1184 - Structural Silicone Sealants.

.6 ASTM C1193 - Guide for Use of Joint Sealants.

.7 ASTM C1311 - Solvent Release Sealants.

.8 ASTM C1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

.9 ASTM C1401-14 - Standard Guide for Structural Sealant Glazing.

.10 ASTM E330/E330M-14 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

1.4 PERFORMANCE REQUIREMENTS

.1 Sealant Design: Design structural sealant to withstand specified loads without breakage, loss, failure of seals, product deterioration, and other defects.

.2 Design installed sealant to withstand:

- .1 Dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as calculated in accordance with BC Building Code. as measured in accordance with ASTM E330.
- .2 Movement from ambient temperature range of 49 degrees C.
- .3 Movement and deflection of structural support framing.
- .4 Water and air penetration.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 30 00 - Coordination:

- .1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with all sections referencing this section.

1.6 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, colour availability and

.3 Samples: Submit two samples illustrating sealant colours for selection.

1.7 QUALITY ASSURANCE

.1 Perform work in accordance with sealant and EIFS manufacturer's requirements for preparation of surfaces and material installation instructions.

.2 Perform sealant application work in accordance with ASTM C1193 and ASTM C1481.

.3 Perform structural sealant application work in accordance with ASTM C1401.

.4 Perform acoustical sealant application work in accordance with ASTM C919.

.5 Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

1.8 MOCK-UP

.1 Section 01 43 00: Requirements for mock-up.

.2 Provide mock-up to include sealant joints in conjunction with window, curtain wall, wall, air barrier system, and door frames.

.3 Construct mock-up with specified sealant types and with other components noted.

.4 Locate where directed.

.5 Approved mock-up may remain as part of the Work.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

.4 Accessories:

.1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.

.2 Joint Backing: Polyethylene, Urethane, Neoprene or Vinyl Foam.

.1 Extruded open cell foam backer rod.

.2 Size: oversize 30 to 50 %.

.3 Tensile strength: 20 to 30psi.

.4 Acceptable material: Tremco Sof-Rod or approved equal to ASTM D1056; round, closed cell, polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

.3 Bond Breaker: Pressure sensitive tape which will not bond to sealant recommended by sealant manufacturer to suit application.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Butyl Sealant (Type A): ASTM C1311, single component, solvent release, non-skinning, non-sagging, black colour.

.2 Acoustic Sealant (Type B): ASTM C920, Acoustic grade, single component, non-skinning, non-hardening; Grey colour.

.3 Polyurethane Sealant (Type C): ASTM C920, Grade NS, single component, chemical curing, non-staining, non-bleeding, non-sagging self-leveling type; colour as selected.

.4 Polyurethane Sealant (Type D): ASTM C920, multi-component, non-sagging type; colour as selected.

.5 Silicone Sealant (Type E): ASTM C920, single component; colour as selected.

.6 Security Sealants – Interior and Exterior applications:

.1 One component, non-sag, moisture cured polyurethane adhesive/sealant, specially designed for use in interior and exterior security areas.

.2 Acceptable Product: MasterSeal CR 195, or approved equivalent.

.7 Structural silicone glazing sealant (Type S) ASTM C920 Grade NS Class 50, use NT, G and A.

2.3 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

2.4 ACCESSORIES

.1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.

.2 Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

.3 Joint Backing: ASTM C1330; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

.4 Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

.5 Masking tape: Non-staining, non-absorbent type compatible with sealant and adjacent surfaces.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that substrate surfaces are clean, dry, and free of frost and ready to receive work.

.3 Verify that joint backing and release tapes are compatible with sealant and EIFS materials.

3.2 PREPARATION

.1 Remove loose materials and foreign matter which might impair adhesion of sealant.

.2 Clean and prime joints in accordance with sealant manufacturer's written instructions.

.3 Perform preparation in accordance with ASTM C1193 for solvent release and latex base sealants, ASTM C1481 for EIFS systems.

.4 Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION

.1 Perform installation in accordance with ASTM C1193 for solvent release and latex base sealants, ASTM C919 for acoustical sealants.

.2 Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.

.3 Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

.4 Install bond breaker where joint backing is not used.

.5 Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

.6 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

.7 Tool joints concave.

3.4 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Clean adjacent soiled surfaces.

3.5 PROTECTION OF FINISHED WORK

.1 Remove masking tape and excess sealant.

.2 Protect sealants until cured.

END OF SECTION

Part 1 General

1.1 SUMMARY

1. Provide PVC panel protective wall coverings to designated areas indicated in Drawings and as specified. It must consider all aspects of the installation process i.e., mechanical ventilation requirements, gypsum wallboard preparation etc.

1.2 RELATED WORK

1. Section 09 21 16 Gypsum Board
2. Section 09 51 13 Acoustic Ceilings
3. Section 09 65 10 Resilient Flooring
4. Section 09 91 00 Painting

1.3 SUBMITTALS

1. Provide submittals in accordance with Section 01 33 00.
2. Product Data:
   - .1 Submit manufacturer's current printed product literature, specifications, installation instructions, and field reports in accordance with Section 01330 - Submittal Procedures.
   - .2 Submit one (1) copy of Material Safety Data Sheets (MSDS) prior to commencement of work for review and for posting at job site asrequired.
3. Submit Shop drawings indicating by large scale details, materials, finishes, dimensions of area to be covered, anchorage and assembly.
4. Samples: Submit duplicate 300 mm long samples of profiles and colours for bothcorner and wall joint areas.
5. Operation and Maintenance Data:
   - .1 Submit one (1) hard copy and one electronic PDF copy on thumb drive of Maintenance Manuals at completion of Project on application for Certificate of Substantial Performance,
   - .2 Manual to include copy of final approved shop drawing issued for Project of which have been recorded changes made during fabrication and installation caused by unforeseen conditions, extended warranties and Project Data Book.
   - .3 Include separate booklet of maintenance requirements for staff reference located in kitchen including maintaining products and precautions against cleaning materials and methods detrimental to finishes and performance.
6. Submit copy of Manufacturer's Warranty for Owner's review, prior to installation

1.4 QUALITY ASSURANCE

1. Installer Qualifications:
   - .1 Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
   - .2 Training: Installer who has attended an ALTRO Whiterock installation training clinic.
   - .3 Source Quality: Obtain wall products from a single manufacturer.

2. Mock-up:

   .1 Install site mock-up using one (1) 4 ft x 9 ft panel of accepted products and manufacturer approved installation methods. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.

   .2 Maintain mock-up during construction for workmanship comparison.

   .3 Mock-up may be incorporated into final construction upon Owner's approval.

3. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE & HANDLING

1. Coordinate manufacturer's ordering instructions and lead time requirements to avoid construction delays.
2. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
3. Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.
4. Store panels in temperature-controlled environments. Leave protective film on panel until ready to use.

1.6 WASTE MANAGEMENT AND DISPOSAL

1. Deposit of packaging materials in appropriate container on site for recycling or reuse.
2. Avoid using landfill waste disposal procedures when recycling facilities are available.
3. Keep discarded packaging away from children.

1.7 PROJECT CONDITIONS

1. Temperature Requirements: If storage temperature is below 65deg F (18deg C), the ALTRO Whiterock wall panel must be moved to a warmer place and allowed to reach this temperature before installation. For further information, refer to current Installation Guide
2. Maintain air temperature and structural base temperature at installation area between 65deg F (18deg C) and 80deg F (26deg C) for 48 hours before, during and 24 hours after installation.

1.8 WARRANTY

1. Submit fully executed Manufacturer's Warranty authorized by company official for Owner's acceptance. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.
2. Warranty Period to be for twenty (20) years commencing on Date of Substantial Completion.

1.9 EXTRA MATERIALS

1. Provide extra materials of product and adhesives in accordance with Section 01 78 00-Closeout Procedures.
2. Provide one (1) full 4 ft x 9 ft panel of same type material required for project for maintenance use in manufacturer's original, unopened, undamaged containers

Part 2 Products

2.1 MATERIALS

1. Wall Protection Systems:
   - .1 Prefabricated components manufactured designed to absorb shock and resist map and abrasions under impact. Smooth, low maintenance PVC panels with matching and caps returns and accessories designed for mechanical attachment directly to continuous aluminum retainer.
   - .2 Fire rating: ULC classified for flame spread and smoke requirements for a Class 1 rating. Acceptable Material for components listed.
   - .3 Accepted Product:
     - .1 **SRP**: ALTRO Whiterock White Hygienic Wall System, maintenance free, impact resistant, extruded semi-rigid PVCu polymer for operating temperatures up to 60deg\C.
       - .1 Thickness: 2.5mm (0.10”)
       - .2 Sheet Size: 4’ x 9’ – 1220 x 3050
       - .3 Colour: white.
       - .4 Impact Strength in accordance with ASTMF476.
       - .5 Chemical and Stain Resistance in accordance with ASTM D-1308.

2.2 ACCESSORIES

1. Vinyl welding rod: Acceptable material:
   - .1 ALTRO weld rod – WSR01, Colour to match panels,
2. Double sided foam tape and tape adhesion promoter Altro W39.
3. Acrylic Adhesive: For dry, climate-controlled areas, use ALTROFix W157, a one- part, water-based, acrylic adhesive as recommended by manufacturer.
4. Polyurethane Adhesive: The default adhesive for most installations, suitable for wet area, non-climate-controlled areas, and non-absorbent surfaces, use ALTROFix W39, atwo-part resin-based polyurethane adhesive as recommended by manufacturer.
5. Caulking and Sanitary Sealant Compounds and Tools:
   - .1 ALTRO Sanitary Sealant – A802 White, 10.5 oz Tube.
6. Vertical trims 2- Part start and edge trims with gaskets as indicated.
7. Any wall graphic images to be provided by consultant. Files will be.ai and .psd or jpegs.
8. Alto Whiterock Recessed Shelf A900. Standard White color.

Part 3 Execution

3.1 EXAMINATION

1. Comply with manufacturer’s product data, including product technical bulletins, product catalog, installation instructions and product label instructions for installation.
2. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer’s instructions.

3.2 SUBSTRATE PREPARATION

1. Walls should be smooth and level. High points must be removed and low points filled with Filler intended for the substrate and environmental conditions.
2. Surfaces must be permanently dry and free from all substances that may contribute to adhesive bond failure.
3. Remove loose paint and conduct an adhesive bond test with paint.
4. Exterior walls must be adequately damp-proofed and insulated.
5. Dry wall substrates should be paint ready.

3.3 PREPARATION

1. All surfaces must be free from dust and cleaned prior to Altro Whiterock installation. The working environment must also be dust free. Failure to comply with these conditions will reduce the bond strength between the adhesive and substrate, and may cause the Altro Whiterock panels to debond.
2. Very absorbent / porous substrates (particularly plaster finishes and unprimed sheetrock) must have a proprietary sealer e.g. PVA primer or similar, applied to the surface a minimum of 12 hours prior to the installation.
3. All electrical switches, power points etc., should be in a first fix / installation state. All electrical equipment should only be moved or altered by a qualified electrician.
4. All plumbing should have pipe-work removed to a first fix or installation state and “tails” left protruding from the substrate. Altro Whiterock panels can then be drilled and slid over the pipe tails. All holes should be drilled 1/8” (3mm) oversize to allow for expansion, then sealed with Altro Sanitary Sealant. Plumbing should always be done by a qualified plumber.
5. Hot pipes and steam pipes should be insulated and a 1/8” to 1/4” (3-6mm) expansion gap should be created when installing panels around these pipes, then sealed with Altro Sanitary Sealant.
6. All pipes, fixing bolts, etc. extending through the Altro Whiterock panels should have a minimum 1/8” (3mm) expansion gap and be sealed using Altro Sanitary Sealant.
7. If fitting to doorframes, these must be in place prior to installation of Altro Whiterock.
8. Prior to installation, it is advisable to complete any painting which comes in contact with Altro Whiterock, as sealant used at junctions is non-paintable.
9. First, check the room using a 6’ (2 m) level to ensure all walls are flat, paying particular attention to the corners, window reveals, and door entrances. These need to be inspected to ensure they are free of any debris or irregularities, which could prevent the panels laying flat to the substrate after the adhesive has been applied and the panel installed.

3.4 INSTALLATION

1. Hygienic Wall Installation: Install Altro Whiterock in accordance with the current published Altro Installation Guide. All panels should be joined via heat welding to ensure a hygienic seal by approved methods as detailed in the installation guide. Failure. to install Altro Whiterock in accordance with recommended procedures will void the Altro Limited Product Warranty.
2. Internal and external pencil radius corners shall be made on site with Altro Thermoformer following the methods detailed in the Altro Whiterock Installation Guide.

3. Install components plumb, true and square, scribed neatly to adjoining surfaces in accordance with Manufacturer's instructions.

4. Keep hands and tools clean during installation. Remove adhesives, sealants, and other stains. Install corner guard on steel stud continuous solid backing and erect with materials and components straight, tight and in alignment.

5. Adhere panel wall protection to substrate at locations and heights as indicated continuous between abutments. Scribe to tight butt joint between door frames and projections.

6. Coordinate with Section 09 65 00 and install wall panels after floor is installed. After wall finish is completed finish edge and seal any remaining gaps with manufacturers matching colour urethane mastic. Wall panels to overlap the floor base by 75mm, seal bottom edge of wall panel with a sanitary sealant.

7. At White Rock in rooms that require wet wall systems all seams to be heat welded.

8. At White Rock locations behind hand hygiene stations which butt against Acrovyn or at standalone locations, utilize the vertical 2-part start and edge trims. Apply Altro Sanitary sealants to the front edge.

9. Install recessed shower shelves where indicated. The factory formed insert to be heat welded directly into the wall panels for a water tight installation. Provide solid plywood backing behind the recessed shelf. Refer to manufacturer's installation guide.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Surface preparation and field application of paints and coatings.

.2 Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including but not limited to the following:

- .1 Interior walls, ceilings, and bulkheads.
- .2 Doors frames.
- .3 Other new items as shown.

.3 Do Not Paint or Finish the Following Items:

- .1 Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
- .2 Data cables
- .3 Cable trays.
- .4 Device boxes
- .5 Items indicated to receive other finishes.
- .6 Items indicated to remain unfinished.
- .7 Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
- .8 Floors, unless specifically so indicated.
- .9 Glass.
- .10 Concealed pipes, ducts, and conduits.
- .11 Existing exposed ducts, pipes, and hangers.
- .12 Concealed ceiling spaces and walls above drywall and t-bar ceilings.
- .13 Any new mechanical ductwork or piping with insulation.
- .14 Surfaces scheduled as having “No Finish” in Room Finish Schedules.

1.2 RELATED SECTIONS

.1 Section 01 78 30 – Spare Parts Maintenance Materials

.2 Section 05 50 00 - Metal Fabrications

.3 Section 08 11 13 – Standard Metal Doors and Frames.

.4 Section 09 21 16 – Gypsum Board Assemblies

1.3 REFERENCES

.1 AWWA (American Water Works Association) - C218 - Standard for Coating the Exterior of Aboveground Steel Water Pipelines & Fittings.

.2 AWWA (American Water Works Association) - D102 - Coating Steel Water Storage Tanks.

.3 NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.

.4 MPI (Master Painters Institute) - Specifications Manual.

.5 SSPC (The Society for Protective Coatings) (formerly SSPC - Steel Structures Painting Council) - Steel Structures Painting Manual.

.6 MPI (Master Painters Institute) Architectural Painting Specification Manual and Maintenance Repainting Manual.

1.4 SUBMITTALS FOR REVIEW

.1 Samples:

.1 Submit the following samples in the sizes indicated:

.1 Draw Down Cards: Submit two (2) sets of 'draw down cards' for each colour a minimum of 30 calendar days prior to commencement of painting. Provide one set to consultant and one set to field office.

.1 Draw Down Cards are to be provided upon completion of the work for their inclusion in the Operation and Maintenance Manuals.

.2 Product List:

.1 Submit a Schedule of Finishes listing manufacturer's product name and colour for each paint system.

.3 Product Data:

.1 Provide data on all finishing products.

1.5 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements indicating special surface preparation procedures, substrate conditions requiring special attention.

1.6 QUALITY ASSURANCE

.1 Applicator Qualifications:

.1 Provide the work of this Section, executed by a competent installer having:

.1 Minimum of five (5) years experience in the application of products, systems and assemblies specified.

.2 All materials, preparation and workmanship shall conform to requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI) (hereafter referred to as the MPI Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.

.3 All paint manufacturers and products used shall be as listed under the Approved Product List section of the MPI Painting Manual. Paint materials will be rated under Environmental Notation System (ENS) with acceptable VOC ranges as listed in the MPI Approved Product List under “E” ranges.

1.7 REGULATORY REQUIREMENTS

.1 Conform to applicable code for flame and smoke rating requirements for finishes.

1.8 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

.2 Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and written instructions for mixing and reducing.

.3 Store paint materials at minimum ambient temperature of 7 degrees C and a maximum of 32 degrees C, in ventilated area, and as required by manufacturer's written instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

.2 Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

.3 Minimum Application Temperatures for Latex Paints: 7 degrees C for interiors; 10 degrees C for exterior; unless required otherwise by manufacturer's written instructions.

.4 Minimum Application Temperature for Varnish and Finishes: 18 degrees C for interior or exterior, unless required otherwise by manufacturer's written instructions.

.5 Provide lighting level of 860 lx measured mid-height at substrate surface.

Part 2 Products

2.1 ACCEPTABLE MATERIALS

.1 Except as specified herein, paint, varnish, stain, enamel, lacquer, and fillers shall be of a type and brand listed under "Product Listings" as covered in the MPI Manual, latest edition, for specific uses.

.2 Only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, etc.) listed in the latest edition of the MPI Approved Product List (APL) and for interior systems, listed as Institutional Low-odor, Low-VOC or High Performance Architectural Latex systems are acceptable for use on this project. All such material shall be from a single manufacturer for each system used.

.3 Indoor Air Quality - Interior applications: Use only materials having a minimum MPI "Environmentally Friendly" E2 or E3 rating based on VOC (EPA Method 24) content levels and within VOC limits described in 1.12.

.4 Paint materials such as linseed, oil, shellac, turpentine, and any of the above materials not specifically mentioned herein but required for work with the finish specified shall be highest quality product of an approved manufacturer.

.5 Paints and materials to be lead and mercury free and shall have a low VOC content where possible or where required by authorities having jurisdiction.

.6 Where required, paints and coatings shall meet the flame spread requirements of local authorities having jurisdiction.

.7 No recycled content paints and primers will be allowed on interior applications.

2.2 EXTERIOR FINISH SYSTEMS - (Not all systems listed my be used for this project)

.1 Steel:

- .1 For exterior areas protected from the elements (covered): EXT 5.1B W.B. Light Industrial Coating, Gloss Level 5 (over inorganic zinc primer).
- .2 For exposed exterior areas: EXT 5.1F: Epoxy Gloss Level 6 (over inorganic zinc primer).

.2 Galvanized Metal (Premium Grade) Factory Primed:

- .1 EXT. 5.3B Alkyd Gloss Level 5 Finish.
- .2 Finish to be used for all exterior galvanized steel, including but not limited to pressed steel frames and hollow metal doors; roof top ducts, vents and piping; and other exterior galvanized metal.

2.3 INTERIOR FINISH SYSTEMS – (Not all systems listed my be used for this project)

.1 Structural Steel and Metal Fabrications:

- .1 INT 5.1S Institutional Low odor/Low VOC, semi gloss, or

.2 INT 5.1B W.B. Light Industrial Coating, semi gloss.

.2 Galvanized Metal High Contact/High Traffic Areas (Doors, Frames, Railings, Pipes, etc.):

.1 INT 5.3M Institutional Low odor/Low VOC, semi gloss.

.3 Dressed Lumber including painted doors and trim:

.1 INT 6.3V High Performance Acrylic Low odor/Low VOC, semi gloss.

.4 Dressed Lumber - clear finish (including trim, and mouldings):

.1 MPI INT 6.3Q: W. B. Varnish, Clear.

.5 Wood Paneling (plywood backboards, etc.):

.1 INT 6.3V Institutional Low odor/Low VOC eggshell finish.

.6 Gypsum Board: All areas except for areas specified below:

.1 INT 9.2M Institutional Latex, Low odor/Low VOC. Acceptable substitution: 9.2L WB Light Industrial Coating (MPI #151).

.1 Walls: Topcoat sheen locations:

.1 All rooms to be eggshell unless otherwise indicated.

.2 The following rooms are to be semi-gloss

.1 Washrooms

.2 Storage Rooms

.3 Housekeeping Rooms

.2 Ceilings and bulkheads: Eggshell.

.3 Note: Provide vapour barrier primer/sealer paint where indicated, MPI#61.

.7 Gypsum Board: Epoxy Finished Surfaces for areas subject to cleaning with alcohol and harsh cleaning products:

.1 INT 9.2E Water-based Epoxy (tile-like) finish, Gloss Level 5.

.8 Gypsum Board: Fire retardant surfaces for Comm. Rooms:

.1 INT9.2H – Pigmented fire retardant coating (UOC rated).

.9 Paint – Fire Resistant: noted PFR in Finish Schedule: Flame Control Coatings No. 20-20 class A flat latex fire retardant paint, two coats, sand between coats.

.10 Allow for 2 walls per room for accent colour, to be selected by Owner from the finishes list.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that surfaces are ready to receive work as instructed by the product manufacturer.

.3 Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

.4 Test shop applied primer for compatibility with subsequent cover materials.

.5 Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

.1 Plaster and Gypsum Wallboard: 12 percent.

.2 Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

.3 Interior Wood: 15 percent, measured in accordance with ASTM D2016.

.4 Exterior Wood: 15 percent, measured in accordance with ASTM D2016.

.5 Concrete Floors: 8 percent.

3.2 PREPARATION

.1 Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

.2 Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.

.3 Seal with shellac and seal marks which may bleed through surface finishes.

.4 Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

.5 Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high-pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

.6 Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

.7 Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

.8 Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

.9 Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.

.10 Copper Surfaces Scheduled for a Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.

.11 Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

.12 Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

.13 Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

.14 Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

.15 Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

.16 Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

.17 Wood Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 APPLICATION

.1 Apply products to manufacturer instructions.

.2 Do not apply finishes to surfaces that are not dry.

.3 Apply each coat to uniform finish.

.4 Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

.5 Sand wood lightly between coats to achieve required finish.

.6 Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

.7 Allow applied coat to dry before next coat is applied.

.8 Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

.9 Prime concealed surfaces of interior woodwork with primer paint.

.10 Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Refer to Section 23 05 53 and Section 26 05 53 for schedule of colour coding and identification banding of equipment, duct work, piping, and conduit.

.2 Paint shop primed equipment. Paint shop prefinished items occurring at interior areas.

.3 Remove unfinished louvres, grilles, covers, and access panels on mechanical and electrical components and paint separately.

.4 Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.

.5 Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvres with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvres, grilles, and convector and baseboard cabinets to match face panels.

.6 Paint exposed conduit and electrical equipment occurring in finished areas.

.7 Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

.8 Colour code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Colour band and identify with flow arrows

.9 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 CLEANING

.1 Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.6 SCHEDULE

.1 Use eggshell for all walls unless noted otherwise.

.2 Use semi-gloss for all patient areas.

.3 Use semi-gloss for all door frames and metal doors.

.4 Use clear coat interior rub varnish for all wood finish doors.

.5 Use eggshell for all ceilings and bulkheads.

3.7 SCHEDULE - COLOURS

.1 Colours: Refer to Interior Finishes List.

.2 Locations: Refer to drawings.

3.8 MAINTENANCE MATERIALS

.1 The following paint is to be provided as maintenance material.

.1 Refer to Section 01 78 30.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Wall protection

.2 Corner guards

.3 Bumper rails

.4 Corridor handrails

.5 Exposed Backing Boards

1.2 RELATED SECTIONS

.1 Section 01 78 30 – Spare Parts Maintenance Materials

.2 Section 05 50 00 - Metal Fabrications: Concealed in wall plates for attachment of work of this section.

.3 Section 06 10 13 – Wood blocking and curbing.

.4 Section 09 21 16 - Gypsum Board Assemblies: Installation of blocking and backing plates in wall assemblies, preparation of substrate and adjacent work to receive work of this section.

.5 Section 09 72 16 - Rigid Sheet PVC Wall Covering

1.3 PERFORMANCE REQUIREMENTS

.1 Installed Wall Rail Component Assembly: Support vertical live load of 1 400 N/m with deflection not to exceed 1/50 of span between supports.

.2 Installed Component Assembly: Resist lateral force of 333 N at any point without damage or permanent set.

.3 Corner Guards: Resist lateral impact force of 445 N at any point without damage or permanent set.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with wall or partition sections for installation of concealed blocking or anchor devices.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

.3 Samples: Submit two (2) sections of bumper rail, corridor handrail, corner guards, 600 mm long, illustrating component design, configuration, colour and finish. Submit one sample to consultant and one to field office.

1.6 QUALITY ASSURANCE

.1 Products of This Section: Manufactured to ISO 9000 certification requirements.

.2 Perform Work in accordance with BC Building Code accessibility requirements.

.3 Installer qualifications: engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

.4 Manufacturer's qualifications: not less than 5 years experience in the production of specified products and a record of successful in-service performance.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to the project site in unopened original factory packaging clearly labeled to shown manufacturer.

.2 Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elementals. A minimum room temperature of 5° C and a maximum of 38° C should be maintained.

1.8 PROJECT CONDITIONS

.1 Materials must be acclimated in an environment of 18° - 24° C for at least 24 hours prior to beginning the installation.

.2 Installation areas must be enclosed and weatherproofed before installation commences.

Part 2 Products

2.1 MATERIALS

.1 Layouts and subsets of wall protection can be found on drawings.

.2 Wall Protection – Rigid Vinyl (**WP-1** – 1220mm high, **WP-2** – 1830mm high)

.1 Refer to the drawings for location and Interior Finishes list for material and colour.

.2 Refer to Section 09 72 16 - Rigid Sheet PVC Wall Covering

.3 Corner Guards: - (**CG-1**)

.1 Manufacturer: C/S Group or approved alternate

.2 Product: CO-8 (Corner Guard)

.3 Material: 304 Stainless Steel

.4 Finish: #4 Satin

.5 Size: 89mm (3 ½") legs 1220mm (4'-0") long adjust length to suit conditions. 90 deg and custom angles required.

.6 Method of attachment: Adhesive

.4 Corner Guards: - (**CG-2**)

.1 Manufacturer: C/S Group or approved alternate

.2 Product: CO-8 (Corner Guard)

.3 Material: 304 Stainless Steel

.4 Finish: #4 Satin

.5 Size: 89mm (3 ½") legs 2438mm (8'-0") long adjust length to suit conditions. 90 deg and custom angles required.

.6 Method of attachment: Adhesive

.5 Handrails - (**HR-1**): C/S Group HRBW-10C to match existing.

.6 Bumper Rail – (**BR-1**): C/S Group SCR-64 to match existing.

.7 Exposed Backing Boards

.1 HDPE 12.5 board c/w rounded corners and smooth edges as indicated on drawings and color as selected by Architect.

.2 Available from Red Wood Plastics, Prince George BC, tel 1-833-381-1195

.3 Provide sample for review.

.8 Door Kickplates: Refer to 08 71 00 - Door Hardware

2.2 MANUFACTURER

.1 **Acceptable products:** Refer to Interior Finishes List 09 09 06.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that field measurements are as indicated on Drawings.

.2 Verify that rough-in for components are correctly sized and located.

.3 Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion. Do not proceed until unsatisfactory conditions have been corrected.

.4 Prior to installation clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as require by manufacturer’s instructions.

3.2 INSTALLATION

.1 Install components to manufacturer's instructions.

.2 Install components level and plumb, secured rigidly in position to wall framing members only.

.3 Position top of bumper rail as detailed.

.4 Position top of corridor hand rail as detailed.

.5 Position corner guard 150 mm above finished floor to heights as detailed.

.6 Terminate rails short of door openings, intersecting walls and other appetences as detailed.

.7 Return rails to wall.

.8 Temperature at the time of installation must be between 65º -75ºF (18º-24ºC) and be maintained for at least 48 hours after the installation.

.9 Relative humidity shall not exceed 80%.

.10 Adjust installed end caps as necessary to ensure tight seams

.11 Where splices occur in horizontal runs, splice retainer and rails at different locations along the run.

.12 Do not expose wall protection to direct sunlight during or after installation. This will cause the surface temperature to rise, which in turn will cause bubbles and delamination.

.13 Coordinate top of wall protection with medical device outlets and cover plates. Adjust wall protection to suit elevations of installed outlets. Device covers are not to be in conflict with top edge of wall protection.

.14 Adjust rail returns at walls to ensure reveal is per manufacturer's details. Provide color matched caulking at rail/wall termination.

.15 Install plywood backing for all handrails and wall bumper guards.

3.3 INSTALLATION TOLERANCES - HORIZONTAL RAILS

.1 Maximum Variation from Required Height: 3 mm.

.2 Maximum Variation from Level or Plane for Visible Length: 3 mm.

3.4 CLEANING

.1 Immediately upon completion of installation, clean rails, wall protection and accessories in accordance with manufacturer's recommended cleaning method.

.2 Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.5 PROTECTION

.1 Protect installed materials to prevent damage by other trades. Use material that may be easily removed without leaving residue or permanent stains.

3.6 SCHEDULES

.1 Refer to drawings for layout and locations.

.2 Refer to Interior Finish List for product details and colour.

END OF SECTION

Part 1 General

1.1 RELATED DOCUMENTS

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

1.2 SECTION INCLUDES

.1 Miscellaneous products for interior and exterior applications.

1.3 SUBMITTALS

.1 See Section 01 33 00 - for Submittal Procedures.

.2 Product Data: Provide data for each miscellaneous specialties describing size, finish, details and attachment methods. Include installation instructions.

.3 Warranties:

.1 Submit manufacturer's written warranty that products supplied are free from defects in materials and workmanship for a period of 1 year beginning from the date of Substantial Completion.

Part 2 Products

2.3 STAINLESS STEEL TABLES AND WORK SURFACES

.1 Manufacturer: Mott Manufacturing - 442 Hardy Road, Brantford, ON, Canada N3T 5L7 T: (519) 752-7825 Website: Mott.ca

.2 Products:

All welded table frames.

- Table frame TDA2248 no lower shelf – 2 required

Work surfaces with 102mm (4") back splash

- 1270mm W x 762mm D x 970mm H (50" W x 30" D x 38" H) – 2 required

.3 Options: Work surface to have marine edge.

.4 Finish: Stainless Steel

.5 Construction: 50mm (2") square tubular legs with leveling feet. Table frame to be height adjustable in 25mm (1") increments.

2.6 WALLPAPER

.1 Wall Covering: Wall covering materials meeting requirements of ASTM F793 or CGSB 41 GP 30M, 1370 mm finished width, ULC labelled, Type 2 - medium duty weight meeting the following minimum requirements:

.1 Fabric weight: 68 g/m2

.2 Vinyl weight: 424 g/ m2
.3 Flame spread: 15.
.4 Fuel contributed: 0.
.5 Smoke developed: 15
.6 Basis-of-Design: as indicated on Drawings and graphic/ image selected by Architect.

.2 Substrate Primer/Sealer: White pigmented low VOC acrylic base primer/sealer specifically formulated for use with vinyl wall coverings.

.3 Adhesive: Mildew resistant, low VOC as recommended by the wallcovering manufacturer and as required to minimize flame spread rating of vinyl wall covering material.

2.7 WALL MOUNTED PEG STYLE LEAD APRON RACKS

1. Provide heavy gauge steel for durability, Electro-magnetic power coated in the color White, Pegs tilt upward at the ends to prevent aprons from sliding. Pegs are 4.3" Long x 0.44" Diameter, designed to mount securely on walls, racks shall hold 1 to 9 lead aprons. Mounted to wall studs; provide a plywood backing to studded wall when mounting.

   a. SKU 7156-80

   b. Number of Pegs 4

   c. Lead Apron Capacity 2

   d. Rack Dimensions 3" H x 12" W

   e. Rack Weight\ 4.2 lbs

   f. Rack Capacity 24 lbs

2.8 PORTABLE AND ACOUSTIC PARTITION

2. Partitions constructed with 2” wide, sound-dampening panels and 4-sided anodized aluminum posts, 6’ High match existing. Submit samples for approval.

3. Aluminum extrusions: Aluminum Association alloy AA6063 T54 or 6061-T6 and meeting the requirements of ASTM B429.

4. Acoustical Insulation: fiberglass insulation as recommended by partition manufacturer to achieve STC rating specified.

5. Steel Components: to ASTM A653M with Z180 zinc coating.

    a. Dimensions 6’ high, match existing office partitions, Hush Panel or equivalent.

    b. Attach up to four panels to one post.

    c. All post kits include a foot.

    d. For stability provide Wall-Mount Brackets.

6. Compatibility: Partition system shall accommodate the following:

    a. Concealed electrical wiring.

    b. Electrical Outlets: base mounted.

    c. Concealed voice and data communication wiring.

    d. Voice and Data Communications Outlets: base mounted.

    e. Wall mounted thermostats.

7. Partition System Dimensions:

    a. Panel Module: as indicated on Drawings.

    b. Height: as indicated on Drawings.

    c. Thickness: manufacturer’s standard

8. Finish: As selected by Architect.

Part 3 Execution

3.1 PREPARATION

.1 Deliver inserts and rough-in frames to site for timely installation.

3.2 INSTALLATION

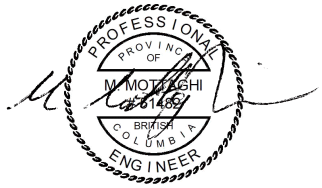
.1 Install accessories in accordance with manufacturers' instructions.

.2 Install plumb and level, securely and rigidly anchored to substrate.

END OF SECTION

Divisions 22-25

Plumbing, HVAC, Controls



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Stantec Permit #1002862

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 AWWA C651 - Disinfecting Water Mains.

.2 CAN4-S115 - Standard Method of Fire Tests of Firestop Systems.

.3 NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

.4 NSF 61 - Drinking Water System Components - Health Effects.

.5 NSF 372 - Drinking Water System Components - Lead Content.

1.2 WORK INCLUDED

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.1 The Division 23 Common Work Results for HVAC shall govern the Division 22 Plumbing sections of the work (read in conjunction with Division 1). This section covers items common to Division 22 series sections and is intended only to supplement the requirements of Division 1 and 23.

.2 Refer to Section 23 06 02 Mechanical Forms and submit all documentation therein that is applicable to Division 22 Plumbing.

1.3 RELATED WORK

.1 Electrical - Division 26

.1 Temporary works are contractors' means and methods; they are excluded from the Consultants' scope of work. The Consultants do not design, coordinate, or review temporary works. The Contractor is solely responsible for, but not limited to: Ensuring all layouts and installations related to temporary work are compliant with the most current building Codes and most current other application Standards; Coordinating all temporary works to not impact the operation of the hospital without a scheduled, managed, shutdown; Ensuring that existing services are protected throughout construction; Remediating any damage or impact to existing conditions as a result of temporary works.

1.4 COORDINATION

.1 Systems indicated in Division 22 sections, located inside and/or buried beneath and/or on the roof of the building shall extend to a point 900 mm (35.43 inch) 36" beyond the exterior face of the building.

.2 Plumbing drawings are diagrammatic and approximately to scale. They establish the scope of the work and the general location and orientation of the plumbing systems. The systems shall be installed generally in the locations and generally along the routings shown, close to the building structure and coordinated with other services. Piping shall be concealed within walls, ceilings or other spaces and shall be routed to maximize head room and the intended use of the space through which they pass, unless specifically noted otherwise.

.3 Provide, for each system, a coordinated layout drawing(s)- coordinate with all other trades. The layout drawings shall indicate the proposed routing of all services, including elevation. Provide fixture and/or equipment rough-in drawing(s) to indicate the rough-in location of all services.

.4 Prior to installation, after the contractor's coordinated layout drawing(s) are complete, convene a meeting with the Consultant, FMO and other stakeholders to show (ie. locate) maintenance items (ie. equipment, valves, other maintenance access points) and describe how these items will be accessed after installation is complete.

.1 After installation is complete, demonstrate to the satisfaction of the Consultant, FMO and other stakeholders that all maintenance items installed can be properly, safely accessed, serviced and replaced, when required. Note that FMO's safe access requirements (ie. safe work procedures) are more stringent than those of WorkSafe BC. Remove and replace unsatisfactorily installed maintenance items to satisfaction of the Consultant, FMO and other stakeholders at no extra cost. Extra costs for unsatisfactory coordination and re-work, removal and re-installation of maintenance items shall not be allowed.

.5 No extra cost will be considered based on failure of the contractor to allow for extra pipe, fittings and pipe work as required during construction to provide offsets to avoid conflicts, and to coordinate with structural components and with other piping services, ductwork, cable trays, conduits or other obstacles whether shown on the drawings or not.

1.5 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Where multiple versions of the same code are published, the most recent version shall be applied, unless noted otherwise by building codes and local by-laws.

.2 Installation, workmanship and testing shall conform to the following standards:

.1 BC Building Code 2024

.2 BC Plumbing Code 2024

.3 CSA Standard Z-317.1 Special Requirements for Plumbing Installations in Health Care Facilities

1.6 LOW LEAD CONTENT

.1 All materials that come in contact with the water flowing through the faucet, piping, or valves shall be certified as "lead-free" as required by the provincial building code, CSA Standards, NSF-372 and NSF 61.

1.7 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 1 and Division 23.

.2 Shop drawings are required for all materials and equipment including, but not limited, to the following:

.1 Cleanouts and access panels.

.2 Floor drains and area drain drains.

.3 Pumps and controls.

.4 Trap primers.

.5 Valves.

.6 Water hammer arrestors.

.7 Pipe, fittings and couplings.

.8 Fixtures and Trim

.9 Fire stopping.

1.8 RECORD DRAWINGS

.1 Provide project As-Built record drawings for all plumbing systems.

.2 Provide project record Final Design and As-Built record drawings as specified in Section 23 05 00 Common Work Results for HVAC.

.3 In addition, as a minimum, during the construction period, keep on site a clean set of drawings marked up, IN COLOUR, to reflect the 'As-Built' state, for examination by the Consultant on a regular basis. Include elevations, rough-in details and detailed locations of all hidden services, including locations of maintenance items and their associated identification code (ie. valves). All concealed (and or underground) services shall be dimensionally located and noted (use gridlines or structure as the reference).

.4 At the time of ‘Ready for Takeover' submit to the Consultant one complete full sized COLOUR Xerox copy of all Record drawing information produced as per the above section. The Record Drawings produced shall be based on the IFC drawings issued. The Record Drawings produced shall be the result of updated IFC drawings issued. Transfer the record drawing mark-ups digitally using Revit onto, and by creating, As-Built record drawings “DWG” and “Revit” files (ie. a Record Revit BIM Model). At the time of ‘Ready for Takeover’ submit to the Consultant, on a USB drive, all produced As-built record drawings DWG and Revit files (ie. the Record Revit BIM Model), including reference files (XRefs, fonts, shapes, line type, plot/print profiles. Consider using the E-Transmit function, and one PDF file for each drawing file produced.

.5 Submit Record Drawings and Record Model which shall also include the Facility (ie. Maximo or other system) Asset Management Number so that a permanent record can be maintained by Langly Memorial Hospital (LMH).

.6 Submit signed and sealed copies of Record Drawings, Final Design Drawings and As-built Drawings as requested by the project Architect, Certified Professional (C.P.), Authority Having Jurisdiction and the Consultant.

.7 Submit hard copies of all As-Built record drawings for inclusion in the paper maintenance manual.

.8 Provide digital files in pdf and AutoCAD formats for inclusion in the digital format manuals and submit files directly to the consultant.

.9 Provide digital files in Revit formats for the 3D model of the facility.

1.9 MAINTENANCE DATA

.1 Provide maintenance data for all fire suppression systems complete with a Table of Contents and coordinate with the plumbing and HVAC trades for incorporation into a designated section of the project Mechanical Operation and Maintenance Manual.

.2 Submit pdf format digital files of all equipment data sheets, approved shop drawings, and maintenance data for inclusion in the maintenance manual.

.3 Include a copy of National Fire Protection Association NFPA 25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.

.4 Detailed instructions for the normal maintenance of all installed equipment including operational procedures, frequency of operational checks, service instructions and troubleshooting instructions. Information provided must be suitable for incorporation into the local Fire Department's operation manual if so requested by the Authority Having Jurisdiction.

.5 Local source of supply for each item of equipment indicating the manufacturer’s and local supplier’s company names, addresses, phone numbers, faxes and e-mails.

.6 Labeling and identification schedules.

.7 Valve schedule including location, service type and normal position for all systems.

.1 Warranties, certificates and miscellaneous reports.

.8 Manufacturer's operating and maintenance brochures, including wiring diagrams.

.9 Comprehensive description of the operation of the system including the function of each item of equipment within the system.

.10 Shop drawings for all components as listed in the Shop Drawings clauses above.

.11 Documentation as listed in the Documentation Submittals clauses above.

.12 In addition to above, comply with LMH FMO’s requirements as follows:

.1 Instruct the building operators in the operation and preventative maintenance of each piece of equipment and system supplied and installed. Complete and turn over documentation prior to Ready for Takeover.

.2 Provide operation and maintenance data as required under Section 01 10 00. Comply with clauses 1.0.4 and 1.0.5 of that section. Electronic copies of manuals are also required as specified in clause 1.1. Operating and Maintenance Data shall form part of Section 01 91 00 – Commissioning.

.3 Index Mechanical Division of Maintenance Manuals according to the following index system.

.4 Tab 1.0 Mechanical Systems: (Prepared by the Mechanical Commissioning Agent – if applicable)

.1 Provide title page with clear plastic cover.

.2 The front title page shall include the cover information in addition to:

.3 The Owner

.4 The Architect

.5 The Engineer

.6 The General Contractor

.7 The Mechanical Contractor

.8 The Agency preparing the Manuals

.9 The addresses, phone and fax numbers for the above will be given adjacent to their name.

.5 Tab 1.1 List of Mechanical Drawings: (Prepared by the Mechanical Commissioning Agent – if applicable)

.6 Tab 1.2 Description of Systems: (Prepared by the Mechanical Commissioning Agent – if applicable)

.1 Provide complete description of each system.

.2 Include detailed system description and components comprising that system, explanation of how each component interfaces with others to complete the system, location of each thermostat, controller, or operating set points.

.3 Provide a complete description of emergency shut-down and start-up procedures for all major equipment, systems and controls, including fire alarm functions, power failure mode, back-up equipment/systems operation.

.7 Tab 1.3 Operating Division:

.1 Provide complete and detailed operation of each major component.

.2 Include starting procedure, exact switch and control location.

.3 Describe operation of component controls, changes required for summer or winter operation and method of accomplishment.

.4 Describe troubleshooting sequence when set points cannot be maintained.

.5 Describe safeguards to check if equipment goes offline.

.6 Describe fire protection and smoke control.

.8 Tab 1.4 Maintenance and Lubrication Division:

.1 Provide detailed preventative maintenance and lubrication schedule for each of the major components including daily, weekly, monthly, semi-annual and yearly checks and tasks.

.2 Describe lubrication and maintenance procedure for equipment components such as bearings, drives, motors, and filters. Include recommended lubricants.

.3 Compile this information for each typical piece of equipment.

.4 Provide a belt schedule.

.9 Tab 1.5 List of Equipment Suppliers and Sub-contractors:

.1 Provide complete list of Equipment Suppliers and Subcontractors, including address and telephone number.

.2 Outline procedures for purchasing parts and equipment.

.3 Provide a parts list and repair manual for each piece of complete equipment specified.

.4 Provide a warranty list for all items that extend beyond the standard one-year contractor’s warranty period such as chillers, variable frequency drives, electrical motors, etc. Indicate the start date of the one-year contractor’s warranty period.

.10 Tab Certification (2.0, 2.1, etc.) Include copies of:

.1 Pre-operational cleaning reports and chemical treatment as specified in Specifications.

.2 Hydrostatic and air tests performed on piping systems.

.3 Equipment alignment certificates.

.4 Balancing reports for air and water systems.

.5 Valve tag identification. Schedule including location, service and normal position.

.6 Pipe colour code.

.7 Inspection approval certificates for plumbing and gas systems.

.8 Inspection approval certificates for all air heating and ventilation systems.

.9 Start-up reports of equipment.

.10 Guarantee certificate.

.11 Tab Shop Drawings (3.0, 3.1, etc.):

.1 Include copy of all reviewed only Shop Drawings.

.2 Include reduced record control drawings (8 ½ x 11 or 11 x 17 fold out).

.12 The divider tabs shall be laminated mylar plastic, and coloured according to Section. The colouring is as follows: Mechanical Systems – 1.0 – 1.5 Orange, Certification 2.0 – 2.4 Green, Shop Drawings and Maintenance 3.0 – 3.17 Yellow. Plastic tabs with typed insertions will not be accepted. (Prepared by the Mechanical Commissioning Agent).

.13 Provide a minimum of three (3) monthly, one day visits to the building to check that building operators are operating and maintaining mechanical systems in proper manner and keeping schedules up to date. Forward complete written report to the Consultant after each visit.

1.10 OCCUPANCY DOCUMENTATION REQUIREMENTS

.1 Provide occupancy documentation for all plumbing work as specified in Section 23 05 00 Common Work Results for HVAC.

.2 The contractor shall submit the following documentation to the Consultant a minimum of 5 working days prior to the project occupancy site walk-through or occupancy date, whichever is scheduled first. The dates will be established by the project architect, project manager or Certified Professional. It is the contractor’s responsibility to provide all documentation to the Consultant in a timely manner. If all documentation is not received, the Consultant may not be able to issue their associated Schedule C-B in support of the building occupancy application and any associated consequences shall become the responsibility of the contractor.

.3 Seismic restraint system letters of assurance Schedules B and C-B from the plumbing contractor’s seismic restraint engineer.

.4 Backflow Prevention Assembly Test Reports for each backflow prevention device, signed by the tester.

.5 Letter confirming that all penetrations of rated assemblies have been firestopped in conformance with CAN4-S115, on the firestopping installing agencies letterhead.

.6 Copies of pressure test reports for all piping systems on contractor’s letterhead.

.7 Chlorination certificates for potable water systems.

.8 Balancing reports for domestic hot water recirculation systems.

.9 Plumbing inspector’s final certificate.

.10 Maintenance manuals for plumbing systems.

1.11 TEMPORARY USAGE OF PLUMBING EQUIPMENT

.1 Plumbing equipment and systems shall not be used without the written permission of the Design Authority and in no circumstances shall be used prior to testing and inspection.

1.12 EXISTING PIPING AND EQUIPMENT TO BE REMOVED

.1 All existing plumbing piping systems that become obsolete as a result of the work or depicted on the drawings for abandonment shall be removed, and/ or disposed of if the Owner declines to retain, in the following situations:

.1 Where specifically noted on the drawings for removal.

.2 Where ceilings are opened-up for any reason that would permit such removal to be implemented. In such a case only those portions of the plumbing system that can be removed without taking down more ceiling shall be removed.

.2 All existing plumbing equipment that become obsolete as a result of the work or depicted on the drawings for removal shall be removed, and/ or disposed of if the Owner declines to retain.

.1 If the Owner is to keep the equipment, move to a location as identified by the Owner.

1.13 SEISMIC PROTECTION

.1 Refer to Section 22 05 49 Seismic Restraint Systems for Plumbing Piping and Equipment.

1.14 BUILDING OPERATION DURING CONSTRUCTION

.1 In order to minimize operational difficulties for the building's staff, the Contractor must cooperate with the Owner throughout the entire construction period and particularly ensure that noise is minimized.

.2 Convenient access for the staff and public to the building must be maintained at all times. Minor inconvenience and interruption of services will be tolerated, provided advance notice is given, but the Contractor will be expected to coordinate his work, in consultation with the owner, so the operation of the facility can be maintained as nearly normal as possible.

.3 Contractor shall be aware, and thereby allow accordingly, that they will be working in Hospital areas and departments that are designated to be continuously in a 24 hour operation by hospital staff. As such the hospital's operation and department function shall not be disrupted or compromised in any way. Particular attention shall be given to related work in Patient, Staff, and Visitor occupied areas. In these areas, the work is to be performed during night time hours as follows:

.1 Monday through Fridays daily: 22:00 to 06:00

.2

.4 All work is to be performed within a protective environment. Provide and conform to Infection Control standards (see Section 01 15 10).

.5 The contractor shall ensure that on a daily basis, prior to turning work areas over for Hospital operation, the area is left clean and all systems are fully functioning. Allow for multiple shut-downs and re-starts/charges to accommodate the work/schedule and multiple phases.

.6 Contractor shall allow for, coordinate and arrange for all systems shut-downs and re-charges, as needed to realize the works, for multiple times, during night time hours as needed.

.7 In addition to all the above, all shut-downs shall be coordinated well in advance (weeks) with the Owner. The contractor's objective shall be to realize minimal the impact of shut-downs as much as possible. Methods such as working during night time hours, and/or existing pipe freezing (by Nitro Pipe Freeze), shall be considered, and allowed for. Prior to any shut-down, the contractor shall site verify and document the existing conditions related to the system being shut-down (pipe routings). The shut-down impacts (including areas and rooms) shall be documented and included with the shut-down request. It shall be the contractor's responsibility to ensure that all work is executed in a planned, safe manner, with no negative impact to the overall hospital operations and/or patient care.

.8 Assurance of continuity of Building Operations: It shall be the contractor's responsibility to ensure the continuity of services to support the continuity of building operations, safe work procedures and safe outcomes. Continuity of operations, and by extension patient care, is of paramount importance. Unplanned, unmanaged shut-downs and or unplanned, unmanaged disruptions to the continuity of building operations cannot be tolerated. It shall be the contractor's responsibility to ensure the continuity of services to support the continuity of building operations. To this end, the contractor shall assign site safety personnel, whom have become familiar with the existing systems (ie. location of maintenance points, shut-off valves and down-stream affect and how to operate the valves), to oversee all works, and to provide training (identification of vulnerabilities, training on safe work practices and training related to mitigation actions (ie. response plan) in the event of unplanned, unmanaged disruptions) to all construction personnel, to ensure safe work procedures and safe outcomes, with no unplanned, unmanaged disruptions to the continuity of services to support the continuity of building operations. Should an unplanned, unmanaged disruption occur (for example resulting from a bump to an active water supply pipe causing a water discharge, or medical gas pipe rupture) the contractor shall have an immediate and coordinated response to close (stop) the discharge and or pipe rupture. The contractor shall have on-hand, and at the ready for deployment (in various locations within vulnerable areas such as interstice spaces) all materials and equipment to contain, manage and close any discharge or pipe rupture (spill kits, pipe repair kits, reservoirs, portable pumps). Continuity of operations, and by extension patient care, is of paramount importance. To this end, the contractor's response shall be coordinated with FMO and patient care stakeholders such that actions are executed to safeguard patient care, property and the preservation of building operations.

1.15 OTHER CONTRACTS ON THIS SITE

.1 These documents include work that will require connection of piping systems to piping already provided under another contract prior to the construction completion of the piping systems described in this set of documents.

.2 Cooperation with respect to on-site coordination of all piping connections is an integral part of the responsibility of this section of the work all within the basic tender price. No extra cost will be allowed based on a failure to allow for scheduling of piping connections to produce a complete workable system whether shown on the drawings or not.

1.16 EXISTING SERVICES

.1 Protect all existing services encountered. Every effort has been made to show the known existing services. However, the removal of concealing surfaces may reveal other existing services. Work with the Owner's staff to trace the originating source and points served. Obtain instructions from the

Consultant when existing services require relocation or modifications, other than those already indicated in the Contract Documents.

.2 Arrange work to avoid shutdowns of existing services. Where shutdowns are unavoidable, obtain the Owner's approval of the timing, and work to minimize any interruptions.

.3 In order to maintain existing services in operation, temporary relocations and/or bypasses of piping may be required.

.4 Be responsible for any damages to existing system by this work.

.5 The Owner reserves the right to withhold permission for a reasonable period with respect to any shutdown, if shutting off a service will interfere with important operations.

.6 Be aware of the following, and take all precautions necessary to ensure safety – allow accordingly:

PART 2 PRODUCTS

2.1 PRODUCT CONSISTENCY

.1 All products utilized on the project shall be as per the shop drawing submissions.

.2 All products of a similar nature used in a similar system or application shall be of the same manufacturer throughout the project.

2.2 ACCESS DOORS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

2.3 CLEANOUTS

.1 Cleanouts shall be full size for pipe sizes up to 100 mm (3.94 inch) 4" and not less than 100 mm 4" on larger sizes. Cleanouts in inside finished areas shall all be of the same shape either round or square.

.2 Cleanouts passing through a waterproofed floor or a slab on grade subject to hydrostatic pressure shall possess a clamping collar which shall be clamped to the floor membrane or lead flashing.

.3 Make cleanouts with Barrett type fitting that has a bolted cover plate and gasket, fitting that has a threaded plug, or a cleanout ferrule that is installed in a wye or extended wye.

.4 Unfinished concrete area cleanouts shall be of heavy-duty construction and have a fully exposed scoriated cover. Standard of Acceptance: Zurn Z1400, Jay R. Smith 4229, Watts, Mifab

2.4 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

2.5 SERVICE PENETRATIONS IN NON-RATED FIRE SEPARATIONS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

2.6 FIRE STOPPING AND SMOKE SEAL MATERIALS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

2.7 MISCELLANEOUS METAL RELATED TO PLUMBING SYSTEMS

.1 Frames shall be of welded construction consisting of angle iron sections with 7.9 mm (0.31 inch) 5/16" locating strips and anchoring lugs at a minimum of 900 mm (35.43 inch) 36" centres.

.2 Cover plates shall be constructed of minimum 7.9 mm (0.31 inch) 5/16" checker plate in sections not exceeding 0.93 square metres 3108.96 cm (102 feet) in size with lifting holes at each end of each section. Cover plates shall be provided complete with at least two lifting keys.

.3 Gasketing between frames and cover plates on sanitary systems shall be of rubber construction.

.4 Backing Plates shall be adequate to support the use intended and shall be a minimum 4.76 mm (0.19 inch) 3/16" in thickness.

PART 3 EXECUTION

3.1 PIPING INSTALLATION

.1 General:

.1 Install piping straight, parallel and close to walls and ceilings, with a fall of not less than 1:100 for gravity piping and with a slope to drain cocks, fixtures or equipment for all pressure piping unless otherwise indicated on drawings. Use standard fittings for direction changes. Provide drain cocks as required.

.2 Install groups of piping parallel to each other; spaced to permit application of insulation, identification, and service access, on trapeze hangers.

.3 Where pipe size differs from connection size to equipment, install reducing fitting close to equipment. Reducing bushings are not permitted.

.4 Brass and copper pipe and tubing shall be free from surface damage. Replace damaged pipe or tubing.

.5 Ream ends of pipe and tubes before installation.

.6 Lay copper pipe so that it is not in contact with dissimilar metal and will not be crimped or collapsed. All joints on cast or ductile iron pressure service piping shall be made electrically conductive.

.7 Install flanges or unions to permit removal of equipment without disturbing piping systems.

.8 Clean ends of pipes or tubing and recesses of fittings to be jointed. Assemble joints without binding.

.9 Install piping to connections at fixtures, equipment, outlets and all other appurtenances requiring service. Trap and vent waste connections to fixtures. Grade all vents to drain back to waste piping.

.10 Plug or cap pipe and fittings to keep out debris during construction.

.11 Jointing of pipe shall be compatible with type of pipe used. Provide dielectric waterway (Victaulic) fittings where required to transition between dissimilar metals.

.12 Non-corrosive lubricant or Teflon tape shall be applied to the male thread of threaded joints.

.13 Flush and clean out piping systems after testing.

.2 Equipment Drainage:

.1 Install drain valves at low points.

.2 Extend equipment drain piping to discharge into floor or hub drain.

.3 Expansion and Contraction and Building Seismic Joints:

.4 Support piping to prevent any stress or strain.

.3 Install pressure piping with loops and offsets which will permit expansion and contraction to occur without damaging the pressure piping system.

.4 Prior to installation, after the contractor's coordinated layout drawing(s) are complete, convene a meeting with the Consultant, FMO and other stakeholders to show (ie. locate) maintenance items (ie. equipment, valves, other maintenance access points) and describe how these items will be accessed after installation is complete.

.5 After installation is complete, demonstrate to the satisfaction of the Consultant, FMO and other stakeholders that all maintenance items installed can be properly, safely accessed, serviced and replaced, when required. Note that FMO's safe access requirements (ie. safe work procedures) are more stringent than those of WorkSafe BC. Remove and replace unsatisfactorily installed maintenance items to satisfaction of the Consultant, FMO and other stakeholders at no extra cost. Extra costs for unsatisfactory coordination and re-work, removal and re-installation of maintenance items shall not be allowed.

3.2 CLEANOUTS

.1 Install cleanouts at the following locations:

.1 Building drain leaving building on the upstream side of exterior wall.

.2 Changes of direction of more than 45 degrees in drainage piping.

.3 Nominally horizontal branch or building drain at intervals of not more than 7.5 metres [25'] for pipe sizes 65 mm [2½"] and less, 15 metres [50'] for 75 mm [3"] and 100 mm [4"] pipe sizes, and 26 metres [85'] for pipe sizes larger than 100 mm [4"].

.4 As called for by the applicable codes.

.2 Cleanouts shall be coordinated with all other obstructions, shall be placed in readily accessible locations and shall have enough clearance for rodding and cleaning.

.3 Extend cleanouts to the finished floor or wall unless exposed in a basement room, pipe tunnel or accessible crawlspace.

.4 Cleanouts in wet floor areas shall extend above the floor in walls or be provided with gasketed waterproofed tops.

.5 Cleanouts on outside drains shall be brought to grade and anchored in a concrete collar.

3.3 HANGERS AND SUPPORTS

.1 Refer to section 22 05 29 for Hangers and Supports for Plumbing Systems.

3.4 PIPE SLEEVES AND ESCUTCHEONS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

3.5 CUTTING, PATCHING, DIGGING, CANNING, AND CORING

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

3.6 MISCELLANEOUS METALS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

3.7 PIPING EXPANSION

.1 All piping systems, including all take-offs shall be so installed within the building that the piping and connected equipment will not be distorted by expansion, contraction or settling.

.2 If circumstances on the job require additional changes in direction from those shown on the drawings, the configuration shall be adjusted to suit at no extra cost.

.3 Anchors shall be installed where necessary to control expansion. Expansion joints or loops shall be installed on hot water piping where required.

3.8 TESTING AND INSPECTION

.1 Furnish all labour, materials, instruments, etc. necessary for all required tests. All work shall be subject to inspection by local plumbing inspector and review by the Consultant. At least forty-eight (48) business hours [2 business days] notice shall be given in advance of making the required tests for projects within 40 km of Stantec's Vancouver office.

.2 All leaks shall be corrected by remaking the joints. The systems shall be retested until no leaks are observed.

.3 No plumbing system or part thereof shall be covered until it has been inspected and approved by the Plumbing Inspector.

.4 If any plumbing system or part thereof is covered before being inspected or approved, it shall be uncovered upon the direction of the Plumbing Inspector or Consultant.

3.9 FLUSHING AND CHLORINATION OF WATER LINES

.1 Thoroughly flush all water piping so that it is free from scale, sediment and debris as soon as possible after the system is filled with water.

.2 On completion of installation and testing, all water piping shall be pre-flushed, chlorinated and flushed again in accordance with AWWA C651-14.

.3 Retain a reputable firm qualified to supervise and inspect the chlorination and flushing procedures and perform chemical biological tests as required.

.4 Submit to the Consultant a certificate from the testing firm stating that chlorination and flushing has been successfully completed.

.5 On projects with water piping being connected to the existing water distribution system including system piping modifications, piping extensions, tenant fit outs etc. flushing and chlorination of all new piping remains a requirement. Provide all required isolation, fill and drain valves required to flush and chlorinate the new piping without impacting the existing system piping.

.6 On completion of installation and testing, all water piping shall be pre-flushed, chlorinated and flushed again in accordance with AWWA C651-14. Provide a minimum two samples, one from the project, directly relatable to the installation (each installation location), and the other that is from a water

source away from the project, but on the same site/campus (in the case of a renovation, elsewhere in the same building), from the same municipal water source. The second sample is to be used for comparison purposes, based on the same test parameters for both samples.

3.10 PROJECT PHOTOGRAPHS

.1 The Contractor shall provide digital photographs in “jpeg” format to the Consultant complete with a text description or each photograph including the date, system type, materials used, and location/direction for all sections of underground piping prior to backfilling and or other concealed piping. Submit the photographs via email and/or disc as requested by the Consultant.

.2 Provide additional digital photographs to document the progress of the work (on a monthly basis) and to document what will be concealed rough-in installations.

.3 Provide additional digital photographs of the work as requested by the Consultant to assist in the resolution of RFIs, prior to covering the work.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Also refer to Section 22 05 48 Vibration Isolation for Plumbing Piping and Equipment, and Section 22 05 49 Seismic Restraint Systems for Plumbing Piping and Equipment.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 The contractor is to arrange and pay for the services of a BC registered professional engineer to provide all required engineering services necessary for the complete design, sizing and detailing of all anchors and anchor supports to the structure required for the project. Submit details for approval.

.3 In addition to the piping, equipment and systems listed in Section 23 05 29 provide hangers and supports on all plumbing piping and equipment including:

.1 Domestic cold water.

.2 Domestic hot water and recirculation.

.3 Sanitary waste and venting.

.4 Related equipment.

.4 Hangers, threaded rods, nuts and associated components for hanging of under-slab piping shall be stainless steel and shall be fixed to the foundation or structural slab.

.1 Spacing of hangers shall comply with the BC Building Code.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Also refer to Section 22 05 49 Seismic Restraint Systems for Plumbing Piping and Equipment.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 48 Vibration Isolation for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 48 provide vibration isolation on all plumbing piping and equipment including the following:

.1 Domestic cold water.

.2 Domestic hot water and recirculation.

.3 Non-potable water.

.4 Sanitary waste and venting.

.5 Related equipment.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Also refer to Section 22 05 48 Vibration Isolation for Plumbing Piping and Equipment.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 49 Seismic Restraint Systems for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 49 provide seismic restraints on all plumbing piping and equipment including the following:

.1 Domestic cold water

.2 Domestic hot water and recirculation

.3 Non-potable water

.4 Sanitary waste and venting

.5 Related equipment

1.3 DOCUMENT SUBMITTALS

.1 Provide letters of assurance signed and sealed by the contractor’s specialist registered Professional Engineer.

.2 The contractor’s Professional Engineer shall provide field reviews of the work on site as the work progresses and submit signed copies of the reports to the Consultant.

.3 The contractor’s Registered Professional Engineer shall provide signed and sealed BC Building Code Letters of Assurance Schedule B and Schedule C-B for the project.

.4 Submit Schedule B to the Consultant and to the local Authority Having Jurisdiction at the time of the shop drawing submission.

.5 Submit Schedule C-B to the Consultant and to the local Authority Having Jurisdiction a minimum of 10 working days prior to Occupancy.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 53 Identification for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 53 provide identification on all plumbing piping, valves and equipment including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Non-potable water.
- .4 Sanitary waste and venting.
- .5 Related equipment.

.3 Identification of all medical gas systems must comply with the requirements of the applicable CSA Standard where the requirements of that standard exceed these specifications. Refer to Section 22 63 02.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 23 05 93 Testing, Adjusting & Balancing for HVAC. Comply with all requirements of that Section of work as related to General Requirements, Products and Execution.

.3 Also refer to Section 22 08 00 Commissioning of Plumbing Systems.

1.2 SCOPE OF WORK

.1 In addition to the piping, equipment and systems listed in Section 23 05 93, testing, adjusting and balancing for all plumbing piping, equipment and systems including the following:

.1 Domestic cold water.

.2 Domestic hot water

.3 Non-potable water

.4 Sanitary waste and venting

.5 Related equipment

.2 Pressure test all plumbing piping systems in accordance with the specific requirements of the specification sections that describe those systems.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 National Energy Code of Canada for Buildings - (NECB).

.2 NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems.

1.2 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.3 REGULATORY REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the B.C. Building Code and NFPA 90A. Generally, the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.2 Insulation thickness and insulating values shall be in accordance with NRC National Energy Code of Canada for Buildings (NECB).

1.4 SCOPE OF WORK

.1 Refer to Section 23 07 19 HVAC Piping Insulation. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping and systems listed in Section 23 07 19 provide piping insulation on all plumbing piping systems including the following:

.1 Domestic cold water.

.2 Domestic hot water and recirculation.

.3 Domestic tempered water (i.e., downstream of a mixing valve)

.4 Non-potable water.

.5 All piping provided with heat tracing cable for domestic hot water temperature maintenance.

.6 Offset waste piping, p-traps and supplies under all wheelchair accessible lavatories and sinks.

.7 Provide foil faced flexible insulation on components requiring adjustment or servicing including booster pumps, meter sets, pressure reducing valves, valve bodies, strainers etc.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Refer to Section 23 08 00 Commissioning of HVAC. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 08 00 provide commissioning of all plumbing piping, equipment and systems including the following:

.1 Domestic cold water.

.2 Domestic hot water and recirculation.

.3 Domestic tempered water, including mixing valves/settings.

.4 Non-potable water.

.5 Sanitary waste and venting.

.6 Relate equipment and or fixture trim.

.3 Commissioning related to plumbing systems shall include the start-up, set up, adjustment and recording of the operational data of at least all the following systems and components as related to the project:

.1 Testing and certification of all backflow preventers.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

.1 This section contains requirements for the following systems:

.1 Domestic water systems include domestic cold water, domestic hot water, domestic tempered water, and domestic water re-circulation systems. Ensure NSF Compliance as per section 22 05 00 – 1.4.2.7 and 1.4.3.

.2 Interior domestic water piping shall be provided as depicted on the drawings.

.3 New interior domestic water piping shall be connected to receive domestic water supply from the existing domestic water piping as depicted on the drawings.

.4 Non-functioning existing interior domestic water piping shall be removed where access is readily available or capped off and abandoned in place as referenced on the drawings.

.2 All products including pipe, valves, fittings, accessories, factory supplied as well as fabricated assemblies/spools that will come in contact with domestic (potable) water shall be tested and certified to ((NSF/((ANSI))/CAN 61)) and 372 for commercial hot and cold water temperature ratings (as applicable). Before any work commences on-site, the installing contractor must provide evidence of agency certification to the afore-mentioned standards through official certification documents and/or online certification Listings including tested and Approved water contact temperature(s). Any products found to be non-compliant with these requirements will be replaced at the contractor's expense.

1.2 RELATED REQUIREMENTS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.1 Refer to Section 21 05 00 Common Work Results for Fire Suppression where domestic water supply and supply to fire suppression systems are combined in one common supply line.

.2 Cross Connection Control

.1 All installations shall be in accordance with the recommendations contained in the latest edition of the Cross-Connection Control Manual published by Pacific Northwest Section of the American Water Works Association.

.2 Double check valve assemblies and reduced pressure principal backflow prevention devices shall have approval from the Foundation for Cross Connection Control, University of Southern California.

.3 Vacuum breakers shall conform to the requirements of C.S.A. B64.5.

.4 Following installation, a test report completed by a certified tester shall be submitted to the Owner, indicating satisfactory operation of each device.

.5 Tests are to be conducted in the period 30 to 60 days prior to date of substantial completion (ready to take over).

.6 Provide one repair kit for every cross-connection control device installed.

1.3 REFERENCE STANDARDS

.1 ANSI - Power Operated Pedestrian Doors.

.2 ANSI/NSF/CAN 61 - Drinking Water System Components – Health Effects.

.3 ASTM A126-B - x.

.4 ASTM A536 - Standard Specification for Ductile Iron Castings.

.5 ASTM B16 - x.

.6 ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

.7 ASTM B88 - Standard Specification for Seamless Copper Water Tube.

.8 ASTM B813 - Standard Specification for Water Flushable Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube.

.9 ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

.10 AWWA C651 - Disinfecting Water Mains.

.11 CAN/CSA-B64.10 - x.

.12 NSF 61 - Drinking Water System Components - Health Effects.

1.4 LEAD-FREE COMPLIANCE

.1 All potable water pipes, pipe fittings, plumbing fittings, faucets, solder, and flux to connect plumbing pipe to be California AB1953 or ((NSF/ANSI/CAN 61)), Annex G, Section 9, or NSF/ANSI/CAN 372 compliant.

.2 All solder joints shall comply with ASTM B828 2002. Flux shall comply with ASTM B813 2010.

.3 No paints containing lead or cadmium.

.4 Contractor shall submit documentation for all applicable products to prove compliance with the above.

PART 2 PRODUCTS

2.1 PIPE AND FITTINGS

.1 All solder joints shall comply with ASTM B828 2002. Flux shall comply with ASTM B813 2010.

.2 Contractor shall submit documentation for all applicable products to prove compliance with the above.

.3 Above ground water pipe inside the building:

.1 Cold water:

.1 Type 'K' hard drawn seamless copper tubing to ASTM B88 or copper pipe to ASTM B42. All copper water tubing shall be certified by the Canadian Standards Association or Warnock Hersey Professional Services Ltd. to ASTM B88.

.2 Hot water:

.1 Type 'K' hard drawn seamless copper tubing to ASTM B88 or copper pipe to ASTM B42. All copper water tubing shall be certified by the Canadian Standards Association or Warnock Hersey Professional Services Ltd. to ASTM B88.

.4 Above ground copper water pipe fittings inside the building:

.1 Use of the 'T-Drill' system of joining copper piping is unacceptable.

.2 Cast brass or wrought copper solder joint pressure fittings with 95/5 Sn/Sb or Silvabrite 100 solder joints; or

.3 Cast bronze or wrought copper roll grooved pressure fittings with grooved mechanical pipe connector couplings with angle bolt pad and Victaulic 'flush seal' gaskets.

2.2 VALVES (LEAD-FREE)

.1 Low Lead Content

.1 All potable water pipes, pipe fittings, plumbing fittings, faucets, solder, and flux to connect plumbing pipe to be California AB1953 or ((NSF/ANSI/CAN 61)), Annex G, Section 9, or NSF/ANSI/CAN 372 compliant.

.2 All solder joints shall comply with ASTM B828 2002. Flux shall comply with ASTM B813 2010.

.3 No paints containing lead or cadmium.

.4 Contractor shall submit documentation for all applicable products to prove compliance with the above.

.2 Ball:

.1 Stainless Steel (50mm 2” and smaller):

.1 Standard of Acceptance:

.1 Soldered. - M.A Stewart B-2-F-LF-SS

.2 Threaded - M.A Stewart B-1-F-LF-SS

.3 Spring Check Valves: (in Vertical or horizontal installation) Grooved End: 50mm 2” to 300mm 12”: 2068.43 kPa (300 psi), grooved end Grade CF8M stainless steel body and disc, 17-4PH stainless steel shaft, with 17-4PH or 316 stainless steel spring, and Grade P Fluoroelastomer seat. Suitable for vertical or horizontal installation. Valves must be ((NSF/ANSI/CAN 61)) listed and certified for domestic cold and commercial hot water (cold +73°F/+23°C and hot +180°F/+82°C). Must also be certified to NSF/ANSI/CAN 372 for low lead requirements

.1 Stainless steel 50 mm (1.97 inch) 2" and larger):

.1 Standard of Acceptance: Victaulic SS Valve Series 816

.4 Mixing:

.1 Mixing valves shall be thermostatic in operation, not mechanical mixing valves. This includes individual mixing valves at single fixtures or groups of fixtures including lavatories, sinks, showers, emergency fixtures etc.

.2 On both the up-stream hot and cold supplies, in an accessible location, provide isolation valves, positive spring check valves and strainers. This requirement applies when such components are supplied with or integral to the mixing valves itself. Where required, provide an access panel to the isolation valves, check valves and strainers.

2.3 VACUUM BREAKERS

.1 Pressure type:

.1 NSF 61 low lead cast bronze, protect against back siphonage of contaminated water into the water supply with upstream and downstream isolation valves and test cocks, spill resistant.

.2 Standard of Acceptance: Zurn 460XL

Pipe Size mm [in.]	Pressure Type Size mm [in.]	Atmospheric Type Size
12 - 25 [½ - 1]	12 [½]	Full Pipe Size
30 - 40 [1¼ - 1½]	19 [3/4]	Full Pipe Size
50 - 75 [2 - 3]	25 [1]	Full Pipe Size

2.4 BACKFLOW PREVENTION STATIONS

.1 Double check valve assembly (DCVA), factory assembled station to CAN/CSA-B64.10 and ((CAN/((CSA B64.10)).1)).

.1 Acceptable Products: Watts Series 709; Ames 3000 Series; Beeco #FDC, #2, CXm F-72; Cla-Val D, D2; Conbraco 400-100; Hersey #1; Neptune 550, DHC; Febco 805; Wilkins 950, MBD-10.

.2 Reduced pressure principal backflow prevention device , with inlet and outlet shut-off valves, double check valve assembly, differential relief outlet and repair/maintenance kit to CAN/CSA-B64.10 and ((CAN/((CSA B64.10)).1)).

.1 Acceptable Products: Watts Series 909; Ames 4000 Series; Beeco #FRP-11, #6CM; Cla-Val RP; Conbraco 40-200; Febco 835B, 825; Neptune 575; Wilkins 975, MBC-8, MBC-10.

.2 To minimize the discharge, install a positive spring check valve located 1200mm 4’ up-stream of the RPBP. To minimize the potential damage to the RPBP due to water hammer, install a water hammer arrestor located immediately down-stream of the RPBP.

2.5 STRAINERS

.1 Sized on a 4 to 1 ratio of basket open area to connecting pipe cross-sectional area, 'Y' pattern, 304 stainless steel screen.

.2 6 mm (0.24 inch) ¼" to 50 mm (1.97 inch) 2", threaded ends, bronze body, 1034 kPa (150 psi) 1034.21 kPa (150 psi) rating.

.1 Acceptable Products: Red & White / Toyo 380, Crane 988-1/2, Armstrong, Muessco, RP&C 59, Sarco (Canada), Kitz 15.

2.6 WATER HAMMER ARRESTORS

.1 Bellows or piston manufactured style with stainless steel casing and welded stainless steel nesting bellows if of the bellows style. Air chambers are unacceptable.

.2 Acceptable Products: Zurn Z-1700 Series bellows style, Jay R. Smith, Ancon, Amtrol, Watts; Precision Plumbing Products Inc. piston style

2.7 PIPE JOINTS

.1 Solders and fluxes having a lead content and self-cleaning acid type fluxes are not acceptable.

.2 All copper to steel or iron and flanged adaptors shall be brass, not copper.

.3 All unions or similar interconnections between dissimilar metals shall be dielectric couplings.

.1 Standard of Acceptance: Victaulic 647 dielectric Waterway Fitting

2.8 TRAP SEAL PRIMERS

.1 Electronic (BMS) Actuated Trap Primer.

.2 Assembly shall include:

.1 16-gauge galvanized steel metal cabinet, suitable for recessed mounting, stainless steel access door with screwdriver latch

.2 Manual shut off valve

.3 Anti-syphon atmospheric vacuum breaker

.4 Calibrated manifold header for equal distribution to suit number of drains

.5 BMS controlled solenoid valve.

.6 24V Solenoid Valve

.7 20mm 3/4” type L copper tubing

.8 Lead-free (<0.2%) soldered joints

.9 Select unit model/size to suit number of connected drains

.3 Standard of Acceptance: Precision Plumbing Products Prime-Time Electronic Trap Priming Assembly

PART 3 EXECUTION

3.1 VALVE INSTALLATION

.1 All valves are to be listed and certified to ((NSF/((ANSI))/CAN 61))

.2 Where possible, disassemble solder end joint valves before soldering.

.3 Where disassembly and the subsequent reassembly is not possible, the contractor shall give special regard to solder jointing in order not to damage, melt or deform and valve parts.

.4 Shut Off Valves:

.1 Install shut-off or isolation valves whether shown on the drawings or not at the following locations:

.1 At each main branch supply point, provide a valve on each outlet leg from the tee or cross.

.2 At all points as indicated on the drawings.

.3 At all points where the plumbing code requires same.

.5 Balancing Valves:

.1 Install circuit balancing valves in hot water recirculating branch mains and branch connections to return mains whether indicated on drawings or not. All valves are to be listed and certified to ((NSF/((ANSI))/CAN 61))

.6 Drain Valves:

.1 Install drain valves 18 mm (0.71 inch) 3/4" minimum, or line size where the piping is smaller than 18 mm 3/4".

.2 Install a hose-end adaptor, cap and chain on the discharge side of each drain valve or pipe to drain where indicated.

.7 Mixing:

.1 On both the up-stream hot and cold supplies, in an accessible location, provide positive spring check valves and strainers. This is a requirement in addition to any check valve device that is common to the mixing valve. Where required, provide an access panel to the check valves and strainers.

3.2 VACUUM BREAKER INSTALLATION

.1 Install at each fixture or item of equipment where contamination of the domestic water system can occur.

.2 Vacuum breaker installation shall be in complete accordance with Clause 1.3 Cross Connection Control and with the manual "Cross Connection Control Manual" published by the Pacific Northwest Section of the American Water Works Association.

.3 Vacuum breaker installation shall be in complete accordance with the manual "Cross Connection Control Manual" published by the Pacific Northwest Section of the American Water Works Association.

.4 All atmospheric type vacuum breakers shall be installed at least 300mm 12" above flood level rim of fixture.

.5 All vacuum breakers serving fume hoods shall be installed outside fume hood.

.6 Provide drain pan with water deflecting enclosure on concealed pressure type vacuum breakers with drain line to appropriate drain.

.7 Complete testing of all vacuum breakers shall be carried out under this section of the work prior to final acceptance of plumbing systems. A certificate shall be submitted duly signed and witnessed that testing was satisfactory.

3.3 BACKFLOW PREVENTION STATION INSTALLATION

.1 Install at each fixture or item of equipment where contamination of the water system can occur.

.2 Pipe differential relief outlet to drain.

.3 Backflow prevention stations shall be in complete accordance with CAN/CSA-B64.10 and ((CAN/((CSA B64.10)).1)) Manual for the Selection and Installation of Backflow Prevention Devices/Manual for the Maintenance and Field Testing of Backflow Prevention Devices.

.4 Complete testing of all double check valve assemblies and reduced pressure principle backflow prevention devices shall be carried out by a certified tester under this section of the work prior to final acceptance of plumbing systems. Submit a certificate for each device duly signed and witnessed that testing was successfully completed.

3.4 FLANGES AND UNIONS

.1 Provide on all connections to pumps, reducing valves, control valves, fixtures, and equipment.

.2 Connections up to and including 50 mm (1.97 inch) 2" size shall be all bronze union, 1,035 kPa (150 psi) 1034.21 kPa (150 psi) rating with ground seat; larger connections shall be flanged.

3.5 WATER HAMMER ARRESTORS

.1 Size in accordance with the Plumbing and Drainage Institute PD1-WH-201 sizing procedures.

.2 Install on branch lines to flush valves, solenoid valves, self-closing faucets, quick closing valves and on refrigeration, kitchen and laundry equipment incorporating solenoid valves.

3.6 TRAP SEAL PRIMERS VALVES

.1 Provide floor drain trap primers in water closet rooms and other areas connected to the sanitary sewer in accordance with the plumbing code and as designated on the drawings.

.2 Locate at locations that are readily accessible by the building maintenance staff.

3.7 PIPE JOINTS

.1 Install dielectric type couplings or dielectric water ways where copper piping and accessories connect to plumbing equipment such as steel storage tanks, pressure reducing stations and ductile iron pipe. Or when there is a connection or transition between dissimilar metals.

3.8 TESTING AND INSPECTION

.1 Testing shall consist of hydraulic pressure testing at 1,400 kPa (203 psi) 1378.95 kPa (200 psig) for 8 hours.

.2 Submit signed and dated pressure test reports for all sections of the water distribution systems.

3.9 FLUSHING AND CHLORINATION OF WATER LINES

.1 Thoroughly flush all water piping so that it is free from scale, sediment and debris as soon as possible after the system is filled with water.

.2 On completion of installation and testing, all water piping shall be pre-flushed, chlorinated and flushed again in accordance with AWWA C651-14.

.3 Retain a reputable firm qualified to supervise and inspect the chlorination and flushing procedures and perform chemical biological tests as required.

.4 Submit to the Consultant a certificate from the testing firm stating that chlorination and flushing has been successfully completed.

.5 On projects with water piping being connected to the existing water distribution system including system piping modifications, piping extensions, tenant fit outs etc. flushing and chlorination of all new piping remains a requirement. Provide all required isolation, fill and drain valves required to flush and chlorinate the new piping without impacting the existing system piping.

.6 On completion of installation and testing, all water piping shall be pre-flushed, chlorinated and flushed again in accordance with AWWA C651-14. Provide a minimum two samples, one from the project, directly relatable to the installation (each installation location), and the other that is from a water source away from the project, but on the same site/campus (in the case of a renovation, elsewhere in the same building), from the same municipal water source. The second sample is to be used for comparison purposes, based on the same test parameters for both samples.

END OF SECTION

PART 1 GENERAL

1.1 SCOPE

.1 Interior sanitary waste and vent piping shall be provided as depicted on the drawings to plumbing fixtures that will discharge sanitary waste and shall be connected to discharge to the existing sanitary waste piping as depicted on the drawings.

.2 Non-functioning existing interior sanitary waste piping shall be removed where access is readily available or capped off and abandoned in place as referenced on the drawings.

1.2 RELATED REQUIREMENTS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

.2 Refer to and comply with the following sections:

- .1 Bidding Requirements and Genera Conditions of Contract - Divisions 00 and 01
- .2 General Mechanical Provisions - Division 23
- .3 Codes, Bylaws, and Standards - Division 23
- .4 Documentation and Submittals - Division 23
- .5 Commissioning and Demonstration - Division 23
- .6 Material Testing - Division 23
- .7 Hangers, Supports and Anchors - Division 23
- .8 Pipe and Duct Penetrations - Division 23
- .9 Access Doors - Division 23
- .10 Seismic Restraints - Division 23
- .11 Mechanical Identification - Division 23
- .12 Pipe, Duct and Equipment Insulation - Division 23
- .13 Mechanical Forms - Division 23
- .14 Electrical - Division 26/27
- .15 Excavation, Trenching and Backfilling - Division 33
- .16 Piped Utilities - Division 33

1.3 SUSTAINABILITY

.1 Refer to Section 23 05 00.

1.4 APPLICABLE CODES AND STANDARDS

.1 Refer to Section 23 05 01, Codes, Bylaws and Standards.

1.5 SUBMITTALS

.1 Shop Drawings

.1 Submit shop drawings in accordance with Division 1 and Division 20.

.2 Shop drawings are required for all materials and equipment.

PART 2 PRODUCTS

2.1 INTERIOR DRAIN, WASTE AND VENT PIPE AND FITTINGS

.1 Above ground pipe and fittings:

.1 Class 4000 cast iron mechanical joint pipe and fittings with mechanical joint stainless-steel couplings to CSA CAN3-B70 up to 200 mm (7.87 inch) 8".

.2 DWV copper drainage pipe with cast brass or wrought copper drainage pattern fittings with recessed solder joints.

.2 Above ground pipe and fittings (AW, Corrosion Resistant, at Sink(s) and Grossing Station drainage):

.1 Watts ORION, Flame Retardant Blueline® Schedule 40: Orion's Blueline® acid waste pipe will be manufactured to the dimensions and tolerances of ASTM F1412 from fire retardant material in 10 ft lengths. Pipe will be cylindrical and straight. Pipe will be supplied with factory grooves. The polypropylene material will conform to ASTM D4101.

.2 Watts ORION, compatible Blueline® acid waste fittings will be manufactured to schedule 40 dimensions per ASTM F1412 and will be made of fire retardant polypropylene. Fitting layouts will conform to ASTM D3311 and ASTM F1412. The polypropylene material will conform to ASTM D4101.

.3 Watts ORION, Rionfuse CF® (Clamp-Free) Electrofusion: The Orion Rionfuse CF system will utilize the same plain end fittings as the No-Hub system, but are to be joined using the Rionfuse CF couplings. The Rionfuse machine will be used to produce a hermetically sealed joint. The joints will conform to ASTM 1290, Technique 1. Provide supplier training and certified personnel for this work. All equipment shall be calibrated and certified for this use/application

PART 3 EXECUTION

3.1 SAFES, FLASHING AND VENT TERMINALS

.1 All cleanouts passing through walls or floors subject to hydrostatic pressure and waterproofed by means other than a membrane shall be provided with clamping collars and flashings of 25 kg/m ² 5 lb/ft² lead.

.2 Supply and fix 25 kg/m² 5 lb/ft² sheet lead flashings to all cleanouts and drains. Securely fix to flashing clamps and extend 300 mm (11.81 inch) 12" beyond edge of cast iron fittings.

.3 Supply and install 25 kg/m² 5 lb/ft² lead safes under built-up showers and mop sinks on any floor which is not slab-on-grade. The safes shall extend across the floors and up walls and curb to a minimum height of 150 mm (5.91 inch) 6" and shall be turned into the floor drain flange, unless specifically noted otherwise. Seams shall be welded (burned), not soldered. Any metal shall be commercially pure lead only. Treat both sides of the safe with two coats of asphalt.

.4 Chloraloy 240 lining material may be used as an alternate to lead under built-up floor sinks and showers; and at floor drains and cleanouts. Materials shall be solvent welded to manufacturer's

installation instructions. Lead shall not be used on roofs where the roofing material is applied by a torch-on method.

.1 Dow reinforced sheeting 45R may be used as an alternative to lead in all applications except in areas in which a rubberized or plastic membrane must be clamped to a drain.

.5 Do not install piping with glued joints at temperatures below those recommended by the solvent manufacture.

3.2 TESTING AND INSPECTION

.1 Tests on the sanitary waste and storm drainage systems shall consist of hydraulic pressure testing of 3000 mm (118.11 inch) 10’ for 8 hours.

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PART 1 GENERAL

1.1 GENERAL

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 CODES AND STANDARDS

.1 All fixtures shall display CSA (Canadian Standards Association) approval where a CSA standard is available and in effect.

.2 Plumbing fittings shall be to CAN/CSA B125, Plumbing Fittings.

.3 Plumbing fixtures shall be to CAN/CSA B45, 'General Requirements for Plumbing Fixtures',

.4 Vitreous china plumbing fixtures shall be to CAN/CSA B45.1, 'Ceramic Plumbing Fixtures',

.5 Enamelled cast iron plumbing fixtures shall be to CAN/CSA B45.2, 'Enamelled Cast Iron Plumbing Fixtures',

.6 Porcelain enamelled steel plumbing fixtures shall be to CAN/CSA B45.3, 'Porcelain Enamelled Steel Plumbing Fixtures',

.7 Stainless steel plumbing fixtures shall be to CAN/CSA B45.4, 'Stainless Steel Plumbing Fixtures'.

.8 Combustible plumbing fixtures including acrylic and / or fiberglass bathtubs and shower bases / shower enclosures shall not exceed the limitations of the flame spread rating (FSR) or smoke development classification (SDC) permitted for the building construction in which they are installed.

1.3 COLOUR

.1 Vitreous china fixtures shall be white unless otherwise noted.

.2 Stainless steel fixtures shall be satin and/or mirror finish or a combination thereof.

.3 Exposed plumbing brass and metal work shall be heavy triple chromium plated.

1.4 QUALITY

.1 Similar plumbing fixtures shall be of one manufacturer.

.2 Plumbing fixture supply brass shall be of one manufacturer unless otherwise specified.

.3 Fixtures shall be free from flaws or blemishes. Surfaces shall be clear, smooth and bright and have dimensional stability.

.4 Plumbing fixtures and trim shall be brand new unless otherwise noted.

.5 All visible or exposed parts, trim, supplies, traps, tubing, nipples escutcheons, check valves on diverter supply lines and valves to sanitary and/or kitchen fixtures shall be chrome plated finish unless otherwise noted.

.6 All fittings shall have heavy duty stems.

PART 2 PRODUCTS

2.1 PLUMBING FIXTURES

.1 Refer to the drawings for the plumbing fixture annotations and specification and or schedule of acceptable products and trim.

.2 Eye Wash EWS-1 (Retractable Eye/Face Wash Drench Hose – counter mount):

.1 Guardian G-5022-FSH-HG, dual purpose eyewash/drench hose for deck mounting. Unit meets the provisions of ANSI Z358.1-2014 as both an eyewash and a drench hose. Two GS-Plus™ spray heads mounted side-by-side, “flip top” dust cover, internal flow control and filter. Forged brass squeeze valve activated by stainless steel lever handle, replaceable stainless steel seat, locking clip engages when handle is depressed, providing “hands free” operation.

.2 Emergency Tempered Water Mixer: Guardian G-6020 Emergency Thermostatic Mixing Valve for Eyewash or Eye/Face Wash, lead-free brass design, with integrated check-stops and filter, vandal-resistant temperature adjustment, stainless steel sliding piston control device allow cold flow through both the fixed and variable bypass, 13 mm (1/2") N.P.T. Outlet, positive hot water shut-off, liquid-filled thermostatic motor control mechanism, 29 °C (84.2 °F) factory set temperature, 9 GPM (34 L/min) at 30 PSI (2.1 bar) pressure drop.Note : Provide shut-offs at emergency mixing valve.

.3 Connections at Grossing Stations, Rooms #0129 and #0130

.1 This equipment is Owner supplied, Contractor assembled and installed, Contractor tested, adjusted and commissioned.

.2 Take responsibility for this equipment once delivered to site. Coordinate with the Owner and move the equipment (and all appurtenances) to the installation location. If on-site storage is required, provide such ensuring that all received equipment is safe and secure. Provide escutcheons for all wall and floor penetrations. Provide commissioning services, thus ensuring operation as intended for the use.

.3 New ½” Hot and ½” Cold water lines shall be connected directly to the factory-supplied water strainers. Extend, within walls and ceilings, new Hot and Cold water piping (down-stream of backflow preventers in Room #0130A) to the location of the Grossing Station connection points. At the wall, provide an accessible ½” brass quarter-turn ball-valve stops. From the stops, as required, transition to stainless steel (of sufficient length), high pressure capable (NSF compliant, Swagelok FX series), reinforced flexible hose and extend (located below the Grossing Station, within the base of the Unit) to the Grossing Station’s Hot and Cold water connection points, connecting directly to the factory-supplied water strainers.

.4 New 1” Formalin supply will connect and extend from the existing base-building supply piping originating from Room #0130A. Connect into the existing piping and extend new piping (PVDF, Polyvinylidene Fluoride pipe/fitting/component material) within the wall(s), through an accessible shut-off valve, to a point located below the Grossing Station, within the base of the Unit. Ensure and provide supports for the piping (with pipe shields at each stud penetration) in the wall such that it does not come into contact with dissimilar materials. From this point, extend the piping and connect into the Grossing Station’s Formalin connection point through an accessible shut-off valve. Be cognizant and aware, and therefore allow accordingly, to respect the Phasing arrangement proposed for the two Grossing Rooms, #0129 and #0130.

Allow and provide for independent pipe system to each room such that the proposed Phasing can be realized whist maintaining operation of Phase 2 whist Phase 1 is being developed.

.5 New 2” Sanitary waste, extend and adjust (ie. remove and re-build existing building sanitary waste arm and or sanitary waste building/stack connection to suit) as required to the correct elevation to receive sanitary waste from the Grossing Station. The Grossing Station will be provided with a loose Disposal Unit (garburator disposal unit). The Contractor is responsible for the assembly, installation and connection of the Disposal Unit (coordinate as needed for associated power). From the grossing Station’s sanitary discharge point, connect and extend corrosion resistant piping to the Disposal Unit, through the Disposal Unit and to the existing building sanitary waste connection point.

.6 New 2” Sanitary vent, adjust (ie. remove and re-build existing building sanitary vent and or sanitary vent building/stack connection to suit) as required to the correct elevation to receive sanitary vent from the Grossing Station. From the grossing Station’s sanitary vent connection point, connect and extend corrosion resistant piping to the existing building sanitary vent connection point.

.4 Backflow Preventers (RPBPs), Rooms #0130A

.1 Provide 1/2” Hot and Cold water reduced pressure backflow preventers (RPBPs), exposed, wall mounted in Chemical Storage Room #0130A. The RPBPs shall be Watts LF009 backflow preventer.

.2 At the existing sink location, below the millwork counter, connect into the existing Hot and Cold water supply. Adapt, at the connection point (ie. remove and re-build existing building and or sink water supply connection to suit) for connected supplies to the existing sink and for the new backflow preventers (RPBPs). Allow for the replacement of the existing fixture stops with new accessible ½” brass quarter-turn ball-valve stops. Extend ½ insulated Hot and Cold water pipe from the connection point to each of the Hot and Cold RPBPs. Up-stream of each RPBP, provide an accessible quarter-turn ball shut-off valve and strainer, and connect to each RPBP. Down-stream of each RPBP, provide an accessible quarter-turn ball shut-off valve and extend insulated ½” Hot and Cold water supplies into the wall and ceiling and distributing to supply to each fixture and or equipment. Provide accessible quarter-turn ball shut-off valves (Hot and Cold) on branches that supply to each fixture and or equipment. Insulate all piping up-stream and down-stream of the RPBPs.

.3 At the existing sink location, below the millwork counter, connect into the existing sanitary waste, up-stream of the sink’s P-Trap and waste arm. Adapt, at the connection point (ie. remove and re-build existing sink’s P-Trap and or waste arm and or sanitary waste building/stack connection) for connected waste (2” DWV copper) to each of the RPBP’s drain discharge points. From each of the RPBP’s drain discharge points, extend 2” DWV copper drains, and connect up-stream of the sink’s P-Trap and waste arm.

PART 3 EXECUTION

3.1 FIXTURE INSTALLATION

.1 Connect fixtures complete with specified trim, supplies, drains accessory piping, vented traps, stops or valves, reducers, escutcheons and fittings for the proper installation of all fixtures and their respective supply fittings.

.2 Provide necessary hangers, supports, brackets, reinforcement, steel back-up plates and floor flanges to set fixtures level and square. Mount fixtures so that 90 kilogram 200 pound mass will not loosen or distort mounting.

.3 Provide minimum 18-gauge circular stainless steel shrouds for concealing all services dropping to island or bench fixtures from ceiling spaces complete with all necessary ceiling and counter flanges. Diameter shall be as necessary to accommodate services; however, all shrouds shall be of the same diameter in any one room or area.

.4 Provide chrome plated quarter turn mini ball valves for all lavatories, sinks and tank type water closets.

.5 ABS p-traps and waste arms are not permitted.

.6 Lavatories and Sinks

.1 Polished chrome flexible supplies with metal compression rings are acceptable. Supply shall incorporate 12 mm (0.47 inch) ½" inlet x 9 mm (0.35 inch) 3/8" compression outlet angle stop complete with a 500 mm (19.69 inch) 20" long flexible riser to fixture.

.2 Double waste fittings for lavatories and sinks shall be a double sanitary tee.

.3 Control handles for all two handle mixing faucets shall be positioned with the cold control on the right and the hot control on the left. Activation shall be accomplished by rotating the cold control handle clockwise and the hot control handle counterclockwise.

.4 Faucets shall be complete with nuts and tailpieces.

.5 Provide appropriate gaskets and/or sealing washers that will prevent the entry of water into fixture trim or faucet holes or punchings in millwork.

.6 Gooseneck spouts shall have a clearance of 200 mm (7.87 inch) 8" from nozzle tip to countertop, unless otherwise specified.

.7 Plastic control handles and spouts are unacceptable.

.8 Lavatory and sink P-traps shall be complete with either a cleanout or possess slip joint connections.

.9 For all water closets, provide and install (within the wall) a supply riser tube clamp.

.10 See drawings for sinks where P-traps are not required as a result of being indirectly connected to waste.

3.2 FIXTURE TRIM HOLES OR PUNCHINGS

.1 Fixture punchings for faucets or other trim shall not contain more punchings than necessary for the specified trim.

.2 Provide fixture and templates to the applicable trades for holes and cut outs required in all countertops.

3.3 WALLS AND FLOORS

.1 Fixtures mounted on glazed tile surfaces shall have ground faces to finished surface.

.2 Where plumbing fixtures come in contact with walls and floors, joints shall be sealed with Dow Corning anti-mildew 786 building sealant, made watertight and beaded smooth in a neat and workmanlike manner.

3.4 WATER HAMMER ARRESTORS

.1 Provide water hammer arrestors or shock absorbers on fixtures with flush valves and/or quick closing valves.

3.5 HANDICAP FIXTURES

.1 Lavatories and Sinks

.1 Install offset P-traps with the run of the P-trap parallel to and close to wall.

.2 Supplies on handicap lavatories shall be offset to accommodate the offset P-trap.

.3 Insulate P-traps and waste arms at all handicap accessible lavatories and sinks with a manufactured insulation kit or 12 mm (0.47 inch) ½" of fiberglass insulation and finished with a polyvinyl chloride jacket in a neat and workmanlike manner.

.4 Acceptable Manufactured Products: Truebro 'Handi Lav-Guard', Brocar Products Inc. 'Trap Wrap', Sexauer 'Handi Lav-Guard' Plumberex 'Handy Shield'.

END OF SECTION

PART 1 GENERAL

1.1 CONFORMANCE

.1 The General Conditions, Supplements and Amendments shall govern this Division (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all sections of Division 23 and 25, and is intended to supplement the requirements of Division 01.

1.2 WORK INCLUDED

.1 Provide complete, fully tested and operational mechanical systems to meet the requirements described herein, in complete accordance with applicable codes and ordinances.

.2 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.

.3 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available.

.4 Any piece of equipment shown on the drawings and / or schedules is deemed to include all the components, accessories, and ancillary elements for its installation in the intended location, the design requirements shown on the drawings and described in the corresponding sections of the specification and the operation sequence indicated in the control section of the specifications.

.5 Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, establish orderly completion and the delivery of a fully commissioned installation.

.6 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.

.7 The most stringent requirements of this and other mechanical sections shall govern. Should inconsistencies exist such as the drawings disagreeing within themselves or with the specifications, the better quality and/or greater quantity of work or materials shall be estimated upon, performed and furnished unless otherwise ordered by the Consultant in writing during the bidding period.

.8 Drawings and specification are complimentary in nature and combined, create a complete set of construction documents. Any item called for by one and not by the other shall be interpreted as being called for by both.

.9 Any discrepancy between drawings and specifications leaving in doubt the true intent of work shall be brought to the attention of the Consultant immediately.

.10 All work shall be in accordance with the project Drawings and Specifications and their intent, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.

.11 Provide seismic restraints for all required equipment, piping and ductwork.

.12 Connect to equipment specified in other sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/separately packaged accessories

.13 "Consultant" shall mean Stantec Consulting Ltd.

.14 Contractor shall be aware, and thereby allow accordingly, that they will be working in Hospital areas and departments that are designated to be continuously in a 24 hour operation by hospital staff. As such the hospital's operation and department function shall not be disrupted or compromised in any way. Particular attention shall be given to related work in the laboratory area. In the scope of work laboratory areas, the work is to be performed during nighttime hours as follows:

.15 Monday through Fridays daily: 21:00 to 06:00. (Confirm with the owner).

.16 Saturdays and Sundays daily: 16:00 to 06:00. (Confirm with the owner).

.17 Night-time and weekend work are required for all shutdowns.

1.3 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Where multiple versions of the same code are published, the most recent version shall be applied, unless noted otherwise by building codes and local by-laws.

.2 Divisions 21, 22, 23, and 25 work shall conform to the following codes, regulations and standards, and all other codes in effect at the time of award of Contract, and any others having jurisdiction.

.3 The latest revision of each code and/or standard shall generally apply unless building codes reference a previous version, or otherwise specified in the contract documents.

.4 Where multiple standards apply, the most stringent requirement shall be incorporated into the work.

.5 Where the contract documents indicate requirements more stringent requirement than any applicable code and/or standard, the contract documents shall be implemented.

.1 By-laws

.1 Local Building By-laws

.2 Canadian Standards Association

.1 CAN/CSA C22.1 Canadian Electrical Code, Part I

.2 CAN/CSA C22.2 Test methods for electrical wires and cables

.3 CAN/CSA S350 Code of Practice for Safety in Demolition of Structures

.4 CAN/CSA-Z305.8 Medical Supply Units.

.5 CAN/CSA Z317.2 Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Healthcare Facilities.

.6 CAN/CSA Z317.13 Infection Control during Construction, Renovation, and Maintenance of Healthcare Facilities

.3 Medical Research Council of Canada

.1 Laboratory Biosafety Guidelines

.4 National Fire Protection Association

.1 NFPA 13 Standard for the Installation of Sprinkler Systems

.2 NFPA 90B Standard for the Installation of Warm Air Heating and Air-Conditioning Systems

.3 NFPA 91 Exhaust Systems for Air Conveying of Vapors, Gases, Mists and Noncombustible Particulate Solids

.4 NFPA 99 Health Care Facilities

.5 NFPA 101 Life Safety Code®

.5 Province of British Columbia

.1 B.C. Building Code

.2 B.C. Plumbing Code

.3 B.C. Fire Code

.4 B.C. Safety Authority Safety Standards Act

.5 B.C. Amendment to Canadian Electrical Code

.6 B.C. Electrical Safety Regulation

.7 B.C. Electrical Safety Branch Bulletins

.8 B.C. Elevating Devices Safety Regulation

.9 B.C. Occupational Health & Safety (OHS) Regulations

.10 WorkSafeBC

.11 R.S.B.C. c39 Safety Standards Act

.6 Underwriter's Laboratories of Canada

.1 CAN/ULC S110 Test for Air Ducts

.2 CAN/ULC S111 Fire Test for Air Filter Units

.7 SMACNA Publications

.1 SMACNA 001 Guidelines for seismic restraints of mechanical systems

.2 SMACNA 006 HVAC Duct Construction Standards, Metal and Flexible

.3 SMACNA 008 IAQ Guidelines for Occupied Buildings Under Construction

.4 SMACNA 012 HVAC Air Duct Leakage Test Manual

.5 SMACNA 014 HVAC Systems Commissioning Manual

.6 SMACNA Fire, Smoke, and Radiation Damper Installation Guide

.8 Miscellaneous Standards

.1 ASHRAE Standard 62 Ventilation for Acceptable Indoor Air Quality

.2 ASHRAE/IES Standard 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings

.3 ASHRAE Standard 202 The Commissioning Process for Buildings and Systems.

.4 ASHRAE/NIBS Guideline 0 The Commissioning Process

.5 ASHRAE Guideline 1.1 HVAC&R Technical Requirements For The Commissioning Process

.6 ASHRAE Guideline 1.3 Building Operations and Maintenance Training for The HVAC&R Commissioning Process

.7 ASHRAE Guideline 1.4 Procedures for Preparing Facility Systems Manuals

.8 Thermal Insulation Association of Canada – TIAC Best Practices Guide

.9 British Columbia Insulation Contractors Association – BC Insulation Contractors Association (BCICA) Standards Manual

.10 Environment Canada Canadian Environment Protection Act

.11 Environmental Protection Agency EPA 625 Radon Prevention in the Design and Construction of Schools and Other Large Buildings

.12 NIBS Guideline 3 Building Enclosure Commissioning Process BECx

.13 ASTM E2813-12e1 Standard Practice for Building Enclosure Commissioning

1.4 SUSTAINABILITY

.1 Follow instructions and initiatives such as pollution preventions and recycling of materials, packaging and debris.

.2 For all Adhesives and Sealants Material Safety Data Sheets (MSDS) highlighting the materials Volatile Organic Compound (VOC) levels.

.3 During construction, meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction.

.4 Protect stored on-site or installed absorptive materials from moisture damage.

.5 If air handling units are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE 52.2.

.6 Mechanical rooms should not be used to store construction or waste materials.

.7 During construction, all openings in supply, return and exhaust HVAC systems shall be protected from dust infiltration. Provide temporary ventilation as required.

.8 Duct Cleaning: Clean and sanitize all supply and return ductwork to ensure that dust and contaminants are effectively removed and contained. Sequence ductwork cleaning in a way that avoids re-contamination.

1.5 ALTERNATE PRICES

.1 Refer to Division 1 General Instructions.

1.6 SEPARATE PRICES

.1 Refer to Division 1 General Instructions. Contractor to provide two (2) separate prices for control. One price for Reliable Control and one price for Delta control.

1.7 UNIT PRICES

.1 Refer to Division 1 General Instructions.

1.8 CASH ALLOWANCES

.1 Refer to Division 1 General Instructions.

1.9 STANDARD OF ACCEPTANCE

.1 Means that an item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

.2 Acceptable Product manufacturers are listed in the list of Equipment Manufacturers in Section 23 99 65.

.3 Where two or more manufacturers are listed, the manufacturer's name shown underlined or shown with a model name and/or number was used in preparing the design. Tenders may be based on any one of those named, if they meet every aspect of the drawings and specifications.

.4 Where other than the underlined manufacturer or scheduled/specified manufacturer is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.

.5 Where two or more items of equipment and/or material, of the same type, are required, provide products of a single manufacturer.

.6 Install and test all equipment and material, in accordance with the detailed recommendations of the manufacturer.

.7 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

1.10 ADDITION OF ACCEPTABLE MANUFACTURERS

.1 Material/products considered to satisfy the specification, but of a manufacturer other than those named in Section 23 99 65 Acceptable Products/Manufacturers may be submitted to the Consultant for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.

.2 Addition of manufacturer's names to the specifications will be only be by formal addendum.

1.11 TENDER INQUIRIES

.1 All contractor queries during the tender period shall be made in writing to the consultant. Contractor queries will be collected, and suitable addenda will be issued for clarification. No verbal information will be issued by the consultant's office during tender. All tender queries may be e-mailed, faxed, mailed or couriered to the consultant's office. No telephone questions will be answered.

1.12 EQUIPMENT LIST

.1 Within ten (10) days after the award of contract submit a completed Equipment List, showing the equipment manufacturer’s name with model number, material included in the Tender, and names of subtrades. The equipment schedules shall be used for this purpose.

.2 The equipment list shall be a full list of equipment and materials intended for installation.

1.13 DETAILED PRICE BREAKDOWNS

.1 Tender Price Breakdown:

.1 Within ten (10) days after the award of contract submit price breakdowns

.2 Submit a separate breakdown for each section of the mechanical work

.2 Proposed Change, Notice of Change, Contemplated Change, etc.:

.1 Provide detailed itemized time and materials breakdowns to assess and evaluate each item indicated in the request for quotation. Indicate number of hours and labour rates, along with quantity of materials and unit costs.

.2 Each supplier and sub-contractor shall be detailed separately.

.3 Indicate mark-ups and allowances separately.

1.14 PROGRESS CLAIMS

.1 For each progress claim, submit a progress claim summary

.2 Submit detailed price breakdowns for each section of the mechanical work listed on the Progress Claim Summary Form and for each change order item being claimed.

.3 This procedure is to allow for any necessary deficiency holdbacks on items, which do not become apparent until the systems are commissioned.

1.15 SCHEDULING

.1 Coordinate with Division 1, Construction Schedule.

.2 Incorporate within the Construction Schedule, a complete and realistic schedule, integrated with, and recognizing the reliance on, other divisions of the work. Consider the lead time for the review of operating and maintenance manuals, commissioning, verification of system operation by the Consultant and the demonstration and instruction to the Owner.

.3 The schedule shall include but not limited to the following items:

.1 Installation and testing of piping systems and equipment;

.2 Installation and cleaning of duct systems and equipment’

.3 Chemical cleaning and treatment of piping’

.4 Control system installation;

.5 Air / Water balancing;

.6 Connection of electrical services to equipment by electrical contractor;

.7 Start-up of mechanical equipment and systems;

.8 Check-out of control systems;

.9 Commissioning of mechanical, plumbing and fire protection systems;

.10 Demonstration of systems and equipment to Consultant;

.11 Demonstration of systems and equipment to Owner;

.12 Preparation of maintenance manuals and as-built drawings and

.13 Submission of the various documents required prior to Ready-For-Takeover.

1.16 RESPONSIBILITIES

.1 Visit the site before tendering. Examine all local and existing conditions on which the work is dependent. No consideration will be granted for any misunderstanding, of work to be done, resulting from failure to visit the site.

.2 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.

.3 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Consultant during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.

.4 Examine carefully the mechanical, electrical, structural and architectural drawings and confirm that the work under this Sub-Contract can be satisfactorily carried out without changes to the building as shown on these plans.

.5 Be responsible for prompt installation of this work in advance of concrete pouring or similar work. Provide and set sleeves where required.

.6 During freezing weather, protect all materials in such a manner that no harm can be done to installations already in place and/or to materials and equipment on the job.

.7 On completion of the work, all tools and surplus and waste materials shall be removed, and the work left in a clean and perfect condition.

1.17 COORDINATION

.1 Check drawings and specifications of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Consultant's written approval.

.2 The drawings indicate the general location and route to be followed by the piping and ductwork. Where details are not shown on the drawings or only shown diagrammatically, the pipes and ductwork shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All ducts and pipes in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All pipes and ducts shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.

.3 Work out jointly all interference problems on the site with other trades and coordinate all work before fabricating or installing any material or equipment. Where necessary produce interference drawings showing exact locations of mechanical equipment within service areas, shafts and the ceiling space. Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Consultant of space problems before fabricating or installing any material or equipment. On completion of the work demonstrate to the Consultant that all equipment installed can be properly and safely serviced and replaced where applicable. Remove and replace improperly installed equipment to satisfaction of the Consultant at no extra cost. Extras for improper coordination and removal of equipment to permit remedial work will not be allowed.

.4 When open web structural joists are used, obtain structural shop drawings to ensure adequate space is available for installation of pipes and ductwork.

1.18 HOISTS AND SCAFFOLDS

.1 Provide all necessary exterior and interior movable or roller scaffolds, platforms, fall protection equipment, lifts and ladders required for the installation of the mechanical work. Confirm with WorkSafeBC requirements OSH Regulation Part 1: Fall Protection for all work on the roof. https://www.worksafebc.com/en/law-policy/occupational-health-safety/searchable-ohs-regulation/ohs-regulation/part-11-fall-protection

.2 Arrange and pay for the services of a B.C. registered professional structural engineer. This structural engineer shall provide all required engineering services related to erection of scaffolds, platforms, or fall arrest devices.

1.19 REVIEW OF WORK

.1 The Consultant representative will field review all work prior to it being concealed. All piping below ground must be approved prior to covering.

.2 All work shall be approved by all authorities having jurisdiction including the City of Prince George.

.3 All openings shall be sealed appropriately in particular in fire rated walls and floors. Sealing shall be inspected / reviewed prior to covering.

1.20 REQUESTS FOR INFORMATION

.1 Where the Contractor determines that more information is required to complete the scope of work, submit a written “Request for Information” to the consultant before making assumptions as to intent.

1.21 PROVISION FOR FUTURE EQUIPMENT AND CONSTRUCTION

.1 Leave clear spaces designated for future equipment or building expansion. Were dotted lines indicate future installation of ducting, equipment etc., plan for the installation under this contract and ensure clear accessible, unhindered access to the space is allowed for.

.2 Where contract documents don’t clearly indicate the future expansion requirements, but known services are required, submit a written “Request For Information”.

.3 Where space is indicated as reserved for future equipment or services, leave such space clear and install piping, raceways and equipment so that connections can be made to future apparatus or building.

.4 Identify provisions and service terminations for future on Record Drawings.

1.22 PERMITS

.1 Obtain all required permits and pay all fees therefore and comply with all Provincial, Municipal, and other legal regulations and by-laws applicable to the work.

.2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

1.23 WARRANTY

.1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.

.2 Take note of any extended warranties specified.

.3 Refer to Section Division 25 for Control System warranty requirements.

.4 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of Ready-For-Takeover ("RFT"), which shall include one (1) complete summer and one (1) complete winter of uninterrupted operation. Warranty shall include any part of equipment, units or structures furnished hereunder that show defects in the works under normal operating conditions and/or for the purpose of which they were intended.

.5 The Mechanical Contractor further agrees that they will at their own expense promptly investigate any mechanical or control malfunction, and repair or replace all such defective work, and all other damages thereby which becomes defective during the time of the guaranty-warranty.

1.24 ENERGY CONSUMPTION

.1 Consultant may reject equipment submitted for approval or review on basis of performance or energy consumed or demanded.

1.25 INFECTION CONTROL

.1 Refer to Division 1 for infection control measures.

.2 Conform to the requirements of CSA Z317.2 Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Healthcare Facilities.

.3 Coordinate with General Contractor and other trades.

.4 Maintain negative pressurization, at all times, in the work area. Exhaust shall be directed to the exterior and filtered.

1.26 ASBESTOS

.1 All material / products installed shall be free of asbestos.

1.27 ASBESTOS DURING RENOVATIONS

.1 If the Contractor, during renovations, should discover asbestos (or material suspected to be asbestos) on piping, ductwork, etc., he shall immediately cease all work in that area and contact the General Contractor or Owner's representative.

.2 The General Contractor or Owner's representative will take immediate appropriate action to verify presence of friable asbestos. The Contractor will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

.3 Refer to Division 2 for removal and disposal of asbestos.

.4 All work performed on systems with asbestos insulation must be reported to WorkSafeBC before work commences.

.5 Removal of all asbestos products shall be carried out in accordance with the applicable codes by a contractor experienced in this specialty.

1.28 WORKMANSHIP

.1 Workmanship shall be in accordance with well-established practice and standards accepted and recognized by the Consultant and the Trade.

.2 The Consultant shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance, quietness of operation, finish and appearance.

.3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Consultant.

1.29 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT

.1 Installed mechanical equipment whose performance is questioned by the Consultant, may be subject to performance verification as specified herein.

.2 When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.

.3 The Consultant will determine by whom testing shall be carried out. When requested, the contractor shall arrange for services of an independent testing agency.

.4 Testing procedures shall be reviewed by the Consultant.

.5 Maintain building comfort conditions when equipment is removed from service for testing purposes.

.6 Promptly provide the Consultant with all test reports.

.7 Should test results reveal that originally installed equipment meets specified performance requirements, Owner will pay all costs resulting from performance verification procedure.

.8 Should test results reveal that equipment does not meet specified performance requirements, equipment will be rejected, and the following shall apply:

.1 Remove rejected equipment. Replace with equipment, which meets requirements of Contract Documents including specified performance requirements.

.2 Replacement equipment will be subject to performance verification as well; using the same testing procedures on originally installed equipment.

.3 Contractor shall pay all costs resulting from performance verification procedure.

1.30 DRAWINGS AND MEASUREMENTS

.1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work and are not detailed installation drawings. Do not scale the drawings. Obtain accurate dimensions from the Architectural and Structural drawings.

.2 Consult the architectural drawings and details for exact locations of fixtures and equipment. Obtain this information from the Consultant where definite locations are not indicated.

.3 Take field measurements, where equipment and material dimensions are dependent upon building dimensions.

.4 Where imperial units have been indicated in brackets following the requirements in SI units, the conversion is approximate and provided for convenience. The SI units shall govern.

1.31 SEQUENCE OF WORK

.1 Before interrupting major services notify Northern Health Facility Maintenance, through the General Contract and Project Manager, well in advance. Arrange an acceptable schedule for the interruptions.

.2 Before interrupting any services complete all preparatory work as far as reasonably possible and have all necessary materials on site and prefabricated (where practical) and work continuously to keep the length of interruption to a minimum.

.3 Include for the cost of all work that may be required out of regular hours to minimize the period of service interruption when connecting into the existing systems.

1.32 BUILDING OPERATION DURING CONSTRUCTION

.1 In order to minimize operational difficulties for the building staff, the various trades must cooperate with Northern Health throughout the entire construction period and particularly ensure that noise is minimized. Please note that the site is an active regional hospital.

.2 Convenient access for the staff and public to the building must be maintained at all times. Minor inconvenience and interruption of services will be tolerated, provided advance notice is given, but the Contractor will be expected to coordinate his work, in consultation with the owner, so the operation of the facility can be maintained as nearly normal as possible.

1.33 EXISTING SERVICES

.1 Work includes changes to existing building and changes at junction of old and new construction. Route pipes, ducts, conduits, and other services to avoid interference with existing installation.

.2 Relocate existing sprinkler, pipes, ducts, conduits, bus ducts and any other equipment or services required for proper installation of new work, including as required for temporary removal and re-installation to suit new installation work.

.3 Protect all existing services encountered, even when the removal of concealing surfaces reveals existing services other than what is shown on the drawings.

.4 Work with the Northern Health staff to trace the originating source and points served. Obtain instructions from the Consultant if existing services require relocation or modifications, other than those already indicated in the Contract Documents.

.5 Remove existing plumbing fixtures, hydronic heating elements, piping, ductwork, wiring, and equipment to suit new construction. Cut back and cap drain, vent and water outlets, conduits and electrical outlets, not being used, at the main branches whenever possible..

.6 Arrange work to avoid shutdowns of existing services. Where shutdowns are unavoidable, obtain the Owner's approval of the timing, and work to minimize any interruptions.

.7 Shutdowns, to permit connections, will be carried out by Northern Health maintenance staff. Contractor to assume that all shutdown will need to occur after hours that impact other departments or spaces in the building.

.8 In order to maintain existing services in operation, temporary relocations and/or bypasses of piping and ductwork may be required.

.9 Be responsible for any damages to existing systems by this work.

.10 The interruption of utility services to permit tie-ins shall be arranged through the Owner's representative. Application must be received in writing at least seven (7) calendar days prior to the date required for the shutdown. Service shutdowns shall only be carried out by Physical Plant and will normally be scheduled to occur during evenings or weekends. Interior Health reserves the right to withhold permission for a reasonable period with respect to any shutdown, if the shutting-off of a service will interfere with important operations.

1.34 SHOP DRAWINGS AND PRODUCT DATA

.1 General

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

.2 Shop drawings shall be reviewed, signed and processed as described in in Division 1, Submittals.

.3 Submit shop drawings to the Consultant as listed in Sections 21 99 65 (Fire Suppression), 22 99 65 (Plumbing), and 23 99 65 (HVAC) Equipment Manufacturers.

.4 Submit shop drawings with reasonable promptness and in orderly sequence so as to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.

.5 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.

.6 Work affected by submittal shall not proceed until the review process is complete.

.7 Installed materials and equipment shall meet specified requirements regardless of whether shop drawings are reviewed by the Consultant.

.8 Shop drawings shall include the Contractor's stamp, signed by Contractor's authorized representative, certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.9 Shop drawings shall be reviewed by the General Contractor and Mechanical Sub-Contractor indicating that the shop drawings have been reviewed, coordinated with the work and that the shop drawings are submitted without qualifications. Shop drawings shall bear the 'reviewed' stamp dated and initialed by the General Contractor and Mechanical Sub-Contractor prior to submitting the shop drawings to the consultant. Shop drawings, which do not bear the contractors and sub-trades 'reviewed' stamp, initials and date will be rejected and sent back as 'not reviewed'.

.10 Submit samples, in addition to drawings, of all items, which in the Consultant's judgment, can be better examined for capacity, quality, finish or detail by sample rather than by drawings. Samples shall be submitted before equipment or material is ordered.

.11 Adjustments made on Shop Drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.

.12 Make changes in Shop Drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.

.13 If upon review, no errors or omissions are discovered or if only minor corrections are made, copies will be returned, and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

.14 If shop drawings are rejected technically after 3 submissions, the Contractor at no additional expense to the Owner shall revert to the specified product and manufacturer for this project.

.2 Content

.1 Submissions shall include transmittal letter containing:

.1 Date, Project title and number;

.2 Name and address of:

.1 Trade Contractor;

.2 Supplier and

.3 Manufacturer

.3 Identification and quantity of each shop drawing, product data and sample and other pertinent data as required

.2 Information shall include and be given in S.I. units

.1 Imperial Units can be included in addition to the S.I. units.

.3 Provide title sheet;

.4 The project name shall be identified: UHN - Lab Histology Ventilation Upgrade.

.5 Identify each piece of equipment as related to specification section and project equipment schedules;

.6 Data shall be specific and technical;

.7 Information shall include all scheduled data;

.8 Information shall include a space for Northern Health Asset Number;

.9 Material for maintenance and operating manuals is not suitable and

.10 Advertising literature, is not required and will be removed or rejected;

.11 The shop drawings/product data shall include:

.1 Clearly mark submittal material using arrows, underlining or circling to show differences from specified ratings, capabilities and options being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pumps, seals, material, or painting.

.2 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with mounting point loads.

.3 Weights of all major equipment for review by the appropriate Consultant.

.4 Mounting arrangements.

.5 Detailed drawings of bases, supports and anchor bolts.

.6 Capacity and performance characteristics indicated on performance curves for fans and pumps.

.7 Sound Power Data, where requested.

.8 Motor efficiencies on motors 1 H.P. and larger.

.9 List of the manufacturers and figure numbers for all valves, traps and strainers.

.10 Control explanation and internal wiring diagrams for packaged equipment.

.11 Control system drawings including a written description of control sequences relating to the schematic diagrams. Refer to additional requirements in Division 25.

.3 Electrical Equipment List

.1 Submit as a shop drawing, an electrical equipment list for any equipment supplied by the mechanical contractor or his subtrades. The list is to be submitted in a timely fashion so that the electrical contractor can utilize the list as a final check prior to ordering motor control centres, starters, or disconnects. The list is to indicate the following:

.1 The horsepower size and number of motors.

.2 The minimum circuit amps (MCA) for packaged equipment such as roof top units.

.3 The voltage and phase of the motors.

.4 Whether or not a starter or a disconnect is included as part of the package.

.4 Format

.1 Submit electronic copy (pdf format) of Shop Drawings for each requirement requested in specification Sections and as Consultant may reasonably request. If electronic copy is not feasible, submit hard copies as necessary.

.2 Include sufficient blank space to allow for review comments and multiple consultant electronic stamps.

.3 An assembly of related components, e.g. grilles, registers and diffusers or plumbing fixtures, shall be submitted with a cover sheet with the contents indicated, identified by tag and model number.

.5 Coordination

.1 Where mechanical equipment requires electrical connections, power or other services, the shop drawings shall also be circulated through the Electrical Contractor or other "services" contractor(s) prior to submission to the Consultants.

.6 Keep one (1) copy of shop drawings and product data, on site, available for reference.

1.35 DUCT MOUNTED CONTROL EQUIPMENT

.1 The following automatic control equipment will be supplied by the Controls Contractor but installed by the appropriate trade sections of the Mechanical Contract:

- .1 Automatic control valves;
- .2 Temperature control wells;
- .3 Pressure tappings;
- .4 Flow switches;
- .5 Automatic control dampers and
- .6 Static pressure sensors.

1.36 MAINTENANCE OF BEARINGS

.1 "Turn over" rotating equipment at least once a month from delivery to site until start-up.

.2 "Run-in" sleeve type bearings in accordance with manufacturer's written recommendation. After "run-in", drain, flush out and refill with new charge of oil or grease as required and recommended by the manufacturer.

.3 Protect bearings, shafts and sheaves against damage, corrosion and dust accumulation during building construction.

1.37 DEMOLITION

.1 Reference Standards

- .1 ASHRAE Guideline 1.1 - Application of the Commissioning Process to New HVAC&R Systems.
- .2 ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- .3 CAN/CSA Z317.13 - Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities.
- .4 CAN/ULC S110 - Standard Methods of Test for Air Ducts.
- .5 CAN/ULC S111 - Standard Method of Fire Tests For Air Filter Units.
- .6 CAN4-S115 - Standard Method of Fire Tests of Firestop Systems.
- .7 CSA C22.1 - Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.
- .8 CSA C22.2 - General requirements — Canadian Electrical Code, Part II.
- .9 CSA S350 - Code of Practice for Safety in Demolition of Structures.
- .10 CSA Z317.2 - Special Requirements for Heating, Ventilation, and Air-conditioning (HVAC) Systems in Health Care Facilities.
- .11 NFPA 13 - Standard for the Installation of Sprinkler Systems.
- .12 NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
- .13 NFPA 91 - Standard for Exhaust Systems for Air Conveying of Vapors, Gases, Mists, and Particulate Solids.

.14 NFPA 99 - Health Care Facilities Code.

.15 NFPA 101 - Life Safety Code.

.16 TIAC - Best Practices Guide.

.17 WorkSafeBC - WorkSafeBC.

.18 Unless otherwise specified, carry out demolition work in accordance with CAN/CSA S350, Code of Practice for Safety in Demolition of Structures.

.2 Existing Conditions

.1 Visit and examine the site and note all characteristics and irregularities affecting the work of this section.

.3 Protection

.1 Cease operations and notify the Prime Consultant immediately for special protective and disposal instructions when any asbestos materials are uncovered during the work of this section.

.2 Prevent debris from blocking surface drainage inlets and mechanical and electrical systems, which remain in operation.

.4 Salvageable Materials

.1 Except as otherwise indicated, salvageable materials from areas of demolition shall become the property of the Owner at his discretion. All material removed from the building not handed over to the Owner for salvage under this project shall be removed from site and disposed of as required by any applicable disposal regulations.

.5 Existing Services

.1 Disconnect and cap all mechanical services in accordance with requirements of local authority having jurisdiction.

.2 Maintain all building services as required during demolition/removal of existing.

.6 Demolition

.1 Carry out demolition in a manner to cause as little inconvenience to the adjacent occupied building area as possible. Coordinate the activity with the Owner and/or the Consultant.

.2 Carry out demolition in an orderly and careful manner.

.3 All removal of existing equipment, pipes and ductwork that may affect occupied areas of the building to be done outside of regular office hours or as scheduled with the Owner.

1.38 SALVAGE

.1 All piping, ducting and equipment, which becomes redundant and is no longer required due to the work in this Contract, shall be completely removed.

.2 All existing items which need to be removed, and which have a reasonable salvage value, such as fans and motors, air terminals, plumbing fixtures, and valves, shall be carefully removed. Northern Health (NH) shall have first right of refusal.

.1 If Northern Health accepts any items, the Contractor shall move those items to theirs designated storage place on site. These items shall not become the property of the

Contractor. Obtain a written receipt from Northern Health detailing each of the items handed over.

.2 If Northern Health declines any items, the Contractor shall remove those items from the site. The Contractor shall be responsible for all costs of removal and disposal of the materials and equipment that are not accepted by the Owner.

1.39 REUSED EQUIPMENT

.1 Where existing equipment is being relocated and re-used, check and report on the condition to the Consultant before reinstallation.

1.40 TEMPORARY HEATING

.1 If it is desired to use the building's mechanical systems to provide temporary heat during construction, submit a formal request, with full details, to FMO and the Consultant. Obtain written permission from Northern Health FMO and the Consultant prior to any building systems being utilized.

.2 The existing air handling supply unit shall not be used for temporary heat.

.3 Use of permanent systems for temporary heat shall not modify terms of warranty.

.4 During the temporary heating period, comply with the following conditions:

.1 Maintain the systems.

.2 Lubricate all equipment operated.

.3 Operate systems only with cleaned piping systems.

.4 Maintain chemical treatment of piping systems.

.5 Keep mechanical rooms broom clean.

.6 Operate fans at proper resistance with filters installed. Change filters at regular intervals.

.7 Operate with proper safety devices and controls installed and fully operational.

.8 Where air systems are used during temporary heating, provide filter media on return and exhaust air outlets.

.9 Where hydronic systems are used, all terminal heating devices shall be brought o "as-new" condition before Ready-For-Takeover review is requested.

.5 Before handing the systems over to the Owner, comply with the following conditions:

.1 Bring equipment to as-new conditions.

.2 Where pumps are used for temporary heating, replace mechanical seals, regardless of condition, with new mechanical seals. All bearings for equipment used shall be checked, re-greased, oiled and cleaned to bring it back to an "As-New" condition.

.3 Replace all panel type air filters installed under this contract with new filters.

.4 Re-clean ductwork and heating/cooling coils as necessary and provide a report from the approved duct cleaning agency certifying that the ductwork is clean.

1.41 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Owner of mechanical equipment supplied under this contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

1.42 PROJECT CLOSE-OUT REQUIREMENTS

.1 The project closeout requirements are specifically listed in each section of this specification. The following is a summary of those requirements. Refer to detailed specifications in each section for further requirements.

.2 Items designated with an asterisk (*) are required to be submitted one week prior to required date of Schedule C-B. All life safety systems must be operational and tested and demonstrated to Consultant prior to issuance of Schedule C. This includes, but not limited to, items such as, sprinklers, seismic supports etc.

.1 Controls:

.1 Controls system completion report (check sheets)*.

.2 Controls system final electrical approval certificate*.

.3 As built control drawings.

.4 Control training signed off by Owner (Indicate dates of training in letter and attendance).

.5 List of control manuals and documents turned over.

.6 Printed copy of control program and database. Printed to disk in word format acceptable.

.7 Disc of control system database.

.8 Airflow station start up and calibration report.

.9 Provide historical trend log data for all control points*.

.1 Trend logs shall cover a one-week period with hourly samples for all points.

.2 Points shall be grouped together on graphs where applicable, e.g all points connected to an air handling unit shall be together.

.3 The controls contractor shall review each set of trend data and provide detailed high level written commentary regarding performance of each item, including suggestions for improvement.

.4 Submit trend log graphs to the Commissioning agency for detailed review and comment.

.5 Submit trend logs with detailed comments from both agencies to the Consultant after verification of proper operation of all control sequences.

.2 Heating / Cooling

.1 Registration certificates for all pressure vessels*.

.2 Vibration isolation report*.

.3 Seismic inspection report*.

.4 Valve tag chart*.

.5 As built drawings.

.6 Welding certificate and x-ray reports*.

.3 HVAC

.1 As built drawings.

.2 Duct cleaning certificate*.

.3 Fume Hood and Laminar Air Flow Workstation equipment and compounding room verification / air balance*

.4 Miscellaneous

.1 Identification Schedules.

.2 Seismic Engineer's Letters of Assurance*;

.3 Demonstrations to Owner signed off by Owner*;

.4 List of incomplete or deficient work prepared by each sub trade*;

.5 Contractor's Letter of Guarantee*;

.6 Signed-off Ready-For-Takeover completion review report.

.7 Power Smart documentation for VSDs etc.;

.8 List of spare parts signed off by Owner and

.9 Sustainability documentation.

.5 Other reports including:

.1 Manufacture start-up reports*;

.2 Air Balance*;

.3 Commissioning*;

.4 Heating chemical treatment*

1.43 READY-FOR-TAKEOVER ("RFT") PERFORMANCE REQUIREMENTS

.1 The contractor shall submit the following documentation to the Consultant a minimum of 5 working days prior to the project occupancy site walk-through or occupancy date, whichever is scheduled first. The dates will be established by the project architect, project manager or Certified Professional. It is the contractor's responsibility to provide all documentation to the Consultant in a timely manner. If all documentation is not received, the Consultant may not be able to issue their associated Schedule C-B in support of the building occupancy application and any associated consequences shall become the responsibility of the contractor.

.2 Before the Consultant is requested to inspect for Ready-For-Takeover of the work:

.1 Commission all systems and prove out all components, interlocks and safety devices.

.2 Submit a letter certifying that all work (including calibration of instruments and balancing of systems) is complete, operational, clean and all required submissions have been completed.

.3 A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Consultant, this list indicates the project is excessively incomplete, a Ready-For-Takeover review will not be performed.

.3 The work will not be considered to be ready for use or Ready-For-Takeover (“RFT”), until the following requirements have been met:

.1 All reported deficiencies have been corrected;

.2 Testing and balancing completed;

.3 Operating and Maintenance Manuals completed;

.4 "As built" record drawing ready for review;

.5 System Commissioning has been completed and has been verified by Consultant;

.6 All demonstrations to the owner have been completed and

.4 Letters of assurance will not be issued until the following requirements have been met:

.1 All items listed in .1 and .2 above have been completed;

.2 Certificate of Penetrations through Separations;

.3 Seismic engineer’s letter of assurance and final inspection report;

.4 Certificate of Ready-For-Takeover (“RFT”);

.5 Ready-For-Takeover requirements are met;

.6 Signed off copy of final inspection report;

.7 Sprinkler and fire alarm test verification, sprinkler materials and test certificate

.8 Plumbing inspection report / card and

.9 Certificate of Backflow Prevention Device.

1.44 DEFICIENCY HOLDBACKS AND DEFICIENCY INSPECTIONS

.1 Work under this Division which is still outstanding when Ready-For-Takeover is certified will be considered deficient and a sum equal to at least twice the estimated cost of completing that work will be held back.

.2 It is expected that outstanding work will be completed in an expeditious manner and the entire holdback sum will be retained until the requirements for Total Performance of Division 21, 22, 23 and 25 work have been met and verified.

PART 2 PRODUCTS

2.1 ACCESS DOORS

.1 Supply flush mounted access doors, for installation by Building Trades in furred ceilings and walls, to permit servicing of mechanical equipment and accessories, inspection of life safety or operating devices, and where specifically indicated.

.2 Refer to Specifications Section 08 31 13 for additional access hatch requirements.

.3 Unless otherwise noted, access doors shall be minimum: 600mm x 600mm 24" x 24" for body entry; 300mm x 450mm 12" x 18" for hand entry; 200mm x 200mm 8" x 8" for cleanout access.

.1 Access doors in building surfaces shall be at least as large as duct access panels accessed through them and shall be oversized when necessary. Size to suit masonry modules when located in a masonry wall.

.4 Locate access doors so that all concealed items are readily accessible for adjustment, operation and maintenance. Locate in service and storage areas wherever possible. Do not locate in paneled, feature or special finish walls, without prior approval of the Consultant.

.1 Access doors in rated fire separations and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch, self-closing.

.5 Access Doors – Non-secure:

.1 Constructed of steel, prime coated, except:

.1 Constructed of stainless steel in areas finished with tile or marble surfaces

.2 Constructed of stainless steel with neoprene gasketed door in damp and high humidity areas

.2 Flush mounted with 180o opening door, round safety corners, concealed hinges, plaster lock and anchor straps and tabs to suit wall or ceiling construction type.

.3 Generally fitted with screwdriver operated latches, except:

.1 in areas subject to security risks (Public Corridors, Psychiatric Patient Areas, Public Washrooms), provide keyed cylinder locks with similar keys.

.2 Allan key cam locks

.4 Plaster or wet wall construction: flush with wall or ceiling type with concealed flange.

.5 Tile, ceramic tile, marble, terrazzo, plaster or wet wall construction in washrooms and other special areas: flush with wall or ceiling type with concealed flange.

.6 Feature wall construction: Recessed wall type that is selected to complement and conform with the architectural module, treatment, or panelling. The size shall conform to adjacent finishes.

.7 Access panels in fire separations and fire walls shall have a compatible fire rating and ULC label.

.8 Access doors are not required in removable ceilings. Provide coloured marking devices after completion of ceilings, at four corners of each panel below point requiring access. Colour code markers to show service or device above.

.9 At time of instruction of owners operating staff, hand-over and obtain signed receipt for 4 sets of each type of key used to lock access doors.

.10 Standard of Acceptance: Maxam, Milcor, Acudor

2.2 OPERATING AND MAINTENANCE MANUALS

.1 Employ an approved independent contractor specializing in operating and maintenance manuals to prepare instruction manuals covering the operation and maintenance of the mechanical systems and equipment installed under this contract.

.2 Comply with requirements indicated in Division 1.

.3 Request the manufacturer’s brochures at the time of equipment purchase. Forward all necessary data including approved shop drawings and manufacturers brochures to the Agency for inclusion in the Manual.

.4 Instructions shall be clearly written in language easily understood by the Operating and Maintenance personnel. Include only specific information pertinent to the equipment installed. Advertising literature and brochures of a general nature will be rejected.

.5 A front title page shall identify the Project, the Owner, the Architect and the Mechanical Consultant. In addition, the names of the General Contractor, Mechanical, Sheet Metal, Control and Sprinkler Sub-Contractors, with addresses and telephone numbers shall be listed.

.6 An index shall be provided, and the manual shall be divided by index dividers including but not limited to the following major sections:

.1 List of Mechanical Design Drawings;

.2 Systems Description;

.1 Comprehensive description of the operation of each system including the function of each item of equipment within the systems and all reset schedules and seasonal adjustments.

.2 Include a schematic drawing and component description for each major mechanical system including air handling systems

.3 Description of actions to be taken in event of equipment failure.

.3 Maintenance and Lubrication;

.1 Maintenance schedules including detailed servicing, maintenance and trouble-shooting instructions for each item of equipment including daily, weekly, monthly, semi-annual and annual checks and tasks.

.2 Lubrication schedules, indicating recommended lubricants and grades (grease or oil) for all lubricated equipment components.

.3 Manufacturer's technical literature for each item of equipment installed. Literature shall include: Operating instructions, Maintenance instructions, Wiring Diagrams, Parts list and Installation instructions, Ventilation requirements, Energy considerations, Automatic temperature control settings, Information regarding air filters and pressure drops for clean and dirty conditions., Trouble Shooting Procedure Guide in spreadsheet form with the most likely causes and recommended actions for all foreseeable problems. Trouble Shooting Procedure guides are required for all the major items of equipment including air handling systems, exhaust fans, circulating pumps, mechanical cooling equipment, etc., and Mechanical Equipment Starting Procedures.

.4 Equipment Suppliers;

.1 Local source of supply for replacement parts for each piece of equipment.

.5 Systems Balancing Reports;

.1 Air system balance report.

.2 Water system balancing report.

.6 Electrical Switchgear;

.1 Electrical switchgear schedule, indicating circuit number, panel location and disconnect location for each item of equipment.

.7 Shop Drawings;

.1 Copies of all final "reviewed" shop drawings including fan and pump performance data including performance curves with the operating point indicated. Shop drawings shall be complete with Consultants review stamp or review form.

.2 Plumbing fixture brochure.

.3 In addition to the shop drawings provided for the various items of mechanical equipment, this section shall also include the Manufacturers' Literature on:

.1 Operating and maintenance instructions

.2 Spare parts lists

.3 Troubleshooting information.

.8 Equipment Schedules;

.1 Belt schedule, indicating size and number of belts required.

.2 Labelling and identification schedules including colour coding.

.3 Air filter schedule indicating model no, size, number of filters required and servicing instructions (i.e.) static pressure readings, etc. for each filter bank.

.9 Guarantees, Certificates and Miscellaneous Reports;

.1 Checklists for start-up

.2 Certificate of Testing and Balancing

.3 Certificate of Duct Cleanliness

.4 Certificate of Penetrations through separations

.5 Certificate of Seismic Restraint Installation

.6 Certificate of Vibration Isolation Installation

.7 Checklists for Demonstrations

.8 Certificate of Ready-For-Takeover

.9 Chlorination report

.10 Commissioning reports/checklists.

.11 Duct leakage test reports.

.12 Equipment performance test results

.13 Extended warranty certificates.

.14 Sprinkler flushing certificate

.10 Control Systems

.1 Descriptive sequence of operation of automatic control system, with "as-built" control schematics indicating the final settings.

.2 Control equipment maintenance bulletins.

.3 Interlock wiring diagrams.

.4 Refer to the Control Sections for Building Management System manual requirements.

.7 Submit a draft copy of the Manual to the Consultant for approval, thirty (30) days prior to start-up of the systems and equipment.

.8 After receiving approval of the draft copy, make any corrections as may be required and then furnish three (3) final copies to the Consultant at least ten (10) days prior to the Ready-For-Takeover review date. Provide more than one volume if the overall thickness of a single binder would exceed 100 mm (3.94 inch) 4".

.9 Printed hard cover manuals shall be supplied in three (3) post hard back Acco expansion style "Fliplock" binders, with stamped lettering on the front cover and spine showing the following:

.1 Name of Project UHN - Lab Histology Ventilation Upgrade

.2 Name of Manual - "Operating and Maintenance Manual Mechanical Systems"

.3 Volume - "X" of "Y"

.10 Digital format manuals shall be supplied on USB drives.

.1 The digital version content and organization for each manual shall be arranged in a manner identical to the hard copy version.

.2 Utilize Portable Document Format (PDF).

.3 The information shall be organized into sections in a user-friendly format that is easy to search for specific information. An indexing system shall be included that remains on an expandable portion of the screen and allows the end user to scroll through the manual information that appears on the main portion of the screen.

.4 The final Digital copies are to be copied to CD media with a custom CD label.

.5 The custom CD label shall include: Project Name, Location of Project, Date of Assembly, name of Mechanical Consultant, and shall be titled “Operating & Maintenance Manual for Mechanical Systems.”

.6 The Digital Manual shall be enhanced with the following features: Bookmarks, Internet Links, Internal Document Links and Optical Character Recognition (OCR). Refer to Scanning Requirements and Organizational Requirements listed below.

.7 Scanning Requirements:

.1 All pages contained within the hard copy manual are to be scanned and/or digitized to Adobe Acrobat 11 (or later) PDF. Include table of contents with links to the referenced pages.

.2 Provide a minimum 300 DPI for all scanned pages.

.3 All scanned material may be searched for text with minimum 60% Optical Character Recognition (OCR).

.4 All scanned shop drawings are to be scanned to a minimum 216mm x 279mm 8.5” x 11” size. If the original page size is 279mm x 432mm 11” x 17”, the digital copy shall also be 279mm x 432mm 11” x 17”.

.5 Rotation of scanned page images/texts shall be displayed within +/- 20 degrees.

.8 Organizational Requirements:

.1 Digital Manual shall be organized in the same manner as the approved Hard Copy Manual. (e.g. Tabs 1.1, 1.2, 1.3, 2.0, 3.0, etc.)

.2 Bookmark all major tabs and subsections

.3 Bookmark each set of shop drawings

.4 Link the Table of Contents page to the referenced sections

.5 Insert an introduction / summary page for all sections indicating major subsections. Link these pages to their referenced sections

.6 Link the system descriptions to the referenced schematic drawings.

.7 Insert internet links and internal document links to mechanical equipment manufacturers / suppliers / contractors official websites; and to mechanical equipment shop drawings.

.8 Use the following colour code for links: internet links shall be light blue with underline, internal document links shall be dark blue (excludes AutoCAD schematic links), and links to other PDF files shall be dark green.

.9 It is the responsibility of the mechanical contractor to provide high quality documentation for scanning.

.10 The digital version of the manuals and the hard cover version shall be prepared by the same company.

.11 Digital Manual shall be reviewed by the Mechanical Consultant for content and

.12 All information within the hard copy manual shall be included within the Digital Manual. At the Owner's / Consultant's discretion the following exceptions may be made so that the manual may be available for use by the Owner at an earlier date:

.1 The final Balance Report may be provided as a later submission in Portable Document Format (PDF). In this case, Balance Report(s) may be kept separate from the Digital Manual.

.2 The final Commissioning Report may be provided as a later submission in Portable Document Format (PDF). In this case, the Commissioning Report(s) may be kept separate from the Digital Manual.

2.3 RECORD DRAWINGS

.1 Comply with requirements indicated in Division 1 – Project Record Documents.

.2 Maintain one hard copy set of contract drawings, including all supplementary and revision drawings on site, solely for the purpose of recording, in red, any change and/or deviation from the Contract Drawings as it occurs. Include elevations and detailed locations of buried services.

.3 The set of drawings will be provided to the contractor by the Consultant at the contractors cost.

.4 The marked-up set of drawings will be reviewed on site monthly by the consultant during the construction process. This review will form a requirement for approval of the monthly progress claim.

.5 Back filling shall not occur until underground services dimensions are marked on the on-site record set.

.6 The Record Drawings shall include, but not limited to, the following changes and shall be recorded daily:

.1 Size, location, arrangement, routing and extent of ductwork, piping, terminal units, equipment, fixtures, clean-outs, valves, rough-in, etc. above and below grade inside the building and including dimensioned locations of buried piping from building walls

.2 Location of fire dampers.

.3 Location of back flow preventers.

.4 Location of water hammer arrestors.

.5 Water lines: Invert elevations to be recorded at each junction, changes of direction and every 30 meter (32.81 yard) 3048 cm (100 feet) run.

.6 Sanitary Sewers: Invert elevations and locations to be recorded at each clean-out.

.7 Storm Drains & Sewers: Invert elevations to be recorded at each manhole, clean-out, changes of direction and every 30 meter (32.81 yard) 3048 cm (100 feet) run.

.8 All services located below ground level and in or below a building slab.

.9 All valve stations, trap stations, coils dampers and ductwork not easily accessible.

.10 Location, tagging, and numbering of all valves as specified in Section 23 05 53.

.7 Drafting:

.1 Refer to Division 1 for cost of preparing record drawings.

.2 Obtain the services of the Consultant or an approved Revit draftsperson to transfer all changes to amend the Revit files in the latest version of Revit.

.3 Include all details from revision drawings, addenda, and change orders. Label each drawing in the lower right corner in letters of at least 12mm 1/2" high as follows:

.1 "AS BUILT DRAWINGS," Contractors name and date.

PART 3 EXECUTION

3.1 CONCEALMENT

.1 Conceal all piping, ductwork and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.

.2 Do not install piping and conduit in outside walls or roof slabs unless specifically directed, in which case, install them with the building insulation between them and the outside face of the building.

3.2 ACCESSIBILITY

.1 Install all work so as to be readily accessible for adjustment, operation and maintenance. Furnish access doors where required in building surfaces for installation by building trades. Refer to item "Access Doors."

3.3 PROTECTION OF WORK

.1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.

.2 Mask machined surfaces. Secure covers over equipment openings and open ends of piping, ductwork and conduits, as installation work progresses.

.3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.

.4 Refinish damaged or marred factory finish.

.5 Air systems to have air filters installed before fans are operated. Install new air filters before system acceptance.

3.4 CUTTING, PATCHING, DIGGING, CANNING, AND CORING

.1 Lay out all cutting, patching, digging, canning and coring required to accommodate the mechanical services. Coordinate with other Divisions.

.2 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls. Openings through structural members of the building shall not be made without the approval of the Consultant.

.3 Be responsible for correct location and sizing of all openings required under Division 21, 22, 23 and 25, including pipe sleeves and duct openings. Allow oversized openings for fire dampers and pipe penetrations where insulation is specified.

.4 Verify the location of existing service runs and steel reinforcing within existing concrete floor and walls prior to core drilling and/or cutting. Repairs to existing services and structural components damaged as a result of core drilling and cutting is included in this section of the work.

.5 The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.

.6 Be responsible for all cutting, patching, digging, canning and coring required to accommodate the mechanical services.

.7 All openings shall be core drilled or diamond saw cut.

3.5 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

.1 Provide pipe sleeves for all piping passing through fire-rated walls and floors. Sleeves to be concentric with pipe.

.2 Submit shop drawings(s) of listed assemblies for each type of penetration through a rated assembly.

.3 All piping, tubing, ducts, wiring, conduits, etc. passing through rated fire separations shall be smoke and fireproofed with ULC approved materials in accordance with CAN4-S115-11 (R2016) and ASTM E814 standards and which meet the requirements of the Building code in effect. This includes new services, which pass through existing rated separations, and all existing services, which pass through a new rated separation or existing separations whose rating has been upgraded.

.4 Sleeves shall be sized to suit fire stopping methods employed for bare pipes, conduits, insulated pipes, and bare and insulated ducts without fire dampers, and

.5 Sleeves shall be sized to suit conditions of approval given in manufacturers installation instructions for fire and smoke dampers.

.6 Fire resistance rating of installed firestopping assembly shall not be less than fire resistance rating of surrounding assembly indicated on Architectural drawings.

.7 All smoke and fire stopping shall be installed by a qualified Contractor who shall submit a letter certifying that all work is complete and in accordance with this specification.

.8 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions in formed, sleeved or cored penetrations.

.9 Combustible pipe penetrations through fire separations that are required to have a fire resistance rating shall be as follows:

.1 Intumescent firestopping material contained in a metal housing that is certified for firestopping use. Installation shall be implemented in full compliance with the certified installation procedures. Standard of Acceptance: FGC Fireguard Corp. DONUT Firestop for flat surfaces; 3M Brand (Intumescent) Fire Barrier, Dow Corning Fire Stop Intumescent Wrap for Q-deck.

.10 Sleeves for fire-rated floor slabs in wet or dry areas shall be as noted on the Standard Details.

.11 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

.12 Sleeves for interior partition (i.e. drywall) shall be as noted on the Standard Details.

.13 Sleeves for interior concrete or block walls shall be steel pipe or removable plastic pipe.

3.6 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

.1 Pipes and ducts passing through separations that have no fire resistance (non-rated separations) do not require a sleeve, but the insulation at the separation shall be wrapped with 0.61 24 ga thick galvanized sheet steel band to which to apply the flexible caulking compound to, to achieve a tight seal.

.2 Sleeves for concrete perimeter walls and foundation walls shall be cast iron sleeve or Schedule 40 steel pipe with annular fin continuously welded at midpoint and protruding 150 mm (5.91 inch) 6” beyond sleeve diameter. Annular fin shall be embedded into centre of wall.

.3 Sleeves for non-rated floor slabs in wet or dry areas shall be steel pipe.

.4 Sleeves for interior concrete or block walls shall be steel pipe or removable plastic pipe.

3.7 FIRE STOPPING AND SMOKE SEAL MATERIALS

.1 References:

.1 CAN4-S115-M, Standard Method of Fire Tests of Firestop Systems.

.2 ASTM E814 Standard Method of Fire Tests and Through-Penetration Firestops.

.3 1997 Certifications Listings Intertek Testing Services N.A. Ltd. (Warnock Hersey).

.4 Underwriters Laboratories of Canada. Listing of Equipment and Materials Vol. 3 Fire Resistance Ratings -Revision 4/95.

.2 Work Included:

.1 Furnish all labour, material, equipment and services necessary to supply and install firestopping and smoke seals around mechanical service piping and duct penetrations through fire rated wall and floor assemblies, as indicated and as specified.

.3 Quality Assurance:

.1 The work of this section shall be carried out only by an approved specialist firm, employing skilled tradesmen experienced in firestopping and smoke seal application and approved, licensed and supervised by the manufacturer of fire stopping materials.

.2 All work to be of the highest quality according to best trade practice and in strict accordance with manufacturer's printed specifications.

.4 Submittals:

.1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Submit manufacturers' product data for materials and prefabricated devices. Include assembly/location design system number references with copies of test information. Construction details should accurately reflect actual job conditions.

.3 For building assemblies which do not correspond to any previously tested and rated assemblies, submit proposals based on related designs using accepted fireproofing design criteria.

.5 Materials:

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC CAN4-S115 and not to exceed opening sizes for which they are intended.

.2 Service penetration assemblies and design numbers: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19. 1997 Certification Listings Intertek Testing Services N.A. Ltd. (Warnock Hersey).

.3 Service penetration firestop components: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC or equivalent approved tests by Warnock Hersey.

.4 Fire resistance rating of installed fire stopping assembly shall be not less than the fire resistance rating of surrounding floor and wall assembly.

3.8 LINK SEALS

.1 Fit each pipe passing through floor slab in contact with ground or basement walls below grade with link seal between sleeve and bare pipe.

.2 Submit manufacturer’s literature and schedule showing location, service, inside diameter of wall opening, sleeve length and pipe outside diameter.

.3 Link seal:

.1 Manufactured from modular synthetic rubber links with stainless steel hardware.

.2 Loosely assembled with bolts to form continuous rubber belt around pipe, with pressure plate under each bolt head and nut.

.3 Constructed to provide electrical insulation between pipe and sleeve.

.4 Installation

.1 Determine inside diameter of each wall opening or sleeve before ordering seal.

.2 Position seal in sleeve around pipe and tighten bolts to expand rubber links until watertight seal is obtained.

3.9 ACCESS DOORS

.1 Install access doors at all concealed cleanouts, traps, unions, expansion joints, valves, control valves, air vents, water hammer arrestors, special equipment, trap primers, vacuum breakers and any other equipment for which subsequent periodic access will be required during the life of said equipment.

.2 Locate access doors so that all concealed items are readily accessible for adjustment, operation, maintenance and replacement.

.3 Do not locate access doors in feature walls or ceilings without the prior approval of the Consultant. Locate in service areas and storage rooms wherever possible.

3.10 ESCUTCHEONS AND PLATES

.1 Provide on pipes passing through finished walls, partitions, floors and ceilings.

.2 Plates shall be stamped steel, split type, chrome plated, or stainless steel, concealed hinge, complete with springs, suitable for external dimensions of piping/insulation. Secure to pipe or finished surface. For all pipes passing through suspended ceilings and uninsulated piping passing through walls. Outside diameter shall cover opening or sleeve.

.3 Where pipe sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.

.4 Do not install escutcheons and plates in concealed locations.

3.11 EQUIPMENT SUPPORTS, PLATFORMS, LADDERS, AND BASES

.1 Provide stands and supports for equipment and materials supplied.

.2 Supports:

.1 Fabricate platforms, gratings, ladders, piping and equipment supplementary supporting steel, and trench and pit covers, from steel and provided by this Division.

.2 Concrete housekeeping bases for mechanical equipment which are in direct contact with floor slab, to be provided by this Division.

.3 Concrete bases for equipment supported on vibration isolation materials (inertia pads), to be provided by this Division.

.4 Construct equipment supports of structural steel or steel pipe. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.

.5 Support ceiling hung equipment with rod hangers and/or structural steel.

.6 Work to be done by firms specializing in these fields.

.7 Submit shop drawings for steel and concrete work, prepared by licensed Professional Engineers.

.3 Concrete bases for housekeeping pads:

.1 Lay out concrete bases and curbs required under Divisions 21, 22, 23 and 25. Coordinate with Division 3. All concrete work is under Division 3.

.2 Constructed using plywood form work and 20 MPa (2903 psi) 3000 lb concrete.

.3 Bases and curbs shall be keyed to the floor and incorporate reinforcing bars and/or steel mesh. Chamfer edges of bases at 45 degrees.

.4 Dowel to concrete floor slab with not less than 13 mm (0.51 inch) 1/2” diameter steel rods.

.5 Plan dimensions:

.1 200 mm (7.87 inch) 8” larger all around than base of apparatus for seismically restrained equipment, and

.2 finished to make smooth, neat surfaces with corners chamfered 25 mm (0.98 inch) 1”.

.3 Provide a deep seal trap path for the air handling unit.

.6 Height conforming to following table;

.1 Equipment:

.1 Motorized: 150mm 6”

.2 Static (tanks, etc): 150mm 6”

.7 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25 1" above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout.

.4 Installation:

.1 Locate supporting steel to permit removal of parts for service or repair, and to allow clear access to valves, fittings, and equipment,

.2 Set equipment on supporting frames and brackets and install hangers, anchor bolts, vibration mountings and snubbers.

.3 Set equipment base plates on housekeeping pads on minimum 13 mm (0.51 inch) 1/2” epoxy grout and fill hollow portion of base with concrete.

.4 Install anchor bolts, vibration mountings and snubbers between equipment and housekeeping pad, or inertia pad and housekeeping pad.

.5 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.6 Provide anchorage, dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.7 Make field connections with bolts to ((CAN/((CSA S16)).1)), or weld.

.8 Supply items for casting into concrete or building into masonry to appropriate trades together with setting templates.

.9 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.10 Where gratings or trench covers are cut in field or damaged, touch up with zinc rich paint.

.11 Hot equipment subject to thermal expansion:

.1 Fasten equipment to building structure to accommodate thermal expansion in accordance with manufacturer's instructions. In the absence of such instructions, fasten equipment support legs as follows unless otherwise noted,

.1 rigidly fasten one support point which is closest to piping connections,

.2 for supports located on the same transverse or longitudinal axis, provide guides with vertical restraint tabs, aligned in direction of fixed support point,

.3 Provide 3mm 1/8" thick PTFE (Teflon) glide pads beneath each support leg.

3.12 EQUIPMENT RESTRAINT

.1 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

3.13 EQUIPMENT INSTALLATION

.1 Provide unions and flanges to permit equipment maintenance and disassembly and to minimize disturbance to piping and duct systems and without interfering with building structure or other equipment.

.2 Provide means of access for servicing equipment including permanently lubricated bearings.

.3 Pipe equipment drains to floor drains.

.4 Line up equipment, rectangular cleanouts and similar items with building walls wherever possible.

3.14 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

3.15 MISCELLANEOUS METALS

.1 Be responsible for all miscellaneous steel work relative to Division 21, 22, 23, 25 of the Specifications, including but not limited to:

.1 Hanging, support, anchoring, guiding and relative work as it applies to piping, ductwork, fans and mechanical equipment.

.2 Earthquake restraint devices - refer to Section 23 05 49.

.3 Access platforms, ladders, and catwalks.

.4 Pipe anchor and/or support posts.

.5 Ceiling ring bolts - secure to structure or steel supports.

.6 All steel work shall be primed and undercoat painted ready for finish under Division 9. Refer to drawings for details.

3.16 FLASHING

.1 New Wall Penetrations: Flash and counter flash where mechanical equipment passes through weather or waterproofed walls.

.2 Existing Wall Penetrations: Remove and replace the existing flashing and counterflashing for all existing ducts being removed and replaced with new ductwork ducts that are re-using existing wall penetrations.

.3 Flash floor drains over finished areas with lead 250 mm (9.84 inch) 10” clear on sides with minimum 900 x 900 mm (35.43 inch) 36’” x 36” sheet size. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations (New Duplex Hazardous Exhaust Fan) 200 mm (7.87 inch) 8” minimum high above roof insulation. Flash and counterflash with galvanized steel, soldered and made waterproofed.

3.17 DIELECTRIC COUPLINGS

.1 On all "OPEN" systems provide wherever pipes of dissimilar metals are joined.

.2 Provide insulating unions for pipe sizes 50mm 2” and under and flanges for pipe sizes 65mm 2.5” and larger.

.3 Provide felt or rubber gaskets to prevent dissimilar metals contact.

.4 Standard of Acceptance: Capital, Walter Vallet, EPCO.

3.18 LUBRICATION OF EQUIPMENT

.1 Lubricate all new equipment prior to being operated, except sealed bearings, which shall be checked.

.2 Use the lubricant recommended by the manufacturer for the service for which the equipment is specified.

.3 Extend lubricating connections and sight glasses to the outside of housings, where lubricating positions are not readily accessible.

.4 Submit a check list, showing that all operated equipment has been lubricated prior to and during any temporary heating period and the demonstration and instruction period.

3.19 PAINTING

.1 Clean exposed bare metal surfaces supplied under Division 21, 22, 23 and 25 removing all dirt, dust, grease and millscale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.

.2 After equipment has been installed and piping and insulation is completed, clean rust and oil from exposed iron and steel work provided under this Division, whether or not it has been factory prime painted.

.3 Paint all pipe hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.

.4 Repaint all marred factory finished equipment supplied under Division 21, 22, 23 and 25, which is not scheduled to be repainted, to match the original factory finish.

.5 In "occupied" areas of building touch up any damage to prime coat resulting from shipping or installation and leave ready for final painting under Finishes, Division 9.

.6 In "un-occupied" areas of the building such as mechanical equipment rooms, boiler rooms, fan rooms, crawl spaces, pipe tunnels and penthouses:

.1 paint exposed galvanized metal surfaces with one coat of zinc dust galvanized primer and one coat of 100% Alkyd base enamel in an approved colour; and

.2 paint exposed iron or steel work with one coat of chrome oxide phenolic base primer and one coat of 100% Alkyd base enamel in an approved colour.

.7 Fire protection piping shall be painted for identification purposes over their entire lengths throughout all exposed areas and in the mechanical room(s) as follows: Fire: Red, C.G.S.B. 509-102

.8 Coordinate with Division 9.

.9 Painting of all equipment and materials, supplied under Division 21, 22, 23 and 25, installed in mechanical equipment areas and inside finished areas of the building or exposed outside the building, is included under Division 9 of the Specification.

.10 Painting by Division 9 shall be in accordance with the following Colour Schedule for Mechanical Equipment Areas:

Item	Primer (Note **)	Colour Finish
Ductwork, Plenums and Miscellaneous Steel	Clear blue undercoat	White (2 coats)
Exposed Misc. Metal (supplied under this contract)	1. Damp-proof Red	To be determined on site
	2. Zinc Chromate	
Fan Casings and Bases	1. Damp-proof Red	Grey
	2. Zinc Chromate	
Guards – Belt and Coupling	1. Damp-proof Red	To match equipment
	2. Zinc Chromate	

.1 Note ** 1. denotes first primer coat and 2. denotes second primer coat.

3.20 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Protect equipment and material in storage, on site and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 All mechanical equipment stored on site shall be kept in a dry, heated and ventilated storage area.

.3 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign material.

.4 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.5 Provide, install and maintain MERV-8 temporary filters to return and exhaust air openings from ceiling spaces to prevent air born dust from entering ducts, plenums and coils. Install filters to return air grilles when fans are operated, and building is not at a clean condition.

3.21 FINAL CLEANING AND ADJUSTMENTS

.1 Conduct final cleaning.

.2 Thoroughly clean exterior surface of exposed piping, and vacuum external surfaces of exposed ducts and interior surfaces of air handling units. Clean strainers in piping systems and install clean filters in air handling systems.

.3 Remove tools and waste materials on completion of work and leave work in clean and perfect condition.

.4 Calibrate components and controls and check function and sequencing of systems under operating conditions.

.5 Supply lubricating oils and packing for proper operation of equipment and systems until work has been accepted.

3.22 START-UP

.1 Before starting the plant, provide a certificate stating that the plant is ready for start-up and the following conditions have been met. Use forms in Section 23 99 60 for this purpose.

- .1 All safety controls installed and fully operational.
- .2 Qualified personnel available to operate the plant.
- .3 Permanent electrical connections made to all equipment.
- .4 All air filters installed.
- .5 Pump and fan drives properly aligned by a journeyman millwright.
- .6 All mechanical equipment rooms, including plenums, vacuum cleaned.

3.23 START-UP AND PERFORMANCE REPORTS

.1 Required reports

- .1 Provide the following Start-Up and Performance Testing reports:
  - .1 Equipment start-up report
  - .2 Authorities report
  - .3 Acoustic survey report
  - .4 Controls / BMS operation report

.2 Equipment start-up report

- .1 Provide a test report in spreadsheet format which summarizes the following data for each piece of equipment which is powered or has automatic controls:
  - .1 equipment ID and name,
  - .2 motor rotation (bump test) - result and initialed by contractor,
  - .3 equipment Start-Up report status - status and initialed by contractor,
  - .4 manufacturer Start-Up report status – status and initialed by contractor,
  - .5 test completion date.
- .2 Provide a test report in spreadsheet format which summarizes the following data for testing of piping systems:
  - .1 system name
  - .2 system limits (if system is not tested in its entirety),
  - .3 type of test (pneumatic, hydrostatic),
  - .4 pressure at start of test,
  - .5 pressure at end of test,
  - .6 duration of test,
  - .7 contractor dated and initialed,
- .3 Equipment/System Start-Up Test Report

.1 Provide a separate start-up report for each piece of the following equipment. The SMACNA “Systems Ready to Balance Check List”, where applicable, may be used for this report.

.1 HVAC Units

.2 Duct Systems

.4 Manufacturer’s Start-Up Test

.1 Provide a separate start-up report for each piece of the following equipment, utilizing the manufacturer’s start-up check list. This report may be prepared by the manufacturer’s service representative:

.1 adjustable frequency drives,

.2 Building Automation Systems.

.3 Authorities review

.1 Submit copies of authorities-having-jurisdiction inspection and test reports, including:

.2 Plumbing and drainage municipal inspector reports

.3 BC Safety Authority for pressure vessel and piping inspection reports

.4 ESA field certification reports

.4 Acoustic survey

.1 Provide acoustic survey test report:

.5 Controls / Building Management System

.1 Provide controls test reports.

.6 Report Submissions

.1 Deficiencies

.1 Immediately report to Consultant, any deficiencies in the systems or equipment performance resulting in design requirements being unobtainable.

.2 Draft report

.1 On completion of the start-up, testing, adjusting and balancing of all systems, submit to the Consultant, two (2) typewritten copies of a full report on all tests, adjustments, and balancing performed.

.2 Attachments including systems schematics with numbered terminals for referring to data above.

.3 Spot checks

.1 After review of the Draft Report by the Consultant and at the Consultants direction, retest up to 30% of all measurements in locations as directed by the Consultant, at no cost extra to the contract.

.2 If results indicate unusual testing inaccuracy, omissions, or incomplete balancing/adjustment, in the opinion of the Consultant, re-balance entire affected system(s) at no increase in Contract Price.

.4 Interim report

.1 After completion of any retesting described above, submit an electronic copy in PDF format.

.5 Final report

.1 Submit to Consultant following completion of alternate season testing and balancing. Submit in Adobe PDF in the same formats as the initial report specified above.

.6 Additional testing

.1 The Consultant may request such additional testing in connection with this project as he deems necessary.

.2 Perform additional testing and balancing at the rates quoted. Costs will be deducted from the Mechanical Subcontractor's allowance for the additional Testing and Balancing work as approved by the Consultant.

3.24 ACOUSTIC TESTING

.1 Scope

.1 Conduct acoustic (noise) measurements.

.2 Qualifications

.1 Acoustic measurements and analysis to be performed under supervision of recognized expert with an established reputation in this field.

.3 Acoustic survey

.1 Provide acoustic performance testing in accordance with SOR 5.3.7.20.

.4 Report format

.1 Reports to incorporate approved standard forms.

.2 Provide a one (1) page summary for each room/space test and include:

.1 date and time of test,

.2 background and operating test results,

.3 RC bandwidth results for 63 through 8000 Hz in both tabular and graphical formats.

.3 Include reduced architectural floor plan drawings, identifying test locations.

.4 Submit four hard copies of acoustic reports.

.5 Submit two soft copies of acoustic reports in Adobe Acrobat PDF format.

.5 Verification

.1 Reported measurements will be verified.

.2 Provide instrumentation and manpower to verify results of up to 10% of reported measurements.

.3 Number and location of verification measurements to be at discretion of Engineer.

3.25 DEMONSTRATION AND INSTRUCTION TO OPERATING STAFF

.1 Provide certified personnel to demonstrate plant operation and to instruct operating staff on operation of mechanical equipment. Provide maintenance specialist personnel to instruct operating staff on

maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

.1 The demonstration shall include:

.2 Operation and sequencing of all automatic control dampers and automatic temperature control devices.

.3 Operability of randomly selected smoke / fire dampers.

.4 Operation and maintenance requirements of all air, gas and water systems and equipment under each mode of operation including:

.1 Automatic controls.

.2 Steam systems

.3 Fans.

.4 Specialty systems.

.2 Provide instruction during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

.3 Use Operating and Maintenance manuals for instruction purposes.

.4 Submit the proposed instructional agenda for approval.

.5 Finalize demonstration and instructions by obtaining a signed statement from the Owner that the demonstration and instructions have been given satisfactorily.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 23 05 49 for required seismic restraint of piping.

1.2 APPLICABLE CODES AND STANDARDS

.1 ASME B31.1 Pressure Piping Code

.2 Manufacturers Standardization Society of Valve and Fittings Industry (MSS)

.1 MSS SP-58 Pipe Hangers and Supports - Materials Design and Manufacture

.2 MSS SP-69 Pipe Hangers and Supports - Selection and Application

.3 MSS SP-77 Guidelines for Pipe Support Contractual Relationships

.4 MSS SP-90 Guidelines for Terminology for Pipe Hangers and Supports

1.3 CONCRETE ANCHORS

.1 As per the BC Building Code, power-actuated or drop in fasteners shall not be used to resist tension forces for the support or restraint of the piping systems or their components. All fasteners shall be reviewed and approved by the Supporting Professional Engineer for Seismic Restraints prior to installation.

1.4 SCOPE

.1 This project is deemed a post-disaster design.

.2 Provide hangers and supports to secure equipment in place, prevent vibration, protect appropriate against damage from earthquake, maintain grade, provide for expansion and contraction and accommodate insulation.

.3 The contractor is to arrange and pay for the services of a BC registered professional engineer to provide all required engineering services necessary for the complete design, sizing and detailing of all supports, all anchors and anchor supports to structure and support frames required for the project. Submit details for approval.

.4 Provide insulation protection saddles on all insulated piping.

.5 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58.

.6 Set inserts in position in advance of concrete work. Use grid system in equipment rooms.

.7 Support from (top of) structural members. Where structural bearings do not exist, or inserts are not in suitable locations, suspend hangers from steel channels or angles. Provide supplementary structural members, as necessary.

.8 Do not suspend from metal deck.

.9 Hangers for copper pipe shall be copper plated or plastic dipped unless pipe hangers bear on piping insulation (cold services).

.10 Hangers and strut located in corrosive areas shall be type 316 stainless steel with stainless steel hardware.

1.5 SPECIAL REQUIREMENTS

.1 The Contractor shall install the anchors and supports in an approved manner to ensure the entire installation (seismic, gravity and lateral forces) will be compliant with the BC Building Code Requirements.

.2 This project shall be constructed as a part of Post-Disaster Facility.

.3 The Contractor shall arrange and pay for the services of a BC registered professional engineer to provide all required engineering services necessary for the complete design, sizing and detailing of all supports, anchors and anchor supports to structure required for the project.

.4 Cast-In-Place Anchors:

.1 Anchors, Bolts, Nuts, and Washers: Bolts and studs, nuts, and washers shall conform to ASTM A307, Grade A, and ASTM A449, ASTM A563, and ASTM F436, as applicable. Hot-dip galvanized bolts and studs including associated nuts and washers in accordance with ASTM A153.

.5 Drilled-In Anchors:

.1 Installer Qualifications

.1 Drilled-in anchors shall be installed by a Contractor with at least five years of experience performing similar installations.

.6 Installer Training:

.1 Conduct a thorough training with the manufacturer or the manufacturer's representative for the Installer on the project. Training shall consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:

.1 hole drilling procedure

.2 hole preparation & cleaning technique

.3 adhesive injection technique & dispenser training / maintenance

.4 rebar dowel preparation and installation

.5 proof loading/torqueing

.7 Field Quality Control:

.1 Testing: 25% of each type and size of drilled-in anchor shall be proof loaded by an independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Engineer. If any of the tested anchors fail to achieve the specified torque or proof load all anchors shall be tested, unless otherwise instructed by the Engineer.

.2 Tension testing should be performed in accordance with ASTM E488.

.3 Torque shall be applied with a calibrated torque wrench.

.4 Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed D/10, where D is the nominal anchor diameter.

1.6 SHOP DRAWINGS

.1 Product data to show:

.1 upper attachment.

.2 hanger rods.

.3 pipe attachment.

.4 riser clamps.

.5 shields and saddles.

.6 inserts.

.2 Submit details for supports, guides, and anchors for glass, fibre-reinforced plastic, and plastic piping systems.

.3 Submit design drawings for custom fabricated trapeze hangers, sealed by a professional engineer licensed in the project location jurisdiction

.1 Shop drawing details:

.1 construction detail drawings for each loading condition,

.2 span deflection calculations,

.3 building attachment load calculations and type.

.2 Provide services of engineer who sealed the custom trapeze hanger shop drawings to conduct a general review of the completed installation on site.

PART 2 PRODUCTS

2.1 UPPER ATTACHMENTS

.1 Concrete:

.1 Inserts for cast-in-place concrete: galvanized steel wedge. ULC listed for pipe 20 mm (0.79 inch) NPS ¾ through 200 mm (7.87 inch) NPS 8 - Grinnell/Anvil Fig. 281.

.2 Carbon steel plate with clevis for surface mount: malleable iron socket with expansion case and bolt. Minimum two expansion cases and bolts for each hanger –Grinnell/Anvil, plate fig. 49, socket fig. 290, expansion case fig. 117.

.3 Drilled concrete insert shall be Hilti Model HSL or HVA.

.4 All inserts shall be ICBO approved. Use only ICBO design load ratings.

.2 Steel Beam (bottom flange):

.1 Cold piping 50 mm (1.97 inch) NPS 2 and under: malleable iron C clamp - Grinnell/Anvil fig. 61.

.3 Steel Beam (top):

.1 Cold piping 50 mm (1.97 inch) NPS 2 and under: malleable iron "top of beam" C clamp - Grinnell/Anvil Fig. 61.

.4 Steel Joist:

.1 Cold piping 50 mm (1.97 inch) NPS 2 and under: steel washer plate with double locking nuts - Grinnell/Anvil fig. 60.

.5 Steel Channel or Angle (bottom):

.1 Cold piping 50 mm (1.97 inch) NPS 2 and under; malleable iron C clamp - Grinnell/Anvil fig. 86.

.6 Steel Channel or Angle (top):

.1 Cold piping 50 mm (1.97 inch) NPS 2 and under: malleable iron "top of beam" C clamp - Grinnell/Anvil fig. 61.

2.2 MIDDLE ATTACHMENTS (ROD)

.1 Carbon steel black (electro-galvanized/cadmium plated for mechanical rooms) continuous threaded rod - Grinnell/Anvil fig. 146 or Myatt fig. 434.

2.3 PIPE ATTACHMENTS

.1 Cold piping, steel or cast iron: hot piping steel, with less than 25 mm (0.98 inch) 1" horizontal movement; hot piping, steel, with more than 300 mm (11.81 inch) 12" middle attachment (rod) length: adjustable clevis - Grinnell/Anvil fig. 260.

.2 Cold copper piping; hot copper piping with less than 25 mm (0.98 inch) 1" horizontal movement; hot copper piping with more than 300 mm (11.81 inch) 12" middle attachment (rod) length: adjustable clevis copper plated - Grinnell/Anvil fig. CT-65.

.3 Suspended hot piping, steel and copper, with horizontal movement in excess of 25 mm (0.98 inch) 1"; hot steel piping with middle attachment (rod) 300 mm (11.81 inch) 12" or less; pipe roller - Grinnell/Anvil fig. 174 or Grinnell/Anvil fig. 181 up to NPS 6 and Grinnell/Anvil fig. 171 NPS 8 and larger.

.4 Bottom supported hot piping, steel and copper: pipe roller stand - Grinnell/Anvil fig. 271.

.5 Spring hangers; where required to offset expansion on horizontal runs which follow long vertical risers - Grinnell/Anvil fig. 171 single pipe roll hanger with Grinnell/Anvil fig. 178.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel - Grinnell/Anvil fig. 261 or Myatt fig. 182.

.2 Copper pipe: carbon steel copper finished - Grinnell/Anvil fig. CT-121.

2.5 SADDLES AND SHIELDS

.1 Cold piping 50 mm (1.97 inch) NPS 2 and under: protection shield with pipe insulation under shield with uninterrupted vapour barrier – Kingspan “K Block” – high density insulation

.2 Hot piping 80 mm (3.15 inch) NPS 3 and under: insulation over pipe hanger.

.3 Hot piping 100 mm (3.94 inch) NPS 4 and over: protective saddle with insulation under saddle - Grinnell/Anvil fig. 160 to 166.

2.6 TRAPEZE HANGERS

.1 Performance:

.1 Manufactured:

.1 to product load listings.

.2 Custom fabricated:

.1 maximum deflection between supports: 1/250 (0.4%) of span

.2 minimum factor of safety : 5 times load to ultimate tensile or compressive strength.

.3 Construction:

.1 Carbon steel shapes, to suit load application:

.1 hollow steel section,

.2 equal leg El section, or

.3 double C channel “strong-back”, with welded clips.

.4 Hanger rods:

.1 as specified above, and

.2 minimum two support rods,

.3 rods selected for minimum factor of safety of 5 times load to ultimate tensile or compressive strength of rod.

.5 Pipe restraint:

.1 restrain pipes from lateral movement with:

.2 bolt-on angle brackets or pipe U-bolts for manufactured hangers,

.3 welded-on angles for fabricated hangers.

.6 Finish:

.1 electro-galvanized finish in mechanical rooms and outdoors.

.2 black steel finish in other areas.

2.7 WALL SUPPORTS

.1 Horizontal pipe adjacent to wall:

.1 Angle iron wall brackets with specified hangers.

.2 Vertical pipe adjacent to wall.

.1 Exposed pipe wall support for lateral movement restraint - Grinnell/Anvil fig. 262 or 263.

.2 Channel type support - Burndy, Canadian Strut, Cantruss or Unistrut - (arrangement to be acceptable to B.C. Boiler Inspection Department).

2.8 FLOOR SUPPORTS

.1 Horizontal pipe.

.1 Do not support piping from the floor unless specifically indicated.

.2 Vertical pipe.

.1 Mid-point of risers between floor slabs - adjustable fabricated steel supports. Refer to Section 23 05 49 Seismic Restraints.

.3 Steel or cast iron pipe:

.1 floor supported, black carbon steel riser clamps to MSS SP-58, type 42, ULC listed, field-welded pipe lugs.

.4 suspended, black carbon steel riser clamps to MSS SP-58, type 42, ULC listed, 4 or 6 bolt pattern, field-welded pipe lugs.

.5 Copper pipe:

.1 carbon steel, copper finished, riser clamps to MSS SP-58, type 8.

2.9 VARIABLE LOAD SUPPORTS

.1 Performance:

.1 Selected for piping loads and estimated travel under service conditions.

.2 Construction:

.1 carbon steel housing and spring,

.2 precommressed spring,

.3 load indicator,

.4 welding to ASME Section IX

.5 welded attachement points

.6 finish: semi gloss primer coat.

2.10 CONSTANT LOAD SUPPORTS

.1 Performance:

.1 maintains constant support load under variable hanger displacements.

.2 selected for piping loads and estimated travel under service conditions, with a minimum safety factor of 25 mm 25.4 mm (1 inch) extra travel or 20% of total travel, whichever is greater.

.2 Construction:

.1 to WW-H-171E, ANSI/MSS SP-69 and 58

.2 carbon steel housing and spring,

.3 combination hanger moment arm and balancing spring design,

.4 horizontal and vertical arrangements,

.5 load adjustment and load indicator scale,

.6 factory set for load and travel,

.7 welding to ASME Section IX

.8 welded attachment points

.9 finish: semi gloss primer coat.

2.11 RODDING FOR MECHANICAL JOINT PIPE

.1 Plain end cast iron and asbestos cement drain waste and vent pipe, NPS 5 and over,

.1 bell clamps and rodding at each joint

.2 bell clamp and rodding at each tee branch

PART 3 EXECUTION

3.1 HANGER SPACING

.1 Support piping and conduit directly from or on structural building elements. Do not support pipe or conduit directly from other services.

.2 Adjust hanger spacing noted below to suit specific pipe manufacturer's recommendations (specifically related to plastic pipe).

.3 If multi-level pipe or conduit supports are proposed, such as trapeze or roller hanger supports, submit shop drawings designed and sealed by a professional engineer licensed as a consulting engineer in the province of the project location and include details for each support system including load calculations.

.4 Coordinate with the structural engineer for point load connections to the building structure.

.5 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below, whichever is more stringent.

.1 Plumbing piping: most stringent requirements of the Plumbing Code or authority having jurisdiction.

.2 Fire protection: to applicable fire code; toggle hangers are unacceptable.

.3 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.4 Within 300 mm (11.81 inch) 12" of each horizontal elbow, tee, joints, etc.

.6 Maximum hanger spacing table.

Pipe Size: mm	Pipe Size: NPS	Rod Diameter mm [ins]	Maximum Spacing Steel Pipe m [ft]	Maximum Spacing Copper Pipe m [ft]
15	½	10 [3/8]	1.8 [6]	1.5 [5]
20, 25	¾, 1	10 [3/8]	2.4 [8]	1.8 [6]
32, 40	1¼, 1½	10 [3/8]	3.0 [10]	1.8 [6]
50	2	10 [3/8]	3.0 [10]	3.0 [10]
65, 80, 100	2½, 3, 4	12 [1/2]	3.0 [10]	3.0 [10]
125, 150, 200	5, 6, 8	16 [5/8]	3.0 [10]	
250, 300	10, 12	22 [7/8]	3.0 [10]	

.7 Where structural members are not suitably located for upper hanger attachments and inserts of adequate capacity cannot be installed in floor slabs over, provide supplementary steel framing members;

.1 fabricate supplementary steel from standard HSS sections, single EL section, double C “strongback” sections, or pipe rolls,

.2 size supporting steel to limit span deflection to 1/250 (0.4%) between support points,

.3 mechanically fasten supplementary steel to structure.

.8 Offset hangers so that rods are vertical in operating position.

.9 Provide hanger within 300 mm 304.8 mm (12 inch) of each horizontal elbow and tee.

.10 Clamp and rod tees, elbows, and joints, in plain end mechanical joint pipe NPS 5 and over.

.11 Riser clamps:

.1 Weld lugs onto steel piping.

.2 Solder copper pipe to copper riser clamps.

.12 Trapeze hangers

.1 Shim pipes on common trapeze hangers to slope each pipe in required direction.

.2 Mechanical fasten shim plates to hanger. Shim plates and pipe lateral restraints may be fastened as one unit.

3.2 SADDLES AND SHIELDS

.1 On cold insulated piping, provide insulation shields between insulation and pipe support.

.2 On hot insulated piping, weld protective saddles to pipe at pipe support locations.

3.3 HANGER INSTALLATION

.1 Adjust hangers to equalize hanger loads, to support piping true to line and grade, and to minimize loads transferred through connections to equipment and outlets.

.2 Offset hanger so that rod is vertical in operating position.

.3 Adjust hangers to equalize load.

.4 Install hanger to provide minimum 12 mm (0.47 inch) ½" clear space between finished covering and adjacent work.

.5 Support vertical piping at every other floor.

.6 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.7 Where practical, support riser piping independently of connected horizontal piping.

.8 Install plastic inserts between steel studs and piping.

.9 For beam clamps, extend hanger rod tight to underside of beam with top bolt and washer.

3.4 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm (3.94 inch) or ducts over 1500 mm (59.06 inch) wide.

.3 Where concrete slabs form finished ceiling, finish inserts, flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square plate and nut above slab, in concealed locations.

.5 Provide a test mock up for review.

.6 Provide inserts for above chillers, pumps and sump pumps to permit equipment servicing. Provide an eyebolt.

.7 Inserts shall be installed in accordance with manufacturer's recommendations and in no case closer than 2,100 mm 213.36 cm (7 feet) apart.

.8 Install anchors per manufacturer instructions, as included in the anchor packaging.

.9 The contractor shall arrange an anchor manufacturer's representative to provide onsite installation training for all of their anchorage products. The Seismic Engineer shall receive documented confirmation that all of the contractor's personnel who install anchors are trained prior to the commencement of installing anchors.

.10 Anchor capacity is dependent upon spacing between adjacent anchors and proximity of anchors to edge of concrete. Install anchors in accordance with spacing and edge clearances indicated on the drawings.

.11 Existing reinforcement bars in the concrete structure may conflict with specific anchor locations. Unless noted on the drawings that the bars can be cut, the contractor shall review existing structural drawings and shall undertake to locate the position of the reinforcing bars at the locations of the concrete anchors by GPR, X-RAY, or other means.

3.5 SET-UP AFTER INSTALLATION

.1 Adjust hangers to equalize hanger loads, to support piping true to line and grade, and to minimize

.2 loads transferred through connections to equipment and outlets.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Provide vibration isolation on all motor driven equipment, piping and ductwork such that noise transmitted to occupied space by any other path than airborne is less than airborne noise transmitted from mechanical space to occupied space. The following specification section contains the minimum requirements to meet this criterion.

1.2 REGULATORY REQUIREMENTS

.1 In undertaking the Design, consider the need to protect the life and safety of all Facility occupants and the need for continuing services following catastrophic events such as earthquakes, severe weather, epidemics, chemical spill, disruption to service utilities and internal events such as fire. Particular attention should be paid to the Acute Care Facilities, generators, transformers and service connections.

1.3 APPLICABLE CODES AND STANDARDS

.1 This project is deemed to be a post-disaster design.

.2 Comply with the latest edition of the following:

.1 British Columbia Building Code and City of Langley by-laws

.2 SMACNA - “Seismic Restraint Manual Guidelines for Mechanical Systems”

.3 NFPA 13 - Installation of Sprinkler Systems

.4 ASHRAE Handbook – HVAC Applications

.5 VISCMA (The Vibration Isolation and Seismic Control Manufacturers Association)

1.4 SCOPE

.1 Isolate motor driven mechanical equipment.

.2 Provide restraints for equipment mounted on vibration isolation to limit movement during start-up and normal operation.

.3 Isolator and base type designations shall comply with the appropriate chapter of current ASHRAE Applications Handbook, as a minimum.

1.5 SHOP DRAWINGS, QUALIFICATIONS AND SUBMITTALS

.1 Anchorage of all equipment shall be certified by a B.C. registered professional structural engineer who specializes in seismic restraint of resiliently mounted systems. All seismic integral isolation mounts or snubbers shall be O.S.H.P.D. (Office of Statewide Health and Planning Department – State of California) approved and the associated OSHPD number clearly indicated on the seismic device. Where OSHPD certification is not available for a restraint device, results of tests consistent

with OSHPD procedures and approvals shall be submitted and certified by a B.C. registered professional structural engineer.

.2 Obtain all relevant equipment information and provide shop and placement drawings for all vibration isolation elements and steel bases for review before materials are ordered.

.3 Provide attachment to both the equipment and the structure meeting the specified forces involved. Attachment details to the structure to be reviewed by the structural consultant for the project.

.4 Submit samples of materials required to complete the work of this section for inspection and review.

.5 Show vibration isolation for each piece of equipment hung from the structure.

.6 Submit product data sheets for isolation components.

.7 Show fabrication details, location and size of anchor bolts and concrete requirements for inertia bases.

.8 Provide vibration isolation equipment by one manufacturer.

1.6 GENERAL

.1 This project is deemed a post disaster design.

.2 Provide vibration isolation on all motor driven equipment with motors of 0.4 kW 1/2 HP and greater power output (as indicated on the motor nameplate) and on piping and ductwork, as specified herein. For equipment less than 0.4 kW 1/2 HP, provide vibration isolation grommets at the support points.

.3 Provide seismic restraint for all equipment including all seismic restraint related hardware (bolts and anchors) from point of attachment to equipment through to and including attachment to structure. The required anchors shall be indicated on the shop drawings and shall be clearly identified for the correct location and to be readily identified after installation. Provide clear instructions for their installation. Refer to Section 23 05 49 - Seismic Restraints.

.4 Ensure isolation systems have a vertical natural frequency no higher than one third of the lowest forcing frequency, unless otherwise specified, recommended or indicated. Use dynamic stiffness correction factors for elastomers and do not exceed 60 durometers.

.5 Isolators and restraining devices, which are factory supplied with equipment, shall meet the requirements of this section. Isolation supplier to check with pump supplier for number and location of isolators and if there is a requirement for structural or inertia bases.

.6 For isolated equipment, design anchors, bolts, isolators and bases to meet Code requirements. For larger isolators, where the Code requirement cannot be met by the isolator housing, provide Type 6P where post-disaster requirement is specified.

.7 Use ductile materials in all vibration and seismic restraint equipment.

.8 Coordinate with Section 23 33 00 "Duct Connectors – Vibration Isolation" for all ductwork connections to fans or plenums.

.9 Provide flexible connectors between equipment and piping where required by manufacturers to protect equipment from stress and reduce vibration in the piping system. Meet connector manufacturer's installation specifications as well as equipment manufacturer's requirements.

.10 Coordinate with Electrical Division 26 for the provision of a minimum 180o hanging loop of flexible conduit for all electrical connections to isolated equipment.

.11 Supply all isolators fully assembled and clearly labelled with full instructions for installation by the contractor.

PART 2 PRODUCTS

2.1 ISOLATORS - GENERAL

.1 Supply all of the vibration isolation equipment by one approved supplier with the exception of isolators, which are factory installed and are standard equipment with the machinery. Confirm with manufacturer that these factory-installed isolators meet the seismic requirements of this specification.

.2 Select isolators at the supplier's optimum recommended loading and do not load beyond the limit specified in the manufacturer's literature.

.3 Design springs in accordance with the Society of Automotive Engineers' Handbook Supplement 9 entitled "Manual on Design and Application of Helical and Spiral Springs - SAE - 1975". Provide neoprene isolators and components using maximum 60 duro "Bridge bearing quality neoprene", as defined by CSA Standard CAN3-S6-M78 Section 11.10. Ensure design of isolation and restraint elements allows adequate clearance to avoid binding.

.4 Design springs "iso-stiff" (kx/ky = 1.0 to 1.5) with a working deflection between 0.3 and 0.6 of solid deflection.

2.2 ISOLATORS - TYPE 4, HANGER MOUNTS

.1 Spring hangers, c/w 6 mm (0.24 inch) 1/4" thick neoprene cup/bushing sized for 1.3 mm (0.05 inch) .05" minimum deflection, or neoprene hangers.

.2 Standard of Acceptance:

.1 Mason HD, HS.

2.3 ISOLATORS - TYPE 4A, HANGER MOUNTS

.1 As per Type 4 except 50mm deflection.

2.4 ISOLATORS - TYPE 6P, “POST DISASTER” SEISMIC SNUBBERS

.1 Seismic stop c/w 18mm 3/4" neoprene bushing, 50 durometer maximum, and 3mm 1/8" air gap with removable sleeve for accurate installation. Snubber is to be designed to act omni-directionally and keep acceleration to the equipment during a seismic event, below the fragility level of the equipment (Equipment to function after an earthquake).

.2 Standard of Acceptance:

.1 Mason Z-1011.

2.5 CLOSED CELL FOAM GASKETS / NEOPRENE GROMMETS - TYPE 7

.1 20 mm (0.79 inch) 3/4" thick continuous perimeter closed cell foam gasket to isolate base of package type equipment, AHU's, exhaust fans, etc. from concrete floors / roof curbs. Select width for nominal 3psi loading under weight of equipment and allow for 25% compression 5mm 3/16". Increase width of curb using steel shim if necessary to accommodate gasket. For light equipment such as exhaust

fans, deflection should be a minimum of 0.05". Contractor to check fire rating requirements specified for project.

.2 Standard of Acceptance:

.1 American National Rubber-EPDM-SBR blend SCE 41 type neoprene.

.2 Mason Industries Type HG Hemi-Grommets.

2.6 PIPE RISER GUIDE / ANCHOR - TYPE 8

.1 Telescoping all direction acoustical pipe anchor consisting of two concentric steel tubes separated by 12 mm (0.47 inch) thick neoprene isolation material. Hot application isolators.

.2 Standard of Acceptance:

.1 Mason ADA and VSG (H).

.2 Generator exhausts, PRV stations, etc - CMT VA 50247/25 Cushions, CMT W302 isolators.

2.7 FLEXIBLE CONNECTORS – TYPE 9

.1 Twin sphere flexible connectors with floating flanges c/w control rods

.2 Standard of Acceptance:

.1 Mason MFTNC Connector.

.2 Mason ACC Control Cables.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

.1 Execute the work in accordance with the specifications and, where applicable, in accordance with the manufacturer's instructions and only by workmen experienced in this type of work.

.2 For all equipment mounted on vibration isolators, provide a minimum clearance of 50 mm (1.97 inch) 2" to other structures, piping, equipment, etc.

.3 Before bolting isolators to the structure, start equipment and balance the systems so that the isolators can be adjusted to the correct operating position before installing (seismically rated) anchors and/or welding.

.4 After installation and adjustment of isolators verify deflection under load to ensure loading is within specified range and isolation is being obtained.

.5 Select Type 4A spring hangers for a minimum static deflection of 50 mm (1.97 inch) 2" for all ceiling hung fans, and air handling units, steam PRV's and any other vibrating sources.

.6 Where ductwork, piping, etc., connected to or serving noise generating equipment, is routed through walls, floors, piping chases, etc. position ductwork, piping, stacks, etc. to avoid contact with the concrete structure, future framing, drywall and other finishes which may radiate noise. Use Type 2 and Type 8 mounts. Submit proposed details to meet this requirement.

.7 Provide Type 8 resilient elements in pipe anchors, where pipe anchors are within 12 meter (13.12 yard) 1188.72 cm (39 feet) of a vibrating source or if located in pipe chases.

.8 Protect neoprene isolator components from overheating or use type 8 mounts.

.9 Be responsible for ensuring that flexible duct connections (see Section 23 33 00) are installed with a minimum of 40 mm (1.57 inch) 1-1/2" metal-to-metal gap. Use flanges to ensure that flexible connectors are clear of the airstream.

.10 Provide stabilizing springs limiting movement at flexible connections to 25% of fabric width under steady state conditions and 40% at start up.

3.2 INSPECTIONS

.1 After installation of connections to resiliently mounted equipment;

- .1 remove shims and blocking and adjust mountings to level equipment,
- .2 adjust connections, hangers, snubbers, and restraints ,
- .3 ensure that there is no physical contact between isolated equipment and building structure.

.2 On completion of installation and start-up of equipment;

- .1 make arrangements for manufacturer/supplier of Vibration Isolation equipment to visit site, check performance of systems, inspect installation, adjust seismic restraints, and submit written recommendations,
- .2 The supplier shall aid the contractor as necessary during the course of installation of isolation equipment.
- .3 provide notice 24 hours in advance of this site visit.
- .4 The supplier shall submit a statutory declaration to the Consultant stating that the complete vibration isolation installation is installed in accordance with his drawings and instructions and operates to his satisfaction. Form MF175 in Section 23 06 02 should be used for this purpose.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of

.1 Local Building By-Law and

.2 The British Columbia Building Code 2024.

.2 In undertaking the Design, consider the need to protect the life and safety of all Facility occupants and the need for continuing services following catastrophic events such as earthquakes, severe weather, epidemics, chemical spill, disruption to service utilities and internal events such as fire. Particular attention should be paid to the Acute Care Facilities, generators, transformers and service connections.

1.3 APPLICABLE CODE AND STANDARDS

.1 This project is deemed to be a post-disaster design.

.2 Comply with the latest edition of the following:

.1 SMACNA - “Seismic Restraint Manual Guidelines for Mechanical Systems”

.2 NFPA 13 - “Installation of Sprinkler Systems”

.3 ASHRAE - “HVAC Applications, Seismic and Wind Restraint Design”

.4 Applicable Codes and Standards.

.5 VISCMA (The Vibration Isolation and Seismic Control Manufacturers Association)

.6 Manufacturers Standardization Society of Valve and Fittings Industry (MSS): MSS SP-127 Bracing for Piping Systems Seismic - Wind - Dynamic Design, Selection, Application.

1.4 SCOPE OF WORK

.1 Provide restraint on all piping, ductwork, equipment and machinery, which is part of the building mechanical service systems to prevent injury or hazard to persons and equipment and to retain equipment in its normal position in the event of an earthquake. This specification covers equipment, which is not specifically covered in SMACNA.

.2 Provide all seismic restraint related hardware, (including bolts and anchors) from point of attachment to equipment through to and including attachment to structure.

.3 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

.4 Seismic restraints may only be omitted where permitted by SMACNA.

.5 Provide design, selection and provision of materials, installation instructions, installation and inspection of seismic restraint of mechanical piping, ductwork, fire protection and equipment.

.6 The requirements under this Section are in addition to the requirements for equipment, piping and duct supports and vibration isolation specified in other Sections.

.7 Where specifications of materials of this Section differ from those in other Sections, this Section governs, including but not limited to vibration isolation devices.

.8 Provide cable restraints on all isolated equipment and seismic restraint on all other equipment, piping and ductwork, all in general accordance with SMACNA Guidelines (see Products).

.9 Power-actuated or drop in fasteners shall not be used to resist tension forces for the support or restraint of the HVAC, plumbing and fire suppression systems or their components. All fasteners shall be reviewed and approved by the Supporting Professional Engineer for Seismic Restraints prior to installation.

.10 Provide support frame and seismic restraint for all mechanical services as per all applicable Codes and Standards. The Div. 23 contractor is responsible for the related design and implementation. The design and fabrication shop-drawings (showing all piping and all supports/restraints) shall be by a registered structural/seismic engineer, coordinated and engaged by the Div. 23 contractor. Allow accordingly.

.11 All support frames and seismic restraints required for mechanical services shall be provided by this Contractor (Div. 23), in accordance with the Seismic P.Eng recommendation

.12 Submit shop drawings for all the pipe, equipment, and duct support frames / racks. Shop drawings shall include the thermal, gravity and lateral / seismic forces at the anchor points, steel specifications, detail of anchor / attachment to building structure, and etc. Indicate resulting forces at all base building attachment points for review by the consultant.

.1 Mechanical contractor shall visit the site and allow for relocation of existing services to suite the location of equipment, pipe and duct support frames in their tender bid. Coordinate with LMH FMO for required shutdowns.

1.5 SEISMIC RESTRAINT DESIGN AND INSPECTION

.1 Arrange and pay for the services of a B.C. registered professional engineer who specializes in the design and restraint of mechanical systems. This engineer, herein referred to as the seismic engineer shall provide all required engineering services related to support and seismic restraints of ductwork, piping and non-vibration isolated equipment as indicated below. For vibration isolated equipment the Engineer shall coordinate with vibration isolation supplier.

.2 Support and restraint analysis shall include all incidental forces such as dead weight, thermal expansion load, thrust, wind, snow, and any vibratory loads. The analysis shall be derived from the service layout provided by the Mechanical Contractor, to accurately represent the conditions upon completion of the installation.

.3 The seismic engineer shall aid the contractor as necessary during restraint of equipment, ductwork and piping.

.4 The seismic engineer shall inspect the completed seismic installation and shall submit a statutory declaration to the consultant stating that the complete seismic installation is installed in accordance

with his drawings and instructions and it complies with the regulatory requirements. Form MF174 in Section 23 06 02 should be used for this purpose. Prior to substantial performance, the seismic engineer shall provide letters of assurance for all mechanical, plumbing and fire protection systems.

1.6 SUBMITTALS

.1 Submit shop drawings of all restraining devices, not covered in the SMACNA Guidelines, including details of attachment to the structure, either tested in an independent testing laboratory or approved by a B.C. registered professional engineer.

.2 Submit shop drawings in accordance with Division 1.

.3 Submit test certificates for each seismic restraint device, identifying maximum tested load capacities.

.4 Submit calculations for each piece of restrained equipment, piping, ductwork and conduit, including seismic forces, restraint selection, and selection data.

.5 Provide a calculation analysis summary (spreadsheet is acceptable) for each piece of equipment, including the following information:

- .1 Equipment ID
- .2 Floor level
- .3 Horizontal seismic force factor
- .4 Equipment weight
- .5 Horizontal seismic force
- .6 Vertical uplift seismic force (where applicable)
- .7 Equipment centre of gravity in three directions
- .8 Design condition (worst case) overturning moment
- .9 Number of restraint fastenings
- .10 Pull-out tension per fastener
- .11 Horizontal shear per fastener
- .12 Pull-out tension load rating per fastener
- .13 Horizontal shear rating per fastener.

.6 Include worst case combination of tension and shear loads at each snubber and restraint location.

.7 Include anchor bolt diameters, embedment depth, full welding details including type and length for field welds, and required housekeeping base dimensions.

.8 Calculations to be sealed by a Professional Engineer licensed in the province of British Columbia.

.9 Proposed inserts or connections to structure to follow directions of project structural consultant.

.10 Proposed inserts or connections to structure to follow directions of project structural consultant.

1.7 QUALITY ASSURANCE

.1 Pre-Construction meeting:

.1 Request and arrange a meeting with the Consultant to review seismic restraint approach, prior to any restraint installation. Obtain approval from the Consultant before commencing work.

.2 Testing and Review

.1 Install the first three lateral and three longitudinal braces for each of: each fire protection systems; one (1) building service piping system; and one (1) ductwork system.

.2 Request and arrange for a review of the installation by the Consultant. Obtain approval of the installation before commencing remainder of the work.

.3 Provide services of the manufacturer's technical representative to conduct site inspections of the Work in progress, and to conduct a final inspection of the work. Provide a copy of the final inspection report to the Consultant for review.

.4 Request and arrange for a construction review by the Consultant of the completed seismic restraint installation, before any ceilings are installed.

PART 2 PRODUCTS

2.1 DESIGN CRITERIA

.1 Mason Type SCB (Seismic Cable Brace) slack cable restraints supplied by Vibra-Sonic Control.

.2 Restraint systems as indicated in 2008 SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems" (third edition), Seismic Hazard Level SHL A. If lesser restraint than recommended by SMACNA SHL A is proposed to meet local Code seismic requirements, provide shop drawings of details certified by a B.C. registered structural consultant.

.3 Design seismic restraint systems to conform to the British Columbia Building Code for the project location:

.4 For all pipework and duct systems, the vertical uplift force is restrained by the systems as defined in the SMACNA standard.

2.2 SEISMIC SNUBBER RESTRAINTS

.1 Single-Axis Limit Stop Snubber Assemblies:

.1 steel construction, attached to equipment structure and equipment, maximum of 6 mm (0.24 inch)¼" seismic movement.

.2 designed to restrict movement in one axis.

.3 minimum 6 mm (0.24 inch)¼" thick resilient neoprene pads to prevent metal-to-metal impact.

.4 minimum four (4) snubbers for each piece of equipment.

.2 Multi-Axis Limit Stop Snubber Assemblies:

.3 interlocking steel construction, attached to equipment structure and equipment, maximum of 6 mm (0.24 inch)¼" seismic movement.

.4 designed to restrict movement in two (2) or three (3) axis.

.5 minimum 6 mm (0.24 inch)¼" thick resilient neoprene pads to prevent metal-to-metal impact.

.6 minimum two (2) snubbers for each piece of equipment.

2.3 SEISMIC VIBRATION ISOLATORS

.1 All Direction Neoprene Isolator:

.1 Molded, oil resistant neoprene compound, with encapsulated cast-in-place top steel load plate, and steel base plate with anchor holes designed for seismic loads in all directions with no metal-to-metal contact.

.2 Restrained Spring Isolator – Constant Load:

.1 Colour coded seismic-controlled spring isolator, single or multiple spring coils, with minimum 6 mm (0.24 inch)¼" neoprene pad.

.2 Removable coil spring element without having to disturb supported equipment.

.3 Lateral stiffness greater than 1.2 times rated vertical stiffness.

.4 Minimum 50% overload capacity

.5 Non-welded spring elements: epoxy coated, with a minimum 1000 hour rating when tested in accordance with ASTM B117.

.6 Steel housing design to limit lateral and vertical movement of the supported equipment.

.7 Neoprene snubber, to limit maximum equipment movement in any direction to 6 mm (0.24 inch)¼".

.8 Adaptor base suitable sized for larger anchors, when required to suit anchorage capacity.

2.4 RESTRAINED SPRING ISOLATOR – VARIABLE LOAD:

.1 colour coded seismic-controlled spring isolator, single or multiple spring coils, with minimum 6 mm (0.24 inch)¼" neoprene pad.

.2 removable coil spring element without having to disturb supported equipment.

.3 lateral stiffness greater than 1.2 times rated vertical stiffness.

.4 minimum 50% overload capacity

.5 non-welded spring elements: epoxy coated, with a minimum 1000 hour rating when tested in accordance with ASTM B117.

.6 steel housing design to limit lateral and vertical movement of the supported equipment.

.1 top load plate with adjustable and leveling bolts.

.7 adjustable vertical restraints

.8 isolation washers

.9 bottom load plate with internal non-skid isolation pads and anchor holes

.1 hot dipped galvanized for outdoor installations.

.10 neoprene snubber, to limit maximum equipment movement in any direction to 6 mm (0.24 inch)¼".

.11 adaptor base suitable sized for larger anchors, when required to suit anchorage capacity.

2.5 PIPING AND DUCTWORK RESTRAINT

.1 Cable Restraints for Suspended Piping and Ductwork:

.1 manufactured system consisting of cable, building attachment, and vertical rod reinforcement assembly,

.2 field-built assemblies are not acceptable,

.3 steel wire strand cables:

.1 galvanized steel aircraft cable

.2 sized for seismic load with a safety factor of 2,

.3 arranged for restraint in both longitudinal and transverse directions.

.4 Rope connections: overlap wire “U” clips, or, tool-less wedge insert lock connectors.

.5 Connector strength rating equal to 90% of cable breaking strength rating.

.4 Building and equipment attachment brackets: designed to permit free cable movement in all directions up to a 45 degree misalignment:

.1 protective thimbles at sharp corners to protect against cable wear,

.2 Selected to exceed the cable working design load by 50%,

.3 Single sided “C” beam clamps are not acceptable.

.5 Vertical Suspension Rods:

.1 braced to avoid potential for buckling due to vertical up-lift forces,

.2 structural steel angle or formed channel brace selected to prevent support rod buckling,

.3 brace attached to support rod with a series of adjustable clips, without the use of hand-tools.

.2 Steel angles or channels:

.1 sized for seismic load with a safety factor of 2,

.2 arranged for restraint in both longitudinal and transverse directions.

.3 Rigidly Mounted Equipment Restraint

.1 Undercut or Heavy-Duty Sleeve type, for post concrete-cure installation:

.2 carbon steel bolt, nut and sleeve,

.3 selected for concurrent shear and tension loads with a safety factor not less than 2.0 x estimated load.

PART 3 EXECUTION

3.1 GENERAL

.1 Design seismic restraints to:

.1 keep equipment in place during and after seismic events in accordance with local building code,

.2 resist vertical loading simultaneously with transverse or longitudinal seismic loading .

.2 It is the responsibility of the contractor to ascertain that an appropriate size device be selected for each individual piece of equipment.

.3 Give special consideration to design for adjacent connections, insulation treatment, thermal movement, vibration isolation, and relation to building seismic joints.

.4 Building structure attachments;

.1 concrete construction:

.1 cast in place anchor

.2 drill-in wedge anchor

.2 steel construction:

.1 double sided beam clamp, loaded perpendicular to beam, or

.2 specifically designed welded or bolted connection.

.3 single sided “C” type beam clamps for support rods for piping, ductwork, conduit, bus duct, cable trays or other equipment are unacceptable as seismic restraint anchor points.

.4 Brace installation;

.1 install cable restraints snug,

.2 install solid braces only in rigidly supported situations,

.3 brace hanger rods forming a part of seismic restraint to accept resulting compressive loads,

.4 transverse and longitudinal braces to be no more than 45° above or below centerline of pipe, duct, or tray.

.5 Equipment:

.1 equipment secured rigidly to wall, floor, or housekeeping pad to have resilient neoprene bushings and washers between equipment and anchor bolts.

3.2 SELECTION OF BRACING DETAILS

.1 Select application type;

.1 single hanger or

.2 trapeze support.

.2 Determine required force level, based on weight of equipment and specified factors.

.1 With required force level, develop transverse and longitudinal brace spacing for single or trapeze hanger in accordance with;

.2 break length into separate straight runs, which are considered to be single straight section between any bends except where bend is at an offset of less than 610mm (2 ft),

.3 brace each straight run in transverse direction at both ends. Check required spacing for transverse bracing and compare it to the length of straight run. If length of straight run is greater than allowable distance for transverse bracing add transverse braces until spacing does not exceed allowable transverse brace distance,

.4 each straight run must have at least one longitudinal brace. Add longitudinal braces so that the spacing does not exceed allowable longitudinal brace spacing. Transverse brace may act as longitudinal brace for an adjacent run when it is located within 610mm (2 ft) of adjacent straight run,

.5 where several short runs occur one after other, each straight run requires longitudinal brace when adjacent short runs exceed offset length of 610mm (2 ft). When adjacent short runs do not exceed maximum offset length the longitudinal braces can act as transverse braces as long as allowable transverse brace spacing is not exceeded. Multiple offsets can be treated as single run when the total offset is less than maximum offset length,

.6 when flexible connection or swing joint is used, such as at pipe drop to mechanical equipment, pipe may cantilever at length equal to or less than half allowable transverse brace spacing. When pipe drop cantilever is greater than half allowable transverse brace spacing, support to floor is required.

.3 Select brace anchorage detail.

.4 Calculate hanger rod load and select rod attachment to structure to suit.

.5 Check if rod stiffeners are required to prevent hanger rod from buckling under compressive load.

3.3 AIR TERMINALS

.1 Where air terminals are installed in mechanical grid ceilings, provide at least two 12 ASWG galvanized steel wire seismic security bridles per air terminal tied either to the building structure or to ceiling hanger wires.

.2 Attach security bridles at opposite corners of each air terminal and in such a manner that the air terminal cannot fall.

.3 Provide all necessary brackets for attachment of security bridles to the air terminals.

3.4 MIXING BOXES AND AIR VALVES

.1 Provide seismic restraints in accordance with details in SMACNA Guidelines or alternatively slack cables may be used.

3.5 ISOLATED PIPING AND EQUIPMENT

.1 Suspended Vibration Isolated Equipment

.1 Provide restraint in accordance with the SMACNA guideline and manufacturers' instructions.

.2 Do not mix cable restraints and rigid bar restraints on the same piping or duct system, except:

.1 On piping or ductwork which is suspended on vibration isolators, use cable type SCR restraints and provide a small amount of slack in the cable to prevent vibration short-circuiting.

.3 Select basic vibration isolator as per Section 23 05 48.

.4 Provide cable restraints in longitudinal and lateral directions.

.5 Provide hanger rod reinforcement.

.6 Do not use ductwork or piping restraints to restrain equipment.

.2 Recessed wall-mounted Equipment and Panels

.1 Same as for surface mounted equipment, except fasten through top bottom and sides of panels to adjacent block wall or wall studs.

.3 Install cables using appropriate grommets, shackles, and other hardware to ensure alignment of the restraints and to avoid bending the cables at connecting points.

.4 Connect slack cable restraints to ceiling hung equipment in such a way that the axial projection of the wires passes through the centre of gravity of the equipment.

.5 Orient restraint wires on ceiling hung equipment at approximately 90 degrees to each other (in plan), and tie back to the ceiling slab at an angle not exceeding 45 degrees to the slab.

.6 On piping systems, provide transverse slack cable restraints at a maximum spacing of 12 meter (13.12 yard) 40 ft and longitudinal restraints at 24 meter (26.25 yard) 80 ft maximum spacing, or as limited by anchor/slack cable performance.

.7 Transverse bracing for one pipe section may also act as longitudinal bracing for the pipe connected perpendicular to it, provided the bracing is installed within 600 mm (23.62 inch) 24” of the elbow or T, and if the connected pipe is the same or smaller in size. Do not use branch lines to restrain main lines.

.8 Provide flexibility in piping joints or sleeves where pipes pass through building seismic or expansion joints.

.9 At vertical pipe risers, wherever possible, support the weight of the riser at a point or points above the centre of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed the transverse spacings discussed above for horizontal pipes, with guide clearance not exceeding 3 mm (0.12 inch) 1/8”.

.10 Vary adjacent spacing of restraints on a piping run by 10% to 30% to avoid coincident resonances.

.11 Install restraints at least 50 mm (1.97 inch) 2" clear of all other equipment and services.

.12 Adjust restraint cables such that they are not visibly slack, or such that the flexibility is approximately 40 mm (1.57 inch) 1-1/2" under thumb pressure for a 1.5 meter (1.64 yard) 5 ft cable length (equivalent ratio for other cable lengths). Adjust the clearance at cable strap/spacer piece restraints to not exceed 6 mm (0.24 inch) 1/4".

.13 Provide transverse and axial restraints as close as practical to a vertical bend.

.14 At steel trusses, connect to top chords and follow truss manufacturer's instructions.

.15 For post disaster installations, provide vertical rod stiffeners when rod length is greater than 50 rod diameters.

.16 The maximum spacing between transverse and longitudinal restraints for piping and ductwork shall be 25% less than specified in SMACNA for SEISMIC Hazard Level (SHL) A.

3.6 MANUFACTURER’S SERVICES

.1 Review design drawings and specifications, and shop drawings.

.2 Provide design and selection of seismic restraints, and preparation of shop and installation drawings.

.3 Provide training of contractor personnel for the installation of seismic restraints.

.4 Conduct site inspections of the Work in progress, and to conduct a final inspection of the work. Provide a copy of the final inspection report to the Consultant for review, including photographs of representative installa tions of each type of restraint used in the Work.

.5 Provide services of the manufacturer's technical representative to conduct site inspections of the Work in progress, and to conduct a final inspection of the work. Provide a copy of the final inspection report to the Consultant for review.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 APPLICABLE CODE AND STANDARDS

.1 Mechanical systems identification, including piping, ducts and equipment, shall be in accordance with the latest edition of:

- .1 CSA B149.1 and B-139.1
- .2 CSA Z317.1 and Z317.2
- .3 CAN/CGSB-24.3
- .4 ANSI/ASME A13.1
- .5 CSA Z-7396.1

.2 Label all systems clearly, including painting and labelling of all pipes, ceiling identification dots, valve tagging, and emergency valve identification signage. Facility labeling system shall follow the same standard of the LMH labeling system. Submit proposed details for approval as part of shop drawing process.

1.3 SHOP DRAWINGS

.1 Submit list of nameplates, with proposed wording, prior to engraving.

.2 Submit sample board with pipe and duct identification materials.

.3 Identification Schedules

- .1 Submit schedules of the following for review, prior to framing:
  - .1 Pipe Identification Colours.
  - .2 Valves.
  - .3 Ceiling Access Identification Colours.
  - .4 Duct Access Identification Colours.
- .2 Schedules will be required in each major mechanical room and at least one schedule will be required on each floor having a minor mechanical room. Frame schedules under glass in matching frames and hang where directed.
  - .1 Include one copy of schedules in each operating and maintenance manual.

1.4 EQUIPMENT IDENTIFICATION

.1 Manufacturer's Nameplates

- .1 Each piece of manufactured equipment shall have a metal nameplate, with raised or recessed letters. Mechanically fasten plate to equipment.

.2 Manufacturer's nameplates shall indicate manufacturer's name, equipment model, size, serial number and electrical characteristics and pertinent information for any other services connections.

.3 Include ULC, (Underwriters' Laboratories Canada) or CSA, (Canadian Standards Association) registration logos and those of other agencies, as required by the respective agencies.

.4 Nameplates shall be located so that they are easily read. Do not insulate or paint over nameplates.

.2 System Nameplates

.1 Each piece of equipment shall be identified with its equipment schedule identification. Follow equipment naming in the mechanical equipment schedule.

.2 Provide laminated plastic plates with black face and white center.

.3 Identification letters for equipment shall be:

.1 3.2mm thick black lamacoid with laser etched white copy

.2 Size: 90mm wide x 40mm high

.3 Tape mount backs

.4 Apply nameplates securely in conspicuous places, on cool surfaces and out of direct sunlight.

.5 Identify systems, and areas or zones of building being serviced.

1.5 PIPING IDENTIFICATION

.1 Piping Identification

.1 Each piping system shall be colour coded for identification and labelled with the system identification code letters, including temperature and pressure, if applicable, and directional flow arrows in accordance with the Pipe Identification Colour Schedule. See diagram for sizes of lettering and bands.

.2 Identify piping (pipe markers and direction arrows) at the following locations:

.1 Adjacent to major valves and where valves are in series at no more than 2000 mm (78.74 inch) 6'-6" intervals.

.2 At least once in each room and at 15 meter (16.4 yard) 1524 cm (50 feet) maximum spacing in open areas..

.3 On both sides where piping passes through walls, partitions and floors.

.4 Adjacent to all major changes in direction.

.5 At point of entry and leaving each pipe chase and/or confined space and piping accessible at each access opening.

.6 At the beginning and end points of each run; and, at each piece of equipment in each run.

.3 Identification labels may be stencilled. Identification arrows labels and letters may be vinyl cloth (Brady B500) or vinyl film (Brady B946), with adhesive compatible with the surface temperature.

.4 Identification colour bands for primary and secondary colours to indicate the type and degree of hazard shall be applied to overlap a minimum of 150 mm (5.91 inch) 6". Ends to be stapled. Bands

shall be Brady B550 vinyl cloth tape or Brady B946 vinyl tape, with adhesive compatible with the surface temperature.

1.6 VALVE TAGS

.1 Provide valve identification tags and secure them using non-ferrous chain braided band or plastic band (suitable for temperature). Tags may be of brass, aluminum, metalphoto, lamicoid or fiberglass, stamped or engraved, of 25 mm (0.98 inch) 1" minimum diameter.

.2 Valves to be tagged include:

- .1 Valves on all main piping circuits.
- .2 Valves on all major branch lines.
- .3 Valves on minor branch lines in horizontal service spaces, vertical service spaces and mechanical equipment rooms.
- .4 Drain valves and hose bibbs on systems containing glycol.
- .5 Control valves.
- .6 DO NOT: Tag valves on control valve stations, fixture stops, or system drain valves.

.3 Schedule the valve numbers using a sequential numbering system indicating location, service and normal position (open or closed). Numbers shall be prefixed by the letter "P" or the letter "H" indicating that the vaBylve is on plumbing or heating service.

.4 Obtain a sample valve tag numbering schedule and valve tag sequence from LMH FMO.

1.7 DUCTWORK IDENTIFICATION

.1 Identify plenum access doors as to accessed items, e.g. Filter F-1, Supply Fan SF-1, Cooling Coil CC-1.

.2 Stencil on all plenum doors, downstream from air filter bank. "Do not open when fan operating".

.3 Identification letters shall be 50 mm (1.97 inch) 2" high black letters on white background. Flow arrows shall be 50 mm 2" wide by 150 mm 6" long black arrows on a white background. Stencil over final finish only.

1.8 CEILING ACCESS IDENTIFICATION

.1 Secure 6 mm (0.24 inch) 1/4" self-adhesive coloured dots, (Brady Quik Dots or Avery Data Dots), to the ceiling, to identify the location of access to equipment concealed above the ceiling according to the following schedule:

Service / Element	Identification Colour
Concealed equipment and cleaning access	Yellow
Control equipment, including control valves, dampers and sensors	Black
Fire and smoke dampers	Red
Fire protection including sprinkler equipment including drains	Red
Heating water, DCW, DHW isolation valves	Green

Pipe mounted equipment, other than fire, smoke and sprinkler equipment	Green

.2 When T-bar ceilings are installed adhere coloured dots to T-bar framing, adjacent to panel to be removed.

1.9 DUCT ACCESS IDENTIFICATION

.1 Secure 50 mm (1.97 inch) 2" high, Gothic style self-adhesive stick on-letters, (Letrasign or Brady Quick-Align) on duct access panels to identify their usage, according to the following schedule:

Service / Element	Colour	Letters
Cleaning and service access	Black	C.A
Controls including sensors	Black	C
Dampers, (backdraft, balance and control)	Black	D
Fire dampers	Red	F.D.
Smoke dampers and detectors	Red	S.D.
Fire smoke dampers	Red	F.S.D.

1.10 TAGGING IDENTIFICATION

.1 Secure engraved laminated plastic identification tags (black face and white centre) on the following items:

.1 Temperature control instruments, gauges and panels, coordinated with control diagrams identification.

.2 Electrical switchgear supplied under the Mechanical Division 15 21, 22, 23.

.3 Refer also to the Controls Section.

1.11 IDENTIFICATION SCHEDULES

.1 Submit schedules of the following for review, prior to framing:

.1 Pipe Identification Colours.

.2 Valves.

.3 Ceiling Access Identification Colours.

.4 Duct Access Identification Colours.

.2 Schedules will be required in each major mechanical room and at least one schedule will be required on each floor having a minor mechanical room. Frame schedules under glass in matching frames and hang where directed.

.1 Include one copy of schedules in each operating and maintenance manual.

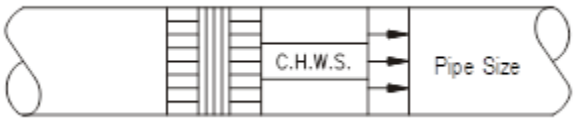
.3 Read in conjunction with all other mechanical documents. If any of the services shown on mechanical drawings are not listed in the table below, include them in the scope of work.

1.12 PIPE IDENTIFICATION COLOUR SCHEDULE

Service	Identification Lettering	Primary Colour	Secondary Colour
Domestic H.W. Recirc.	DOM.HW.CIRC	Yellow	Black
Domestic H.W. Supply	DOM.HW.SUPPLY	Yellow	Black

Domestic C.W. Supply	DOM. CWS	Green	Black
Fire lines W.S.	W.S.	Red	White
Glycol Heating Return	GLR - do not drain	Yellow	Black
Glycol Heating Supply	GLS - do not drain	Yellow	Black
Hot Water Return	HEATING RETURN	Yellow	Black
Hot Water Supply	HEATING SUPPLY	Yellow	Black
Safety Valve Blowdown	-	Yellow	Black
Sprinkler Lines	S.P.R.	Red	White
Sanitary	SAN	Green	White
Plumbing Vent Line	SAN. VENT	Green	White

1.13 PIPE IDENTIFICATION BANDING COLOURS



.1 LETTERS:

.1 15 mm (0.59 inch) 1/2" high – 32 mm (1.26 inch) 1-1/4 NPS pipe & smaller.

.2 25 mm (0.98 inch) 1" high – 40 mm (1.57 inch) 1-1/2 NPS up to 65 mm (2.56 inch) 2-1/2 NPS pipe.

.2 BANDS:

.1 38 mm (1.5 inch) 1-1/2" wide, except flow arrow bands 50 mm (1.97 inch) 2" wide.

.3 COLOURS:

.1 Horizontally hatched - primary colour.

.2 Vertically hatched - secondary colour.

.3 Black letters and arrows on yellow primary colour.

.4 Background, white letters and arrows or red, blue or green backgrounds.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Sections 01 91 13 – Commissioning General Requirements and 23 08 00 – Commissioning of Mechanical for additional responsibilities.

1.2 CODES AND STANDARDS

.1 Procedures shall be in accordance with AABC'S National Standards for Field Measurement and Instrumentation and ASHRAE Standards.

1.3 CONTRACTOR QUALIFICATIONS

.1 Prior to finalizing contractual arrangements with the balancing agency, submit the names, qualifications and years of direct field testing and balancing experience in the testing and balancing field for all members of the balancing team that is scheduled to carry out the balancing work.

.1 The senior site technologist must have a minimum of five years testing and balancing experience of similar projects.

.2 Provide a list of a minimum of ten comparable projects successfully completed by all key members of the balancing team.

1.4 TESTS

.1 Give at least written 48 hour notice of date for tests or longer if possible (due to travel time required to get to site).

.2 Do not externally insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

.3 Conduct tests in presence of Consultant. Arrange for the Owner’s representative to be present.

.4 Bear costs including retesting and making good.

.5 Refer to Piping Sections for specific test requirements.

.6 Refer to Ducting Sections for specific test requirements.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

1.5 TESTING AND BALANCING

.1 General

.1 Employ an approved independent testing and balancing agency to test and balance the following systems.

.1 Supply air system;

.2 Exhaust air system;

.3 Return air system;

.4 Lab fume hood exhaust air system;

.2 The Agency shall be responsible to the Contractor but report jointly to the Consultant and the Contractor. Report in writing to the Consultant any lack of cooperation and any discrepancies or items not installed in accordance with the contract documents.

.3 The balancing agency shall agree to perform spot checks, where requested, in the presence of the Consultant's designated representative.

.4 Work with the agency to:

.1 Ensure that all mechanical systems are complete and ready to be balanced and provide sufficient time for testing and balancing prior to substantial performance.

.2 Make corrections to achieve system balance without delay, include all corrections made during the balancing procedure on "As Built" Drawings. Mechanical Contractor to provide “As Built” information to the balancing agency before balancing commences.

.3 Adjust fan drives, change blade pitch angles and change sheaves and belts as directed by the agency.

.4 Maintain all systems in full operation during the complete testing and balancing period.

.5 Employ control technicians to adjust the control systems to facilitate the balancing process.

.6 Employ the journeyman millwright to check the alignment of any V-belt drives and/or shaft coupling drives if they have been adjusted during the balancing process. Belt tension correctness to be verified.

.5 Consult with the Consultant to clarify the design intent where necessary or in case there are any problems foreseen as the balancing processes.

.6 Complete air balance before commencing water balance where heating/cooling coils are installed in the air system. Balancing shall not commence until systems have been cleaned and treated and the air removed from within the piping systems.

.7 Accuracy: Balance to maximum flow deviation of 10% at terminal device and to 5% at equipment. Measurements to be accurate to within plus or minus 5% of actual values. Please note that the Pharmacy clean and ante rooms need to be balanced within the required differential pressures indicated in the NAPRA model standards.

.8 This agency shall remove and re-install ceiling tile to provide access to ductwork and piping. The balancing agency will make good any damage or soiling caused by his forces.

.9 Instrument calibration: At the Consultants request, the balancing agency shall submit a dated calibration chart for all instruments.

.10 Permanently mark final settings on valves, dampers and other adjustment devices. Set and lock all memory stop balancing devices.

.11 Seal all holes with snap plugs or approved alternate method, used for flow and pressure measurements.

.12 The controls contractor and balancing agency are to allow for checking and making adjustments during the 12-month warranty period, when weather conditions provide natural loads and in cases where complaints arise.

.13 Submit a draft balance report to the Consultant for approval and submit approved copies to the agency preparing the O & M manuals for inclusion in each operating and maintenance manual. Provide field notes in the balancing report to clearly identify unusual conditions, problem areas and report on any cases where the specified flow rates or conditions could not be achieved by adjustment. Identify outstanding problems that cannot be corrected by the balancing team or that will not be corrected by the installing trades (e.g. in cases where additional balancing dampers are required).

.14 Submit a statutory declaration to the Consultant, certifying that the testing and balancing procedures have been completed, that complete factual reports have been distributed and that directions have been given to the Contractor to correct faults and omissions and, finally, that follow-up testing, after correction of faults and omissions, has been completed and recorded. Reports to be signed by the senior member of the balancing team.

.15 Employ the testing and balancing agency to test all fire dampers as follows:

.1 Test all fire dampers (including combination smoke/fire dampers). The test shall be made by releasing the fusible link and witnessing closure of the damper. All fire dampers shall be left in the open position.

.2 A set of prints shall be marked up to show that each damper has checked for closure, accessibility and installation or provide schematic mechanical drawing showing all fire damper locations, label all fire dampers on drawing. The prints shall be certified correct by the agency and submitted to the consultant with completed test certificates.

.16 Prior to demolition, in renovated areas, measure and record supply, return and exhaust airflow into existing areas that are not included in the renovations. After renovations are completed, rebalance existing branches to the conditions as found in the pre-construction measurements. Provide written report indicating all areas that have been pre-measured including Pitot tube traverse sheets.

.17 Adjust duct and terminal balance dampers and adjust or change drive sheaves and fan blade pitch angles to obtain design quantities (within +/-10%) at each outlet and inlet.

.18 Use terminal balance dampers to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. The sheet metal sub-contractor shall provide additional dampers where required by the balancing agency to achieve a satisfactory balance without creating objectionable sounds levels.

.19 Make air quantity measurements in ducts by "Pitot Tube" traverse of entire cross-sectional area of duct. Provide a Pitot tube traverse test sheet for each major duct branch.

.20 Measure air quantities at each air terminal.

.21 Maintain the design relationship between the supply and exhaust air system quantities.

.22 Check to ensure that supply and return air quantities provide reasonable building pressurization. Test building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. Exit doors and elevator shafts should be checked for air flow so that exterior conditions do not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

.23 Adjust the air terminals to obtain the optimum air distribution pattern. The total airflow through each air valve/mixing box should be adjusted and reported by the balancing agency for maximum and minimum flow conditions.

.24 Controllers on air valves/mixing boxes are to be checked by the controls contractor and the commissioning agent and they shall also verify that room thermostats / sensors are cycling valves/mixing boxes properly.

.25 Air systems shall be balanced with clean filters in place, at a total of 105% to 110% of specified total airflow rates.

.26 Where variable air volume systems are installed, take measurements at maximum and minimum flows. Record the minimum operating duct static pressure setpoint for each air handling system.

.27 Balance of the rooms in the pharmacy to ensure that the air flow into or out of the rooms is in the correct direction. Balance to maintain the required pressures. Report to the Consultant where the desired pressure differential cannot be achieved within 10% of the design values for further direction. This may indicate a problem with how well the rooms are sealed or excessive leakage needs to be dealt with.

.28 The Balancing Agency shall include for return visits for readjustment of systems after the owner has moved in.

.29 Include in the air balance report:

- .1 Date of test, Name and address of building and balancing technician's name.
- .2 Range of outdoor air temperature during the balancing period.
- .3 System schematics indicating damper positions, design and measured air quantities at each inlet and outlet. Show room numbers and floors.
- .4 If installation permits, record both air terminals and fan discharge traverse air volumes to establish system leakage.
- .5 Main branch duct traverses. Maximum and minimum outdoor air quantities.
- .6 Static pressure across each component in an air handling system at full flow.
- .7 Face velocities across major components such as filter or coils.
- .8 Static pressure across each fan.
- .9 System static pressures at selected points throughout a VAV supply duct system and in main branch ducts in low velocity systems.
- .10 Fan and motor speed.
- .11 Motor size, starting time, amps and voltage.
- .12 Coil air entering and leaving temperatures (D.B. and W.B.).
- .13 Maximum and minimum zone supply air temperatures under prevailing conditions at time of test.
- .14 Provide fan performance curve for each new air handling system.
- .15 Air pressure map (i.e. positive, negative, neutral) and directional airflow for all spaces.

.16 Contractor to re-balance the supply air, exhaust air and return air systems of the space as well as the existing mains of that system.

1.6 FUME HOODS - BALANCING

.1 Certifying and balancing of all exhaust fume hoods (FH-2 and FH-3) systems shall be carried out as follows:

.1 Check room condition in front of the fume hoods using an anemometer and a smoke source to verify that the velocity of cross drafts does not exceed 20% of the specified average face velocity. Any cross drafts that exceed these values shall be eliminated before proceeding with the fume hoods tests.

.2 Determine specified average face velocity (required by NAPRA / Manufacturer) by averaging the velocity of at least nine readings taken at the BCS face. Readings shall be taken at the centres of a grid made up of three sections of equal area across the top one third, three across the centre and three across the bottom third of the fume hood face. Use of a thermal anemometer or equivalent is recommended for this test. Adjust exhaust fan as required to achieve specified average face velocities within minus 0% and plus10%.

.3 Smoke tests shall be conducted at fume hoods face openings. These tests are to be used as an evaluation of spillage or backdraft conditions at all levels and positions across face opening. Small smoke gun is recommended for these tests.

.4 Upon completion of these tests, a report analysis shall be prepared which will list the following final conditions:

.1 Exhaust fan operating characteristics including speed, static pressures, motor amperages and total exhaust flow.

.2 Position of hood sash.

.3 Face velocity readings taken at fume hoods opening.

.4 Results of smoke test spillage tests.

.5 Operating condition of surrounding area air conditioning or supply air system.

END OF SECTION

Part 1 General

PART 1 MECHANICAL FORMS

1.01 MF 100 CHECK LIST – SUBMISSIONS TO CONSULTANT

ITEM	CHECKED BY	DATE
10 WORKING DAYS BEFORE CLOSE OF SUBTRADE TENDER – Request for addition of acceptable manufacturers		
10 DAYS AFTER AWARD OF THE CONTRACT – List of equipment suppliers and subtrades – Detailed price breakdown (MF 120, 121, 122)		
A.S.A.P. – Product & Fabrication samples (MF 131) – Shop Drawings		
WITH EACH APPLICATION FOR PROGRESS PAYMENT – Price breakdown (MF 120, 121, 122)		
PRIOR TO CLOSING IN CEILINGS & SHAFTS – Duct and pipe test data - Piping Test Data (MF 141)		
PRIOR TO STARTING SYSTEMS – Checklists for start-up (MF 151, 152, 153)		
PRIOR TO COMMISSIONING SYSTEMS – Checklists for operation (MF 151, 152, 153) – Commissioning schedule		
PRIOR TO DEMONSTRATION OF SYSTEMS – Demonstration agenda		
10 DAYS PRIOR TO SUBSTANTIAL PERFORMANCE INSPECTION – Submission of items listed on Form MF-188		
WHEN REQUESTING INSPECTION OF OUTSTANDING WORK – Certificate of total completion (MF 192) – Checklist of work remaining (MF 191) – Checklists of Demonstrations (MF 181, 182, 183)		

1.02 MF 120 PROGRESS CLAIM SUMMARY – DIVISIONS 21, 22, 23

				CLAIM NO.			
				FOR MONTH OF:			
ITEM	PRICE	WORK TO DATE		PREVIOUS WORK		THIS MONTH	
	$	%	$	%	$	%	$
Base Contract Summary							
- HVAC							

- Plumbing							
- Cash Allowances							
Total Base Contract							
Change Order Summary							
Total Change Orders							
Total Contract							
Amount due less 10% mechanic's lien holdback							

A. Notes: Submit this form as called for on MF 100 for tender price breakdown and for each progress claim.

1.03 MF 121 DETAILED PRICE BREAKDOWN – HVAC

					CLAIM NO.			
					FOR MONTH OF:			
ITEM		**PRICE**	**WORK TO DATE**		**PREVIOUS WORK**		**THIS MONTH**	
		$	%	$	%	$	%	$
Mechanical								
Mobilization & Permits								
Air Handing Equipment	Matl. Lab.							
HVAC Piping & Equipment	Matl. Lab.							
Insulation – Piping & Equipment	Matl. Lab.							
Sub-total								
Sheet Metal								
Air Terminal & Access.	Matl.							
Ductwork	Matl. Lab.							

Insulation – Ductwork	Matl. Lab.							
Duct Cleaning	Lab.							
Testing & Balancing	Lab.							
Sub-total								
Refrigeration	Matl. Lab.							
Sub-total								
Controls	Matl. Lab.							
Sub-total								
Finishing								
Comm. & Demonstration								
Maintenance Manuals								
Sub-total								
TOTAL								

A. Notes:

1. Submit this form as called for on MF 100 for tender price breakdown and with each progress claim.
2. Submit a separate form for each item listed on MF 120.

1.04 MF 122 DETAILED PRICE BREAKDOWN - PLUMBING

					CLAIM NO.			
					FOR MONTH OF:			
ITEM		**PRICE**	**WORK TO DATE**		**PREVIOUS WORK**		**THIS MONTH**	
		$	%	$	%	$	%	$
Plumbing								
Sanitary & Storm Drainage	Matl. Lab.							
Domestic Water	Matl. Lab.							
Fixtures & Equipment	Matl. Lab.							
Plumbing Insulation	Matl. Lab.							
Medical Gas								
Fire Protection								
Wet & Dry Vacuum								
Outside Services								

TOTAL								

A. Notes
1. Submit this form as called for on MF 100 for tender price breakdown and with each progress claim.
2. Submit a separate form for each item listed on MF 120.

1.05 MF 141 PIPING TEST DATA

System: _____ (Heat pump loop water piping, Heating water piping, Chilled water piping, Condenser water piping, Steam piping, Boiler and boiler room piping, Domestic water piping main, Fire protection piping)		
Date:	**Time:**	**AM / PM**
Section of System Tested:		
Pressure at start of Test: _____ kPa [psi] Pressure at end of Test: _____ kPa [psi]		TEST: Length: _____ hrs Medium: water /air / nitrogen
Test performed by:		
Name	Signature	Company
Test witnessed at start:		
Name	Signature	Company
Test witnessed at end:		
Name	Signature	Company
Remedial Work / Comment		

1.06 MF 151 CHECK LIST - START-UP AND OPERATION REQUIREMENTS - AIR SYSTEMS

A. System:

ITEM	CHECKED BY	DATE
Prior To Start-Up		
Safety Controls Installed & Operational		
Control And Smoke Dampers Operational		
Permanent Electrical Connections Made		
Fan Drives Aligned By Millwright		
Fan Rooms & Plenums Vacuum Cleaned		
Equipment Lubricated		

Building Swept & Clear Of Dust		
All Filters Installed		
Operating & Maintenance Data Available		
During Start-Up		
Qualified Operator In Charge		
Supply Ducts Blown Out Using Fans		
R.A. & Exhaust Ducts Blown Out Using Fans		
During Subsequent Operation		
Qualified Operator In Charge		
Ensure that building has remained clean		
Equipment Maintained		
Lubrication Maintained & Logged		

B. NOTES:

1. This is a brief checklist and does not cover all procedures, which may be advisable in a particular case. Additional information is available from equipment suppliers.
2. Prior to starting or operating each system, complete the appropriate section of this form and submit it to the Consultant.
3. Submit completed copies of this form for each system with the certificate of substantial performance.

1.07 MF 152 CHECK LIST - START-UP AND OPERATION REQUIREMENTS – WATER / GLYCOL SYSTEMS

A. System: _____

ITEM	CHECKED BY	DATE
Prior To Start-Up		
Safety Controls Installed & Operational		
Permanent Electrical Connections Made		
Equipment Lubricated		
System Flushed Out		
Operating & Maintenance Data Available		
Boiler Inspector Notified		
Chemical Treatment Agency Notified		
During Start-Up		
Qualified Operator In Charge		
Chiller Manufacturer's Rep. Present		
During Subsequent Operation		
Qualified Operator In Charge		
Equipment Maintained		
Lubrication Maintained & Logged		
Chemical Treatment Maintained & Logged		

1.08 NOTES:

1. This is a brief checklist and does not cover all procedures, which may be advisable in a particular case. Additional information is available from equipment suppliers.
2. Prior to starting or operating each system, complete the appropriate section of this form and submit it to the Consultant.
3. Submit completed copies of this form for each system with the certificate of substantial performance.

1.09 MF 153 CHECK LIST - START-UP AND OPERATION REQUIREMENTS – REFRIGERATION SYSTEMS

A. System: _____

ITEM	CHECKED BY	DATE
Prior To Start-Up		
Safety Controls Installed & Operational		
Permanent Electrical Connections Made		
Equipment Lubricated		
System Charged and Tested		
Operating & Maintenance Data Available		
Boiler Inspector Notified & Start-up Approved		
During Start-Up		
Qualified Operator In Charge		
Manufacturer's Rep. Present		
Prior to Operation		
Inspector3s Approval Obtained		
During Operation		
Qualified Operator In Charge		
Equipment Maintained		
Lubrication Maintained & Logged		

B. NOTES:

1. This is a brief checklist and does not cover all procedures, which may be advisable in a particular case.
2. Prior to starting or operating each system, complete the appropriate section of this form and submit it to the Consultant.
3. Submit completed copies of this form for each system with the certificate of substantial performance.

1.10 MF 170 CERTIFICATE OF TESTING AND BALANCING

I hereby declare that I _____ am an Employee / Principal of _____ and certify that the testing and balancing procedures specified under Division 23 have been satisfactorily completed and I hereby certify that complete factual reports have been distributed.

SIGNED: _____	DATE:_____

A. NOTES:
1. This certificate must be submitted prior to substantial performance.

1.11 MF 171 CERTIFICATE OF DUCT CLEANLINESS

I hereby certify that I _____ am an Employee / Principal of _____ and have personally witnessed that the following duct systems have been vacuumed as necessary, are now clean and have been resealed with access panels in place at all cleaning openings in the ductwork.

FAN NO.	SYSTEM DESCRIPTION
SIGNED: _____	DATE:_____

A. Notes;
1. This certificate must be submitted prior to substantial performance.

1.12 MF 172 CERTIFICATE OF FIRE DAMPER INSPECTION

I hereby certify that I _____ am an Employee / Principal of _____ and that all fire dampers have been tested by removing the fusible link and witnessing closure of the damper.

SIGNED: _____	DATE:_____
Contract drawings supplied by:	
Latest addendum number or date of plans used:	

A. Notes:
1. This certificate must be submitted prior to substantial performance.

1.13 MF 173 CERTIFICATE OF PENETRATIONS THROUGH SEPARATIONS

I hereby certify that I _____ am an Employee / Principal of _____ and have personally witnessed that all mechanical (HVAC & Plumbing) service penetrations through fire separations (rated & non-

rated) and sound separations in the following areas have been properly sealed in accordance with the specified requirements.

AREA	SIGNED	DATE
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		

A. Notes:
1. This certificate must be submitted prior to substantial performance.

1.14 MF 174 CERTIFICATE OF SEISMIC RESTRAINT INSTALLATION

I hereby certify that I _____ am an Employee / Principal of _____ and certify that the seismic restraint of all mechanical equipment, piping and ductwork specified under Division 23 has been satisfactorily completed and that the installation meets the requirements of the B.C. Building Code as it relates to seismic restraint.

SIGNED: _____ DATE:_____

A. Notes:
1. This certificate must be submitted prior to substantial performance.

1.15 MF 175 CERTIFICATE OF VIBRATION ISOLATION

I hereby certify that I _____ am an Employee / Principal of _____ and certify certify that the vibration isolation installation specified under Division 23 has been satisfactorily completed.

SIGNED: _____ DATE:_____

A. Notes:
1. This certificate must be submitted prior to substantial performance.

1.16 MF 180 CHECK LIST & RECORD – ITEMS TO BE HANDED TO OWNER

ITEM	RECEIVED	DATE
C.O. System Portable Calibration Kit		
Chemical Test Kit		
Control Drawings (Framed/Plasticized)		
Electric Humidifier Replacement (Cylinder(s))		
Fan Belts – Spare Sets		
Filters - Spare Sets (Panel and Final)		
Glycol (enough to fill mixing tank when mixed)		
Hydrometer & Specific Gravity Chart		
Identification Schedule (Framed)		
Maintenance Program (Schedules & Cards)		
Master Key For B.A.S. Field Panels		
Rated Access Door Keys		
Salvaged Materials (Attach List)		
Spare Chemicals		
Sprinkler Heads & Cabinet		
Test Thermometer		
Thermostat Keys		
Valve List (Framed)		
Water Cooler Spare Filters		
Water flow meter for liquid flow measuring devices		
Differential Pressure Meter for Circuit Setting Balance Valves		
P/T Plug Master Test Kit		

A. Notes:

1. This certificate must be submitted prior to substantial performance.

1.17 MF 181 CHECK LIST – DEMONSTRATION OF AIR HANDLING SYSTEMS

A. System

	CONTRACTOR		OWNER	
Item	**Signed**	**Date**	**Signed**	**Date**
Review of System Concept				
Review of Maintenance Manual				
Review of System Balance				
Troubleshooting				
Points of required maintenance				
Access to Equipment				
Location of Control Devices				
All Electric Interlocks				
All Alarms				

Temperature Control				
Humidity Control				
Air Pressure Control				
Air Volume Control				

B. Notes

1. Contractor to submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance. (See MF 190).
2. Owner's representative to sign off each item during the demonstration.
3. Contractor to strike out items where they do not apply to the systems being demonstrated.
4. Interlocks and controls to be demonstrated by following the descriptions and diagrams in the contract documents and proving that all controls function as required.
5. Where multiple identical controls are installed (thermostats) the owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.18 MF 182 CHECK LIST – DEMONSTRATION OF WATER / GLYCOL SYSTEM

A. System

	CONTRACTOR		OWNER	
Item	**Signed**	**Date**	**Signed**	**Date**
Review of System Concept				
Review of Maintenance Manual				
Review of System Balance				
Review of Chemical Treatment				
Troubleshooting				
Points of required maintenance				
Access to Equipment				
Location of Control Devices				
All Electric Interlocks				
All Alarms				
Temperature Control				
Pressure Control				
Volume Control				

B. Notes:

1. Contractor to submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance (See MF 190).
2. Owner's representative to sign off each item during the demonstration.
3. Contractor to strike out items where they do not apply to the systems being demonstrated.
4. Interlocks and controls to be demonstrated by following the descriptions and diagrams in the contract documents and proving that all controls function as required.

5. Where multiple identical controls are installed (thermostats) the owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.19 MF 183 CHECK LIST – DEMONSTRATION OF REFRIGERATION SYSTEM

A. System

	CONTRACTOR		OWNER	
Item	**Signed**	**Date**	**Signed**	**Date**
Review of System Concept				
Review of Maintenance Manual				
Review of System Balance				
Troubleshooting				
Points of required maintenance				
Access to Equipment				
Location of Control Devices				
All Electric Interlocks				
All Alarms				
Temperature Control				
Pressure Control				

B. NOTES:

1. Contractor to submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance. (See MF 190).
2. Owner's representative to sign off each item during the demonstration.
3. Contractor to strike out items where they do not apply to the systems being demonstrated.
4. Interlocks and controls to be demonstrated by following the descriptions and diagrams in the contract documents and proving that all controls function as required.
5. Where multiple identical controls are installed (thermostats) the owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked all of them.

1.20 MF 188 CHECK LIST – SUBSTANTIAL COMPLETION SUBMISSIONS - HVAC

Section	Item	Checked
23 05 00	Boiler Inspection Certificate	
23 05 00	Gas Inspection Certificate	
23 05 00	Equipment Extended Warranties Certificates	
23 05 00	Lubrication of Equipment Checklist	
23 05 00	Penetrations through Separations Certificate (MF-173)	
23 05 13	Millwright Setting and Alignment Certificate	
23 05 93	Air and Liquid Balancing Report	
23 06 02	Testing & Balancing Certificate (MF 170)	
23 06 02	Fire Damper Inspection Certificate (MF 172) and Checked Dwgs	

23 08 00	Commissioning Report and Checklists	
23 05 00	Operating & Maintenance Manuals	
23 05 00	Record Drawings	
23 05 00	Maintenance Program	
23 05 00	Demonstration to Operating Staff agenda	
23 05 54	Identification Schedules	
23 06 02	Vibration Isolation Installation Certificate (MF-175)	
23 06 02	Seismic Restraint Installation Certificate (MF-174)	
23 25 00	Chemical Treatment and Cleaning Report for Piping Systems	
23 13 00	Fuel Oil Tank and Piping Pressure Test Report	
23 52 00	Boiler Start-up Test Reports	
23 23 00	Refrigeration System Start-up Test Reports	
23 64 00	Chiller Capacity and Efficiency Test Reports	
23 31 00	Duct Leakage Test Reports	
23 31 00	Duct Cleanliness Certificate (MF 171)	
23 06 02	Demonstrations Checklists (MF 181, 182, 183)	
23 06 02	Items handed to Owner Checklist (MF 180)	
23 06 02	Substantial Performance Certificate (MF(190)	
23 06 02	Checklist of work remaining after Substantial (MF 191)	

A. NOTES:

1. This list is provided as a checklist and may not include all substantial completion requirements.

1.21 MF 189 CHECK LIST – SUBSTANTIAL COMPLETION SUBMISSIONS - PLUMBING

Section	Item	Checked
	Operating & Maintenance Manuals (also 15400 & 15500)	
	Record Drawings (also 15400 & 15500)	
	Plumbing Inspection certificate	
	Buried drainage piping. Pipe leakage and bedding tests	
	Buried gas pipe covering report (also 02715 & 15400)	
	Water mains chlorination report (also 02713 & 15400)	
	Backflow prevention station test certificate	
	Hose Bibb operating keys. Signed receipt from Owner	
	Pipe test reports	
	Spare Water filters (also 15450, 15451 & 15452)	
	Backflow prevention (RPPD) test certificate	
	Fire protection system test certificate	

A. Notes:

1. This list is provided as a checklist and may not include all substantial completion requirements.

1.22 MF 190 CERTIFICATE OF SUBSTANTIAL PERFORMANCE DIVISION 21, 22, 23

I hereby certify that I _____ am an Employee / Principal of _____ and have personally witnessed the following with regard to the mechanical systems work specified on the above project and that to the best of my knowledge except as noted on MF 191 (attached);.

- The installation is complete and as specified.
- The systems have been commissioned and operate satisfactorily.
- Every control sequence and every control performs as specified.
- The systems are clean.
- All of the required submissions have been made to the consultant.

SIGNED: _____ DATE:_____

A. Notes:

1. This certificate must be completed and submitted to the consultant prior to substantial performance.
2. If it is apparent during this inspection that the systems or their operation are seriously deficient then all reasonable costs of any subsequent inspections shall be deducted from the contract sum.

1.23 MF 191 CHECK LIST – WORK REMAINING AFTER SUBSTANTIAL PERFORMANCE

		COMPLETION		
Item No.	**Description**	**Claimed By**	**Date**	**Verified Date**

A. NOTES:

1. This form must be filled in and submitted to the Consultant prior to substantial performance.
2. Items arising out of this inspection will be added to the list by the Consultant. Copies of the complete list will be circulated to the Owner, the Architect and the Contractor.
3. The Contractor may include estimated values against the outstanding work but determination of the actual amounts to be held will be made by the Consultant.
4. The Contractor shall sign off each item as it is completed and submit the list monthly to the Consultant. When all items are signed off the completed list shall be submitted with the certificate of total performance MF 192.

1.24 MF 192 CERTIFICATE OF TOTAL PERFORMANCE – DIVISIONS 21, 22, 23

I hereby certify that I _____ am an Employee / a Principal / an Agent of _____ and have personally witnessed that each item of outstanding work on the checklist and record of work remaining after substantial completion MF 191 (attached) has been satisfactorily completed and I hereby certify that the Mechanical systems work specified on the above project is complete.

SIGNED: _____	DATE: _____

A. Notes:

1. This certificate must be completed and submitted to the Consultant prior to substantial performance.
2. If it is apparent during this inspection that the systems or their operation are seriously deficient then all reasonable costs of any subsequent inspections shall be deducted from the contract sum.

END OF SECTION

END OF SECTION

Part 1 General

1.1

BALANCING	RAINCITY TECHNICAL SERVICES LTD.
	K.D. ENGINEERING CO.
	WESTERN MECHANICAL SERVICES
	INLAND TECHNICAL SERVICES LTD.
COMMISSIONING	RAINCITY TECHNICAL SERVICES LTD.
	WESTERN MECHANICAL SERVICES
	AIRMEC SYSTEMS LTD.
	INLAND TECHNICAL SERVICES LTD.
	K.D. ENGINEERING CO.
OPERATING & MAINTENANCE MANUALS	RAINCITY TECHNICAL SERVICES LTD.
	WESTERN MECHANICAL SERVICES
	INLAND TECHNICAL SERVICES
	K.D. ENGINEERING
CLEANING AGENCIES	
- Ductwork	POWER SUCTION SERVICES LTD.
	ACE MOBILE POWER SERVICES LTD.
	ENVIRO-VAC SYSTEMS INC.
	CLEAN AIR SERVICES CANADA LTD.
- Water Piping	BIRD ARCHER
	GRACE DEARBORN
	IPAC CHEMICALS
	KEMTREET
	PACE CHEMICALS
	SAVOLITE
CONTROLS	RELIABLE CONTROLS - HOULE CONTROLS (BASE BUILDING CONTROLS CONTRACTOR)
CHEMICAL TREATMENT	BASE BUILDING WATER TREATMENT SPECIALIST

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 GENERAL

.1 Provide external thermal insulation for plenums and ductwork as called for.

.2 Provide internal acoustical insulation for plenums and ductwork, as called for. Note: do not externally insulate any ductwork that is specified to be internally insulated.

.3 Journeyman insulation applicators, skilled in this trade, shall perform the work.

.4 Be responsible for ensuring that sufficient space is always provided to allow proper installation of insulation materials.

.5 As applicable, use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Standards Manual" as a reference standard if sufficient detail/information is not specified herein.

1.3 SUSTAINABILITY REQUIREMENTS

.1 Adhesives shall meet the VOC limits of the South Coast Air Quality Management District Rule #116. MSDS sheets for VOC content shall be submitted with the adhesive and sealant shop drawings for approval.

1.4 REGULATORY REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the BC Building Code and NFPA 90A. Generally, the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.2 Duct linings shall be in accordance with CSA Z317.2-2019.

.3 Insulation thickness and insulating values shall be in accordance with ASHRAE 90.1-2016 and NRC Model National Energy Code of Canada for Buildings (MNECB). The more stringent insulation value (between the two codes) will be the level required for this project.

.4 All insulation materials are to be formaldehyde free. Note that listed insulations under products section are to be used for reference only, and they do not necessarily comply with formaldehyde free requirement.

.5 Insulating materials and accessories shall withstand service temperatures without smoldering, glowing, smoking, or flaming when tested in accordance with ASTM C411.

1.5 APPLICABLE CODES AND STANDARDS

.1 Material and method of application to comply with or be tested in accordance with the latest applicable versions of the following Standards;

.2 B.C. Building Code and local by-laws

.3 B.C. Insulation Contractors Association (BCICA) Standards Manual

.4 Thermal Insulation Association of Canada (TIAC) National Insulation Standard, excluding section 12

.5 ASHRAE/IES 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings

.6 NFPA 255 Test of Surface Burning Characteristics of Building Materials

.7 CAN/ULC S102 Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies

.8 ASTM C411 Standard Test Method for Hot Surface Performance of High Temperature Thermal Insulation

.9 ANSI/NFPA 90A Air Conditioning and Ventilating Systems and Installation.

.10 ANSI/NFPA 90B Warm Air Heating and Air Conditioning Systems.

.11 CGSB 51-GP-10M Thermal Insulation, Mineral Fiber, Block or Board, for Ducting.

.12 CGSB 51-GP-11M Thermal Insulation, Mineral Fiber, Blanket for Piping, Ducting, Machinery and Boilers.

.13 ASTM C411 Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation

.14 ASTM C518 Standard Test Method for Steady State Thermal Transmission Properties by Means of Heat Flo Meter Apparatus

.15 ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

.16 ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

.17 ASTM C552 Standard Specification for Cellular Glass Thermal Insulation

.18 ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

.19 ASTM C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.20 ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.21 ASTM C1126 (Gr.1) Standard Specification for Faced and Unfaced Rigid Cellular Phenolic Thermal Insulation

.22 CGSB 51-GP-52MA Vapour Barrier, Jacket and Facing Material for Pipe, Duct, and Equipment Thermal Insulation.

.23 CAN/CGSB-51.2 Thermal Insulation, Calcium Silicate, for Piping, Machinery and Boilers.

.24 CAN/CGSB-51.12 Cement, Thermal Insulating and Finishing.

.25 CAN/CGSB-51.40 Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.

.26 CGSB 51.53-95 Polyvinyl Chloride) Jacket Sheeting, for Insulated Pipes Vessels and Round Ducts.

.27 CAN/ULC S102 - Surface Burning Characteristics of Building Materials and Assemblies

1.6 QUALIFICATIONS AND SAMPLES

.1 Submit, for approval, substantiating manufacturer's documentation (and samples when requested) for all materials, applications and finishing methods to establish that all will satisfy this specification and meet all applicable code requirements, before commencing work.

1.7 MINIMUM STANDARDS

.1 All ductwork shall be insulated to meet or exceed the minimum requirements of the National Energy Code for Buildings and ASHRAE 90.1-2016. The more stringent insulation value (between the two codes) will be the level required for this project.

.2 Refer to the following table taken from NECB Table 5.2.2.5: Insulation of Ducts for additional information:

Temperature Difference, (1) oC	**Min. Thermal Resistance (RSI) for Ducts and Plenums** m^2*^oC/W	**Min. Thermal Resistance (RSI) for Run-outs, (2)m2*oC/W**
< 5	0	0
5 to 22	0.58	0.58
>22	0.88	0.58
Notes:The temperature difference at design conditions between the space within which the duct is located and the design air temperature of the air carried by the duct. Where duct is used for both heating and cooling purposes the larger temperature difference shall be used. Ducts not exceeding 3 metres in length connecting to terminal grilles		

1.8 DEFINITIONS

.1 "CONCEALED" insulated mechanical services in furred spaces, shafts and hung ceilings considered to be concealed.

.2 "EXPOSED" will mean not concealed.

1.9 ASBESTOS INSULATING MATERIALS

.1 If the Contractor, during renovations, should discover asbestos (or material suspected to be asbestos) on piping, ductwork, etc., he shall immediately cease all work in that area and contact Owner's representative. The Owner will take immediate appropriate action to verify presence of friable asbestos. The Contractor will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

PART 2 PRODUCTS

2.1 EXTERNAL FLEXIBLE INSULATION

.1 External flexible glass fibre insulation with integral vapour barrier.

.2 Minimum density - 12 kg/cu.m. 3/4 lbs/cu. ft..

.3 Thermal Conductivity at 24 deg.C. - 0.042 W/m/deg.C.

.4 Acceptable Manufacturers: Certainteed STD Ductwrap #75 FSK, Manson Alley-Wrap FSK, Owens Corning all service faced duct wrap, Knauf FSK Ductwrap, Schuller Micro Lite FSK.

2.2 DUCT LINER

.1 Duct linings shall be in accordance with CSA Z317.2-2019.

.2 Duct Liner – Flexible (fiber free foam)

.1 Foam materials, if used as internal insulation, shall only be used in locations where spinning/oscillating cleaning systems will not be used (e.g., terminal units, air intakes, or exhaust plenums.) Such materials shall

.1 be made of fibre-free, closed cell foam that is specifically designed for internal lining of air ducts;

.2 have smooth, cleanable surfaces; and

.3 comply with applicable requirements regarding foam materials (i.e. ASTM C411)

.2 Internal flexible elastomeric fiber free acoustical insulation

.3 Minimum sound absorption (NRC) of 0.70 as tested per ASTM C423 using type "A" mounting.

.4 Thermal Conductivity at 24oC (75oF) - 0.033 W/sq.m/oC (0.24 btu/h/sq.ft/oF).

.5 The flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.1 Acceptable Manufacturers: K-flex, Armacell

2.3 ACCESSORIES

.1 Insulation Adhesive

.1 Bakelite 230-39, Childers CP-82, CP-56W, Epolux Cadoprene 400, Foster 85-20, Polymer Glasstack #25, Robson Ticki-Tuff.

.2 Vapour Barrier Tape

.1 Finishing tape as commercially available to meet flame spread rating and smoke developed classification requirements of NBC 1985 and compatible with facing material.

.2 Scrim foil self-adhesive tape.

.3 Vapour Barrier Adhesive

.1 Bakelite 230-21, Childers CP-82, Epolux Cadoprene 400, Foster 85-20, 3M 4230.

.4 Insulation Coating

.1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36, Robson White Lag.

.5 Finish Jackets

.1 Aluminum Jacket:

.1 0.51 mm (0.02 inch) 22 ga. thick stucco embossed aluminum jacketing with longitudinal slip joints and 50 mm (1.97 inch) 2" end laps with factory applied protective liner on interior surface.

.2 Childers, Alco Thermoclad 1 or other as commercially available.

.2 Aluminum Fitting Covers:

.1 0.51 mm (0.02 inch) 22 ga. thick, die shaped components with factory applied protective liner on interior surface.

.2 Childers Ell-Jacs, Perma-Ells or Shield-Ells or other as commercially available.

.6 Weather Coating - vapour barrier

.1 Bakelite 110-14, Childers CHIL-PRUF CP22/23/24, Foster 60-25, Insul-Mastic 15187.

.7 Reinforcing Membrane

.1 Glass reinforcing membrane as commercially available.

.8 Seal Coating

.1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36, Robson White Lag.

.9 Fabric Adhesive

.1 Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 30-36.

.10 Fabric Coating

.1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36.

2.4 SCOPE OF INSULATION

.1 Scope 1: External Flexible Insulation with vapour barrier. (Exposed ducts within a room, which is being served by the exposed ducts, do not require external insulation)".

	Thickness	
Service	**mm**	**[ins]**
All cooling and heating supply ducts; - where the temperature difference between the space within which the duct is located and the design air temperature in the duct, is less than or equal to 22.2°C [40°F]	40	1.5
All cooling and heating supply ducts; - where the temperature difference between the space within which the duct is located and the design air temperature in the duct, is greater than 22.2°C [40°F].	50	2
Outdoor air ductwork and plenums (from intake to mixing plenum).	50	2
Exhaust air discharge through roof (including sides and bottom of plenum).	50	2
All exhaust air ductwork from outside wall or roof to 3 m [10 ft.] inside building.	50	2
Exhaust air ductwork outside of the building. Also provide aluminum jacket around and seal by providing weatherproof seal. Exhaust air ductwork shall be insulated up to the fan.	50	2

2.5 SCOPE 2: INTERNAL FLEXIBLE DUCT LINER

	Thickness	
Service	**mm**	**[ins]**
All ductwork where indicated by double hatching	25	1
All ductwork where indicated by single hatching	50	2

PART 3 EXECUTION

3.1 APPLICATION

.1 Apply external insulation to ductwork only after all tests have been made and systems accepted by the Consultant as airtight.

.2 Apply insulation and insulation finish in a workmanlike manner so that the finished product is uniform, smooth in finish, pleasing to the eye and with longitudinal seams concealed from view. Apply ductwork insulation materials, accessories and finishes in accordance with manufacturer's recommendations.

.3 Insulation and vapour barrier shall be continuous through all non-rated separations.

3.2 INSULATION TERMINATION

.1 Terminate insulation short of all control, smoke and fire dampers so as not to interfere with their operation.

.2 Terminate insulation 900 mm (35.43 inch) 36" short of duct mounted electric heating coils.

3.3 EXTERNAL FLEXIBLE INSULATION WITH VAPOUR BARRIER

.1 Adhere insulation with insulation adhesive applied in 150 mm (5.91 inch) 6" wide strips on 300 mm (11.81 inch) 12" centres.

.2 On rectangular ductwork and plenums, over 610mm 24" in width, spotweld pins 6mm 1/4" longer than the insulation thickness, one per square foot of duct minimum. If pins are installed in the field, a capacitor gun shall be used. Impale the insulation over the pins, and hold in place using metal or nylon clips (washers). Alternatively, use an assembly consisting of a welded pin with integral head washer welded in place over the insulation. (Clinched pins not acceptable).

.3 Adhere foil faced vapour barrier tape over all butt joints, raw edges, holding washers and other points of penetration of the vapour barrier jacket on all exposed hot and cold ducts and concealed cold ducts.

3.4 INTERNAL FLEXIBLE DUCT LINER APPLICATION

.1 Foam materials, if used as internal insulation, shall only be used in locations where spinning/oscillating cleaning systems will not be used (e.g., terminal units, air intakes, or exhaust plenums.) Such materials shall

.1 be made of fibre-free, closed cell foam that is specifically designed for internal lining of air ducts;

.2 have smooth, cleanable surfaces; and

.3 comply with applicable requirements regarding foam materials.

.2 Adhere insulation with insulation adhesive applied to the whole of the metal surface, with the coating side of insulation exposed to the airstream.

.3 Ducts 610 mm (24.02 inch) 24" in width and less require no further adhesion.

.4 Ducts sides and plenum panels greater than 610 mm (24.02 inch) 24" in width shall also have metal clips or nylon pins adhered to the metal surface at 300 mm (11.81 inch) 12" to supplement the adhesive. (Welding pins may be used provided a capacitor type gun is used.) Impale insulation or the pins or clips, with the coated side of the insulation exposed to the airstream and secured with holding washers. Cover holding washers with reinforcing membrane and insulation coating / sealer.

.5 Seal all transverse joints, raw edges, and other points of penetration of the coating with reinforcing membrane and insulation coating/sealer.

.6 Seal all longitudinal joints with insulation coating sealer.

.7 No raw edges of internal insulation material shall be exposed to the moving airstream.

.8 NOTE: duct size shown is dimension inside the insulation. Metal duct sizes shall be increased to allow for the internal acoustic insulation thickness.

.9 Adhere alpha temp cloth over the internal surface of all acoustic insulation. Overlap all edges and seal all joints with insulation adhesive/coating/sealer.

3.5 INTERNAL RIGID DUCT LINER APPLICATION

.1 Adhere the internal rigid duct liner in the same manner as specified for internal flexible duct liner.

.2 Adhere Alpha Temp #1610/1067 UL Class #1 Material film over the internal surface of all acoustic insulation. Overlap all edges and seal all joints with insulation adhesive/coating/sealer.

.3 Cover plenum wall insulation with solid galvanized sheet metal. Protective metal shall be held in place by securing it to the projecting pins with washers.

.4 Cover insulated walk-on plenum floors with solid galvanized sheet metal to protect insulation from damage. Provide supports under sheet metal to prevent insulation and pins from being crushed.

.5 All sheet metal and perforated sheet metal is under Section 15810 23 31 00.

3.6 DUCTWORK INSULATION FINISHES

.1 "Exposed" ductwork insulation "inside" finished floor spaces, fan rooms, chiller room, valve rooms etc. shall be finished with two coats of white, foil-finishing, insulation coating.

.2 "Exposed" ductwork insulation, in unfinished floor spaces will have no further finish.

.3 "Exposed" ductwork insulation "inside" finished floor spaces, fan rooms, boiler room, chiller room, valve rooms and generator room shall be finished with two coats of white, foil-finishing, insulation coating.

.4 "Exposed" insulated ductwork outside shall be covered all around with insulation aluminum jacketing. Exterior application shall be a vapour sealed installation. Over the insulation, apply 0.53 mm (0.02 inch) 22 ga thick Childers corrugated aluminum. The moisture barrier shall be continuous across the full width of the jacketing. The longitudinal seams shall be located to shed water. Attach with holding strap at 150 mm (5.91 inch) 6" on centres. Provide a complete aluminum jacket system using all of the parts, accessories and installation procedures of the manufacturer. Seal all outdoor jacketing watertight.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 GENERAL

.1 Provide thermal insulation on all piping, valves, and fittings, as called for and as scheduled. Note items listed that do not require insulation.

.2 Journeyman insulation applicators, skilled in this trade, shall perform the work.

.3 Be responsible for ensuring that sufficient space is always provided to allow proper installation of insulation materials.

.4 Use the latest edition of the "B.C. Insulation Contractors Association (BCICA) Quality Standards Manual", as a reference standard if sufficient detail/information is not contained herein.

1.3 REGULATORY REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the BC Building Code and NFPA 90A. Generally, the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.2 Insulation thickness and insulating values shall be in accordance with ASHRAE 90.1-2016 and NRC Model National Energy Code of Canada for Buildings (MNECB). The more stringent insulation value (between the two codes) will be the level required for this project.

.3 Provide fire rated insulation on piping as required.

.4 Adhesives and sealants shall meet the VOC limits of the South Coast Air Quality Management District Rule #1168, as summarized in Low Emitting Materials section of the LEED Canada Reference Guide. MSDS sheets for VOC content shall be submitted with the adhesive and sealant shop drawings for approval.

.5 All insulation materials are to be formaldehyde free. Note that listed insulations under products section are to be used for reference only, and they do not necessarily comply with formaldehyde free requirement.

1.4 APPLICABLE CODES AND STANDARDS

.1 Material and method of application to comply with or be tested in accordance with the latest version of the following Standards;

.1 B.C. Building Code and local by-laws

.2 B.C. Insulation Contractors Association (BCICA) Standards Manual

.3 Thermal Insulation Association of Canada (TIAC) National Insulation Standard, excluding section 12

.4 ASHRAE/IES 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings

.5 NFPA 255 Test of Surface Burning Characteristics of Building Materials

.6 CAN/ULC S102 Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Covering, and Miscellaneous Materials and Assemblies

.7 ASTM C411 Standard Test Method for Hot Surface Performance of High Temperature Thermal Insulation

.8 ANSI/NFPA 90A Air Conditioning and Ventilating Systems and Installation.

.9 ANSI/NFPA 90B Warm Air Heating and Air Conditioning Systems.

.10 CGSB 51-GP-10M Thermal Insulation, Mineral Fiber, Block or Board, for Ducting.

.11 CGSB 51-GP-11M Thermal Insulation, Mineral Fiber, Blanket for Piping, Ducting, Machinery and Boilers.

.12 ASTM C518 Standard Test Method for Steady State Thermal Transmission Properties by Means of Heat Flo Meter Apparatus

.13 ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

.14 ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

.15 ASTM C552 Standard Specification for Cellular Glass Thermal Insulation

.16 ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications

.17 ASTM C177 Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.

.18 ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation

.19 ASTM C1126 (Gr.1) Standard Specification for Faced and Unfaced Rigid Cellular Phenolic Thermal Insulation

.20 CGSB 51-GP-52MA Vapour Barrier, Jacket and Facing Material for Pipe, Duct, and Equipment Thermal Insulation.

.21 CAN/CGSB-51.2 Thermal Insulation, Calcium Silicate, for Piping, Machinery and Boilers.

.22 CAN/CGSB-51.12 Cement, Thermal Insulating and Finishing.

.23 CAN/CGSB-51.40 Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.

.24 CGSB 51.53-95 Polyvinyl Chloride) Jacket Sheeting, for Insulated Pipes Vessels and Round Ducts

1.5 QUALIFICATIONS AND SAMPLES

.1 Submit, for approval, substantiating manufacturer's documentation (and samples when requested) for all materials, applications and finishing methods to establish that all will satisfy this specification and meet all applicable code requirements, before commencing work.

.2 Submit, for approval, samples of each type of firestopping, smoke seal and accessory.

1.6 ASBESTOS

.1 If the Contractor, during renovations, should discover asbestos (or material suspected to be asbestos) on piping, ductwork, etc., he shall immediately cease all work in that area and contact

Owner's representative. The General Contractor will take immediate appropriate action to verify presence of friable asbestos. The Contractor will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

1.7 CONNECTIONS TO EXISTING PIPING

.1 Make good all existing insulation disturbed or removed to facilitate alterations and additions to existing piping.

1.8 DEFINITIONS

.1 "CONCEALED" insulated mechanical services in trenches, chases, furred spaces, shafts, and hung ceilings.

.2 "EXPOSED" will mean not concealed.

1.9 SHOP DRAWINGS

.1 Submit shop drawings for:

.1 Each type of insulation with model number.

.2 Table indicating the type and thickness of insulation for each type of system type (i.e. chilled water, etc.) and pipe sizes.

.3 Details illustrating pipe support, insulation, vapor barrier, jacketing and finish for various systems. For instance, submit details for the chilled water pipes over pipe racks showing insulation, jacketing and installation / supporting strategy (i.e. on rollers) to protect piping against moisture diffusion and rusting.

PART 2 PRODUCTS

2.1 PREFORMED PIPE COVERING

.1 Mineral Fibre - Low and Medium Temperature:

.1 With integral vapour barrier jacket and longitudinal lap.

.2 Thermal conductivity at 24oC - 0.033 W/m/deg.C.

.1 Acceptable Products: Manson Alley K, Owens Corning SSL-11, Knauf 850 ASJ/SSL, Johns Manville Micro-Lok AP-T Plus, Owens Corning 1200 ASJ/SSL.

.2 Flexible Foamed Elastomeric:

.1 Thermal Conductivity at 24oC - 0.040 W/m/deg.C.

.2 Acceptable Products: AP Armaflex, Rubatex R-180-FS.

.3 Flexible Closed Cell:

.1 Thermal Conductivity at 24oC - 0.036 W/m/deg.C.

.2 Acceptable Products: Bondtex Polyethylene, Therma-Cel.

.4 Phenolic closed cell – rigid:

.1 With integral vapour barrier jacket and longitudinal lap.

.2 Thermal conductivity @ 24oC - 0.019 W/m/deg.C.

.3 Acceptable Products: Kingspan Koolphenk

2.2 FIRE STOPPING AND SMOKE SEAL MATERIALS

.1 References:

.1 CAN4-S115-M, Standard Method of Fire Tests of Firestop Systems.

.2 ASTM E814 Standard Method of Fire Tests and Through-Penetration Firestops.

.3 1997 Certifications Listings Intertek Testing Services N.A. Ltd. (Warnock Hersey).

.4 Underwriters Laboratories of Canada. Listing of Equipment and Materials Vol. 3 Fire Resistance Ratings -Revision 4/95.

.2 Work Included:

.1 Furnish all labour, material, equipment and services necessary to supply and install firestopping and smoke seals around mechanical service piping and duct penetrations through existing and new fire rated wall and floor assemblies, as indicated and as specified.

.3 Quality Assurance:

.1 The work of this section shall be carried out only by an approved specialist firm, employing skilled tradesmen experienced in firestopping and smoke seal application and approved, licensed and supervised by the manufacturer of fire stopping materials.

.2 All work to be of the highest quality according to best trade practice and in strict accordance with manufacturer's printed specifications.

.4 Submittals:

.1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Submit manufacturers' product data for materials and prefabricated devices. Include assembly/location design system number references with copies of test information. Construction details should accurately reflect actual job conditions.

.3 For building assemblies which do not correspond to any previously tested and rated assemblies, submit proposals based on related designs using accepted fireproofing design criteria.

.5 Materials:

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC CAN4-S115 and not to exceed opening sizes for which they are intended.

.2 Service penetration assemblies and design numbers: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19. 1997 Certification Listings Intertek Testing Services N.A. Ltd. (Warnock Hersey).

.3 Service penetration firestop components: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40 U19.15 under the Label Service of ULC or equivalent approved tests by Warnock Hersey.

.4 Fire resistance rating of installed fire stopping assembly shall be not less than the fire resistance rating of surrounding floor and wall assembly.

.5 Acceptable Products: DOW FS 2000/2001, Tremco Fyre-Sil, 3M 1000 silicone, 3M CP25WB, Firestop Systems 4800DW, Nuco Self Seal Fire Stops.

2.3 ACCESSORIES

.1 Insulation Fastenings:

.1 1.6 mm (0.06 inch) 16 ga. galvanized wire or 1.6 mm thick copper wire as commercially available.

.2 Jacket Fastenings:

.1 Thermocanvas and All Service:

.1 Staples (flare type), compatible jacket finishing tape, contact adhesives recommended by the jacket manufacturer.

.2 Metal Jackets:

.1 Sheet metal screws, pop rivets, bands.

.3 PVC Jacket and Fitting Covers:

.1 PVC self-adhesive tape, plastic pop rivets, bonding cement.

.3 Adhesives:

.1 Flexible elastomeric and flexible closed cell insulation adhesive:

.1 Armstrong 520, Therma-Cel 1590, RubatexR-373, Zipcoat 8A.

.2 Vapour barrier jacket adhesive:

.1 Bakelite 230-39, Childers CP-82, Epolux Cadoprene 400, Foster 85-20.

.3 Fabric adhesive, to insulation pipe covering:

.1 Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 30-36, Robson White Lag.

.4 Coatings:

.1 Vapour barrier coating on reinforcing membrane or on insulating cement:

.1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36.

.2 Childers CP-30 (refrigeration suction lines only).

.2 Flexible elastomeric and flexible closed cell insulation finish coating:

.1 Armstrong, Bakelite 120-13, Rubatex, Zipcoat.

.5 Finish Jackets:

.1 Thermocanvas Jacket:

.1 Fattal's Thermocanvas, Robson Flamex FR Canvas or Tai-Can Canvas.

.2 All Service Jacket (with 0.03 mm (0 inch) 0.0019” minimum thick foil:

.1 Fattal's Fat-Lock ASJ, Fiberglass ASJ, Knauf ASJ, Kingspan ASJ, Manson APT, Johns Manville AP-T Plus, Owens Corning ASJ, Roxul ASJ.

.3 PVC Finishing Jacket (minimum 0.5 mm (0.02 inch) 0.02” thick:

.1 Proto PVC, Speedline PVC, Zeston PVC.

.4 Aluminum Jacket:

.1 0.51 mm (0.02 inch) 22 ga. thick corrugated or smooth aluminum jacketing with longitudinal slip joints and 50 mm (1.97 inch) 2" end laps with factory applied protective liner on interior surface.

.1 Childers, Alco Thermoclad 1 or other as commercially available.

.6 Reinforcing Membrane:

.1 Glass reinforcing membrane as commercially available.

.7 Insulating Cement:

.1 Fibrex Superkote, Partek No. 1, Ryder Thermokote MW high temperature.

.8 Finishing Cement:

.1 Ryder Thermokote 1 FW.

.9 Flexible Insulation:

.1 Manson Alley-Wrap, Owens Corning AF 300 Series, Knauf Plain Wrap, Johns Manville Microlite, Roxul Wrap (RW).

.10 Preformed Fitting Covers:

.1 Aluminum Fitting Covers:

.1 0.51 mm (0.02 inch) 22 ga. thick, die shaped components with factory applied protective liner on interior surface.

.1 Childers Ell-Jacs, Perma-Ells or Shield-Ells or other as commercially available.

.2 PVC Fitting Covers:

.1 0.5 mm (0.02 inch) 0.020" thick premoulded one piece covers.

.1 Certainteed Snapform, Childers, Proto PVC, Speedline PVC, Zeston PVC, Fattal PVC.

.11 Preformed Insulation fittings:

.1 Shur-Fit, Moulded Acoustic Products or from insulation fabricators.

2.4 SCOPE OF INSULATION

.1 Heating Pipe, Fittings and Valves:

.1 Insulate the following systems, unless otherwise noted:

.1 Hot water and glycol heating supply and return piping

.2 DO NOT insulate the following, unless otherwise noted:

.1 Relief piping.

.2 Drain lines.

.3 Insulate the following valves and fittings if the pipe is insulated:

.1 Elbows, tees, reducers.

.2 Valve bodies on valves and check valves, over NPS 2-1/2".

.3 Flanges.

.4 Strainers.

.4 The following hot pipe fittings that operate at 60o C 140o F shall be coated with Thermalite –SG as per manufacturer's specifications to prevent skin burns:

.1 Valves, NPS 2-1/2" and smaller.

.2 Valve bonnets.

.3 Unions.

.4 Drip legs.

.5 Flexible connections.

.6 Expansion joints.

.7 Check valve covers.

.2 DO NOT insulate the following, unless otherwise noted:

.1 Drain lines for sumps 15oC 60oF and over.

.3 Insulate and vapour seal the following fittings, if the pipe is insulated:

.1 Elbows, tees, reducers.

.2 Valves, (bodies and bonnets) except check valve covers.

.3 Strainers.

.4 Flanges.

.5 Unions.

.4 Plumbing pipes, fire suppression pipes, fittings, valves (Refer to Section 22 07 19):

.1 Insulate the following systems, unless otherwise noted:

.1 Domestic cold-water system;

.2 Domestic hot water supply and recirculation piping;

.3 Domestic tempered water supply and recirculation piping.

.4 All drains, lines, stacks, *fire standpipes and sprinkler mains in unheated areas (insulation shall cover heat tracing cables).

.5 Water valves, flanges, strainers, check valves.

.6 Sanitary vent stacks for the last 3 meters (3.28 yards) 304.8 cm (10 feet) prior to penetrating the roof or penetrating into a cold attic or similar space.

.7 Interior irrigation / hose bibb supply piping.

.2 DO NOT insulate the following, unless otherwise noted:

.1 Piping used exclusively for fire protection (unless in unheated spaces).

.2 Soil stacks, vents, etc.,

.3 All special service piping, e.g. gas, compressed air, etc.

.4 Unions.

.5 Flexible connections or expansion joints (unless noted on the drawings).

.6 Check valve covers.

.7 Strainer leg and basket covers.

.8 Flexible fixture connections.

.5 Pipe penetrations through walls and floors:

.1 All material for the stuffing, sealing and caulking of the pipe penetration shall be supplied and installed under this section.

2.5 HANGERS AND SUPPORTS

.1 Provide insulation protection based on pipe size and service process temperature.

.2 Pipe saddle insulation protection:

.1 Insulate the interior void spaces of pipe saddles, of same material as adjacent pipe insulation, butt insulation up to sides and end of pipe saddle, and leave bottom surface of saddle exposed for direct contact with pipe support.

.3 Pipe shield insulation protection:

.1 Install insulation shield between outside of insulation and pipe support; pipe support is sized for outside dimension of insulation.

.2 In accordance with pipe size, provide high density insulation insert of same thickness as adjacent pipeline material.

2.6 PIPE INSULATION THICKNESS TABLE - MM INS

	NOMINAL PIPE SIZE (NPS)					
Service	**Design Operating Temperature**	**Under 1 and runouts**	**1 - $1^{1}/_{4}$**	**$1^{1}/_{2}$ to 3**	**4 - 6**	**8 and larger**
Domestic Cold Water	5C [40F]	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]
Domestic Hot & Tempered Water Supply and Recirc.	40-60C [105-140F]	25 [1]	25 [1]	40 [1.5]	40 [1.5]	40 [1.5]
Hot Water Heating	40-60C [105-140F]	25 [1]	25 [1]	40 [1.5]	40 [1.5]	40 [1.5]
Hot Water Heating	61-93C [141-200F]	40 [1.5]	40 [1.5]	50 [2]	50 [2]	50 [2]
Hot Water Heating	94-121C [201-250F]	65 [2.5]	65 [2.5]	65 [2.5]	75 [3]	75 [3]

.1 Note 1: Runouts to individual terminal units not to exceed 3.7 meter (4.05 yard) 12 ft in length.

PART 3 EXECUTION

3.1 APPLICATION

.1 Apply insulation to piping only after all tests have been made and systems accepted by Consultant as tight.

.2 Apply insulation and insulation finish in a workmanlike manner so that the finished product is uniform in diameter, smooth in finish, pleasing to the eye and with the longitudinal seams positioned to be concealed from view. Apply piping insulation materials, accessories and finishes in accordance with manufacturer's recommendations.

.3 Insulation and vapour barrier shall be continuous through all non-rated separations.

3.2 INSULATION TERMINATION POINTS

.1 Terminate insulation 75 mm (2.95 inch) 3" back from all uninsulated fittings to provide working clearance and terminate insulation at 90o and finish with reinforced scrim cloth and vapour barrier mastic system. Cover onto pipe and over the insulation vapour barrier. On concealed hot services terminate insulation 75mm 3" back from all uninsulated fittings, cut off at 90o and apply reinforced scrim cloth and breather mastic system.

.2 Cut back insulation at 45o and finish with a silicone caulking sealant around the base of thermometer wells, pressure gauges, flow switches and pressure and control sensors.

3.3 VERTICAL RISERS

.1 On vertical pipe over 75 mm (2.95 inch) 3" provide insulation supports welded or bolted to pipe, directly above lowest pipe fitting. Thereafter, locate on 4.5 meter (4.92 yard) 457.2 cm (15 feet) centres.

3.4 HOT APPLICATION 26.7˚C 80˚F AND OVER

.1 Piping:

.1 Install medium temperature pipe insulation with integral jacket to pipe and hold in place by stapling the flap, with spreading staples at 75 mm (2.95 inch) 3" centres. Pipe insulation with integral self-sealing jacket will not require additional fastening.

.2 Install strips of vapour barrier jacket over butt joints and secure with spreading staples.

.2 Fittings:

.1 Insulate fittings, to thickness of adjacent pipe insulation, with sections of the pipe insulation mitred to fit tightly, or with preformed insulation fittings (Shur-Fit) or from insulation fabricator.

.3 Valves, Strainers:

.1 Insulate valve bodies and strainers with fitted pipe insulation, or mitred blocks all to thickness of adjacent pipe insulation or insulate with preformed insulation fittings (Shur-Fit) or from insulation fabricator. Drains, blowoff plugs and caps shall be left uncovered.

3.5 COLD APPLICATION 10˚C 50˚F AND LESS

.1 Piping:

.1 Install low/medium temperature pipe insulation with integral vapour barrier jacket to pipe and hold in place by securing the jacket flap. Seal all flaps with vapour barrier adhesive. Pipe insulation with integral self-sealing vapour barrier jackets will not require additional fastening.

.2 Install strips of vapour barrier jacket over butt joints with vapour barrier adhesive. Over wrap butt strips by 50 percent for insulation O.D. 300 mm (11.81 inch) 12” and above apply strips on 250 mm (9.84 inch) 10” centres for additional securement.

.2 Fittings:

.1 Insulate fittings to thickness of adjacent pipe insulation with sections of the pipe insulation mitred to fit tightly, or preformed insulation fittings (Shur-Fit), then apply reinforcing membrane embedded barrier coating and apply finish vapour barrier coating.

.2 Alternatively insulate fittings with tightly placed flexible insulation and apply premoulded 25/50 rated PVC fitting covers. Apply vapour-barrier adhesive and tape on all joints and overlaps.

.3 Valves, Strainers:

.1 Insulate valve bodies, bonnets and strainers with fitted pipe insulation, or mitred blocks all to thickness of adjacent pipe insulation, then apply reinforcing membrane embedded in barrier coating. Alternately, insulate with preformed insulation fittings (Shur-Fit) covered with reinforcing membrane, stapled in place and covered with a barrier coating. Drains, blow-off plugs and caps shall be left uncovered.

.4 Unions, Flange and Victaulic Fittings:

.1 Insulate cold unions and flanges with oversized pipe insulation or mitred blocks to the thickness of the adjacent pipe covering, then apply reinforcing membrane embedded in barrier coating and final coating of vapour barrier mastic.

.5 Where exposed apply low temperature finish.

3.6 ANTI-SWEAT COATING

.1 Coat with an anti-sweat coating - "No Sweat" by Robson Thermal Mfg. Ltd. or approved alternate the following uninsulated cold surfaces:

.1 Connecting surfaces of thermometers, pressure gauges, flow switches, controllers, etc.

.2 The coating thickness shall be as recommended by the coating manufacturer for the system operation conditions.

3.7 PIPE INSULATION FINISHES

.1 Definitions

.1 "Concealed" insulation in horizontal and vertical service spaces will require no further finish.

.2 "Concealed" pipe insulation in damp locations, e.g. pipe trenches shall have a vapour barrier jacket, vapour sealed.

.3 "Exposed" flexible insulation shall be painted with a heavy brush coating of foam plastic white insulation coating.

.4 "Exposed" insulation inside the building shall be finished as follows:

.2 “Exposed" insulation inside the building shall be finished as follows Over a factory applied integral all-service type jacket on the pipe insulation, apply PVC jacket.

.1 Over a factory applied integral all-service type jacket on the pipe insulation apply PVC jacket.

.2 Over insulated fittings apply PVC fitting covers. Over insulated valve bodies, valve bonnets, strainers and flanges apply purchased PVC covers or field fabricate from PVC sheeting secured with solvent bonding cement.

.3 "Exposed" outdoor insulation shall be finished as follows:

.1 Insulation shall have a vapour sealed vapour barrier jacket.

.2 Over the pipe insulation jacket apply aluminum weather protecting jacket. The longitudinal seam shall be located to shed water. Secure the jacket using necessary metal banding on approximately 250 mm (9.84 inch) centres and at the overlaps. Screws are not permitted on cold operating systems, since they will penetrate the vapour barrier.

.3 Over insulated fittings, valve bodies, valve bonnets, strainers and flanges apply metal jacket or preformed metal fittings to provide a complete jacket system. Secure with necessary fastenings.

.4 Seal all outdoor jacketing watertight.

3.8 FIRE STOPPING AND SMOKE SEALS

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

.2 Maintain insulation around pipes penetrating fire separation only as permitted by Firestop Assembly Listing.

.3 Submit Certificate of Inspection (Form MF173) that all work is complete and in accordance with the specified requirements before Substantial Completion.

3.9 INSULATION PACKING OF PIPE SLEEVES

.1 Tightly pack the space between all pipe sleeves and pipe or between pipe sleeve and pipe insulation with mineral wool insulation - Thermal Ceramics "Cerafiber" or Carborundum "Fiberfax" to full depth of sleeve to prevent transmission of sound and/or passage of smoke.

END OF SECTION

PART 1 GENERAL

1.1 REFERENCE STANDARDS

.1 ASHRAE Guideline 1.1 - Application of the Commissioning Process to New HVAC&R Systems.

1.2 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.3 QUALITY ASSURANCE

.1 The commissioning shall be executed in accordance with the intent of:

.1 ASHRAE Standard 202 - The Commissioning Process for Buildings and Systems.

.2 ASHRAE/NIBS Guideline 0 - The Commissioning Process

.3 ASHRAE Guideline 1.1 - HVAC&R Technical Requirements For The Commissioning Process

.4 ASHRAE Guideline 1.3 - Building Operations and Maintenance Training for The HVAC&R Commissioning Process

.5 ASHRAE Guideline 1.4 - Procedures for Preparing Facility Systems Manuals

.6 CSA Z8001-13 Commissioning of health care facilities

.2 An independent firm specializing in building systems commissioning has been retained by the Owner to act as the project Commissioning Authority (CA). This firm will be responsible to manage and administrate the commissioning process on this project.

.3 The list of commissioned equipment and systems is found in Section 01 91 13 Commissioning – General Requirements. Commissioning requires the participation of contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in the same section.

.4 Contractors shall be familiar with all parts of Section 01 91 13 Commissioning – General Requirements, 01 91 15 Commissioning – Training, and the Commissioning Plan issued by the CA and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.4 RESPONSIBILITIES

.1 Be responsible for the performance and commissioning of all systems and equipment supplied under the Sections of Division 23 and 25.

.2 Commissioning is the process of advancing the installation from the stage of static completion to full working order in accordance with the contract documents and design intent. It is the activation of the completed installation.

.3 In consultation with the General Contractor, ensure that sufficient time is allowed and fully identified on the construction schedule for the proper commissioning of all mechanical systems

.4 Due to the phased nature of the construction it will be necessary to commission, test, balance and demonstrate each Phase of the work prior to commencing the next Phase of work so that the hospital can relocate their departments and create working space for subsequent Phases of work to proceed.

.5 Please refer to the Architectural Drawings and Specifications for a detailed description of the phases. Please not that some phases (like the Sterile Compounding portion of the work) have critical deadlines that must be met to achieve accreditation and continue operations.

1.5 COMMISSIONING AND DEMONSTRATION

.1 Provide a designated representative to report to the Commissioning Authority, and coordinate the commissioning process specified under this division and those items of other Divisions which interact with work of this Division as outlined herein, including the complete life safety and fire protection system.

.2 The cooperation of all trades is essential for an efficient and planned process. A team comprising the following is recommended:

.1 General Contractor,

.2 Mechanical Contractor's Supervisor,

.3 Mechanical Consultant,

.4 Control Contractor Div. 25

.5 Building Owner's representative;

.6 Division 23, 25 and Trades: especially Controls Contractor & Balancing Agency and Division 26 Electrical.

.3 Prepare a commissioning statement for each of the four 4 phases that the process is perceived to be worked through. In sequence, the phases are expected to be:

.1 PHASE 1 - System readiness.

.2 PHASE 2 - System start-up, testing, balancing etc.

.3 PHASE 3 - Verification of system performance.

.4 PHASE 4 - Demonstration & instruction.

.4 Each phase is applicable to each major and/or separate system making up the work in Division 21, 22, 23 and 25 plus Division 26 interface as applicable.

.5 Regular meetings shall be held during the commissioning process. Minutes of the meetings shall be issued to all contractors involved, the Consultant and the Owners representative.

.6 Plan the work to be specific in respect of personnel, schedule, review and laboratory tests.

.1 Personnel: Assign direct overall charge of commissioning to a person (the commissioning coordinator) fully qualified through practical experience and a comprehensive knowledge of the interactive nature of building systems and their controls to understand the complete system and be available to carry the project through to total completion. This person shall be responsible for: Commissioning, Demonstration to the Consultant and Owner and Certifications of Substantial and Total Performance.

.2 Schedule: Submit a schedule, as part of the construction schedules, for the commissioning phase of the work. This schedule shall show:

.1 Equipment start-up schedule.

.2 Submission dates for the various documents required prior to substantial performance.

.3 Timing of the various phases of the commissioning, testing, balancing, and demonstration process.

.3 Review: Within three 3 months of commencing with the project work, the person having direct overall charge of commissioning shall review design intent and intended commissioning procedures with the Consultant. Six 6 months prior to the date of scheduled substantial performance, submit a detailed plan that addresses the entire approach to the commissioning process. The plan should be prepared specifically for the project at hand. The plan should include the following components:

.1 Name and qualifications of the commissioning coordinator.

.2 Itemized check lists for the readiness, start-up and operational verification of all equipment and systems.

.3 Outline of proposed method of notification and correction of interim operational deficiencies.

.4 Outline of proposed demonstration and operator training program.

.4 Troubleshooting: Where problems become apparent during the commissioning process, work at the identification and resolution of these problems. The basic functions in trouble shooting are:

.1 What - Identification and definition of the problem.

.2 Why - Determination and evaluation of the causes.

.3 When - Determine the time available to resolve the problem.

.4 Involve the Consultant in the review of the problem and proposed resolution.

.5 Co-ordinate remedial action with the appropriate parties.

.6 Evaluate the effectiveness of the remedial action.

.5 Laboratory Tests: If the field tests indicate that equipment supplied to the project does not meet specifications, Pharmacy certification of the potentially deficient equipment may be requested by Northern Health. In the event that equipment does not meet specifications, be responsible for the costs of:

.1 The above laboratory tests, and

.2 All subsequent testing and correction required.

.7 The work included in each of the four phases shall be generally as follows:

.1 PHASE 1 System readiness

.1 Before starting any of the separate systems, provide a certificate stating that the specific system is ready for start-up and the following conditions have been met (see also Section 23 99 60).

.1 All safety controls installed and fully operational (dry run test).

.2 Qualified personnel available to operate the plant.

.3 Permanent electrical connections made to all equipment.

.2 Confirmation of Room Tightness

.1 Refer to Division 1 for additional information

.2 Rooms to be Tested

.1 Laboratory

.3 System readiness shall include, but not necessarily be limited to the following:

.1 Checking system physical completion, including all instrumentation.

.2 Flushing, chemical cleaning (as required), charging, fluid treating (as required).

.3 Equipment lubrication and prestart checks.

.4 Rotational checks.

.5 Air system cleaning complete.

.6 Adjusting vibration isolation and seismic restraints.

.7 Alignment of drives (direct and belt).

.8 Control function checks, including all alarms.

.9 Self-diagnostic packaged control items checked.

.10 All deficiencies to be recorded, reviewed by the commissioning team, and, subsequently, corrected before proceeding to PHASE 2.

.2 PHASE 2 System startup, testing, balancing

.1 System commissioning shall include, but not necessarily be limited to:

.1 Activation of all equipment and systems.

.2 Testing and adjustment of all equipment and systems.

.3 All deficiencies are to be recorded, reviewed by the commissioning team and, subsequently, corrected. The process at the point of the deficiency, shall be repeated before proceeding to PHASE 3.

.2 Phase 2 is concluded when the installation is in full working order and acceptable for use. The work will include the following:

.1 Balancing of the air systems as specified in this section.

.2 Set up air diffusers, registers and grilles for optimum distribution/comfort.

.3 Set up all automatic control valves/dampers and automatic temperature control devices.

.4 Set up constant volume and variable volume fans.

.5 Adjust air balancing dampers as necessary.

.6 Plug all air pressure and flow measuring holes.

.7 Adjust vibration isolators and earthquake restraints as necessary.

.8 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations.

.9 Verification of water tightness of all roof and exterior wall penetrations.

.10 Testing and debugging of B.M.S. (Building Management System).

.11 Set up and test all alarm protective devices.

.12 Calibration and adjustment of the smoke venting and pressurization systems.

.13 Power failure test with emergency generator start-up.

.3 Fine Tuning

.1 Setting up automatic controls for accurate response and precise sequencing.

.2 Correction of problems revealed by Balance Agency and change of fan speed and pitch as necessary.

.4 Testing

.1 A detailed check by a person having direct overall charge of commissioning. This check to include all items and functions to be later demonstrated to the Consultant and Owner's representatives.

.3 PHASE 3 Verification of System Performance

.1 Please note that each new and renovated department are sequentially stages and must be coordinated throughout the whole project, For example the new laboratory will need to be up close to commissioned prior to moving the existing fume hood from the existing space to the new laboratory. There will be a short time frame where the department can operate without the fume hood. This will need to be carefully planned and coordinated.

.2 Verification of system performance by the Consultant will not commence until PHASE 2 has been totally completed. Submit test procedure completion test certificates at the time of requesting the commencement of the verification procedure. The verification process will include the demonstration of the following:

.1 The ease of access that has been provided throughout for servicing coils, motors, drives, fusible fire damper links, control and smoke dampers and damper operators.

.2 Location of and opening and closing of all access panels.

.3 Operation of all automatic control dampers and automatic temperature control devices.

.4 Proper response of all variable volume air valves to thermostats and volume adjustment controls.

.5 Operation of all smoke dampers and all smoke pressurization and removal provisions.

.6 Operability of randomly selected fire dampers.

.7 Noise level from typical mixing boxes and variable volume air valves under extreme operating conditions.

.8 Operation of all equipment and systems, under each mode of operation including:

.1 B.M.S. control features.

.2 Laboratory Controls

.3 Exhaust Fan

.4 Coils (Pre-Heat, Heating and Re-Heat Coils)

.5 Fume hoods

.3 At the completion of Phase 3, the Contractor shall submit the following to the Consultant:

.1 A letter certifying that all work specified under this contract is complete, clean and operational in accordance with the specification and drawings.

.2 A commissioning report which should include completed copies of all Phase 2 documentation outlined in the commissioning plan plus copies of start-up reports from specialty contractors and vendors and any other relevant information for inclusion in the operating & maintenance manuals.

.3 Record drawings as specified, update to include changes resulting from commissioning.

.4 A statement confirming completion of B.M.S. acceptance test, Division 25 Controls.

.4 PHASE 4 Demonstration and Acceptance

.1 Demonstration and acceptance shall not commence until the commissioning process PHASE 3 has been successfully completed.

.2 The Demonstration process is a planned process requiring a preplan approval before commencement and a signed statement of satisfaction from the Owner upon completion.

.3 Systems operation in the fire mode (pressurization and smoke removal) shall be demonstrated to the Authorities having jurisdiction. Obtain a written statement/certificate of approval.

.4 For additional demonstration and instruction to Operating staff requirements refer to the following clauses and to Division 25 Controls.

.5 Demonstration and Instruction to Operating Staff

.1 Provide certified personnel to demonstrate plant operation and to instruct operating staff on operation of mechanical equipment. Provide maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

.2 The demonstration shall include:

.1 Operation and sequencing of all automatic control dampers and automatic temperature control devices.

.2 Operation and maintenance requirements of all air and water systems and equipment under each mode of operation including:

.1 Air Handling Unit Operation including Catastrophic Event Management and failure operation modes.

.2 Automatic controls

.3 BSC and associated Exhaust Fan

.3 Provide instruction during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

.4 Use Operating and Maintenance manuals for instruction purposes.

.5 Submit the proposed instructional agenda for approval.

.6 Finalize demonstration and instructions by obtaining a signed statement from the Owner that the demonstration and instructions have been given satisfactorily.

.6 Post Substantial Performance Visits

.1 Provide follow-up visits to the site at one month and six months after substantial performance for a minimum period of two days, to ensure that the systems are operating correctly and that they are being operated and maintained properly.

.2 Submit a report to the Consultant and Owner which documents any problems that have arisen and correction action required.

.7 Post Substantial Performance Visits

.1 Provide follow-up visits to the site at one month and six months after substantial performance for a minimum period of two days, to ensure that the systems are operating correctly and that they are being operated and maintained properly.

.2 Submit a report to the Consultant and Owner which documents any problems that have arisen, and correction action required.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 All sections of Division 23 Specifications form part of Contract Documents and are to be read, interpreted and coordinated with all pages. Conform to General Conditions and Division; Instructions to Bidders, Contract General Conditions and Supplements thereto form part of this Division and contain items related to mechanical work.

1.2 SCOPE

.1 Provide for cleaning, degreasing and chemical treatment of all systems that use water as a heat transfer medium.

.2 Provide for cleaning and disinfection of domestic hot, cold and recirculation systems.

.3 Provide all temporary strainers, connections and by-pass lines as required.

.4 Provide equipment to add chemicals to the systems.

.5 Provide appropriate protection so that capped off unused piping does not corrode.

.6 Piping systems to be chemically treated include the following new and existing systems:

.1 Heating water system.

.2 Domestic water system.

1.3 QUALITY ASSURANCE

.1 The water treatment chemicals and treatment process shall be supplied and performed by the Contractor. This work shall be supervised by the Water Treatment Specialist who, upon completion shall certify that the process is satisfactory and submit a report outlining the cleaning operation and the treatment process.

.2 Notify Consultant 48 hours prior to chemical cleaning so that work may be verified and inspected.

1.4 REFERENCE STANDARDS

.1 AWWA C651 - Disinfecting Water Mains.

.2 Do HVAC water treatment in accordance with ASME Boiler Code Section VII, and requirements and standards of regulating authorities, except where specified otherwise.

1.5 SUBMITTALS

.1 Submit shop drawings including proposed chemicals, quantities, calculations, procedures and equipment to be supplied. Provide written operating instructions and system schematics.

.2 Provide written report containing log and procedure of system cleaning, giving times, dates, problems encountered and condition of water.

.3 Submit written report containing test results and list of chemicals added every 14 days from time of commissioning to acceptance.

.4 Provide monthly visits to check chemical treatment, take water samples and recommend any necessary changes to treatment. Provide written report.

.5 Chemical water treatment company shall provide a laboratory test report as required. Provide laboratory test reports confirming the correct chemical concentration has been achieved.

1.6 WATER TREATMENT SERVICE

.1 The Water Treatment Specialist shall provide supervision of installations, set-up and adjustments and shall submit a written report on system operations.

.2 Provide chemicals and instructions for the cleaning of piping systems and equipment.

.3 All chemicals, feed systems and test equipment shall be provided by the Water Treatment Specialist.

.4 Treatment chemicals shall not contain hydrazene.

.5 Replenish existing systems where fluid is drained or system is expanded. Chemicals shall match existing.

.6 Treatment chemicals shall be non-foaming.

.7 The Water Treatment Specialist shall instruct the maintenance personnel before substantial completion. Written instructions of the treatment, dosages control charts and test procedures shall be included in the maintenance manuals.

1.7 SHOP DRAWINGS

.1 Submit WHIMS data sheets for chemicals to be used for water conditioning and cleaning.products

1.8 MATERIALS

.1 System Cleaner: Use a Sodium Metasilicate, Sodium Nitrite and a wetting agent compound which in solution removes grease and petroleum products. Concentration level to be determined by Water Treatment Specialist. (PACE Chemicals Ltd. - PURGEX L-24 or approved equal).

.2 Closed System Treatment (Hot Water, Chilled Water): Use an all-organic based corrosion inhibitor. Maintain levels at 60 to 100 ppm. (PACE Chemicals Ltd. - BAR COR CWS-105 or approved equal.) Note: The use of Nitrite only, Molybdate only or Sulphite only will not be accepted.

.3 Materials which may contact finished areas must be colourless.

PART 2 EXECUTION

2.1 PRE-OPERATIONAL CLEANING AND CHEMICAL TREATMENT

.1 All new systems must be chemically cleaned and flushed before water treatment is added. This includes partial or complete filling for pressure testing.

.2 Provide drain connections to drain system in one hour.

.3 All drains for chemical treatment shall be piped to the sanitary sewer.

.4 After all components of the piping system have been pressure tested and proven to be in full operational condition and leak free, flush entire system with fresh, clean make-up water to remove loose mill scale, sediment and construction debris.

.5 After initial flushing has been completed, clean all strainer screens.

.6 System pumps may be used for cleaning, provided that pumps are dismantled and inspected, worn parts repaired with new gaskets and seals installed. Submit used seals.

.7 Add cleaner to closed systems at concentration levels recommended by the Water Treatment Specialist.

.8 For hot water heating systems, apply heat while circulating, raise temperature slowly to 70ºC and maintain at 70ºC for minimum of 12 hours. Remove heat and circulate at 40ºC or less. After cleaning, drain system as rapidly as possible. Flush system by opening drain valves and opening bypass valve on water make-up to system. Continue flushing until tests show pH, Iron, TDS and Chloride levels of water leaving system are the same as entering system. Install corrosion coupons, refill system and immediately add water treatment to proper level.

.9 Use neutralizing agents upon recommendation of the Water Treatment Specialist and as approved by Consultant.

.10 Inspect, remove sludge and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

2.2 EQUIPMENT BYPASS

.1 Install temporary bypass connections around coils and equipment before commencing chemical cleaning. Equipment required water quality standards shall be referred to within submittals, installation and operating manuals.

.1 Dynamic flush all pipework prior to chemical cleaning. Run water, with balanced fresh water feed using the designed flushing ports. Check for any pipework crosses and achieve minimum flow rates as per below:

.2 Dynamic flush is complete when discharge water runs clear.

.3 Remove, clean and re-install all strainer baskets.

.4 Only open isolation to bypassed equipment after flushing is completed and verified.

2.3 CLEANING AND CHLORINATION OF POTABLE WATER PIPING

.1 All domestic water piping shall be thoroughly flushed so that it is free from scale, sediment, construction debris, etc.

.2 On completion of installation and testing of the potable water systems, pre-flush, chlorinate with Sodium Hypochlorite to AWWA C651-14 specifications and let stand for 24 hours. Thoroughly flush again until flush water meets AWWA standards.

.3 Retain an independent inspection firm to supervise and inspect the chlorination and flushing procedures and perform chemical tests as required.

.4 On projects with water piping being connected to the existing water distribution system including system piping modifications, piping extensions, tenant fit outs etc. flushing and chlorination of all new piping remains a requirement. Provide all required isolation, fill and drain valves required to flush and chlorinate the new piping without impacting the existing system piping.

.5 On completion of installation and testing, all water piping shall be pre-flushed, chlorinated and flushed again in accordance with AWWA C651-14. Provide a minimum two samples, one from the project, directly relatable to the installation (each installation location), and the other that is from a water source away from the project, but on the same site/campus (in the case of a renovation, elsewhere in the same building), from the same municipal water source. The second sample is to be used for comparison purposes, based on the same test parameters for both samples.

.6 Submit to the Consultant, a certificate from the testing firm, stating that the chlorination and flushing have been successfully carried out.

.7 Acceptable Firms: PACE Chemicals Ltd., GE Betz Dearborn.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 23 05 49 for required seismic restraint of ductwork.

1.2 SUBMITTALS

.1 Submit a schedule indicating the ductwork standards to be used, including metal gauges, joints and reinforcements before construction of any ductwork.

1.3 REFERENCE STANDARDS

.1 ASTM C423 - Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.

.2 CSA Z317.2 - Special Requirements for Heating, Ventilation, and Air-conditioning (HVAC) Systems in Health Care Facilities.

.3 NADCA ACR - The NADCA Standard for Assessment, Cleaning, and Restoration of HVAC Systems.

.4 The construction and installation of ductwork and plenums shall be in accordance with the latest edition of the following referenced SMACNA manuals and ASHRAE handbooks.

.1 SMACNA - H.V.A.C. Duct Construction Standards.

.2 SMACNA - H.V.A.C. Air Duct Leakage Test Manual.

.3 ASHRAE - Handbook - Equipment Volume.

1.4 GENERAL

.1 Duct sizes on drawings indicate clear inside dimensions. For acoustically lined or internally insulated ducts, maintain inside duct dimensions.

.2 Where duct sizes are shown in nominal metric sizes, round and oval duct sizes may be supplied in the nearest available sizes in equivalent imperial units.

.3 Proper sized openings shall be arranged for in the correct locations through all slabs and walls. Openings shall be planned to include for the installation of fire dampers at all rated fire separations.

.4 Where ducts penetrate roofs, provide roof curbs with flashing and counterflashing.

.5 Arrange for 100 mm (3.94 inch) 4" high by 100 mm 4" wide concrete curbs around all duct penetrations through floor slabs outside of duct shafts.

.6 The project drawings are diagrammatic and although efforts have been made to provide information regarding the number of offsets and transitions, not all are necessarily shown. Changes may be required in duct routings, elevation and duct shape to eliminate interference with structure and other services. All required adjustments shall be established when coordinating and field measuring the work prior to fabrication and must be provided as part of the contract and all associated costs must be considered and included.

.7 Ductwork used on this project shall be clean and free from scale, corrosion and deposits. All ductwork shall be degreased and wiped clean of all oil and other surface films with appropriate solvents prior to installation.

.8 All ductwork shall be delivered clean to the site and maintained in clean condition. Dirty ductwork shall be removed from site.

.9 Where welded ductwork is indicated, the welding shall be continuous with Everdur welding. Tack welding is unacceptable except as specifically noted. Paint damaged areas with zinc coating after welding.

.10 Provide seismic restraints for ductwork in accordance with SMACNA "Guidelines for seismic restraints of mechanical systems and plumbing piping systems".

.11 Coordinate with the Construction Manager and refer to the project phasing plan and Architectural specifications and drawings for the sequence of work in each stage of the project. Seal, clean, and protect ductwork system at the completion of each stage, to make the ventilation system suitable for serving the spaces.

.12 Allow for all required means of isolation (i.e. tight shut-off dampers, etc.) and capped connections at the ductwork system to enable connecting the new section of ductwork to the previously installed and commissioned sections without the need to shut the ventilation system down during the phased construction process. Refer to the construction phasing plan in Architectural specifications and Section 23 05 00 for details.

PART 2 PRODUCTS

2.1 GALVANIZED STEEL

.1 Galvanized steel shall have a 380 g/sq.m. 1-1/4 oz/sq.ft galvanizing coat both sides to ASTM A525 G90.

2.2 DUCTWORK AND PLENUM PRESSURES

.1 Provide ductwork and plenums fabricated from galvanized steel for the static pressure categories listed below:

.1 500 Pa 2" W.G. static pressure

.1 SMACNA Seal Class A.

.2 All supply ductwork downstream from mixing boxes/air valves to terminal air outlets.

.3 All supply ductwork and plenums on systems without mixing boxes/air valves.

.4 All return air ductwork and plenums, except where otherwise specified.

.5 All exhaust and relief air ductwork and plenums, except where otherwise specified (welding/sawdust exhaust).

2.3 DUCTWORK - 500 PA 2" W.G. STATIC PRESSURE

.1 Construct to SMACNA Seal Class A.

.2 Provide galvanized iron ductwork for system operating pressures 500 Pa 2" W.G. and less. Ductwork shall be constructed, reinforced, sealed and installed to withstand 1-1/2 times the working static pressure.

.3 Construct rectangular ductwork in accordance with Section I including Tables 1-5, 1-10, 1-11, 1-12, 1-13 and Figs. 1-4 through 1-18 of the SMACNA Duct Standards.

.4 Nomasco "Ductmate System, Lockformer TDC" or Exanno "Nexus System" may be used for rectangular duct joints.

.5 At least two opposite faces of all rectangular ductwork must be joined together using a type of joint, which cannot pull apart.

.6 Construct rectangular duct fittings in accordance with Section II including Figs. 2-1 to 2-11 and Figs. 2-16 to 2-18 of the SMACNA Duct Standards.

.7 Construct round ductwork in accordance with Section III including Table 3-2 and Figs. 3-1 and 3-2 of the SMACNA Duct Standards, but excluding beaded crimp joints and snaplock seams.

.8 Construct flat oval ductwork in accordance with Section III including Table 3-4 and Fig. 3-6 of the SMACNA Duct Standards. Joints and seams shall be similar to those indicated for round ducts. Flat oval duct to be used for positive pressure application only.

.9 Construct round and flat oval duct fittings in accordance with Section III including Table 3-1 and Figs. 3-3 through 3-6 of the SMACNA Duct Standards. Round elbows shall have a centreline radius of 1.0 times duct diameter. Sheet metal gauge of fittings and elbows shall be not less than the thickness of that specified for longitudinal seam straight duct. Adjustable elbows are not permitted.

.10 The use of duct sealing tape is not acceptable.

2.4 DUCTWORK - ACOUSTICALLY LINED

.1 Duct liners shall comply with the requirements of CSA Z317.2-2019 Clause 6.9.5 – Lining of HVAC Elements. Fibrous insulation / sound absorbing materials shall not be in contact with the air stream (supply air, return air, and exhaust air). Internal duct liner shall be of durable materials, and suitable for cleaning per NADCA requirements.

.2 Duct Liner – Flexible (fiber free foam)

.1 Foam materials, if used as internal insulation, shall only be used in locations where spinning/oscillating cleaning systems will not be used (e.g., terminal units, air intakes, supply plenums (up to AHU), or exhaust plenums. Such materials shall

.1 be made of fibre-free, closed cell foam that is specifically designed for internal lining of air ducts;

.2 have smooth, cleanable surfaces; and

.3 comply with applicable requirements regarding foam materials.

.2 Internal flexible elastomeric fiber free acoustical insulation

.3 Minimum Noise Reduction Criteria (NRC): 0.7 as per ASTM C423 ‘Type A mounting’.

.4 Thermal Conductivity at 24 deg.C. - 0.033 W/m/deg.C.

.5 The flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.3 Where rectangular ductwork is indicated to be acoustically insulated with flexible acoustic duct liner, liner shall be installed in accordance with instructions and Figures 2-22 through 2-25, SMACNA Duct Standards. Duct sizes shown are inside the duct liner.

.4 Where round ductwork is indicated to be acoustically insulated, it shall consist of two concentric round ducts with 25 mm (0.98 inch) 1" thick with duct liner between the two ducts. The inner duct shall be perforated and correspond to the duct diameter noted on the drawings. The outer duct shall be suitable for the static pressure and shall be sealed airtight where it joins the adjacent ductwork.

2.5 COIL END COVERS

.1 Provide coil end casings to eliminate coil frame air leakage.

.2 Provide for cooling coil ends to drip condensate to the coil drain pan. Insulate the inside of the coil end casing to prevent casing condensation and provide closure panels to retain insulation.

2.6 WIRE MESH SCREENS

.1 Provide wire mesh screens in open ended all air intake and discharge openings.

.2 Screens shall be constructed from aluminum wire 1.3 mm (0.05 inch) diameter 16 ga.

.3 Screen mesh shall be 12.7 mm (0.5 inch) 1/2".

.4 Mount screens in 0.66 mm (0.03 inch) thick 20 ga folded aluminum frames.

PART 3 EXECUTION

3.1 DUCTWORK & PLENUM INSTALLATION

.1 Where a duct contains a fire or smoke damper, construct the duct so that the free area of the duct is maintained through the fire or smoke damper.

.2 Where a duct is to be internally insulated, enlarge the duct so as not to reduce the duct free area.

.3 Make the taper of diverging transitions less than 20 deg. and the taper of converging transitions less than 30 deg., in accordance with Fig. 2-9 of the SMACNA Duct Standards. Maximum divergence upstream of equipment to be 30 deg. and 45 deg. convergence downstream.

.4 Make the inside radius of any rectangular duct elbow at least equal to the duct width, measured in the direction of the radius. If space conditions do not permit a full radius elbow to be installed, use square elbows with multi-blade turning vanes.

.5 Turning vanes shall be single wall type. Vanes in galvanized sheet metal ducts shall be constructed from galvanized steel, minimum thickness 0.76 mm (0.03 inch) 22 ga. Vanes shall be spaced at 40 mm (1.57 inch) 1-1/2" centres and shall turn through 90 deg., with a radius of 50 mm (1.97 inch) 2". Vanes shall not include a straight trailing edge. Refer to Figs. 2-3 and 2-4 of the SMACNA Duct Standards. Vanes and runners in aluminum ducts shall be constructed from aluminum. Aluminum vanes shall be 0.86 mm (0.03 inch) thick 18 ga.

.6 For 500 Pa 2" pressure systems, install tie rods to limit the maximum unsupported vane length to 914 mm (35.98 inch) 36". Refer to Fig. 2-4 of the SMACNA Duct Standards.

.7 Install duct necks before grilles, registers and diffusers and cushion heads after diffuser take-offs as required to suit site conditions.

.8 Where indicated, install adjustable air turning devices, where full radius take-off fittings cannot be installed, in accordance with Fig. 2-16 of the SMACNA Duct Standards. Adjustment shall be accessible outside the duct with lockable quadrant operator or through the grille or register with key-operated worm gear mechanism.

.9 Cross-break or bead all metal duct panels unless otherwise noted. Do not cross-break duct panels on 750 Pa 3" and greater static pressure systems. Do not cross-break bottom duct panels when ductwork is handling moisture.

.10 Cross-break or bead all metal duct panels unless otherwise noted.

.11 Do not cross-break duct panels on 750 Pa 3" and greater static pressure systems.

.12 Do not cross-break bottom duct panels when ductwork is handling moisture.

.13 Grade all ductwork handling moisture, a minimum of 1:120 1" in 10 ft back to the source or at low points in the ductwork, provide a 150 mm (5.91 inch) 6" deep drain sump and 32 mm (1.26 inch) 1-1/4" dia. drain connection with deep seal trap and pipe to drain.

.14 Construct ductwork handling moisture with three sided bottom sections and a separate top panel. Install the three sided bottom sections and internally seal the transverse joints with CGE Silicone Sealant "Silpruf". Then install the top panels and seal the top panel seams and joints.

.15 Provide floor drains in outside air and humidifier sections with deep seal traps.

.16 Provide moisture collection sections inside all louvres for outside air and exhaust air.

.17 Support ductwork using galvanized steel straps, cadmium plated threaded rods, flat bar or angle hangers. Attachments to the structure shall be compatible with the structure and selected for the load of the ductwork. Install ductwork hangers in accordance with Section IV including Tables 4-1 through 4-3 and Figs. 4-1 through 4-9 of the SMACNA Duct Standards.

.18 Support duct risers at their base and at each floor and at not greater than 3.7 meter (4.05 yard) 12 ft intervals.

.19 Prior to the fabrication of ductwork, co-ordinate and field measure all ductwork to ensure a complete installation respecting all other services. Provide all necessary fittings, offsets, and alternate construction methods to facilitate the installation.

.20 Arrange ductwork and plenums so that duct and plenum mounted equipment can be easily removed.

.21 Arrange access doors so that they open against the airflow and static pressure.

.22 Ducts passing through non-rated fire separations, sound insulated walls and through non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with silicon sealant to prevent passage of smoke and/or transmission of sound. (U.L.C. approved fire stop sealant is not a requirement). Where ducts are insulated provide a 0.61 mm (0.02 inch) 24 ga thick galvanized steel band tightly fitted around insulation and then caulk to band.

.23 During construction, protect openings in ductwork, from dust infiltration, by covering with polyethylene, and protect floor outlet duct openings with metal caps.

.24 Where ductwork is required to pass through open web steel joists, coordinate with the joist fabricator before fabricating ductwork.

.25 Provide drip pans under piping and shields for protection of communication and electrical panels and equipment.

.26 Unless noted otherwise, line all builder's shafts and air plenums used as ducts and plenums with sheet metal.

.27 All interior duct surfaces shall be smooth, nonporous, and free of obstructions to airflow in order to minimize the possibility of growth and dissemination of micro-organisms in the system.

.28 Guage of the sheet metal ductwork shall suite the duct size and the required fire resistance. Refer to fire rated insulation duct wrap installation requirements.

3.2 DUCT PENETRATIONS IN NEGATIVE / POSITIVE PRESSURE ROOMS

.1 All ducts passing through walls, floor and ceiling slabs of rooms that are required to be maintained at negative or positive pressure, shall be tightly fitted and sealed on both sides of the separation with silicon sealant to prevent the transmission of air.

3.3 DUCTWORK LEAKAGE TEST

.1 General:

.1 Use equipment capable of demonstrating leakage.

.2 Maintain pressure for minimum 10 minutes. Examine construction joints for damage or weakening. Check joints for audible leaks. Mark each leak and repair after pressure is released. Retest repaired section of duct.

.3 The total allowable leakage for each entire system shall be:

.1 $L_{max} = C_L P^{0.65}$

.2 where

.1 L_{max} = maximum permitted leakage, cfm/100 sq ft duct surface area

.2 C_L = 4, duct leakage class, cfm/100 sq ft duct surface area at 25.4 mm (1 inch). of water

.3 P = test pressure, which shall be equal to the design duct pressure class rating, in. of water

.4 Submit test reports for all ducts.

.2 Up to 500 Pa 2" static pressure rated ductwork

.1 Test the first 30 meter (32.81 yard) 100 ft of installed ductwork in the presence of the Consultant.

.2 Test a 30m 100ft section of 500 Pa 2" static pressure ductwork, where complete systems over 30m 100 ft long are installed under this contract to a static pressure of 500 Pa 2" W.G..

3.4 DUCT SEALING

.1 Ductwork and all plenums with pressure class ratings shall be constructed to Seal Class A.

.2 Openings for rotating shafts shall be sealed with bushings or other devices that seal off air leakage. Pressure-sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL 181A or UL-181B by an independent testing laboratory, and the tape is used in accordance with that certification.

.3 All connections shall be sealed, including but not limited to spin-ins, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required.

.4 Spiral lock seams need not be sealed. All duct pressure class ratings shall be designated in the design documents.

3.5 STAINLESS STEEL DUCTWORK - GENERAL

.1 CSA Z317.2 Section 6.13 requires stainless steel ductwork with sealed seems for the following locations:

.1 Exhaust “ducts conveying corrosive fumes and vapours or other hazardous substances (including fume hoods and biological safety cabinet exhaust systems); and”

.2 Exhaust “ducts where condensation is likely to occur.”

.2 “Ducts shall be sloped to provide drainage where condensation is expected. The exhaust duct and the sheet metal transition to the connection of the fan and to the connection of the hood or cabinets shall be pressure tested to meet SMACNA Class A leakage criteria.”

.3 “Note: Special requirements might be necessary for duct drain lines.”

.4 Refer below for additional information:

3.6 DUCTWORK - STAINLESS STEEL - RECTANGULAR

.1 The following ductwork shall be fabricated from stainless steel with sealed seems:

.1 Sterile *Compounding* Pharmacy Hazardous Exhaust ducts serving the Sterile Hazardous Compound suite and

.2 Where indicated on the drawings.

.2 Low-pressure stainless-steel ductwork shall be suitable for system operating pressures 500 Pa [2" W.G.] or less.

.3 Material: 1.14 mm [18 ga.], 316L stainless steel, with No. 2B finish where concealed and No. 4 finish where exposed. (Exposed areas shall include finished occupied areas of the building but not mechanical rooms).

.4 Do not cross break duct panels. Grade to drain as indicated.

.5 Weld all longitudinal seams and lateral joints and finish all exposed seams and lateral joints by grinding smooth and buffing to finish of the sheet. Do not penetrate stainless steel with screws, bolts or rivets.

.6 Provide gasketted companion flange connections where necessary to connect to equipment. Flanged connections shall be made up by slipping a formed 1.8 mm [14 ga.] thick matching stainless-steel welded angle frame over the end of the duct, leaving space for continuously welding the frame to the duct on the inside.

.7 Provide escutcheon trim bands around all duct ceiling penetrations.

.8 Provide gasketted cleanouts (not smaller than 450 mm x 300 mm [18" x 12"], with formed 1.8 mm [14 ga.] thick matching stainless steel welded angle reinforcing frames, in the side of the ductwork at not more than 6 m [20 ft.] intervals, changes in direction and base of risers. Cleanouts shall be fastened with wing nuts at 150 mm [6"] centres. Cleanouts openings shall terminate not less than 40 mm [1-1/2"] from the bottom of the duct.

.9 Gaskets shall be 3 mm [1/8"] thick teflon or an approved alternate.

.10 Support exposed ductwork with 50 mm x 1.8 mm [2" x 14 ga.] matching stainless steel (No. 4 finish) U-strap hangers on 2.4 m [8 ft.] centres.

3.7 DUCTWORK - STAINLESS STEEL - ROUND

.1 The following ductwork shall be fabricated from stainless steel with sealed seems:

.1 Sterile *Compounding* Pharmacy Hazardous Exhaust ducts serving the Sterile Hazardous Compound suite and

.2 Where indicated on the drawings.

.2 Material:

.1 1.14 mm [18 ga.], 316L stainless steel with No. 2B finish where concealed and No. 4 finish where exposed to the room or exposed outdoors.

.3 Fabrication:

.1 BSC exhaust ducts shall be constructed to SMACNA Seal Class A Standards as a minimum.

.2 All joints on duct and fittings shall be butt seams continuously MIG. welded. Lap type joints are not acceptable. All welded joints in exposed locations must be ground and polished.

.3 Provide gasketted companion flanged joints and any required transitions for fume hood duct connections.

.4 Provide escutcheon trim bands around all duct ceiling penetrations.

.4 Elbows:

.1 Round duct elbows shall be made of mitred, welded matching stainless steel or stamped elbows of the same material. Welded elbow thickness shall be 1.14 mm [18 ga.]. 90 deg. elbows shall have a minimum of five sections. Centreline radius shall be 1.5 times duct diameter.

.5 Support:

.1 Support exposed ductwork with 50 mm x 1.8 mm [2" x 14 ga.] stainless steel (No. 4 finish), U-strap hangers at 2.4 m [8 ft.] centres.

.2 Support concealed ductwork with 50 mm x 1.8 mm [2" x 14 ga.] galvanized steel, U-strap hangers, at 2.4 m [8 ft.] centres.

3.8 DUCTWORK AND PLENUM CLEANING

.1 This Contractor shall be responsible for and ensure that all supply, return and exhaust ducts installed under this contract, as well as existing ductwork that form part of the complete HVAC system serving the spaces within the project scope, are internally CLEAN when handed over to the Owner. This responsibility includes the entire systems, from outdoor air intakes to air terminals and from air terminals to relief outlets. It includes all ductwork, lined and unlined, all plenums and all equipment within or connected to ducts and plenums.

.2 Refer to the mechanical drawings and coordinate with the General Contractor for the complete scope of ductwork and duct cleaning. Visit the site during the Tender to review the project area, the scope of new ductwork and equipment, and the existing ductwork and equipment that will serve the project area, to verify the scope of ductwork and plenum cleaning.

.3 The surfaces shall be considered clean when all foreign materials capable of particulating and visible to the naked eye are removed.

.4 Installation Procedure

.1 All ductwork shall be handled and installed in accordance with the advanced level specified in SMACNA's Duct Cleanliness for New Construction Guidelines

.2 All ductwork shall be wiped clean prior to installation.

.3 LEED Requirement: Oil film on sheet metal shall be removed before shipment to Work Site. Ducts shall be inspected to confirm that no oil film is present.

.4 Close all dampers immediately following installation thus checking the operation and retarding movement of contaminants through the system.

.5 Seal all openings at the end of each day and at such other time as site conditions dictate.

.5 Cleaning Procedure

.1 All portions of supply, return and exhaust ducts shall be cleaned in accordance with NADCA Standard for Assessment, Cleaning & Restoration (ACR) of HVAC Systems, 2021.

.2 Verification of HVAC system cleanliness shall be in accordance with NADCA ACR 2021.

.1 If visual inspection (Method 25.4 mm (1 inch) NADCA ACR 2021) is inconclusive, surface comparison testing (Method 50.8 mm (2 inch) NADCA ACR 2021) should be used.

.2 If surface comparison testing is inconclusive, vacuum testing (Method 76.2 mm (3 inch) NADCA ACR 2021) should be used.

.6 On completion of the duct and plenum installation and prior to the installation of air terminals and prior to balancing of the air systems, but not until the areas are substantially clean (floors have been swept and vacuumed) and all "dirty" construction has been completed, employ an approved Cleaning Agency to vacuum clean the following:

.1 All plenums.

.2 3 meters (3.28 yards) upstream and downstream of tie-in point at existing ductwork.

.3 All supply, return, general and washroom air ducts.

.4 All components within each system shall be thoroughly cleaned and shall include but not be limited to the following: coils, fans and motors, silencers, air terminals and mixing boxes / air valves.

.7 When connecting to existing supply ductwork, clean existing supply ducts upstream from connection back to the filters. Clean existing supply ductwork downstream from new connections to outlets.

.8 Cleaning shall generally be by high capacity power vacuum. High-pressure compressed air, wire brushing and/or non-toxic solvent cleaning shall be used where dirt or scale cannot be removed otherwise. Coils shall be de-scaled.

.9 The Cleaning Contractor shall be responsible for removing and replacing filter media. This contractor will remove the temporary filters and replace with new after cleaning the systems.

.10 The Cleaning Contractor shall mark balancing damper positions before cleaning and return them to their original position when cleaning is completed unless the system is still to be balanced.

.11 Reinstall any grilles, registers and diffusers, which may have been removed for cleaning purposes.

.12 After the duct systems have been cleaned they should be resealed if they are not being used. Provide filter media on the return air terminals if the return air fans are run after cleaning has been completed.

.13 The Cleaning Agency shall perform a full inspection of the duct interior. Utilizing a fibre optic borescope with dedicated light source, inspect interior ductwork surfaces, and ductwork accessories including terminal units, mixing boxes / air valves, ductwork liners, duct-mounted coils, filters, dampers, humidifiers and all other appurtenances within the ductwork system.

.14 Spot checks will be made by the Consultant during the cleaning process to verify that the required standard is being met. When substantial performance is claimed, final spot checks will be made to verify that the ducts are clean. Make available for the use of the Consultant a fibre optic borescope with dedicated light source. If any ducts are found to be unclean, then they shall be recleaned.

.15 Submit a report from the cleaning agency that certifies all specified air systems have been cleaned.

.16 Openings in mechanical equipment and ductwork shall be sealed before shipping. Measures shall be taken to ensure that seals are not damaged during shipping or handling. Equipment shall remain protected until it is installed and functioning without interruption. See CSA Z317.13.

.17 All ductwork shall be handled and installed in accordance with the advanced level specified in SMACNA's Duct Cleanliness for New Construction Guidelines.

.18 Plan and execute demo and new works such that contamination of existing ductwork system (e.g. ingress of dust) is avoided. Coordinate with the Mechanical Contractor and the Construction Manager for the sequence of work and duration of each shutdown. Clean existing ductwork (e.g. main hot, cold, exhaust, etc.) as necessary due to modification and/or shutdown of existing ventilation systems.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 QUALITY ASSURANCE

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards

PART 2 PRODUCTS

2.1 BACKDRAFT DAMPERS

.1 Minimum Requirements:

.1 1.4 mm (0.06 inch) thick 16 ga galvanized steel or aluminum channel frame.

.2 1.2 mm (0.05 inch) thick 15 ga aluminum blades, complete with stiffening ribs/bends.

.3 Full blade length shafts; brass, ball or nylon bearings.

.4 Felt or neoprene anti-chatter blade strips.

.5 Blade connecting linkage with eyelet and pin bearings.

.6 Maximum blade length of 760 mm (29.92 inch) 30", use multiples for larger dimensions.

.7 Manufacturer's label.

.8 Only balanced backdraft damper (BBD) shall be used, and they shall incorporate an adjustable counterbalance weight and lever.

.9 Maximum pressure drop across damper at 4.06 meter (4.44 yard)/s 800 FPM shall be 45 Pa 0.18" w.g.

.10 Standard of Acceptance: Nailor 1390CB, Ruskin CBD6.

2.2 BALANCING DAMPERS

.1 Construction in accordance with SMACNA Duct Standards - Figs. 2-14 and 2-15.

.2 Minimum Requirements:

.1 Rectangular ducts:

.1 Up to 300 mm (11.81 inch) 12" deep - single blade (butterfly type).

.2 330 mm (12.99 inch) 13" to 400 mm (15.75 inch) 16" deep - two opposed blades, mechanically interlocked with pivots at quarter points.

.3 430 mm (16.93 inch) 17" deep and over - multiple opposed blades, mechanically interlocked with blades not greater than 200 mm (7.87 inch) 8" deep and pivots equally spaced.

.2 Round Ducts:

.1 Single blade (butterfly type).

.3 Material:

.1 Minimum 1.47 mm (0.06 inch) 16 ga thick galvanized steel blade on all butterfly dampers.

.2 Minimum 1.47 mm (0.06 inch) 16 ga thick galvanized steel blades on multi-blade dampers with rigidly constructed galvanized steel frame (no frame required on single blade dampers).

.3 Minimum 1.14 mm (0.04 inch) 18 ga thick stainless steel blades for fume exhaust ducts.

.4 Bearings:

.1 End bearings on all low pressure single blade dampers above 300 mm (11.81 inch) 12" dia.

.2 Bearings on multiple blade dampers shall be bronze oilite type.

.5 Operating Mechanism:

.1 Lockable quadrant type with end bearing on accessible rectangular ducts up to 400 mm (15.75 inch) 16" deep and on accessible round ducts.

.2 Wide pitch screw mechanism type with crank operator on accessible rectangular ducts 430 mm (16.93 inch) 17" and over in depth and on inaccessible rectangular and round ducts.

.3 Override limiting stops.

.4 No blade movement in set position.

.6 Concealed Regulators:

.1 For all drywall ceilings which do not have access panels provide concealed balancing damper regulators embedded in the finished ceiling, mounted behind grilles, on or inside plenum slot diffusers and various types of diffusers. Concealed damper regulator to be connected to balancing damper by means of flexible Bowden cable and to be installed flush with ceiling. Coverplate to be held in place with 2 screws and to be easily removed for damper adjustment. Concealed damper regulator to be similar to Young Regulator Co. Model No. 270-301. Provide all necessary hardware including Young Regulator balance damper model 5020-CC, Bowden cable and Young Regulator Model 030-12 wrench. Refer to Mechanical Detail MD 30 014.

.2 Drawing designation: D (CR).

2.3 DUCT AND PLENUM ACCESS

.1 Locations: Refer to Part 3 (Execution).

.2 Dimensions:

.1 Doors:

.1 500 mm (19.69 inch) 20" wide x 1370 mm (53.94 inch) 54" high.

.2 Head of door 1780 mm (70.08 inch) 70" above floor.

.2 Panels:

.1 380 mm (14.96 inch) x 500 mm (19.69 inch) 15"x20".

.2 Where the far corners of the duct are closer than 500 mm (19.69 inch) 20" and the equipment within the duct is closer than 300 mm (11.81 inch) 12" the size may be reduced to 400 mm (15.75 inch) x 300 mm 16"x12" or 450 mm (17.72 inch) x 250 mm (9.84 inch) 18"x10" elliptical.

.3 Where space will not permit the above dimensions to be attained they should be matched as closely as possible and where necessary additional access be provided.

.3 Products:

.1 Doors - construct in accordance with SMACNA Duct Standards Fig. 6-12 except for latch type. 40 mm (1.57 inch) 1-1/2" thick insulation.

.2 Panels - Nailor Hart, Ventlok, 25 mm (0.98 inch) 1" thick insulation.

.3 Gaskets - neoprene or foam rubber.

.4 Access doors shall have an effective seal (i.e., no air leakage) and latching or lever mechanisms.

.4 Hardware:

.1 Panels up to 400 mm (15.75 inch) x 300 mm (11.81 inch) 16"x12" - 2 sash locks.

.2 Panels - 380 mm (14.96 inch) x 500 mm (19.69 inch) 15"x20" - 4 sash locks.

.3 Doors - piano hinge and Ventlok 310 latches c/w front and inside handles and front door pull.

2.4 DUCT CONNECTORS – THERMAL BREAKS

.1 Provide flexible duct connections to provide thermal breaks in all sheet metal ducts and plenums passing through or terminating at the exterior of the building. Install inside the building.

.2 Minimum Requirements:

.1 Pre-assembled 75 mm (2.95 inch) 3" long thermal barrier with 75 mm 3" long, 0.61 mm (0.02 inch) 24 ga galvanized steel duct connectors on each side of the thermal break.

.2 Thermal break - heavy fiber glass fabric with elastomer coating.

.3 Standard of Acceptance: Duro Dyne "Durolon", Ventfabrics "Ventlon".

2.5 DUCT CONNECTORS - VIBRATION ISOLATION

.1 Provide flexible duct connections to provide vibration isolation at all duct and plenum connections to fan and air handling units. See Figure 2-19 SMACNA Duct Standards.

.2 Minimum Requirements:

.1 Pre-assembled 75 mm (2.95 inch) 3" minimum long flexible connection with 75 mm 3" long 0.62 mm (0.02 inch) 24 ga galvanized steel duct connectors on each side of the flexible connection. Flexible connector - fiber glass fabric with elastomer coating.

.3 Centrifugal fans with 900 mm (35.43 inch) 36" diameter and larger fan wheels, use 150 mm (5.91 inch) 6" long flexible connection.

.4 Do not install connectors on perchloric acid fume exhaust systems.

.5 Standard of Acceptance: Duro Dyne "Durolon", Dynair "Hypalon", Ventfabrics "Ventlon".

2.6 DUCTWORK - FLEXIBLE - PLAIN

.1 Provide factory fabricated plain, flexible air ductwork for the following applications:

.1 Connections to air terminals.

.2 Connections to downstream side of mixing boxes / air valves.

.3 Connections to round fire dampers (up to 300 mm (11.81 inch) 12" diameter).

.2 Minimum Requirements:

.1 Non-corrosive spiral wire reinforcing with flexible vinyl coated fiberglass cloth membrane.

.2 Suitable for up to 2500 Pa 10" w.g. positive static pressure and 250 Pa 1" w.g. negative static pressure.

.3 U.L. or U.L.C. labelled, Class 1, duct connector.

.4 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

.5 Standard of Acceptance: Flexmaster FAB4, Thermaflex SLP10,

2.7 DUCTWORK - FLEXIBLE - INSULATED

.1 Provide factory fabricated insulated flexible ductwork for the following applications:

.1 Connections to downstream side of variable volume and constant volume mixing boxes, where indicated.

.2 Connections to air terminals where indicated.

.2 Minimum Requirements:

.1 Flexible vinyl coated steel helix bonded to inner duct liner. Fibrous glass thermal insulation shall not be exposed to the air stream.

.2 Outer jacket of metalized fire-resistant vapour barrier.

.3 Suitable for up to 500 Pa 2" w.g. positive static pressure and/or 250 Pa 1" w.g. negative static pressure.

.4 UL or ULC labelled, Class 1, duct connector.

.5 Acoustically rated.

.6 Standard of Acceptance: Glass-Flex ABL-181, Thermaflex M-KE, Wiremold WK, FlexMaster

.7 Pressure rating: 6” w.c. positive, 2” w.c. negative

.8 Medical Grade Acoustic (MGA) certified.

.9 Flame and smoke spread rating: 25/50

.10 R-6 thermal insulation.

2.8 DUCTWORK AND PLENUM SEALERS

.1 The use of duct sealing tapes is not acceptable.

.2 Provide duct sealing compounds for use in fabrication of all ductwork and plenum joints.

.3 Low Pressure Systems - SMACNA Seal Classification B. Medium and High Pressure Systems - SMACNA Seal Classification A.

.4 Standard of Acceptance:

.1 Foster 32-14, Hardcast Versa Grip, Hardcast Foil Grip 1402, Robson's Duct Seal-WB, United Duct Sealer, Trans Continental Multi-Purpose.

.5 Where accessible, apply sealer to inside of joints on ducts and plenums under positive pressure - e.g. on the discharge side of fans.

.6 Apply sealer to outside of joints on ducts and plenums under negative pressure - e.g. on the suction side of fans.

2.9 FIRE DAMPERS

.1 Minimum Requirements:

.1 Fire dampers shall be U.L.C. or Warnock Hersey tested and shall bear the testing agency's label.

.2 Fire dampers shall meet requirements of the National Building Code and authorities having jurisdiction.

.3 All fire dampers shall be "dynamic"; rated to close under airflow.

.4 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire separation.

.5 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type in horizontal position with vertical airflow.

.6 Fire dampers in low-pressure ductwork may be multi blade or curtain type.

.7 Fire dampers in medium and high-pressure ductwork shall be curtain type.

.8 Curtain fire dampers shall have blades retained in a recess so free area of connecting ductwork is not reduced.

.9 Fusible links: U.L.C. approved with a melting point of 74oC 165oF on supply, return and exhaust air systems. Use fusible links with a melting point of 141oC 286oF on all return and exhaust air systems if used for smoke venting.

2.10 FIRE STOP FLAPS

.1 Minimum Requirements:

.1 Single damper flap with spring catch.

.2 U.L.C. tested and labelled.

.3 Construct of minimum 1.35 mm (0.05 inch) 16 ga thick sheet steel with 1.6 mm (0.06 inch) 1/16" thick asbestos on unexposed side and corrosion-resistant pins and hinges.

.4 U.L.C. approved fusible links with a maximum melting point of 74oC 165oF.

.5 Arranged so as not to reduce duct free area.

.6 Standard of Acceptance: Ruskin CFSF.

2.11 FLOW MEASURING DEVICES - AIR

.1 Airflow Probe (Duct or Fan Inlet)

.1 Minimum Requirements:

.1 Aluminum construction.

.2 Multiple traverse probes.

.3 Traverse probe to contain multiple total and static pressure sensors located along exterior surface of probe and internally connected to their respective averaging manifolds.

.4 Threaded end support rod and mounting plate with gasket and signal fittings.

.5 Fan inlet probes (two per inlet) shall have dual end support swivel brackets suitable for mounting in the fan inlet bell.

.6 Capable of producing an output signal linear and scaled to air volume (4-20 mADC, 0-10 VDC, 0-5VDC).

.7 Capable of local digital display of continuous indication of air volume.

.2 Standard of Acceptance:

.1 Air Monitor VOLU-probe/7200AZ (Duct).

.2 Air Monitor VOLU-probe/7200AZ (Fan Inlet).

PART 3 EXECUTION

3.1 BALANCING DAMPERS

.1 Provide balancing dampers at points on low pressure supply, return and exhaust systems where branches are taken from larger duct as required for proper air balancing.

.2 Provide balancing dampers at each run out to a grille or diffuser.

.3 Identify the airflow direction and blade rotation and open and closed position.

.4 On all round ductwork larger than 300 mm (11.81 inch) 12" diameter and on externally insulated rectangular ductwork, provide sheet metal bridge to raise quadrant type operators above the insulation thickness (coordinate with Section 15270 23 07 13). Provide an open end bearing where bridges are used. Bridges on uninsulated round ducts shall be at least 25 mm (0.98 inch) 1" high.

.5 Where quadrant type operators are used, the lever shall be arranged parallel with the damper blade.

.6 Balancing dampers shall be positioned as close to main duct as possible and not closer than 3 meter (3.28 yard) from diffusers. Install a minimum of 1 metre of flexible duct after damper where damper is within 3 metres of diffusers. No damper should be installed within 1 metre of air inlets and outlets.

3.2 BACKDRAFT DAMPERS

.1 Install balanced backdraft dampers on all exhaust and relief openings through the building walls and roof on all exhaust fans where control dampers are not called for or indicated.

3.3 DUCT AND PLENUM ACCESS

.1 Locations: Provide access doors and panels as follows:

.1 Doors: where shown on the drawings.

.2 Panels:

.1 Every 12 meter (13.12 yard) 40 ft on all ductwork;

.2 At the base of each duct riser;

.3 Both sides of any equipment blocking the duct;

.4 In front of and behind turning vanes, silencers, and duct-mounted coils

.3 At or to one side of other equipment in duct:

.1 backdraft dampers (counter weight side)

.2 balance dampers serving multiple outlets/inlets

.3 bearings (fans/motors)

.4 control dampers

.5 control sensors (e.g. airflow sensors)

.1 Note: coordinate with Ainsworth for access, and installation of new access doors and humidity, airflow, and pressure sensors for JPS air handling units AH-2, 4, and 7.

.6 fire dampers (rectangular ducts and round ducts 330 mm (12.99 inch) 13" dia. and larger - latch side)

.7 heat detectors (upstream from device)

.8 smoke dampers (operator side)

.9 smoke detectors (upstream from device)

.10 Fresh air ducts near the intake louvers

.11 Such that any section of duct downstream of a HEPA filter is not more than 3 meter (3.28 yard) from a point of access

.12 In fresh air ducts near the intake louvers

.13 At locations having an internally mounted piece of equipment or device

.14 At existing ductwork, as required for cleaning. Coordinate with the ductwork cleaning agency and inspect the existing ductwork during Tender to verify the scope of duct cleaning and requirements for new access panels.

.4 Panels need not be provided where access is available through a door or a register mounted on the side of the duct.

.5 Patches:

.1 Where required for cleaning and where access panels are not specified, e.g. on both sides of turning vanes.

.6 Flexible duct - on round duct and round fire dampers up to 300 mm (11.81 inch) 12" dia.

.2 Seal frames airtight.

.3 Install so as not to interfere with airflow.

.4 Do not use sheet metal screws for attaching access panels to ductwork.

.5 Round ducts 330 mm (12.99 inch) 13" dia. and larger shall include a short collar for the installation of access panels.

.6 Small rectangular ducts shall be transitioned to a minimum dimension across the duct of 330 mm (12.99 inch) 13" for the installation of access panels.

.7 Provide retaining chains on panels 2.1 meter (2.3 yard) 7 ft above floor, and higher.

.8 Access points shall be coordinated with all related trades to provide unimpeded access.

.9 Provide “as-built” drawing noting location of all duct cleaning access doors.

3.4 DUCT CONNECTORS - VIBRATION ISOLATION

.1 Ensure flexible duct connectors do not reduce duct free area on suction side of fans.

3.5 DUCTWORK – FLEXIBLE

.1 Installed lengths shall be limited to 6 times duct diameter but not longer than 1200 mm (47.24 inch) 4 ft.

.2 Connect to ductwork and diffusers with stainless steel worm drive clamps or Panduit adjustable clamps or Thermaflex duct strap applied over two wraps of duct tape. Use stainless steel clamps on connections to fire dampers.

.3 Minimum centreline radius of flexible ductwork bends shall be 1.5 times the duct diameter, alternatively, sheet metal elbows may be used at branch takeoffs and boot/diffuser connections.

.4 Support with 25 mm (0.98 inch) x 0.76 mm (0.03 inch) 1"x22 ga galvanized steel straps at a maximum of 600mm 24". Straps shall completely encircle duct.

.5 Support clear of ceiling assembly, light fixtures and hot surfaces.

.6 Flex ducting may only be used for supply air diffusers, and shall not be used for return and exhaust grilles.

.7 Flex duct shall be installed with a minimum of bends, compressions, or kinks, so that the maximum free internal area of the duct is maintained throughout its length. The minimum centreline bend radius shall be 1.5 duct diameters.

.1 Notes: Flex ducting should be used to accomplish only one change of direction, such as a 90-degree bend for acoustic attenuation.

3.6 FIRE DAMPERS

.1 Install in accordance with the SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems.

.2 Fire damper sleeves must not extend more than 75 mm (2.95 inch) 3" from wall on each side.

.3 Fire dampers must be installed within wall thickness of fire separation.

.4 Wall openings sized to allow sleeve/damper expansion.

.5 Arrange dampers so that linkages and locking catches are accessible from the access side of fire damper.

.6 Install so as to close in the direction of normal airflow.

.7 Size so that the free area of duct is maintained through the assembly.

.8 Install in galvanized steel sleeve, retained in place with retaining angles on all four sides at each face of wall.

.9 Connect ductwork to damper sleeves using break-away duct joints on all faces.

3.7 FLOW MEASURING DEVICES - AIR

.1 Install in accordance with manufacturers recommendations. The minimum distances from air turbulence - producing fittings, transitions etc. shall be maintained.

.2 When specified mount air volume gauges at a convenient height for easy visual inspection and install interconnecting piping.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 QUALITY ASSURANCE

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards

PART 2 PRODUCTS

2.1 AIR TERMINALS

.1 General:

.1 Grilles, registers and diffusers shall be product of one manufacturer.

.2 Refer to drawings for sizes and air quantities.

.3 Refer to equipment schedule drawings for details.

.4 Base air outlet application as follows:

Max. NC	Areas
30-35	Operating Rooms, ICU/CCU, Patient Rooms
30-40	Wards, Corridors and Public Areas
35-40	Recovery Rooms
35-40	Open Plan Office Areas
30-35	Meeting Rooms
25-30	Video Conference Areas
30	Isolation Rooms
35	Medical Imaging, Emergency, Treatment Areas, Laboratories
30	Director's Office / Managers' Office
25-30	Conference Room / Board Room / Library / Classrooms / Seminar Rooms
30-35	Offices / Counselling
30	Multi-Purpose
35	Exam Rooms / All Testing Rooms
45	Storage
35-40	Lounge

.5 All air terminals must be checked for compatibility with ceiling types. Refer to Architectural reflected ceiling plans.

.6 Ceiling tee-bar modules are in soft conversion metric, SI metric, measurements unless where specifically noted otherwise. Confirm the actual dimensions of the tee-bar ceiling with the CM and Architect prior to ordering air terminals.

.1 Note: Ceiling tee-bar modules are in Imperial measurements unless where specifically noted otherwise.

.7 The manufacturer (other than the design listed) shall match performance data and indicate a specific comparison for each item, with the shop drawing submission.

.8 All ceiling mounted air terminals shall be provided with means for attachment of two seismic security wires at opposite corners of each air terminal.

.9 Provide concealed baffles, where necessary, to direct air away from walls, columns or other obstructions within the radius of air terminal operation.

.10 Provide auxiliary frames for diffusers located in drywall ceilings and grilles mounted in gypsum board walls in public areas. In other areas the grilles should be attached to the ductwork, flanged to the outside of the wall opening.

2.2 LOUVRES - STATIONARY

.1 General:

.1 Refer to drawings for size and quantity.

.2 Extruded aluminum frames and blades.

.3 All welded construction with exposed joints ground flush and smooth or mechanically fastened with stainless steel fasteners.

.4 Lower assembly sealed and watertight.

.5 Removable 1.3 mm (0.05 inch) 16 ga dia. aluminum wire birdscreen with 12 mm (0.47 inch) 1/2" mesh. Birdscreen mounted in 0.66 mm (0.03 inch) 20 ga thick aluminum folded frame. Frame to be installed inside louvre.

.6 Factory applied baked enamel finish to Consultants colour choice.

.7 Mill finish.

.8 Anodized permanodic hard colour finish.

PART 3 EXECUTION

3.1 AIR TERMINALS

.1 Install with cadmium plated screws in countersunk holes where fastenings are visible.

.2 Install ductwork as high as practical, using offsets where required to obtain maximum duct neck lengths for diffusers.

.3 Refer to Architectural Reflected Ceiling plans for exact locations of air terminals.

.4 Paint ductwork behind grilles with matte black paint where duct or insulation surfaces are visible.

.5 Attach registers and grilles to branch ducts with duct necks having minimum length to prevent grille or register damper from protruding into branch duct.

.6 Where air terminals are installed in mechanical grid ceilings, provide at least two 12 ASWG galvanized steel wire seismic security bridles per air terminal tied either to the building structure or to ceiling hanger wires. Attach security bridles at opposite corners of each air terminal and in such a manner that the air terminal cannot fall.

.7 Hand over door grilles to the General Contractor for installation.

.8 Diffuser, grille, and register cores in air systems shall be removable for cleaning.

3.2 LOUVRES

.1 Provide all necessary flashing and counterflashing for louvres installed in walls.

.2 Caulk louvre and flashing and counterflashing to make installation water tight.

.3 Blank-off panels shall be constructed to SMACNA standards, minimum 20 Ga. Sandwich panel with 25 mm (0.98 inch) 1” thick fibreglass insulation.

.4 All blank-off panels shall have a painted flat black enamel finish.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Sections – Commissioning General Requirements and Commissioning of Mechanical for additional responsibilities of the BAS contractor

1.2 SCOPE OF WORK

.1 The new control system, while being a completely stand-alone system, shall be connected to the existing University Hospital of Northern BC Building Automation System.

.2 New control system to match with the existing base building control system (Reliable Controls – Houle Controls)

.3 This project includes adding new vented fume hoods to the existing histology laboratory.

.4 The Controls Contractor shall provide the following:

.5 Integrated control of the new fume hoods and associated existing exhaust fan EF-406 to the existing building management system (Reliable Controls – Houle Controls). New control system to match with the existing base building control system (Reliable Controls – Houle Controls).

.6 The new controls and systems shall be integrated into the existing system and operator interface shall be through the existing operator's workstations. In addition, the new systems will provide access to Facility & Energy Management Software Use through the existing base building controls (Reliable Controls).

.7 The control will be coordinated and provided by controls supplier approved by North Health, including the generation of new graphics for all control components.

.8 All controls to be BACnet control compatible.

1.3 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Where multiple versions of the same code are published, the most recent version shall be applied, unless noted otherwise by building codes and local by-laws.

1.4 GENERAL

.1 The control system is to be fully microprocessor based as well as provide connections to the existing base building controls (Reliable Controls).

.2 management system.

.3 The controls system is to be complete with all necessary control components and connections to achieve the specified functions and to permit the H.V.A.C. systems to perform properly in the manner described and as hereinafter specified.

.4 The controls contractor shall furnish all materials, including all central computer hardware and software, operator input/output peripherals, standalone DDC panels, automation sensors and controls and wiring.

.5 The controls contractor shall be responsible for the design, installation, supervision and labour services, calibration, all software programming, and checkout necessary for a complete and fully operational Building Automation System.

.6 The control system is to be set up and adjusted to achieve optimum operation of the lab systems and other H.V.A.C. system. This includes sequencing, timing and readjustment, as required. Modifications to the sequence of operation using points indicated will not be considered as extra to the Contract. These modifications to continue through the construction period, commissioning period and warranty period as required to achieve optimum operation of the mechanical system.

.7 This Section is a performance specification clarified in certain sections to establish minimum standard of equipment, installation or level of control. The specification describes the basic functions required but not all of the installation details or components. This Trade is expected to have sufficient experience to be able to design and estimate the cost of an appropriate control system. Materials and work necessary to achieve a satisfactory result will not be considered extra to the contract.

.8 The contractor shall review all contract documents and visit the site if possible, prior to the closing date of the tender and site confirm the requirements regarding the routing of interconnecting transmission network, etc..

.9 When preparing shop drawings, review the proposed sequences, suggest improvements and review these with the Consultant.

.10 Work with the other parties involved in commissioning, assess how the programming can be modified to improve function, review this with the Consultant and modify the programming as instructed by the Consultant.

.11 The control system shall be a modular, flexible and fully commissioned Direct Digital Control (DDC) System except that controls not scheduled on the points list may be electric. Items identified in the sequence of operation as being under DDC control but which are not included in the points list shall be included in the DDC system.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 1 and Division 25.

.2 Shop drawings shall include:

- .1 Control centre layouts.
- .2 Manufacturer's descriptive technical literature for all equipment and devices.
- .3 Interconnection schematics.
- .4 Wiring and piping diagrams.
- .5 One-line diagram from sensor and control points to Field Interface device and/or standalone DDC panel including all components and cables.
- .6 Terminal cabinets, including termination listing.
- .7 Written description indicating sequence of operation. Shop drawings will be rejected if the written description is not included with the submission. Sequences should reference English descriptors and labels for each point described.
- .8 All input/output points which shall include the following information associated with each point.

.1 Sensing element type and location.

.2 Details of associated field wiring schematics and schedules.

.3 Software and programming details.

.9 Detailed block diagrams of transmission trunk routing and configuration.

.10 Valve and damper schedules indicating size, configuration, capacity and locations. If size varies greater than 10%, obtain approval of Consultant.

.11 Copies of all system graphics complete with system specific point labels.

1.6 OPERATING & MAINTENANCE MANUALS

.1 The maintenance manual data is intended to cover the operation and maintenance of all control systems and equipment installed. Forward 3 copies of the Controls and Instrumentation section of the operating and maintenance manuals to the Balancing Agency to ensure the binding and format of material are compatible. Ensure sufficient time has been given to the Balancing Agency for the compiling of the complete operating and maintenance manuals by the commissioning deadline. One complete manual shall be furnished prior to the time that system or equipment tests are performed.

.2 The manuals shall include the name, address and telephone number of the control subcontractor installing the systems and a list of emergency numbers for service personnel. The manuals shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject.

.3 Manuals shall be furnished which provide full and complete coverage of the following subjects:

.1 Operational Requirements: This document shall describe, in concise English terms, all the functional and operational requirements for the system and its functions that have been established. It shall not require knowledge of digital processor programming or electronic techniques or control system theory.

.2 System Operation: Complete guidance and procedures for operation of the system, including required actions at each operator station; operation of computer peripherals; input and output formats and procedures; and emergency, alarm, and failure recovery procedures. Provide step-by-step instructions for system startup, back-up equipment operation, and execution of all system functions and operating modes.

.3 Functional Description: Detailed documentation, in language readily understandable to engineering personnel, of the theory of operation and specific functions of the system. Provide full details of data communications, including data types and formats, data processing and disposition data link components and interfaces and operator test or self-test of data link integrity for all system components and computer peripherals during each system function and operating mode. Hardware and software functions, interfaces, and requirements shall be explicitly detailed for all system components in all system functions and operating modes. Any operating procedures currently implemented or planned for implementation in an automatic mode shall be stated and described.

.4 Software: Documentation of the theory, design, interface requirements, and functions of all software modules and systems for all digital processors. Include test and verification procedures and detailed descriptions of program requirements and capabilities. Provide all data necessary to permit modification, relocation, or other reprogramming and to permit

combination of new and existing software modules to respond to changing system functional requirements without disrupting normal control system operation. Include, as a minimum, for all software modules, fully annotated source code listings, error-free object code files ready for loading via a peripheral device, and complete program cross reference, plus any calling requirements, data exchange requirements, necessary subroutine lists, data file requirements, and other information necessary to ensure proper loading, integration, interfacing, and program execution. All DDC panel software shall be provided individually for each DDC panel while a single section shall reference all DDC panel common parameters and functions.

.5 Maintenance: Documentation of all maintenance on all system components including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective units. Include calibration, maintenance, and repair of all sensors and controls, plus diagnosis and repair or replacement of all system hardware.

.6 Test Procedures and Reports: The test implementation shall be recorded with a description of the test exercise script of events and documented as Test Procedures. A provision for the measurement or observation results, based on the previously published Test Specification, forms the Test Reports. The procedures record and the results of these exercises shall be conveniently bound and documented together.

.4 Refer to Section 23 05 00 for additional requirements.

1.7 WARRANTY

.1 Refer to General Conditions for additional information.

.2 The system including all hardware and software components shall be warranted for a period of one year following the date of final acceptance per department. Any manufacturing defects arising during this warranty period shall be corrected without cost to the Owner.

.3 All applicable software as detailed in this specification shall be updated by the Controls Contractor free of charge during the warranty period. This will ensure that all system software will be the most up-to-date software available from the Controls Contractor. All future patches to the software shall be made available to the Owner.

.4 Repairs required by a total system failure, or the malfunction of any priority portion of the system shall be considered an emergency repair, and shall be performed within eight (8) hours of the report of the failure.

.5 Repairs of a non-emergency nature shall be promptly repaired on the next normal business day.

.6 Provide written assurance that a local service centre will be maintained with a complete stock of replacement parts, and capable of servicing any and all troubles in the system.

.7 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.

.8 Take note of and provide any extended warranties specified.

1.8 ELECTRICAL COMPONENTS, WIRING AND CONDUIT

.1 By Division 25 Control Contractor (Twin Rivers):

.1 All control system components to make a complete and operable system, except those supplied as part of packaged equipment controls, but including all auto-sequencing devices and electrical interlocks required to accomplish the sequences specified hereafter. Refer to the electrical equipment schedule, the electrical drawings and the electrical specification, which describes the limits of the extent to the work in Division 26 serving mechanical systems. Materials, equipment, connections and power not provided by Division 26 but required for the Control System shall be provided under this section.

.2 All control circuit transformers (120/1/60 or 24/1/60 and as designated).

.3 All control wiring and metallic conduit for mechanical system controls.

.4 Supply, installation and connection of all electric control items including: damper motors, relays, outside sensors, sub-master control circuits, safety devices, electric thermostats, aquastats, flow switches, wiring to terminal strips, proportional controllers, controllers, etc..

.5 All wiring and conduit from power distribution system to any control devices needing power (including B.M.S components)

.6 Be responsible for coordinating with Division 26.

.7 Electrical work installed under Division 25 shall be to the standards specified under Division 26. Refer to Section 26 05 34 for additional information.

.8 All controls wiring shall run in conduits.

.2 By Division 26 Electrical:

.1 All power wiring and conduit from power distribution system up to and including connection to all motors and starters.

.2 All disconnect switches required (unless specified in schedules as being integral with equipment).

.3 All motor protection switches, stop-start switches, magnetic starters, contactors and hand-off-automatic selector switches except those supplied as part of packaged equipment.

.4 Fire alarm signals.

.3 Note Division 25:

.1 All magnetic starters for equipment shall have the following features supplied under this division:

.1 Hand-off-automatic selector or on-off selector or start-stop buttons in cover with hand-automatic bridge if applicable.

.2 120-volt coils;

.3 120-volt control transformer and

.4 Four auxiliary dry contacts for interlocks; two normally open and two normally closed.

.2 The Controls Contractor is responsible for reading Division 26 plans and specifications to determine scope of responsibility and standards.

.4 Wiring:

.1 Refer to electrical specification sections for overall wiring requirements.

.2 Wiring shall match electrical wiring requirements to ensure consistent wiring is provided throughout the project.

.3 Carrier System – Open, exposed areas including mechanical, electrical and equipment rooms:

.1 All wiring shall be run in EMT conduit except the final 900mm of wiring to all operators and to all sensors subject to vibration, which shall be run in flexible metallic conduit.

.2 Provide steel fittings with nylon throats for all conduit connections.

.4 Carrier System – Concealed, accessible areas.

.1 Class II low voltage BMS open cable, neatly bundled, shall be routed parallel to building lines. Cable may follow ductwork routing and may be tied to the side or top of the ducting at duct supports, using suitable cable ties. If cabling does not follow ducting, it shall be fixed to the structure, supported at a minimum of every 5m. Open cable must be properly rated per electrical code.

.5 Wire:

.1 Line voltage power or switched power wiring - 12-gauge copper wire minimum.

.2 Line voltage control wiring - 14-gauge copper wire, length not to exceed 50 meters (54.68 yards); 12 gauge copper wire, lengths exceeding 50 meters.

.3 Low voltage - minimum 22-gauge wire as directed by applicable electrical codes and requirements. 24-gauge wire for thermostat cables

.6 Cable:

.1 Data transmission cable shall be minimum 18-gauge twisted pairs (shielding as per manufacturers recommendations).

.7 Note:

.1 Run carrier system parallel to building lines.

.2 Support conduit carrier system one meter on centre independent of piping, ductwork and equipment.

.3 All wiring shall be concealed in finished spaces.

.4 Seal all penetrations through fire separations or walls as per code requirements.

.5 Identify all junction box covers with control company label.

.6 Identify with colour bands, all conduits at all junction and pullboxes, at both sides of wall and floors and at not more than 7.5 meter (8.2 yard) 25 Ft intervals along the length. Identification bands to be sprayed on and not less than 100mm 4" wide. Bands to be pink in colour unless in conflict with Division 26 colours.

.7 Use colour coded conductors.

.8 Adhere to all applicable electrical codes and regulations.

.9 Obtain electrical permit.

.10 For non-CSA equipment where required by electrical code, submit to Inspection Authorities and obtain approval prior to installation of equipment on site.

.11 All controls wiring shall run in conduits.

.5 Wiring for B.M.S Life Safety Systems:

.1 Conductors for communications between the front-end CPU and standalone DDC panels and between DDC panels shall be high temperature, 200oC, Teflon FEP insulated and jacketed, shielded twisted cable pairs of minimum 18 gauge provided by the controls contractor for the distances involved. Wiring shall be fully redundant for separate channels of communication to the CPU via a different route (so as to protect the communication links in the event of a fire in a particular area).

1.9 EQUIPMENT SUPPLIED FOR INSTALLATION UNDER OTHER SECTIONS

.1 The following equipment shall be supplied under this section but installed under the appropriate trade sections of Division 25:

.1 Automatic control valves.

.2 Temperature sensor wells.

.3 Automatic control dampers.

.4 Pressure tappings.

.5 Static pressure sensors.

.6 Flow switches.

.2 The Controls Subcontractor shall be responsible for arranging, coordinating and supervising the installation of the above devices in a suitable manner and readily accessible location.

1.10 ALARMS - GENERAL

.1 No alarm shall be triggered for a device until the device has been started and is in stable operation. Use software time delays to achieve this effect.

.2 Generate an alarm on the B.M.S. if any equipment is not in the intended operating condition or if any analog input is not within the intended operating range.

1.11 IDENTIFICATION

.1 Identify all controls with symbols relating directly to the control diagram. Use plasticized tags, engraved brass, aluminum, metalphoto or lamicoid labels and secure them to, or adjacent to, the control devices with key chains or cable ties.

.2 All manual switches supplied by this trade, unless they come with standard nameplates, shall be labelled with engraved lamicoid plastic nameplates to clearly indicate the service. Wording on nameplates shall be subject to approval by the Consultant.

.3 Where "day" and "night" thermostats are adjacent to one another they shall be labelled with engraved lamicoid plastic nameplates.

.4 Motor control centre and motor starters should be provided with labels identifying that motors are under remote control.

.5 Mount an input/output layout sheet within each main DDC panel. This sheet shall include the name of the points connected to each controller channel.

.6 Identify all DDC panels and associated devices with symbols relating directly to the control diagram. Provide durable wire labels for each input and output point with the following information:

.1 Point descriptor.

.2 Point type and channel number.

.3 Corresponding DDC panel number.

1.12 SYSTEM COMMISSIONING AND CALIBRATION

.1 Program each standalone DDC panel immediately following installation.

.2 Set up and calibrate all control loops and sensors during the initial start-up of the systems and check, recalibrate and readjust as necessary during the Owner's Demonstration and Instruction period.

.3 Upon completion of the installation, perform all necessary testing and debugging operations satisfactorily.

.4 Perform all modifications and alterations as required to correct any deficiencies noted during these tests.

.5 Check sensor calibration and control system operation during the first heating season and prior to the first cooling season.

.6 Following each visit submit printed graphs of trend logs one week in duration with hourly samples for all analog inputs connected to each DDC panel.

1.13 VERIFICATION OF SYSTEM COMMISSIONING

.1 Preliminary Tests

.1 After installation of each part of the system and completion of mechanical and electrical hook-up, perform tests to confirm correct installation and functioning of equipment.

.2 Notify the Consultant in writing at least seven days before testing is to take place stating the following:

.1 Location and part of system to be tested.

.2 Describe testing procedure and anticipated results.

.3 Provide all necessary testing equipment and personnel.

.4 Provide portable 2-way radios for communications during demonstrations. Provide three units on the same frequency and of sufficient power and quality as to be useful throughout the building.

.5 Perform tests in presence of the Consultant.

.6 Demonstrate the proper operation of each component.

.7 Correct any deficiencies and re-test in the presence of the Consultant, until designated part of the system performs satisfactorily.

.2 Final Operational Acceptance Test

.1 A final operational test of not less than thirty (30) consecutive days, twenty-four (24) hours per day, shall be conducted on the complete and total installed and operational Control System to demonstrate that it is functioning properly in accordance with all requirements of this specification.

.2 The correct operation of all monitored and controlled points shall be demonstrated as well as the operation and capabilities of all sequences, reports, specialized control algorithms, diagnostics, and all other software. If the equipment operates at an average effectiveness level (AEL) of at least 95% during the performance test period of thirty (30) consecutive calendar days, it will be deemed to have met the Acceptable Standard of Performance, and final acceptance of the system shall be made, provided the contractor has satisfied all other requirements of this specification.

.3 The average effectiveness level (AEL) is defined as the ratio between the total thirty-day test period less any system downtime accumulated within that period, and the thirty-day test period.

.4 In the event the required AEL is not reached during the initial thirty (30) consecutive calendar day period, the final operational acceptance test period shall be extended on a day-to-day basis until the required AEL is reached for thirty (30) consecutive calendar days.

.5 Downtime shall result whenever the control system is unable to fulfill all required functions detailed within this specification due to any malfunction of either BMS hardware or software. Any defect of hardware or software shall be corrected when it occurs before the test may be resumed. Downtime created by non-BMS equipment or activities will not be considered as downtime for the AEL calculation.

1.14 DEMONSTRATION AND INSTRUCTION TO OWNER

.1 The Controls Contractor shall provide the services of competent instructors who will give full instruction to designated personnel in the adjustment, operation and maintenance, including pertinent safety requirements, of the equipment and system specified.

.2 The training shall be oriented toward the system installed rather than being a general (canned) training course. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach.

.3 The number of instruction furnished shall be, as specified below, as a minimum.

.4 A training manual shall be provided for each trainee which describes in detail the data included in each training program. All equipment and material required for classroom training shall be provided by the Contractor.

.5 Training Program: The training program shall be accomplished in two phases.

.1 First phase: this phase shall be for a period of at one day at a time mutually agreeable between the Contractor and Owner. Operating personnel will be trained in the functional operations of the system installed and the procedures that the operators will employ for system operation. First phase training shall include the following:

.1 Changes to the existing contol system architecture.

.2 System communications.

.3 Operational changes and new peripheral devices including the pharmacy differential pressure monitoring and control system elements.

.4 Elementary preventative maintenance.

.5 New report generation.

.6 Operator control functions.

.2 Second phase: this phase of training shall be conducted four to eight weeks after system acceptance for a period of one to two days as required. The training shall include as a minimum, but not be limited to:

.1 A review of Phase 1 training, response to any questions etc.

.2 Equipment maintenance - this training shall include:

.1 General equipment layout.

.2 Trouble shooting of all control system components.

.3 Preventative maintenance of all control system components.

.4 Sensors and controls maintenance and calibration.

.3 Programming - this training shall include:

.1 New system architecture.

.2 New application programs.

.3 DDC panel programming.

.4 Software access code review.

1.15 MAINTENANCE SERVICE DURING THE WARRANTY PERIOD

.1 The Contractor shall provide all services, materials and equipment necessary for the maintenance of the entire Control System, for a period concurrent with the warranty period. Any necessary material required for the maintenance work shall be provided by the Contractor.

.2 The Controls Contractor shall provide minor and major inspections, as required, by the manufacturer, and all service for the required maintenance.

.3 Major Inspections: these inspections shall include but not be limited to the following:

.1 Work as detailed hereinafter for minor inspections.

.2 Clean all peripheral equipment, CPU, interface panels, multiplexing panels and microprocessor interior and exterior surfaces.

.3 Provide signal, voltage and system isolation checks of all CPU, interface panels, multiplexing panels and peripherals.

.4 Provide mechanical adjustments

.5 Check and/or calibrate each field input/output device.

.6 Run system software diagnostics as required.

.4 Minor Inspections: Provide inspections as required by facility and Maintenance staff. Regular service calls shall be performed during regular working hours, 8:00 a.m. to 4:30 p.m. Monday through Friday excluding legal holidays.

.5 Emergency Service:

.1 The Owner will initiate service calls when there is indication that the control system is not functioning properly.

.2 The Contractor shall have qualified control personnel available during the warranty period to provide service to the "critical" control system components whenever required at no additional cost to the Owner.

.3 The Contractor shall furnish the Owner with a telephone number where the service mechanic can be reached at all times. The service mechanic shall be on the job ready to service the control system within the next eight (8) hours, after receiving a request for service and the work shall be performed continuously until the control system is back in reliable operating condition.

.4 Repairs of a non-emergency nature shall be promptly repaired on the next normal business day.

.6 Records and Logs: records and logs shall be kept of each maintenance task.

.7 System Modifications: recommendations for system modification shall be provided in writing to the Consultant. No system modification, including operating parameters and control settings, shall be made without prior approval.

.8 Software: provide implementation of all software maintenance updates. These shall be accomplished as required and full coordination with control system supervisory personnel shall be maintained.

END OF SECTION

PART 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 GENERAL REQUIREMENTS

.1 Provide all new required remote sensing points and instrumentation as required for the complete operational capability of the Control System. All sensors shall have the accuracies as stated hereinafter. Hysteresis, relaxation time, span, maximum / minimum limits, etc. shall also be accounted for in all application of sensors and controls.

.2 All instruments of a particular category shall be of the same type and manufacture.

.3 All external trim material shall be completely corrosion resistant with all internal parts assembled in watertight, shockproof, vibration proof, heat resistant assembly.

.4 Use standard conduit box termination with screwdriver connector block unless otherwise specifically stated.

.5 Operating conditions -5□C to 60□C with 10-90% RH (non-condensing) unless otherwise specifically stated or required.

PART 2 PRODUCTS

2.1 GENERAL

.1 Control Devices provided by the Control Contractor (Twin Rivers)

.2 Generally, all control devices shall be

.1 Delta Controls for the new air handling unit, exhaust fan and associated equipment and

.2 Compounding Pharmacy Controls to be Phoenix including Venturi Valves, Controllers, Terminal Display Units and Differential Pressure Control Display Panels and associated equipment.

2.2 SOFTWARE

.1 For the new control systems provide Reliable Controls or Delta Controls enteliWEB FACILITY & ENERGY MANAGEMENT SOFTWARE connections as well as connections to the existing BMS. (Contractor to provide two separate prices. One price for Delta Controls and one price for Reliable Controls). System shall be a web-based application that connects to Northern Health facilities and centralizes building management operation, site engineering and energy analytics. The system shall provide the ability to create personal dashboards for Northern Health Facility Staff.

2.3 CONTROL DAMPERS

.1 Minimum Requirements:

.1 Provide control dampers configured as follows:

.1 Modulating; opposed blade dampers.

.2 Mixing; parallel blade dampers.

.3 Two position; parallel blade dampers.

.2 Assemblies - rigid and adequately braced with corner gussets.

.3 Galvanized steel or extruded aluminum frames.

.4 Maximum frame dimensions - 1220 mm (48.03 inch) 48" wide and 1220 mm 48" high, unless otherwise indicated. Multiple sections to have stiffening mullions.

.5 Maximum blade width - 200 mm (7.87 inch) 8".

.2 Low leakage control dampers:

.1 Minimum performance, based on 610x610 24"x24" damper size as tested in an independent testing laboratory:

.1 Maximum 62 Pa 0.25" static pressure drop at 15.2 M/s 3000 fpm (damper fully open).

.2 Maximum 55 L/s / sq m 10.75 cfm/sq.ft leakage at 747 Pa 3" wg (Damper fully closed).

.3 Maximum blade length of 1219mm 48" suitable for minimum 100 Pa 4" wg and 15.2 M/s 3000 fpm velocity.

.2 Minimum 2 mm (0.08 inch) 14 ga galvanized steel airfoil type or 2.1mm 12 ga extruded aluminum airfoil type blades.

.3 Synthetic sleeve type bearings (no metal to metal contact).

.4 Linkage concealed within the damper frame.

.5 Square or hexagonal axles locked into blades.

.6 Synthetic rubber blade seals mechanically locked into the blade edge (adhesive or clip-on type seals not acceptable).

.7 Flexible metal compression type or extruded synthetic rubber jamb seals.

.8 Standard of Acceptance: Low pressure drop Stainless Steel Greenheck

.3 Note:

.1 Control dampers integral to air handling units provided, and factory installed, by the unit supplier (actuators by this Division). All other control by this Division. Control dampers supplied by the unit manufactures shall follow the above specifications

.2 Instruct the Sheet Metal Trade on damper installation.

.3 Indicated size is outside frame dimension. Increase size of damper and oversize ductwork, to include for depth of the frame, for all dampers with a pressure drop greater than 12 Pa 0.05" w.g.. Confirm with the Sheet Metal Sub-Contractor before fabrication.

.4 Check that dampers are installed square and true and that blades close tightly against seals and stops.

.5 Blades to be horizontal in vertical mounted dampers. Refer to drawings for orientation of dampers.

.6 Ensure that damper end-linkages are easily accessible (coordinate with the Sheet Metal Sub-Contractor).

.7 Provide an additional drive shaft bearing if the drive shaft is longer than 75 mm (2.95 inch) 3".

.8 Do not install dampers within the thickness of any wall unless otherwise indicated (coordinate with the Sheet Metal Sub-Contractor).

.9 Dampers shall be adequate for the maximum system pressure. Refer to the appropriate Section of the specification.

2.4 CONTROL DAMPER ACTUATORS

.1 General:

.1 Valve operators shall allow smooth operation of the valve throughout its entire range and assure tight shut-off against system pressure.

.2 Valve actuator shall be easily removed from the valve body for replacement.

.2 Electric Two Position Valve Actuators (VTE):

.1 Two Position Control Valve Actuators (only to be used where specifically specified):

.3 Incremental Control Valve Actuators (only to be used where specifically specified) (VMI):

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 3-wire control signal (24 VAC). The actuator shall remain in position until the signal is applied.

.2 The valve shall maintain its shutoff force even if power is lost.

.3 The TUC shall calculate valve position based on the motor speed and duration of control signal. The valve shall be driven to a full position and the calculation reset once every 24 hours.

.4 Proportional Control Valve Actuators (VME):

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 0-10 VDC or 4-20 mA control signal. The actuator shall remain in its position until the applied signal changes. In the event of a control signal loss, the actuator shall move to the zero-voltage input position.

.2 The valve shall maintain its shutoff force even if power is lost.

2.5 CONTROL PANELS

.1 General:

.1 Fabricate from prime and enamel coated steel suitable for flush mounting.

.2 Panel doors shall be hinged and complete with locks.

.3 Construct so that instruments and gauges are flush mounted.

.4 Provide sub-panel, inside control panel, for mounting control components.

.5 Adhere Lamicoid nameplates on the control panels to clearly identify the service of each device.

.6 Submit shop drawings of control panel for review.

.2 Panel mounted devices:

.1 Temperature gauges and manual reset (where applicable) for:

.1 Exhaust Air Return air.

.2 Mixed air.

.3 Discharge air (each zone).

2.6 DIFFERENTIAL PRESSURE TRANSMITTERS (DPT)

.1 Provide differential pressure transmitters having the following minimum specifications:

.1 Internal materials to be suitable for continuous contact with the process material measured including compressed air, water, glycol or steam as applicable.

.2 Output signal of 4 - 20 mA into a maximum of 500-ohm load.

.3 Output variations of less than 0.2% full scale for supply voltage variations of +/- 10%.

.4 Combined non-linearity, repeatability and hysteresis effects not to exceed +/- 1% of full-scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effect of +/- 1.5% full scale/50□C or less.

.7 Output short circuit and open circuit protection.

.8 Over-pressure input protection to a minimum of twice rated input.

2.7 DAMPER ACTUATORS

.1 General:

.1 Provide electric or electronic type damper actuators where indicated or required.

.2 Damper actuators for all fan variable volume devices, all control dampers and all smoke/fire dampers shall be supplied by this trade. Refer to Section 23 99 55 or the drawings for schedule of control and smoke/fire dampers.

.3 Damper actuators for mixing boxes and air valves shall be supplied by this trade for factory installation by unit manufacturer. Damper actuators shall meet the requirements of the unit manufacturer in all cases.

.4 Spring return for "fail-safe" in Normally Open or Normally Closed position where required.

.5 Size actuators to control dampers against maximum pressure or dynamic closing pressure whichever is greater.

.6 Size damper actuators so that they will provide smooth and full travel of the dampers while stroking in both directions.

.7 Where individual dampers are installed, install a separate damper actuator for each damper.

.8 Where multi-section dampers are installed, install a separate damper actuator for each section.

.9 Locate damper actuator so that they are easily accessible for testing and servicing.

.10 Where damper actuator operates outdoor and exhaust air dampers, pretension the damper drive linkage to ensure tight closure.

.11 Where a damper actuator is installed on an insulated surface of a duct or plenum, mount it on a stand-off bracket, so as not to interfere with the continuity of the insulation.

.2 Electronic Damper Actuators (DME & DTE):

.1 Actuators shall be direct coupled enabling it to be mounted directly to the damper shaft without the need for connecting linkage.

.2 The actuators shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

.3 Proportional actuators shall accept a 2 to 10 VAC or 4 to 20 mA signal.

.3 Incremental Control Damper Actuator (DMI):

.1 For VAV box damper control only.

.2 The damper actuator shall modulate the damper between fully open and fully closed based on a 3-wire control signal (24 VAC). The actuator shall remain in position until the signal is applied.

.3 The TUC shall calculate damper position based on the motor speed and duration of control signal. The damper should be driven to a full position and the calculation reset once every 24 hours.

2.8 ELECTRIC RELAYS (ER)

.1 Provide DPDT relays for control and status indication of alarms and/or electrical starters and equipment.

.2 Relay coils shall be rated for 120V or 24V. Where other voltages occur provide transformer.

.3 Contacts rated at 5 amps at 120V AC.

.4 Relays to be plug in type with termination base.

2.9 ELECTRONIC AIR FLOW MEASURING STATIONS (FMS)

.1 Air flow measuring stations are to be provided by the Sheet Metal Sub-Contractor c/w 4 – 20 mA electronic pressure transmitter for connection by the controls contractor.

.2 Controls contractor to provide required external power supply to pressure transmitters.

.3 Specify range of air flow to ensure station can read the velocity,

.4 Note the required “straight lengths of ducting required for the station to read the flow accurately

2.10 ELECTRONIC AIR FLOW MEASURING STATIONS (FMS)

.1 Air flow measuring stations for the VAV supply, return and exhaust fans shall be supplied and installed by this trade.

.2 The electronic air flow measuring stations shall be as manufactured by Air Monitor Corporation or approved equal. The station shall consist of all necessary components to provide the required VAV control and interface with the BAS.

.3 As a minimum the electronic air flow measuring stations shall consist of FI probes located in the bell mouth of the fans to be controlled and a Vectron DPT 2500 transmitter with digital readout.

2.11 PRESSURE SWITCHES (PSW)

.1 Provide pressure or differential pressure switches for ranges as indicated.

.2 Pressure sensing elements shall be Bourbon tube, bellows or diaphragm type.

.3 Adjustable setpoint and differential.

.4 Pressure switches shall be snap action type rated at 120 volts, 15 amps AC or 24 volts DC.

.5 Sensor assembly shall operate automatically and reset automatically when condition returns to normal.

.6 Sensor Ratings: sensors shall have the following pressure and accuracy ratings:

.1 Low and medium steam sensors shall be rated at 1030 kPa (149 psi). Low pressure shall operate from 0 to 207 kPa (30 psi) with an accuracy of plus or minus 3 kPa (0 psi). Medium pressure shall operate from 0 to 700 kPa (102 psi) and with an accuracy of plus or minus 7.0 kPa (1 psi).

.2 Pressure switches for pump operation shall have a range of 20 kPa (3 psi) to 350 kPa (51 psi) and adjustable differential from 1 kPa (0 psi) to 35 kPa (5 psi).

.3 Pressure switches for fan operation shall have a range of 0 to 1500 Pa and adjustable differential from 10 to 50 Pa.

.4 Sensors on steam humidification lines and high temperature water shall be protected by pigtail siphon installed between the sensor and the fluid line.

.5 All sensors shall have an isolation valve and snubber installed between the sensor and pressure source.

2.12 STATIC PRESSURE TRANSMITTERS (SPT)

.1 Output of 4 - 20 mA linear into maximum of 500-ohm load.

.2 Calibrated span: not greater than twice the static pressure at maximum flow.

.3 Accuracy: +/- 1% of span.

.4 Repeatability: within 0.5% of output.

.5 Linearity: 1.5% of span.

.6 Deadband or Hysteresis: 0.1% of span.

2.13 VELOCITY PRESSURE TRANSMITTERS (VPT)

.1 Output of 4 - 20 mA linear into maximum of 500-ohm load.

.2 Calibrated span: not greater than twice the static pressure at maximum flow.

.3 Calibrated accuracy: +/- 1.0% of span.

.4 Repeatability: within 0.1% of output.

.5 Linearity: 0.5% of span.

.6 Deadband or Hysteresis: 0.1% of span.

PART 3 EXECUTION

3.1 GENERAL

.1 All equipment shall be installed according to manufacturers' published instructions.

.2 Temperature, Humidity Sensors, Thermostats and Humidistats:

.1 All sensors shall be stabilized to such a level as to permit on-the-job installations that will require minimum field adjustments or calibration.

.2 Sensor assemblies shall be readily accessible and adaptable to each type of application in such a manner as to allow for quick, easy replacement and servicing without special tools or skills.

.3 Outdoor installation shall be weatherproof construction in NEMA 4 enclosures. Install space instruments at a height of 1.5 meter (1.64 yard) above the finished floor, unless otherwise indicated.

.4 Install corridor instruments at a height of 2.1 meter (2.3 yard) above the finished floor.

.5 Locate instruments in the same vertical centreline as light switches.

.6 Where instruments are indicated on an outside wall install on a stand-off wall bracket which provides an air space between the instrument and the wall; or on an insulating base (e.g. a cork pad).

.7 Install protective metal guards on instruments in areas where they may be subject to damage (loading areas, gymnasiums, workshops, public corridors and storage areas). Bolt guards, independent of instruments to separate baseplates. Provide backing in wall for securing mounting bases.

.8 Sensors in ducts shall be mounted in locations to sense the correct temperature of the air only, and shall not be located in dead air spaces. The location shall be within the vibration and velocity limits of the sensor. Where an extended surface element is required to properly sense the average temperature it shall be securely mounted within the duct to measure the best average temperatures. Elements shall be thermally isolated from brackets and supports to respond to air temperature only. Sensor element to be supported separately and not connected to coils or filter racks.

.9 Wells shall be installed in the piping at elbows where piping is smaller than the length of the well to effect proper flow across the entire area of the well. Well shall not restrict flow area to less than 70 percent of line-size-pipe normal flow area.

.3 Temperature Transmitters, Humidity Transmitters, Controllers and relays to be installed in NEMA I enclosures.

.1 Panels to be either free standing or wall mounted ANSI 61 polyester powder coated steel cabinets with hinged and key locked front door. Arrange for conduit and tubing entry from top, bottom or either side.

.2 Panels shall be modular multiple panels being used if required for capacity in any particular location.

.3 All panels shall be lockable with same key.

.4 All wiring and tubing within panels to be located in trays or individually clipped to back of panel, and clearly identified.

.4 All field devices to be properly identified.

.5 Mount electrical instruments on standard electrical rough-in boxes fastened to structure.

.6 Testing:

.1 All field devices shall be properly calibrated and tested for performance and accuracy. A report detailing test performed and results to be submitted to the consultant for approval. The consultant will verify results at random. Provide all testing equipment necessary. Provide manpower necessary to assist consultant's verification.

END OF SECTION

PART 1 GENERAL

1.1 DESCRIPTION OF THE PROJECT

.1 BMS contractor shall ensure the existing BMS system and associated wiring and devices essential for operation of the mechanical systems of the building remain protected and operational during construction.

.2 Note: this project involves integration of new controls into the existing BMS system. Unless otherwise noted, the sequence of operation for all the exiting systems that will remain, or removed and reinstalled, shall be reinstated. Test and verify the operation of all the existing equipment (i.e. rooftop exhaust fans) that will be impacted by this project.

1.2 PROJECT SCOPE

.1 Construction – Providing new fume hoods and associated exhaust air system including exhaust air duct, existing exhaust fans.

PART 2 PRODUCTS – REFER TO SECTION 25 09 13

PART 3 EXECUTION

3.1 HVAC CONTROL OBJECTIVES

.1 Temperature Requirements:

.1 The temperature will be monitored and controlled by room temperature sensors (BMS system) and controlled in each space as indicated on the drawings.

.2 Vented Class II Type C1 Bio-Safety Cabinet

.1 Bio-Safety Cabinet and associated exhaust fans and control dampers to be controlled and monitored by BMS system

3.2 ALARM AND SAFETIES

.1 Fume Hood, Existing exhaust fans (EF-406) shall alarm their failure condition, as defined in the system database, at the operators Terminal Display Unit (TDU). Alarm points will be taken from dry contacts on the TDU and connected to the existing BMS.

.2 An alarm shall be generated at the OWS when any motor status as sensed by a current sensing relay does not match the commanded value for that motor.

.3 A fan alarm is generated at the OWS when any motor status as sensed by a current sensing relay does not match the commanded value for the supply fan VFD.

3.3 MONITORING

.1 The BMS monitors the following conditions and parameters as a minimum:

3.4 FUME HOODS (FH-2 AND FH-3)

.1 Components:

.1 Fume Hood FH-2 and FH-3

.2 Existing exhaust fan (EF-406).

.2 Related Points:

.1 FH on/off

.2 Existing exhaust fan EF-406

.3 Existing exhaust fan EF-406 on/off

.4 Existing exhaust fan EF-406 operating status

.3 Related Systems:

.1 Main AHUs

.4 Normal Operation:

.1 Fume hoods FH-2 and FH-3 to be completed with dry contact relay kit (the dry contact relay kit connects fume hoods FH-2 and FH-3 to the existing roof mounted exhaust fan EF-406 and BMS system. Control contractor to connect the FH-2 and FH-3 dry contact relay kit to the roof mounted existing exhaust fan EF-406 and BMS system.

.2 Fume Hoods FH-2 and FH-3 to operate 24 hours, 7 days a week (24/7).

3.5 LAB EXISTING EXHAUST FAN (EXISTING EF-406)

.1 Components:

.1 Fume Hoods FH-2 and FH-3

.2 Existing Exhaust fan (EF-406).

.2 Related Points:

.1 Existing exhaust fan EF-406

.2 Existing exhaust fan EF-406 operating status

.3 Fume hood FH-2 on/off

.4 Fume hood FH-3 on/off

.3 Related Systems:

.1 Main AHUs

.4 Normal Operation:

.1 Fan stopped

.1 exhaust fan stopped closed.

.2 Start-up (start switches activated by BMS or by manual command).

.1 Existing exhaust fan control damper opens and exhaust fan starts at minimum delivery.

.2 If existing exhaust fan EF-406 fails to operate, the BMS shall send an alarm signal to BMS.

.3 Fume hoods to operate 24 hours, 7 days a week (24/7).

.4 Provide an air flow sensor in the exhaust air duct of fume hoods and connect it to BMS system. If the air flow sensor is reading below its intended operation range a BMS alarm shall be initiated.

3.6 TREND LOGGING AND HISTORIAN

.1 Set up trend logs with archiving as required for sustainability documentation, for troubleshooting, energy management and preventive maintenance.

3.7 TECHNOLOGY INTERFACE

.1 Include for interface with the following: Lighting, Fire Alarm, occupancy sensors, Electric metering, etc. as outlined in the electrical specification.

3.8 DIVISION 26 ALARMS

.1 Various pieces of electrical equipment are specified complete with BACNet capabilities. Provide connection to the items and provide interface with the building's DDC system.

.2 Wiring between the dry contacts and the BMS panels shall be by Division 23 contractor.

END OF SECTION

PART 1 GENERAL

1.1 MANUFACTURER

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
Control Systems	To match existing base building control system; Reliable Control – Houle Control	X

.1 NOTES:

.1 The design is based upon the equipment listed in the equipment schedules and/or underlined in the Equipment Supplier Schedules.

.2 X - denotes required submission.

END OF SECTION

Part 1 Work Included

1.1 RELATED WORK

.1 The Administrative Sections under Division 26 - Bidding and Contract Requirements and 26 05 00.11 - Electrical General Requirements shall be considered to be part of these Specifications.

1.2 GENERAL REQUIREMENTS

.1 General Clean-up.

.2 All inspection and other permits, licenses required by various Inspection Agencies and local regulations related to the Electrical Trade.

.3 Special testing or inspection, additional to the above as specified or covered by a Cash Allowance.

.4 Scaffolding.

.5 Shop Drawings.

.6 Project Record Documents (As-Built Drawings) where specified.

.7 Operating and Maintenance Data, where specified.

.8 Electrical fault, coordination, and arc flash studies.

1.3 MATERIALS

.1 Bus systems including all forms of buses integral with the electrical power system, together with their associated insulation, supports, bus ducts and protective devices.

.2 Conductors, including all types of wires, conductors, cables, which form an integral part of the electrical power system.

.3 Cables and bus support systems which are intended to enclose or support all forms of electrical conductors used for any purpose covered by this scope. This includes cable trays, raceways and all forms of rigid, flexible, metallic and non-metallic conduit, and including conduit for communication systems or others, which may be installed at a later date, or buried conduit for wiring work by others, only when such buried conduit is indicated in the Contract Documents.

.4 Control panels associated with any electrical equipment covered under this section of Work.

.5 Panelboards, switchboards, circuit breakers of all types, and for all applications associated with electrical equipment which receives its power supply from the main, auxiliary, stand-by or emergency (including battery) system.

.6 Lighting Control Systems.

.7 Duct systems, floor, riser, etc. which are intended to contain cables, buses or any device associated with or connected to the power system.

.8 Grounding systems, as required by the Electrical Code, or as otherwise specified in the bid documents.

.9 Lighting - all forms of electric lighting devices, both individual and packaged types, including complete modular and integrated ceiling together with all associated troffers, deflectors, diffusers, lens, and mounting devices, and which are used for all purposes, such as floodlighting exterior parking areas, landscaping lighting, etc.

.10 Motor starters of all types and for all types of applications, including combination starters, multi-speed, sequential, reversing operations, etc., unless part of Mechanical Equipment.

.11 Transformers for all applications, except control transformers supplied with Mechanical Equipment included in Division 21, 22 and 23.

.12 Communications and security systems.

.13 Temporary Power

.14 Temporary Lighting

PART 2 Workd

2.1 GENERAL REQUIREMENTS

.1 Hoisting.

.2 Barriers.

.3 Special testing or inspection not specified or covered by Cash Allowance.

2.2 OTHER WORK EXCLUDED

.1 Control wiring associated with equipment (not necessarily mechanical equipment) not included in the Electrical Specifications, (buried conduit for such wiring shall be included).

.2 Special starters, including multi-speed switches, which are associated with packaged units not detailed in the Electrical specifications.

.3 Perforations through roofing materials for electrical servicing or attachments (Division 07).

.4 Ducted fans (Division 21, 22 and 23).

.5 Cooling, exhaust and miscellaneous mechanical systems related to generators (Division 21, 22 and 23).

.6 Ducted heaters (Division 21, 22 and 23).

.7 Pneumatic tube systems (Division 21, 22 and 23).

.8 Control transformers supplied with Mechanical Equipment (Division 21, 22 and 23).

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Provide all power and control wiring, conduit, wire, fittings, disconnect switches, motor starters, for all mechanical equipment unless otherwise specified.

.2 Ground all motors to conduit system with separate grounding conductor in flexible conduit or bonding conductor in the flexible conduit.

.3 Connections shall be made with watertight flexible conduit with watertight connectors.

.4 Control wiring and conduit standards are specified in the Electrical Divisions. Refer to Mechanical Divisions for scope of work and particular details.

Part 3 Units of Measurement

3.1 GENERAL

.1 The Contract Documents have been prepared using the modified International System (SI) units of metric measurement. Whenever appropriate, available metric products shall be used unless otherwise specified herein. Note that lighting fixtures are often expressed in feet.

.2 Only metres (m) and millimetres (mm) are used for distant measurements. Generally, metres are used for measurements of 10 metres or more, and millimetres for measurements below 10 m.

3.2 CONVERSION

.1 The following three conversion methods were used in product and location dimensions:

.1 Hard Conversion: Industry available products which are manufactured in metric measurements.

.2 Soft Conversion: Products which are still manufactured in Imperial units and are converted in specifications using arithmetic conversion factors.

.3 Rationalized Conversion: Dimensions which are soft converted and rounded off for ease of measurements.

.4 In cases where measurements may be open for interpretation, dual dimensions have been incorporated until hard conversions can be used exclusively.

Part 4 Definitions

4.1 GENERAL

.1 All terminologies, abbreviations and acronyms used in this document are as listed in the various Standards, Codes, Rules and Bulletins used herein.

Part 5 Install roof jacks where conduit and cables penetrate roofs. Apply sealant after installation.

5.1 SECTIONS

.1 The Sections are written in a three-part format: General, Products and Execution.

5.2 REFERENCE

.1 Imperative tense has been used throughout this Document for work intended for the successful Contractor. There shall be no work exclusions unless they have been clearly identified as such herein.

.2 Any reference to "Design Authority" shall mean Stantec Consulting Ltd.

.3 The word "provide" shall mean "supply, install, connect" unless otherwise indicated.

Part 6 Codes

6.1 GENERAL

.1 All Codes, Standards, Rules, Regulations, Bulletins, By-laws etc., shall be those that are currently enforced in the locality of job site, unless otherwise specified herein.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS AND SUMMARY

.1 The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all Electrical sections and is intended only to supplement the requirements of Division 01.

.2 Reference to “Electrical Divisions” shall mean all sections of Divisions 26, 27, 28, 33, 34 & 1219.2 mm 1219.2 mm (48 inch) the Master Format or the Canadian Master Specifications.

.3 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.

.4 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, and establish orderly completion and the delivery of a fully commissioned installation.

.5 The most stringent requirements of this and other electrical sections shall govern.

.6 All work shall be in accordance with the PROJECT Drawings and Specifications and their intent, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.

.7 Provide seismic restraints for all required equipment and wiring systems.

.8 Connect to equipment specified in other Sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/separately packaged accessories.

.9 The Subcontractor shall be responsible for all electrical connections—whether power or otherwise—between Owner-supplied equipment and the base building infrastructure. This responsibility includes the provision and installation of all necessary materials, components, and accessories required to complete these connections, except where such items are explicitly provided by the equipment manufacturer or the Owner. It is the Subcontractor’s obligation to thoroughly review all Contract Documents to identify any equipment requiring electrical connection. Failure to do so shall not exempt the Subcontractor from fulfilling this requirement.

1.2 DIVISION 01

.1 Work Included

- .1 Complete and operational electrical system as required by the drawings and as herein specified.
- .2 Refer to Section 26 05 00 - Scope of Work
- .3 References
  - .1 Install in accordance with CSA C22.1 (current adopted edition) - except where specified otherwise.
  - .2 Refer to CSA C22.1 Appendix A “Safety Standards for Electrical Equipment” for applicable codes and the related revisions.

.3 Refer to CSA C22.1 Pages xxix - xxxii for related ‘Reference Publications’

.4 Refer to NBCC Table 1.3.1.2 for applicable codes and the related revisions.

.5 Comply with Local Electrical Bulletins and by-laws relating to the Authority having Jurisdiction.

.6 Install overhead and underground systems in accordance with CSA C22.3 No.1 (current adopted edition) - except where specified otherwise.

.7 Preferred Voltage Levels for AC Systems, 0-50,000V in accordance with CAN3-C235 (current adopted edition)

.8 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.3 DESIGNATION OF PARTIES AND DEFINITION

.1 The following defines various items used within the Electrical Specification Division 26:

.1 ‘Engineer or Electrical Engineer’: This refers to Owner or Owner appointed representative.

.2 ‘Electrical Trade of Contractor’: The Contractor undertaking to do the electrical work described in the Electrical Specification and on the electrical drawings.

.3 ‘General Contractor or General Construction Trade’: The Contractor that has the agreement with the Owner for the construction of the project.

.2 ‘Mechanical Trade or Mechanical Contractor’: Sub-contractors undertaking to do the work described in the mechanical specifications and/or on the mechanical drawings.

.1 ‘Provide’: Means "supply, install, connect" unless otherwise indicated.

.2 ‘Approved Equal’: Items listed under Approved Manufacturer’s in specification or addendum that shall be included in base bid.

.3 ‘Concealed’: Where used in connection with the installation of electrical raceways and wiring, means that they are hidden from sight as in furred out spaces, ceiling spaces, etc.

.4 ‘Exposed’: Where used in connection with the installation of electrical raceways and wiring and electrical equipment, means that they are visible to persons within the building.

.5 "Consultant" shall mean Stantec Consulting Ltd.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235- current edition

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

.3 Drawings and Specifications

.1 The General Conditions, Supplementary Conditions and Division 01 are a part of this specification and shall apply to this Division.

.2 The intent of the drawings and specifications is to include all labour, products and services necessary for complete work, tested and ready for operation. Drawings and specifications are

complementary to each other and what is called for by one shall be binding as if called for by both.

.3 Symbols used to represent various electrical devices often occupy more space on the drawing than the actual device does when installed. In such instances, do not scale locations of devices from electrical symbols. Install these devices with primary regard for usage of wall space, convenience of operation and grouping of devices.

.4 These specifications and the drawings and specifications of all other divisions shall be considered as an integral part of the accompanying drawings. Any item or subject omitted from either the specifications or the drawings, but which is mentioned or reasonably specified in and by the others, shall be considered as properly and sufficiently specified and shall be provided.

.5 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the Work. Electrical drawings indicate general location and route to be followed by conduit and/or wire and do not show all structural and mechanical details. In some cases, conduit or wiring is not as shown on the plans or shown diagrammatically on schematic or riser diagrams. Conduit and wire to be installed to provide a complete operating job and to be installed physically to conserve headroom, furring spaces, etc.

.6 If discrepancies or omissions in the drawings or specifications are found, or if the intent or meaning is not clear, advise the Engineer for clarification before submitting tender.

.7 Responsibility to determine which Division provides various products and work rests with the Contractor. Additional compensation will not be considered because of differences in interpretation of specifications.

1.5 SUBMITTALS

.1 Within 30 days of award of contract, the contractor shall submit a completed equipment procurement schedule which lists the manufacturer and model of equipment, indicating the projected ordering, shop drawing submittal date and delivery dates of all products to meet the required construction schedule. Refer to section 01 33 00 and appendix 16 for further detail

.2 Submit samples as required where specified in Division 26.

.3 Prior to delivery of any products to job site and sufficiently in advance of requirements to allow ample time for checking, submit shop drawings for review as specified in Division 01. Submit shop drawings for all equipment as required in each section of this specification.

.4 Prior to submitting the shop drawings to the Consultant, the Contractor shall review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings.

.5 The term “shop drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data which are to be provided by the Contractor to illustrate details of a portion of the Work.

.1 Indicate materials, methods of construction and attachment of support wiring, diagrams, connections, recommended installation details, explanatory notes and other information necessary for completion of Work. Where equipment is connected to other equipment, indicate that such items have been coordinated, regardless of the section under which the

adjacent items will be supplied and installed. Indicate cross-references to design drawings and specifications.

.2 Adjustments made on shop drawings by the Consultant are not intended to change the contract price. If adjustments affect the value of the work state such in writing to the Consultant prior to proceeding with the Work.

.6 All equipment on shop drawings to be clearly identified with specific device tagging as identified in the specifications and drawings. Where tagging is not applicable, make other identification as instructed by the Contract Administrator.

.7 Manufacture of products shall conform to revised shop drawings.

.8 Keep one complete set of shop drawings at job site during construction.

.9 Submittals to be in accordance with Division 01.

.10 Product Data: submit WHMIS MSDS in accordance with Division 01 - Sustainable Requirements and Division 02- Hazardous Materials

.11 Single Line Diagram

.1 Provide single line electrical diagrams under plexiglass as follows:

.1 Submit full size plot for review prior to installing:

.2 Electrical distribution system: locate in main electrical room.

.3 Electrical power generation and distribution systems: locate in power plant rooms.

.12 Fire Alarm Riser

.1 Provide fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel and annunciator. Submit full size plot for review prior to installing.

.13 Shop Drawings

.1 Submit shop drawings, product data and samples in accordance with Division 01. The submission shall be reviewed, signed and processed as described in Division 01.

.2 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.3 Where applicable, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with work of other Sections.

.4 Where integration is required, includes integrated system details.

.14 Content

.1 Shop drawings submitted title sheet.

.15 Data shall be specific and technical.

.1 Identify each piece of equipment.

.2 Information shall include all scheduled data.

.3 Advertising literature will be rejected.

.4 The project and equipment designations shall be identified on each document.

.5 Information shall be given in S.I. units Imperial Units.

.6 The shop drawings/product data shall include:

.1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.

.2 Mounting arrangements.

.3 Detailed drawings of bases, supports and anchor bolts.

.4 Control explanation and internal wiring diagrams for packaged equipment.

.5 A written description of control sequences relating to the schematic diagrams.

.16 Format

.1 Black line prints 216 mm 215.9 mm (8.5 inch) x 280 mm (11.02 inch) (279.91 mm (11.02 inch)) 8-1/2" x 11" or 280 mm x 430 mm (430.02 mm (16.93 inch)) 11" x 17".

.2 Larger drawings may be submitted on reproducible single sheet media (ie not bound) with space for stamps and signatures - master set plus one working copy.

.3 Bill of Quantities for related components, identified by model number, listed on the front cover with item identification numbers.

.17 No. of copies

.1 Provide number of copies indicated in Section Division 01 with a minimum of 2 copies to be retained by the Consultant.

.18 Coordination

.1 Where electrical equipment requires support or backing by other trades or mechanical connections, the shop drawings shall also be circulated through the other "services" contractor(s) prior to submission to the Consultants.

.19 Keep one copy of shop drawings and product data, on site, available for reference.

.20 Quality Control: in accordance with Division 01 - Quality Control

.1 Provide CSA certified equipment and material. Where CSA certified equipment and/or material is not available, submit such equipment and/or material to the authority having jurisdiction for special approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Submit, upon completion of Work, the electrical “load balance” report.

1.6 PERMITS AND FEES

.1 Submit to Electrical Inspection Department, Local Fire Authorities and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain all required permits and pay all fees.

.2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

1.7 QUALITY ASSURANCES

.1 Codes, Rules, Permits & Fees

.1 Comply with all laws, ordinances, rules, regulations, codes, standards, rules, regulations, bulletins, by-laws and orders of all authorities having jurisdiction relating to this work.

.2 Comply with the current edition of CSA C22.1– Canadian Electrical Code, Part 1 and the latest applicable Building Code and Z32 Electrical safety and essential electrical systems in health care facilities.

.1 Quality of work specified and/or shown on the drawings shall not be reduced by the foregoing requirements.

.2 Give all required notices, submit drawings, obtain all permits, licenses and certificates and pay all fees required for this work.

.3 Furnish a Certificate of Final Inspection and approvals from inspection authority to the Consultant.

1.8 STANDARDS OF WORKMANSHIP

.1 Execute all work in a competent manner and to present an acceptable appearance when completed.

1.9 EMPLOY A COMPETENT SUPERVISOR (CONSISTENCY IS ESSENTIAL) AND A SUFFICIENT NUMBER OF LICENSED TRADESMEN TO COMPLETE THE WORK IN THE REQUIRED TIME.

.1 Arrange and install products to fit properly into designated building spaces.

.2 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

.3 Quality Assurance: in accordance with Division 01 - Quality Control

.4 Qualifications: All electrical work shall be performed by a contractor holding a valid Electrical Contractor Licence issued by Technical Safety BC (or the applicable authority having jurisdiction). Electrical work to be carried out by qualified, licensed electricians who hold valid Master Electrician certifications or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial and/or Territorial Act respecting manpower vocational training and qualification.

.1 Electrical installations shall be carried out by individuals who are:

.1 Licensed electricians holding a valid Certificate of Qualification (Red Seal or provincial equivalent), and/or

.2 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.3 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.2 Compliance with the Canadian Electrical Code, the BC Electrical Code, and all local regulations and safety orders is mandatory.

.5 Site Meetings: in accordance with Division 01 - Construction Progress Schedule

.1 Site Meetings: as part of Manufacturer's Field Services: schedule site visits, to review Work, at stages listed below:

.1 At time of initial shop drawing submission to confirm any existing conditions and to coordinate with the project schedule and any cross discipline requirements.

.2 After delivery and storage of products, and when preparatory Work is complete but before installation begins.

.3 During progress of Work at key schedule points as determined.

.4 At commissioning.

.5 Upon completion of Work, after cleaning is carried out.

.2 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - Health and Safety Requirements.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Consultant with schedule within 4 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and/or recycling in accordance with Division 01 Construction/Demolition Waste Management and Disposal.

1.11 SYSTEM START-UP

.1 Refer to Division 01, and as follows.

.2 Instruct Consultant and operating personnel in the operation, care and maintenance of equipment.

.3 Arrange and pay for services of manufacturer's factory service Engineer to supervise start-up of installation, check, adjust, balance and calibrate components, where required in these specifications.

.4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

.5 Integrated systems testing of fire protection and life safety systems (CAN/ULC-S1001)

.1 Reference

.1 Specification 01 91 13

.1 Perform integrated system testing as described in item 3.11.

.2 General Requirements

.1 Integrated systems testing shall be conducted in accordance with CAN/ULC-S1001 to verify that all fire protection and life safety systems are properly interconnected and function as intended.

.3 Testing shall comply with the applicable building and fire codes, including the National Building Code of Canada (NBC) and the British Columbia Building Code (BCBC).

.4 Scope of Work

.1 The scope includes testing of fire alarms, sprinklers, standpipes, smoke control systems, emergency power systems, and other interconnected life safety systems.

.2 The testing process shall ensure proper integration and functionality of all systems under normal and emergency conditions.

.5 Testing Coordinator

.1 The Integrated Testing Coordinator (ITC) shall be a registered professional, such as an engineer or architect, qualified to oversee the testing process.

.2 The ITC shall prepare and submit an Integrated Testing Plan (ITP) outlining the methodology, schedule, and documentation requirements.

.6 Documentation

.1 All testing activities shall be documented, including test procedures, results, and any deficiencies identified.

.2 A final report shall be submitted to the authority having jurisdiction (AHJ) and the building owner, certifying compliance with CAN/ULC-S1001.

.7 Periodic Testing

.1 Periodic integrated systems testing shall be conducted as required by the standard to ensure continued compliance and functionality of the systems.

1.12 OPERATION AND MAINTENANCE MANUALS

.1 Provide hard and electronic copies of both Operation & Maintenance Manuals.

.2 Within 30 days prior to substantial performance, the Contractor shall submit a draft copy of the proposed contents of each maintenance manual to the Consultant for review. Once the draft copy is approved, the Contractor will supply 3 hard copies in suitably labelled, hard back, D-Ring type commercial binders, each complete with an index and tabbed title sheets for each section and 1 digital copy complete with an index and digitally tabbed title sheets for each section. Final copies of manuals to be received by Consultant not less than 7 days prior to substantial performance.

.3 All maintenance manual data shall be printed on 8 1/2” x 11” heavy bond, indexed, tabbed, punched and bound in the binders. Each manual shall have a title sheet which is labelled “Operation & Maintenance Manual”, and lists the Project name, Contractor’s & Consultant’s names, date submitted, and a Table of Contents for each volume. If a manual exceeds 75 mm 74.93 mm (2.95 inch) in thickness, provide additional manuals as required.

.4 Provide an electronic version of complete manual.

.5 Each section of the manual shall contain the following information:

.1 Systems Descriptions. A brief synopsis of each system typed and inserted at the beginning of each section. Include sketches and diagrams where appropriate.

.2 Descriptive and technical data.

.3 Maintenance and operating instructions for all electrical equipment and controls. (These operating instructions need not be manufacturer's data but may be typewritten instructions in simple language to guide the Owner in the proper operation and maintenance of his installation.)

.4 Lubricating and servicing intervals recommended.

.5 A copy of all wiring diagrams complete with wire coding.

.6 List of spare parts of all electrical equipment complete with names and addresses of sales, service representatives and suppliers.

.7 Copy of test data

.6 A motor list showing each motor number, name, horsepower, full load amps, overload settings, nameplate, current rating, heater size and type, and current being drawn, on the form specified in Section 26 08 00.12.

.1 Include type and accuracy of instruments used to obtain test data.

.2 Copy of final inspection certificate.

.3 Copy of the purchase order, showing equipment make and model numbers issued to the manufacturer complete with all addendums. All cost details may be hidden.

.4 Copy of all warranty certificates.

.5 Set of final reviewed Shop Drawings.

.6 Names, addresses, phone numbers and facsimile numbers of Contractor, Consultants, sub-contractors and suppliers used on the Work together with a specification reference of the portion of the Work they undertook.

1.13 AS-BUILT DRAWINGS

.1 Submit as-built drawings in accordance with Division 01.

.2 The Contractor shall keep one complete set of white prints at the site office, including all addendums, change orders, site instructions, clarifications and revisions for as-built drawings. As the work on site proceeds, the Contractor shall clearly record in Red Pencil all as-built conditions which deviate from the original contract documents. As-built drawings to include circuiting of all devices, conduit and feeder runs (complete with conductor size and number) and locations of all electrical equipment. Include actual room names and numbers on these drawings.

.3 Prior to substantial performance, the contractor shall obtain CAD files of all electrical drawings, using the latest AutoCAD, and use the services of a competent CAD operator to transfer all as-built information, including: Addendums, Change Orders, Clarifications, Revisions, Site Instructions and shop drawings. Upon completion, the contractor shall certify, in writing, that the as-built drawings are complete and that they accurately indicate all electrical services, including exposed as well as concealed items.

1.14 CONTRACTOR TO FORWARD LETTER OF CERTIFICATION AND AS-BUILT CAD DRAWINGS TO THE CONSULTANT FOR FINAL REVIEW. AS-BUILT DRAWINGS TO BE SUBMITTED IN THE FORM OF ONE SET OF CAD FILES ON CD DISCS OR MEMORY STICKS. CONTRACTOR IS ALSO TO FORWARD THE HARD COPY RED-LINED AS-BUILT DRAWING TO THE CONSULTANT.

.1 The contractor may borrow copies of the electrical contract drawings on disc from the Consultant.

1.15 PRODUCT HANDLING

.1 Use all means necessary to protect the products of this Division before, during and after installation and to protect products and installed work of all other trades.

.2 Immediately make good any damage by repair or replacement at no additional cost to the Owner and to the approval of the Consultant.

.3 Remove advertising labels from all electrical equipment. Do not remove identification of certification labels.

.4 Remove dirt, rubbish, grease, etc. resulting from this work from all surfaces, including the inside of all cabinets, equipment enclosures, panel board tubs, etc.

1.16 ALTERNATE AND SEPARATE PRICES

.1 In accordance with the Instructions to Bidders, state on the Tender Form in the space provided, the amount to be added or deleted from the base bid tender amount for the use and installation of equipment as an alternate to those specified.

1.17 GUARANTEE

.1 Furnish a written guarantee to the Owner prior to final contract payment, which will be in effect for one year from the date of final acceptance of the complete work. Replace or repair at no cost to the Owner any defective material or workmanship except where, in the opinion of the Consultant, such defects are due to the misuse or neglect by the Owner.

.2 This general guarantee shall not act as a waiver of any specified or special equipment guarantees, which cover a greater length of time.

.3 Note: Certain sections of this Electrical Specification are subject to the following warranty clause:

.1 In the event of an emergency failure during the warranty period of any product(s), material(s) or system(s) installed under this Section, and the issuer of the warranty is unable to or chooses not to respond to a request by the owner for immediate emergency repair/replacement of the affected product, material or system, then the owner reserves the right to recover, from the issuer of the warranty, all costs incurred by the owner or owner engaged forces in effecting the immediate repair/replacement.

1.18 PROGRESS CLAIMS

.1 Within thirty (30) days after award of contract, a breakdown of material and equipment items including labour and expense components shall be compiled on the Consultant's format. Subsequent requests for payment shall be documented accordingly.

1.19 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 01 74 19 - Construction Waste Management and Disposal

.2 Separate and recycle waste materials.

.3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with the Waste Management Plan.

.4 Fold up metal banding, flatten and place in designated area for recycling.

.5 Ensure emptied containers are sealed and stored safely for disposal away from children.

.6 Place materials defined as hazardous or toxic waste in designated containers.

.7 Collect, package and store any salvaged or remaining materials such as wire, conduit, busbars, wireways, copper ground straps and other associated components for recycling and reuse.

.8 Green Initiatives and LEED™ Certification

.1 The intent is to follow and comply with green initiatives and LEED certification. Refer to Division 01 "LEED Certification" for additional requirements. Comply with the requirements and assist in achieving the goals and the LEED certification of the work.

.2 Follow instructions and initiatives such as pollution preventions and recycling of materials, packaging and debris.

.3 Follow procedures and provide documentation on all installed materials in order to meet the requirements of the LEED rating system and to obtain the required LEED certification. Documentation shall include:

.4 For all Adhesives and Sealants Material Safety Data Sheets (MSDS) highlighting the materials Volatile Organic Compound (VOC) levels.

.5 Construction IAQ:

.1 Protect stored on-site or installed absorptive materials from moisture damage.

.2 Electrical rooms should not be used to store construction or waste materials.

.3 During construction, all electrical equipment openings shall be protected from dust infiltration. Provide temporary ventilation as required.

.4 Materials that emit VOC's are to be avoided, however, maintain sufficient temporary ventilation of areas where materials are being used that emit VOC's. Maintain ventilation continuously during installation, and until emissions dissipate after installation. If continuous ventilation is not possible via the building's HVAC system(s), then ventilation shall be supplied via open windows and temporary fans, sufficient to provide no less than three air changes per hour.

.5 The period after installation shall be sufficient to dissipate odours and elevated concentrations of VOC's. Where no specific periods stated in these specifications, a time period of 72 hours shall be used.

.6 Ventilate areas directly to outside; ventilation to other enclosed areas is not acceptable.

1.20 EXAMINATION

.1 Visit the site before preparing the tender and examine all existing conditions. No extra cost will be considered for any misunderstanding of work to be done resulting from failure to visit the site.

.2 Examine the documents for details of work included. Obtain a written clarification in the event of conflict within the specification, between the specification and the drawing, or in the drawing. Obtain written clarification from the Consultant if work affecting the installation is not clear. Where this is not done in advance, allow in the tender sum for providing the more costly alternative.

.3 Responsibilities

.1 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.

.2 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Consultant during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.

.3 Protect equipment and material from the weather, moisture, dust and physical damage.

.4 Cover equipment openings and open ends of conduit, piping and pullboxes as work progresses. Failure to do so will result in the Trade being required to adequately clean or replace materials and equipment at no extra cost to the Owner.

.5 Protect all existing services encountered. Obtain instructions from the Engineer when existing services require relocation or modification.

.6 Refinish damaged or marred factory finish to factory finish.

.7 The specifications and drawings form an integral part of the Contract Documents. Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, vice versa, shall be considered as

properly and sufficiently specified and shall be provided. Misinterpretation of any requirement of either plans or specifications shall not relieve this Contractor of the responsibility of properly completing his trade to the approval of the Consultant.

1.21 PROJECT COORDINATION

.1 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Consultant's written approval.

.2 The drawings indicate the general location and route to be followed by the electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.

.3 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. Where necessary, produce interference/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Architect and Consultant and all affected parties.

.4 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Consultant of space problems before installing any material or equipment. Demonstrate to the Consultant on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

1.22 PROVISION FOR FUTURE EQUIPMENT AND CONSTRUCTION

.1 Leave clear spaces designated for future equipment or building expansion where indicated. Plan for the installation under this contract and ensure clear accessible, unhindered access to the space is allowed for.

.2 Were contract documents don’t clearly indicate the future expansion requirements, but known services are required, provide written “request for information” to the consultant before making assumptions as to intent.

1.23 STANDARD OF ACCEPTANCE

.1 Standard of Acceptance means that the item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

.2 Where two or more manufacturers are listed, the manufacturer's name shown first or underlined or shown with a model name and/or number was used in preparing the base design. Tenders may be based on any one of those named, provided that they meet every aspect of the base design and every aspect of the drawings and specifications.

.3 Where other than the first named or the underlined manufacturer or scheduled/specified manufacturer is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Equipment/materials shall not exceed the available space limitations. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.

.4 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

.5 Provision for Future Equipment and Construction

.1 Leave clear spaces designated for future equipment or building expansion where indicated. Plan for the installation under this contract and ensure clear accessible, unhindered access to the space is allowed for.

.2 Where contract documents do not clearly indicate the future expansion requirements, but known services are required, provide written “request for information” to the consultant before making assumptions as to intent.

1.24 ADDITION OF ACCEPTABLE MANUFACTURERS

.1 Material/products considered to satisfy the specification, but of a manufacturer other than those named may be submitted to the Consultant for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.

.2 Alternate approvals will be given by written addendum only. No other substitution will be permitted after closing of tenders.

.3 Alternate approvals granted before the closing of tenders will be limited to a manufacturer's system and/or series only. This limited approval will not preclude substitute equipment/material from complying with specific features included with equipment/material specified. Determine that the alternate product meets the specification intent before basing a tender on the product

.4 Where alternate equipment/materials are selected, allow for effects on other parts of the work of this Trade and other Trades. Where substantial changes in arrangement are required, submit shop drawings of the proposed changes with Plan and Section views and show effects on work of other Trades. Alternate equipment/materials shall not exceed the available space limitations. Maintain installation, access and servicing clearances. No extra will be allowed due to the use of alternate equipment/materials.

.5 Where two or more items of equipment and/or material, of the same type, are required, provide products of a single manufacturer.

.6 Install and test all equipment and material, in accordance with the detailed recommendations of the manufacturer.

1.25 SPRINKLER PROOF REQUIREMENTS

.1 All equipment and wiring systems shall be sprinkler proof standard where sprinkler fire protection systems are installed.

.2 In rooms where electrical equipment is installed surface mounted, electrical equipment contained in these rooms to be protected by non-combustible driphoods, shields, and gasketed doors as

applicable to inhibit water ingress into electrical equipment. Exposed conduits connected to equipment to utilize watertight connectors. Top entry to be avoided where possible

.3 In particular all unit substations, transformers, switchgear, motor control and panelboard shop drawings shall be certified 'sprinkler proof' design.

1.26 EQUIPMENT RESTRAINT

.1 Related Section: 26 05 05 Seismic Restraint.

.2 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

1.27 REUSED EQUIPMENT

.1 Where existing equipment is being relocated and re-used, check and report on the condition to the Consultant before reinstallation. Protect and carefully store equipment designated for reuse.

1.28 SEQUENCE OF WORK

.1 Before interrupting major services notify the Owner well in advance and arrange an acceptable schedule for the interruptions.

.2 Before interrupting any services complete all preparatory work as far as reasonably possible and have all necessary materials on site and prefabricated (where practical) and work continuously to keep the length of interruption to a minimum.

.3 Include for the cost of all work that may be required out of regular hours to minimize the period of service interruption when modifying the existing systems.

.4 All trades in this Division shall make allowance for the implications of having to totally complete all work in the new addition before proceeding with work in the existing building.

.5 Building Operation During Construction

.1 In order to minimize operational difficulties for the existing building staff, the various trades must cooperate with the owner throughout the entire construction period and particularly ensure that noise is minimized.

.2 Convenient access for the staff and public to the building must be maintained at all times. Minor inconvenience and interruption of services will be tolerated, provided advance notice is given, but the Contractor will be expected to coordinate his work, in consultation with the owner, so the operation of the facility can be maintained as nearly normal as possible.

1.29 EXISTING SERVICES

.1 Protect all existing services encountered. Every effort has been made to show the known existing services. However, the removal of concealing surfaces may reveal other existing services. Work with the Owner's staff to trace the originating source and points served. Obtain instructions from the Consultant when existing services require relocation or modifications, other than those already indicated in the Contract Documents.

.2 Arrange work to avoid shutdowns of existing services. Where shutdowns are unavoidable, obtain the Owner's approval of the timing, and work to minimize any interruptions.

.3 Shutdowns, to permit connections, to be coordinated with the maintenance staff.

.4 In order to maintain existing services in operation, temporary relocations and wiring may be required.

.5 Be responsible for any damages to existing systems by this work.

.6 The interruption of utility services to permit tie-ins shall be arranged through the owner's representative. Application must be received in writing at least seven (7) calendar days prior to the date required for the shutdown. Service shutdowns shall only be carried out by Physical Plant and will normally be scheduled to occur during evenings or weekends. The Owner reserves the right to withhold permission for a reasonable period with respect to any shutdown, if the shutting-off of a service interferes with essential building operations.

1.30 SALVAGE

.1 All conduit, wiring and equipment which becomes redundant and is no longer required due to the work in this Contract shall be completely removed.

.2 All existing items which need to be removed, and which have a reasonable salvage value, shall be carefully removed and handed over to the Owner. Handing over to the Owner includes moving to Owner's designated storage place on site. These items shall not become the property of the Contractor. Obtain a written receipt from the Owner detailing each of the items handed over.

1.31 REMOVE ALL REDUNDANT MATERIAL NOT REQUIRED BY THE OWNER FROM THE SITE.

1.32 WARRANTY

.1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the Division 01.

.2 Take note of any extended warranties specified.

.3 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of substantial performance.

.4 Promptly investigate any electrical or control malfunction, and repair or replace all such defective work and all other damages thereby which becomes defective during the time of the warranty.

1.33 TENDER INQUIRIES

.1 All contractor queries during the tender period shall be made in writing to the consultant. Contractor queries will be collected and suitable addenda will be issued for clarification. No verbal information will be considered valid or issued by the consultant's office during tender. All tender queries may be faxed, mailed or couriered to the consultant's office. No telephone questions will be answered.

1.34 CASH ALLOWANCES

.1 Coordinate cash allowances with bid documents. Allowances directly affecting this Division include: none.

1.35 EQUIPMENT LIST

.1 Submit a completed Equipment List, showing the make of equipment and material included in the Tender, including the names of the subtrades, 10 days after the award of the Contract. Form EF110 in Appendix A shall be used for this purpose.

.2 The equipment list shall be a full list of materials or systems intended for installation.

1.36 PROGRESS CLAIM AND CHANGE ORDER BREAKDOWNS

.1 Ten (10) days after the award of contract, submit price breakdowns on photocopies of the Price Breakdown Form EF112 included in Appendix A.

.2 In particular cases more detail may be necessary to properly assess a change order or progress claims. This additional information could include all suppliers and all sub-contractors when requested by the Consultant. Provide details for each section of the electrical work listed for each separate electrical change order item exceeding $10,000.00.

.3 Mark-up information is required for change orders but is optional on the original tender price.

.4 Progress claims will not be certified nor payment made beyond 90% of the overall Electrical contract until commissioning and verification of the systems are complete. This procedure is to allow for any necessary deficiency holdbacks on items which do not become apparent until the systems are commissioned.

1.37 PROJECT CLOSE-OUT REQUIREMENTS

.1 Refer to detailed specifications in each section for detailed requirements. Also refer to Specification Appendix A Form EF-142 for list of required substantial completion submissions. Record drawings to be submitted to Consultant and all life safety systems must be operational, verified and tested and demonstrated to Consultant prior to issuance of Schedule C.

.2 Substantial Performance Requirements

.1 Before the Consultant is requested to make an inspection for substantial performance of the work:

.1 Commission all systems and prove out all components, interlocks and safety devices.

.2 Submit a letter certifying that all work is complete for the intended use, operational, clean and all required submissions have been completed. Form EF143 in Appendix A should be used for this purpose.

.3 A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Consultant, this list indicates the project is excessively incomplete, a substantial completion inspection will not be performed.

.2 The work will not be considered to be ready for use or substantially complete until the following requirements have been met:

.1 All reported deficiencies have been corrected.

.2 Operating and Maintenance Manuals completed.

.3 "As Built" Record Drawing ready for review.

.4 Systems Commissioning has been completed and has been verified by Consultant.

.5 All demonstrations to the owner have been completed.

.6 All documents required on Form EF142 in Appendix A have been submitted.

.7 All documentation required for LEED TM certification has been submitted.

.3 Consultant's Letters of Assurance will not be issued until the following requirements have been met:

.1 All items listed in .1 above have been completed or addressed.

.2 Certificate of Penetrations through separations (Form EF130).

.3 Provincial or City Electrical Inspection - Certificate of inspection.

.4 Seismic Engineers letter of Assurance and final inspection report.

.5 Certificate of Substantial Performance (Form EF143).

.6 Signed off copy of Consultants final inspection report.

.7 Fire alarm verification.

1.38 DEFICIENCY HOLDBACKS AND DEFICIENCY INSPECTIONS

.1 Work under this Division which is still outstanding when substantial performance is certified will be considered deficient and a sum equal to at least twice the estimated cost of completing that work will be held back.

.2 It is expected that outstanding work will be completed in an expeditious manner and the entire holdback sum will be retained until the requirements for Total Performance of Division 26, 27, 28, 33 (electrical) work have been met and verified.

Part 2 Products

2.1 REFERENCE STANDARDS

.1 ANSI - Power Operated Pedestrian Doors.

.2 British Columbia Building Code - British Columbia Building Code.

.3 CAN/ULC S115 - Standard Method of Fire Tests of Firestop Systems.

.4 CAN4-S115 - Standard Method of Fire Tests of Firestop Systems.

.5 CSA C22.1 - Canadian Electrical Code, Part 1 (25th Edition), Safety Standard for Electrical Installations.

.6 CSA C22.3 - Canadian Electrical Code, Part 3.

.7 National Building Code of Canada - National Building Code of Canada 2020.

.8 NBCC - National Building Code of Canada.

2.2 SUSTAINABLE REQUIREMENTS

Materials and products in accordance with Division 01 - Sustainable Requirements: Construction

3.1 DO VERIFICATION REQUIREMENTS IN ACCORDANCE WITH DIVISION 01 SUSTAINABLE REQUIREMENTS: CONTRACTOR'S VERIFICATION.

3.2 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Division 01 and as follows.

.2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.

.3 Where equipment or materials are specified by technical description only, they are to be of the best commercial quality available for the intended purpose.

.4 Factory assemble control panels and component assemblies.

3.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Provide all power and control wiring, conduit, wire, fittings, disconnect switches, motor starters, for all mechanical equipment unless otherwise specified.

.2 Ground all motors to conduit system with separate grounding conductor in flexible conduit or bonding conductor in the flexible conduit.

.3 Connections shall be made with watertight flexible conduit with watertight connectors.

.4 Control wiring and conduit standards are specified in the Electrical Divisions. Refer to Mechanical Divisions for scope of work and particular details.

3.4 WARNING SIGNS

.1 Provide warning signs, as specified or to meet the requirements of Inspection Department, Authority having Jurisdiction, Engineer and Architect.

.2 Use decal signs, minimum 175 x 250 mm 249.94 mm (9.84 inch) 7” x 10” size

3.5 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

3.6 SELECTED PRODUCTS & EQUIVALENTS

.1 Products and materials provided shall be new and free from all defects. Defective products or materials will be rejected, regardless of previous inspections. The Contractor shall be responsible to remove and replace defective products at their expense and shall be responsible for any resulting delays and associated expenses, which result from defective products being rejected. Related materials shall be of the same manufacturer throughout the project.

.2 Products and materials referred to in the specifications by trade names, manufacturer's name and catalogue reference are those which shall be used as the basis for the Tender.

.3 The design has been based on the use of the specified product.

3.7 ALTERNATIVE PRODUCTS

.1 All product substitutions must be approved by the Consultant. Failure to obtain approval from the Consultant will result in the alternative product being rejected, in which case the Contractor shall provide an approved product at no additional cost to the owner.

.2 The Contractor shall assume full responsibility for ensuring that when providing alternative products or materials, all space, weight, connections, power and wiring requirements etc. are considered. Any

costs incurred for additional components, changes to services, structural or space requirements, layouts and plans, etc. that may be necessary will be borne by the contractor.

.3 Contractor to submit all requests for alternative product approval to the Consultant. Submissions must be received by the Consultant not less than seven (7) working days prior to the close of tenders. Submissions received after the “Cut-Off” date will not be reviewed. All submissions, which are approved by the Consultant, shall be identified as “Approved Alternatives” in an Addendum. Alternative products not listed in the Addendum will be rejected.

.4 Approval of an alternate is not intended to change the original specifications unless specifically stated in the addenda. The submitter is responsible for all costs incurred by other trades as well as his own, to install the product/system in accordance with the contract documents.

.5 All submissions to be provided with technical data and whatever pertinent information that may be required by the Consultant to evaluate equivalency to the specified product. The responsibility to provide sufficient technical data with respect to submissions will remain solely with those making the submission.

3.8 QUALITY OF PRODUCTS

.1 All products provided shall be fully approved by the Canadian Standards Association (CSA), Canadian Underwriters' Laboratory (cUL) or other recognized Canadian testing agency unless otherwise specified, for use as installed and meet the requirements of this specification in all respects.

.2 If products specified are not approved as listed above, obtain special approval from a recognized Canadian testing agency. Pay all applicable charges levied and make all modifications required for approval.

.3 Products provided, if not specified, shall be new, of a quality best suited to the purpose required and their use subject to approval by the Consultant.

3.9 UNIFORMITY OF MANUFACTURE

.1 Unless otherwise specifically called for in the Specifications, uniformity of manufacture shall be maintained for similar products throughout the work.

3.10 PRODUCT FINISHES

.1 All equipment including switchgear, switchboards, transformers, cabinets and motor control centers, panelboards, pull boxes and raceways to be finished in ANSI/ASA Grey No. 49 or 61.

.2 Apply primer on all items, which are to be finished on the job.

.3 Touch up all damaged painted finishes with paint, or, if required by the Consultant, completely repaint damaged surface.

.4 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside and at least two coats of finish enamel.

.5 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.

.6 Clean and prime paint exposed hangers, racks, fastenings to prevent rusting. Finish painting shall be provided by Division 09.

3.11 PAINT OUTDOOR ELECTRICAL EQUIPMENT "EQUIPMENT GREEN" FINISH.

3.12 ACCESS PANELS (DOORS)

.1 Unless otherwise noted, access doors shall be minimum: 450mmx450mm 18"x18" for body entry; 300mmx300mm 12”x 12” for hand entry.

.2 Access doors in fire separations of 3/4 hour rating, and higher, and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch, self closing.

3.13 MINIMUM REQUIREMENTS:

.1 180 degree door swing, mitred rounded safety corners flush welded, concealed hinges, screwdriver latches, and anchor straps or lugs to suit construction, all steel prime coated.

.2 Plaster or wet wall construction: 14 gauge bonderized steel flush with wall or ceiling type with concealed flange.

.1 Acceptable Product: Acudor PS-5030.

.3 Masonry or drywall construction: 16 gauge for 400 mm (15.75 inch) 400.05 mm (15.75 inch) 16" x 400 mm 16" and smaller, 14 gauge for 450 mm (17.72 inch) (450.09 mm (17.72 inch)) 18" x 450 mm 18" and larger bonderized steel face of wall type with exposed flange.

.1 Acceptable Product: Acudor UF-5000.

.4 Tile, ceramic tile, marble, terrazzo, plaster or wet wall construction in washrooms and other special areas: 14 gauge stainless steel flush with wall or ceiling type with concealed flange.

.1 Acceptable Product: Acudor PS-5030 stainless.

.5 Acoustical tile ceiling and similar block materials: 14 gauge bonderized steel recessed ceiling type.

.1 Acceptable Product: Acudor AP-5010 or AT-5020.

.6 Feature wall construction: Recessed wall type that is selected to complement and conform to the architectural module, treatment, or panelling. The size shall conform to adjacent finishes.

.7 Access panels in fire separations and fire walls shall have a compatible fire rating and ULC label. (ie. Acudor Fire Rated FW-5050 or FB-5060).

.2 Standard of Acceptance : Zurn, Wade, Acudor, Can-Aqua, Milcor, Maxam, Van-Met.

3.14 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other Divisions.

3.15 FASTENING TO BUILDING STRUCTURE

.1 General:

.1 Do not use inserts in base material with a compressive strength less than 13.79 MPa 13796.41 kPa (2001 psi) 13789.52 kPa (13789.52 kPa (2000 psi)).

.2 All inserts supporting conduit racks shall have a factor of safety of 5. All other inserts shall have a factor of safety of 4.

.2 Types:

.1 Cast-in-place type:

.1 Channel type - Burndy, Canadian Strut, Unistrut, Cantruss or Hilti Channel.

.2 Wedge type galvanized steel concrete insert, Grinnell Fig. 281 for up to 200 mm 199.9 mm (7.87 inch) 8" pipe size.

.3 Universal type malleable iron body insert, Grinnell Fig. 282 for up to 200 mm 199.9 mm (7.87 inch) 8" pipe size.

.2 Drilled, mechanical expansion type:

.1 Hilti HSL or UCAN LHL heavy duty anchor for use in concrete with compressive strength not less than 19.6 MPa 19615.59 kPa (2845 psi) 19581.12 kPa (19581.12 kPa (2840 psi)).

.2 Hilti Kwik-Bolt or UCAN WED stud anchor for concrete. (Do not use in seismic restraint applications).

.3 Hilti HDI or UCAN IPA drop-in anchor for concrete.

.4 Hilti or UCAN Sleeve Anchor (medium and light duty) for concrete and masonry.

.5 Hilti ZBP or UCAN Zamac pin bolt (light duty) for concrete and masonry.

.3 Drilled, adhesive type:

.1 Hilti HVA or UCAN Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.

.2 Hilti HY150 consisting of anchor rod with a 2 part adhesive system.

.3 For use in concrete housekeeping bases (in vertical downward position) where the distance to the edge of the concrete base could cause weakness if a mechanical expansion type anchor were used.

.4 Rod assemblies shall extend a minimum of 50 mm 50.04 mm (1.97 inch) 2" into the concrete slab below the housekeeping bases.

.3 Note:

.1 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.

.2 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.

.3 Where specifically called for, drills shall include a dust vacuum system, Hilti SAV Dust Vacuum System.

3.16 EQUIPMENT SUPPORTS

.1 Provide stands and supports for equipment and materials supplied.

.2 Lay out concrete bases and curbs required under Electrical Divisions. Coordinate with Concrete Divisions.

.3 Concrete bases shall be a minimum of 100 mm 100.08 mm (3.94 inch) 4" thick, or as noted and shall project at least 150 mm (150.11 mm (5.91 inch)) 6" outside the equipment base, unless otherwise

directed. Bases and curbs shall be keyed to the floor and incorporate reinforcing bars and/or steel mesh. Chamfer edges of bases at 45 degrees.

.4 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25mm 1" above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout - Embeco or In-Pakt.

.5 Construct equipment supports of structural steel. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.

3.17 SUPPORT CEILING HUNG EQUIPMENT WITH ROD HANGERS AND/OR STRUCTURAL STEEL.

3.18 MISCELLANEOUS METAL

.1 Be responsible for all miscellaneous steel work relative to Electrical Divisions of the Specifications, including but not limited to:

.1 Support of equipment .

.2 Hanging, support, anchoring, guiding and relative work as it applies to wiring raceways and electrical equipment.

.3 Earthquake restraint devices - refer also to “Seismic Restraint” sections

.4 Bridle rings - secure to structure or steel supports.

.2 All steel work shall be prime and undercoat painted ready for finish under the related Division.

3.19 MAINTENANCE MATERIALS AND CABINET

.1 Provide maintenance materials in accordance with Division 01 and specified in appropriate Sections.

.2 Refer to Specification Appendix A Electrical Form EF140 “Items to be handed to the Owner” Obtain the Building Owners representative sign off. Use Form EF 140 for this purpose.

.3 Provide a finished painted sheet steel “spare equipment cabinet”. Cabinet to have a continuous hinge and complete with shelves and hasp to suit padlock. Minimum size 600 24” x 900 36” x 200 8” deep. Mount on wall in the Electrical Room. Provide a plastic covered typewritten list of spare parts and affix to the inside of the door.

3.20 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into maintenance manual specified in Division 01 and as follows.

3.21 INCLUDE IN OPERATIONS AND MAINTENANCE DATA:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.

.3 Wiring and schematic diagrams.

.4 Names and addresses of local suppliers for items included in maintenance manuals.

.2 Include in the manual the following major sections:

.3 Title page (in plastic cover).

.1 Comprehensive description of the operation of the systems, including the function of each item of equipment within the system.

.2 Detailed instructions for the normal maintenance of all systems and equipment installed including procedures and frequency of operational checks and service and troubleshooting instructions.

.3 Local source of supply for each item of equipment.

.4 Wiring and control diagrams.

.5 Spare parts list.

.6 Copies of guarantees and certificates.

.7 Manufacturer's maintenance brochures and shop drawings.

.4 The owner will provide a template form for the documentation and scheduling of all ongoing equipment maintenance activities. Populate these forms under the direction of the Commissioning Authority (CA).

3.22 PROJECT RECORD DRAWINGS

.1 Provide project record documents as specified in Division 01 as further called for in this Division.

.2 During the construction period, keep on Site a clean set of drawings marked up to reflect the "As-Built" state, for examination by the Consultant on a regular basis. Include elevations and detailed locations of buried services, empty conduit systems and junction and pull boxes.

.3 At the time of "substantial performance" purchase a set of CAD files from the Consultant. Allow a single per project cost of $250 or $10 per drawing (whichever is greater) for the CAD files. The Electrical Division shall include all associated costs to obtain and complete the CAD Record Drawings including retaining the services of an approved CAD draftsperson to transfer all changes to amend the CAD files in the latest version of AutoCAD. Include all revisions and change orders.

.4 Submit the "Record Drawing" CAD files and one set of plots to the consultant prior to Total Performance of the contract.

.5 Note: The Contractor will be required to sign a standard Stantec / Contractor agreement entitled "Authorization to Use CAD drawing files". The agreement restricts the use of the CAD files to the purpose of "as-built" only and determines the editing procedures.

3.23 USE OF PRODUCTS DURING CONSTRUCTION

.1 Any equipment used for temporary or construction purposes shall be approved by the Construction Manager and in accordance with the General Conditions, "Use of Premises." Clean and restore to "as new" condition all equipment prior to the time of substantial completion.

.2 The warranty period shall not begin until the date of substantial performance of the work.

Part 3 Execution

4.1 SITE EXAMINATION

.1 Examine the site of work and become familiar with all features and characteristics affecting this work before submitting tender.

.2 No additional compensation will be given for extra work due to existing conditions, which such examination should have disclosed.

.3 Report to the Consultant any unsatisfactory conditions, which may adversely affect the proper completion of this work.

4.2 CO-ORDINATION WITH OTHER DIVISIONS

.1 Examine the drawings and specifications of all divisions and become fully familiar with their work. Before commencing work, obtain a ruling from the Consultant if any conflict exists, otherwise no additional compensation will be made for any necessary adjustments.

.2 Lay out the work and equipment with due regard to architectural, structural and mechanical features. Architectural and structural drawings take precedence over electrical drawings regarding locations of walls, doors and equipment.

.3 Do not cut structural members without approval of the Consultant.

.4 Coordinate with all Division installing equipment and services and ensure that there are no conflicts.

.5 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.

.6 Examine previously constructed work and notify the Consultant of any conditions, which prejudice the proper completion of this work. Commencement of this work without such notification shall constitute acceptance of other work.

4.3 LOCATION OF OUTLETS & LUMINAIRES

.1 Electrical drawings are, unless otherwise indicated, drawn to scale and approximate distances and dimensions may be obtained by scaling. Figured dimensions shall govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural and Structural drawings.

.2 Outlet and equipment locations shown on the drawings are approximate. Locations may be revised up to 3 meters 3 meters (3.28 yards) to suit construction and equipment arrangements without additional cost to the Owner, provided that the Contractor is notified prior to the installation of the outlets, or equipment.

.3 Maintain luminaire locations wherever possible. Notify the Consultant of conflicts with other services.

4.4 UNLESS OTHERWISE SPECIFIED OR SHOWN, INSTALL PRODUCTS IN ACCORDANCE WITH RECOMMENDATIONS AND RATINGS OF MANUFACTURERS.

.1 Do not install outlets back-to-back or in the same stud space in wall; allow minimum 400mm 16” horizontal clearance between boxes.

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm 10”- 0” and information is given before installation.

.3 Locate light switches on strike side of doors unless otherwise indicated.

.4 Locate light switches on latch side of doors.

.5 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

4.5 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit and protruding 50 mm 50.04 mm (1.97 inch) 2".

.2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.3 Install roof jacks where conduit and cables penetrate roofs. Apply sealant after installation.

.4 All cables and conduits to be installed concealed in finished areas.

4.6 MOUNTING HEIGHTS

4.7 MOUNTING HEIGHT OF EQUIPMENT IS FROM FINISHED FLOOR TO CENTRELINE OF EQUIPMENT UNLESS SPECIFIED OR INDICATED OTHERWISE.

.1 If mounting height of equipment is not indicated verify before proceeding with installation. Confirm the height of devices in handicapped facilities before installation.

.2 Refer to detail on drawings.

4.8 IN THE ABSENCE OF A DRAWING DETAIL OR DRAWING NOTE, USE THE FOLLOWING:

Device	Height	Comment
Local switches	1050	[42"]
Wall receptacles/data	457	[18"]
Wall receptacles/data Healthcare	450 to 900	[18"] to [36"]
Panelboards	1900 Top	[75"]
Wall mtd telephone	1500	[60"]
Card Readers	1050	[42"]
Fire alarm stations	1050	[42"]
Fire alarm bells/audio	2100	[83"]
Fire alarm visual devices	2100	[83"]
Fire alarm Annunciator	1800 Top	[72"]
End of line resistors	1800	[72"]
Wall mounted speakers & clocks	2100	[84"]
Emergency Lighting (wall mounted)	2100	[83"]

.1 **NOTE**: REFER TO ARCHITECTURAL DRAWINGS FOR MOUNTING HEIGHT DETAILS. ARCHITECTURAL DRAWINGS TAKE PRIORITY WHERE CONFLICTS EXIST WITH VALUES INDICATED IN THIS SECTION.

4.9 SEPARATION OF SERVICES

4.10 MAINTAIN SEPARATION BETWEEN ELECTRICAL WIRING SYSTEM AND BUILDING PIPING, DUCTWORK, ETC. SO THAT WIRING SYSTEM IS ISOLATED (EXCEPT AT APPROVED CONNECTIONS TO SUCH SYSTEMS) TO PREVENT GALVANIC CORROSION.

.1 In particular, contact between dissimilar metals, such as copper and aluminium, in damp or wet locations is not permitted.

.2 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Consultant and the ceiling installer, and approved clips or hangers are used.

4.11 EQUIPMENT IDENTIFICATION

.1 Identification nameplates shall be 3 mm 3.05 mm (0.12 inch) thick plastic lamacoid with minimum 6 mm (6.1 mm (0.24 inch)) high lettering, coloured face to match system colour, white core, mechanically attached with self-tapping screws, to be attached to the front face of the following equipment:

.1 Distribution Centres (designation, bus capacity, voltage)

.2 MCCs (designation, bus capacity, voltage)

.3 Starters, Contactors, Disconnects (designation, voltage, load controlled)

.4 Panelboards (designation, voltage, bus capacity)

.5 Automatic transfer switch (designation, voltage, rating)

.6 Terminal cabinets and pull boxes (system, voltage)

.7 Transformers (designation, capacity, primary and secondary voltage)

.2 Apply owner provided asset tags as noted in section Section 01 78 40

.3 Final equipment naming to be in accordance with Owners provided naming convention.

.4 Warning nameplates shall be 3mm thick plastic lamacoid with minimum 6 mm (0.24 inch) 6.35 mm 6.35 mm (1/4 inch) white letters on red background, the wording to be reviewed by the Contract Administrator. All warning nameplates to be screwed to equipment.

CDP AND PANEL LAMACOIDS		
System	**Colour**	**Text Colour**
Vital	Red	White
Delayed Vital	Yellow	White
Normal	Blue	White
Conditional N/V	Blue / Red	White
Conditional N/DV	Blue / Yellow	White
Conditional V/DV	Red / Yellow	White

.5 Colour code concealed conduits (including conduits above T-bar ceilings and under raised floor), concealed junction and pull boxes, and metallic sheathed cables with paint or plastic tape 25 mm 24.89 mm (0.98 inch) wide band) at 15 metre intervals and at both side of transition through walls. All conduit, junction boxes and pull boxes in service rooms to be colour coded. Colour coding to be as follows:

System	Major Band	Minor Band	2nd Minor Band
347/600V Normal	Yellow	Green	
120/208V Normal	Grey		
347/600V Vital	Yellow	Red	
120/208V Vital	Grey	Red	
347/600V Delayed Vital	Yellow	White	
120/208V Delayed Vital	Yellow		
277/480V	Green	Red	
Conditional N/V 347/600V	Blue	Red	
Conditional V/DV 347/600V	Red	Yellow	
Conditional N/DV 347/600V	Blue	Yellow	
Conditional V/DV 277/480V	Red	Yellow	Green
Conditional N/V 277/480V	Blue	Yellow	Green
Fire Alarm System	Red		
Communications / Data	Blue		
Telephone	Light Green		
Building Alarm	Pink		
Television	Blue		
AV/TV Systems	Light Brown		
Clock System	Yellow		
Security Systems / Personal Alarms	Purple		
Central P/A	Light Green	White	
Card Access	Brown		
Door Intercom/Video	Purple	Yellow	
Computers	Black	Yellow	
DC Voltages	Red	Black	

.6 Provide neatly typed circuit directories in panelboards to indicate the area or equipment controlled by each branch circuit.

.7 Identify pull boxes, terminal cabinets and junction boxes enclosing cables or connections with nameplates indicating voltage, box number (if available) and circuit number.

.8 Provide junction boxes, relay panels and miscellaneous equipment energized from two or more sources with a warning nameplate prominently displayed, noting number and location of sources and their voltage.

.9 Receptacles and Light Switches:

.1 Label all devices including receptacles and light switches on faceplate with circuit number and panel from which it is fed.

.10 All conductors shall be identifiable by coloured insulation and permanent markers at every terminal and accessible points throughout its entire run.

.1 Conductors

.1 Equipment Grounding - Green

.2 Neutral – White

.11 120/208 Volt System

.1 Phase A - Red

.2 Phase B - Black

.3 Phase C - Blue

4.12 FIELD QUALITY CONTROL

.1 Load and Balance

.1 Measure voltage and phase & neutral currents to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase and neutral currents to dry-core transformers and motor control centres, operating under normal load,

.3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.2 Conduct and pay for the following tests:

.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system and communications.

.6 Main ground resistance (at all grounding locations).

.3 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.4 Provide Consultant with at least one weeks notice prior to testing.

.5 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

4.13 MANUFACTURER'S FIELD SERVICES:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.

.2 Furnish manufacturer's certificate or letter conforming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.3 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.4 Schedule site visits to review Work.

.2 Reports:

.3 Provide written reports in a timely manner upon completion of the testing and load balance. Indicate test hour and date.

4.14 CLEANING

.1 Do final cleaning in accordance with Division 01.

.2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

.3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.4 Clean and prime paint exposed non-galvanised hangers, racks, fastenings to prevent rusting. Coordinate finish painting with Division 09.

4.15 WORKMANSHIP

.1 Workmanship shall be in accordance with well established practice and standards accepted and recognized by the Consultant and the Trade.

.2 The Consultant shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance, quietness of operation, finish and appearance.

.3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Consultant.

.4 Protection of Work

.5 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.

.6 Mask machined surfaces. Secure covers over equipment openings and open ends of equipment and conduit, as the installation work progresses.

.7 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.

.8 Refinish damaged or marred factory finish.

.9 Refinish damaged or marred factory finish.

4.16 PROTECTION OF ELECTRICAL EQUIPMENT

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts, e.g. "LIVE 120 VOLTS".

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

4.17 CONCEALMENT

.1 Conceal wiring and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.

.2 Do not install wiring and conduit on outside walls or on roofs unless specifically directed.

.3 Service Penetrations in Rated Fire Separations

.4 All cabling, wiring, conduits, cable trays, etc. passing through rated fire separations shall be smoke and fire stopped to a ULC or cUL tested assembly system, in accordance with CAN4-S115-95, that meets the requirements of the Building code in effect.

.5 The scope includes new services which pass through existing rated separations and also all existing services which pass through a new rated separation or existing separations whose rating has been upgraded.

.6 Fire resistance rating of installed firestopping assembly shall not be less than fire resistance rating of surrounding assembly indicated on Architectural drawings. Where this is not indicated assume a minimum of one hour for walls and two hours for floors.

.7 Install firestopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions. The Applicator shall be approved, licensed and supervised by the manufacturer in the installation of firestopping and are to follow the requirements of a rated system as detailed above.

.8 Contractors are expected to submit system information detailing firestopping product, backing, penetrant, penetrated assembly, Fire (F) and Temperature (T) rating, and ULC or cUL system number.

.9 Provide fire stopping material and system information in the maintenance manuals and via labels at major penetrations that are likely to be repenetrated.

.10 All penetrations are to be firestopped using EZ Path System (Specified Technologies Inc - STI) or approved equal (i.e.Hilit Speed Sleeve).

.11 Allow openings for 100% capacity of raceway or 200% capacity of J-hooks.

.12 Provide split systems where existing cables are involved.

.13 Provide Firestopping approval certificate in including a Building Code / By-Law Schedule B-1, B-2 & C-B signed by a BC registered Professional Consultant. Submit a letter certifying that all work is complete and in accordance with this specification. Electrical Form EF130 in Section 16991 26 06 02 should be used for this purpose.

4.18 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

.1 All cabling, wiring, conduits, cable trays, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with caulking or silicon sealant to prevent the passage of smoke and/or transmission of sound.

.2 Provide sleeves of galvanised steel pipe with machine cut ends of ample size to accommodate conduits passing through walls, partitions, ceilings, floors, etc. Sleeves to be concentric with conduit or wiring.

4.19 FOR WALL, PARTITIONS AND CEILINGS THE ENDS SHALL BE FLUSH WITH THE FINISH ON BOTH SIDES BUT FOR FLOORS THEY SHALL EXTEND 4" ABOVE FINISHED FLOOR LEVEL.

.1 The space between the sleeve and the conduit shall be filled with Dow Corning silicone RTV foam for fire stop and caulked around the top and bottom with approved permanently resilient, non-flammable

and weatherproof silicone base compound and ensure that the seal is compatible with the floor and ceiling finishes.

.2 Locate and position sleeves exactly prior to construction of walls, floors.

.3 Failure to comply with the above requirements shall be remedied by Division 26 expense.

4.20 EXCEPT AS OTHERWISE NOTED CONDUIT SLEEVES ARE NOT REQUIRED FOR HOLES FORMED OR CORED IN INTERIOR CONCRETE WALLS OR FLOORS.

.1 Conduit sleeves shall extend 50 mm 50.04 mm (1.97 inch) 2" above floors in unfinished areas and wet areas and 6 mm (6.1 mm (0.24 inch)) 1/4" above floors in finished areas.

.2 Conduit sleeves shall extend 25 mm 24.89 mm (0.98 inch) 1" on each side of walls in unfinished areas and 6 mm (6.1 mm (0.24 inch)) 1/4" in finished areas.

.3 Conduit sleeves shall extend 25mm 1" beyond exterior face of building. Caulk with flexible caulking compound.

.4 Sleeve Size: 12 mm 11.94 mm (0.47 inch) 1/2" clearance all around, between sleeve and conduit or wiring.

.5 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.

.6 Packing of Sleeves:

.1 Where sleeves pass through foundation walls and perimeter walls the space between sleeve and conduit shall be caulked with waterproof fire retardant non-hardening mastic.

.2 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

4.21 ACCESSIBILITY AND ACCESS PANELS

.1 Install all equipment, controls and junction boxes so as to be readily accessible for future modification, adjustment, operation and maintenance as appropriate.

.2 Provide access panels where required in building surfaces. Do not locate access panels in panelled or special finish walls, without prior approval of the Consultant.

.3 Access panels in U.L.C. fire separations and fire walls shall have a compatible fire rating and U.L.C. label. Acquire approval in writing from the local fire authority if required.

4.22 ACCESS PANELS SHALL BE PAINTED WITH A PRIMER COAT IF APPLICABLE AND THEN WITH A FINISH COAT, COLOUR AND TYPE TO THE CONSULTANT'S APPROVAL.

.1 Locate equipment and junction boxes in service areas wherever possible.

.2 Where electrical equipment, junction boxes, remote ballasts or the like are concealed, access panels shall be supplied. Panels shall be of adequate size for servicing of the electrical work and complete with necessary frames and hinged doors held closed with captive fasteners. Coordinate type and size of panels with the Consultant.

.3 In removable ceiling areas, provide markers on ceiling tile to locate equipment requiring access. Markers shall be of a type approved by the Consultant.

4.23 EQUIPMENT INSTALLATION

.1 Provide means of access for servicing equipment.

.2 CSA identification and equipment labels to be clearly visible after installation.

4.24 CUTTING, PATCHING, DIGGING, CANNING , CORING & CONCRETE

.1 Lay out all cutting, patching, digging, canning and coring required to accommodate the electrical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.

.2 Be responsible for all cutting, patching, digging, canning and coring required to accommodate the electrical services.

.3 Be responsible for correct location and sizing of all openings required under Electrical Divisions, including piped sleeves.

4.25 VERIFY THE LOCATION OF EXISTING AND PLANNED SERVICE RUNS AND STRUCTURAL COMPONENTS WITHIN CONCRETE FLOOR AND WALLS PRIOR TO CORE DRILLING AND/OR CUTTING. REPAIRS TO EXISTING SERVICES AND STRUCTURAL COMPONENTS DAMAGED AS A RESULT OF CORE DRILLING AND CUTTING IS INCLUDED IN THIS SECTION OF THE WORK.

.1 Openings through structural members of the building shall not be made without the approval of the Structural Consultant.

.2 Openings in Concrete:

.1 Be responsible for the layout of all openings in concrete, where openings are not left ready under previous contract.

.2 All openings shall be core drilled or diamond saw cut.

.3 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls.

.4 Refer to structural drawings for locations of steel reinforcing.

.3 Be responsible for repairing any damage to steel reinforcing.

.4 Openings in building surfaces other than concrete:

.1 Lay out all openings required.

.5 Poured concrete for duct encasements, pole bases, transformer pads and housekeeping pads shall be provided by other Divisions, coordinated and supervised by the Electrical Divisions.

.6 Precast concrete items such as transformer pad bases, pull boxes and light pole bases to be provided and installed by the Electrical Divisions unless otherwise specified.

.7 Excavation and backfilling will be provided by other Divisions. This Division to superintend the work and provide all layouts and parameters.

4.26 WIRING TO EQUIPMENT SUPPLIED BY OTHERS

.1 Equipment supplied by the Owner or under other Division will be moved to the installation site by others. However, the electrical connection to the equipment shall be done by this Division.

4.27 TESTING

.1 Refer to Section 26 08 00.11 - Testing, Adjusting and Balancing of Electrical Equipment and Systems.

4.28 SINGLE LINE DIAGRAM

.1 Provide and mount a framed as-built single line diagram produced by a cad program to be located adjacent to the main electrical equipment. Use a clear plexiglass cover. The diagram shall be 914 mm 913.89 mm (35.98 inch) x 600 mm (599.95 mm (23.62 inch)) minimum.

4.29 INSTRUCTIONS TO OWNER'S PERSONNEL

.1 Refer to Section 26 08 00.12 - Electrical Equipment and Systems Demonstration and Instruction.

4.30 SEALING OF WALL AND FLOOR OPENINGS

.1 All conduit and cable entries through outside walls of buildings, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade shall be sealed to prevent passage of moisture, dust, gasses, flame, or to maintain pressurization.

.2 Openings shall be sealed when all wiring entries shown on the drawings have been completed.

.3 Sealing material shall be fire resistant CAN/ULC S115 certified, rated for FTH and shall not contain any compounds, which will chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations to be sealed.

4.31 SPRINKLER PROOF EQUIPMENT

.1 Electrical equipment installed where sprinklers are also installed shall be constructed so that water from the sprinkler heads shall not impair the effectiveness of the equipment. This will include, but not be limited to: Distribution Centres, Equipment Enclosures, Cabinets, Transformer enclosures, Panelboards.

.2 A separate and complete cover shall be provided on free-standing or surface mounted equipment. An overhang at the front, rear and sides shall prevent the entrance of water either at the top or through projecting face plates, meters, etc.

.3 Where conduits or cables are required to penetrate sprinkler proof covers, rain tight connectors shall be used in conjunction with sealing rings with stainless steel retainer.

.4 Distribution, power and lighting panelboards and switchboards shall be complete with gasketted covers and doors.

.5 Louvres shall be of the outdoor type.

4.32 HOUSEKEEPING PADS

.1 All floor mounted electrical equipment installed by this Division shall be mounted on concrete housekeeping pads, which, unless otherwise noted, shall be the responsibility of the General and Electrical Contractor. Coordinate layout with General Contractor.

.2 The Contractor shall determine the extent of the housekeeping pads required and supply all information and details as to size and locations to the Consultant within thirty days after the award of the Contract.

4.33 PAINTING

.1 Be responsible for field touch-up painting of all shop painted electrical equipment installed in this Contract.

.2 All surfaces to be painted shall be dry, clean, free from dust, dirt, grease, frost, rust, loose crystals or extraneous matter, tool and machine marks. Feather out edges of scratch marks to make patch inconspicuous.

.3 Apply one or more coats of paint until the damaged surface has been restored to original finish condition. Do not apply succeeding coats until preceding coat is dry and hard. Sand lightly between coats with No. 00 sandpaper.

.4 Clean exposed bare metal surfaces supplied under the Electrical Divisions removing all dirt, dust, grease and millscale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.

.5 Paint all hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.

.6 Repaint all marred factory finished equipment supplied under the Electrical Divisions, to match the original factory finish.Coordinate with Division 09.

4.34 CUTTING AND PATCHING

.1 Do all drilling, cutting, fitting and patching necessary for the installation and securing of conduits, cable tray, wireways, and other electrical equipment.

.2 Provide supports necessary for same.

.3 Provide bracing and anchorage of work subject to the Contract Administrator's approval.

.4 No cutting of the structural members or of their fireproofing shall be done without the written consent of the Contract Administrator.

.5 Caulk and flash all conduits passing through walls, roofs or other surfaces exposed to weather or as indicated on the drawings to prevent the passage of water and/or sewer gases.

4.35 HANGERS AND SUPPORTS

.1 Provide hangers, angles, channels, and other supports necessitated by field conditions to install all items of electrical equipment. Design of supports and methods of fastening to building structures shall be subject to the Contract Administrator’s approval.

.2 All local motor control devices are to be grouped and mounted on a free-standing frame of stainless steel construction easily accessible and as close to the motor as possible.

.3 Provide weight-distribution facilities, where required, so as not to exceed the load-bearing capacities of floors or walls that bear the weight of, or support, electrical items.

.4 Paint all exposed parts of hangers and supports with a rust inhibiting primer.

4.36 EQUIPMENT SHALL NOT BE HELD IN PLACE BY ITS OWN WEIGHT. PROVIDE BASE ANCHOR FASTENERS IN EACH CASE.

4.37 ELECTRICAL CONDUIT IN SLABS

.1 Electrical Trade Contractor to submit a drawing indicating the proposed layout for any electrical or other conduit to be cast into a structural slab or slab on grade.

.2 Locate conduit to be cast into a structural slab within the centre third of the slab thickness only; arrange crossovers to ensure that all conduits are contained within the centre third of the slab thickness. Maximum outside diameter of conduit is to be one quarter of the slab thickness.

.3 Do not displace reinforcing steel in order to place conduit; do not secure conduit in place by tying parallel to reinforcing bar.

.4 Place conduit with minimum spacing between parallel conduits equal to four (4) conduit diameters.

4.38 TEMPORARY LIGHTING & POWER

.1 Provide grounded extension cords and temporary lights required for electrical work.Co-ordinate with General Contractor for obtaining temporary power service.If Owner’s operations will be affected by any power outage required for this work, give adequate notice to the Owner and do not interrupt power until approval has been obtained.Give adequate notice to Contractor of any power outage required for this work. Schedule outages to provide least interference with other work.

4.39 INSULATION RESISTANCE TESTING

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

4.40 MEGGER CIRCUITS, FEEDERS AND EQUIPMENT FROM 350-600 V WITH A 1000 V INSTRUMENT.

.1 Check resistance to ground before energizing.

.2 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.3 Submit test results for Consultant’s review.

4.41 LOAD BALANCE

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

4.42 NEUTRAL WIRING

.1 Provide a separate white neutral conductor for each circuit in the offices unless specified otherwise.

4.43 GROUND WIRING

.1 Provide a separate green ground conductor in all conduits.

.2 Delivery and Storage

.3 Ship and store equipment as per manufacturer’s recommendations.

.4 Ship channel bases and anchor stencils in advance of equipment.

.5 Keep equipment doors locked. Protect equipment from damage, dust and weather during shipping and storage.

.6 Block moving parts when necessary to prevent damage during movement and shipment of equipment. Instructions to remove blocking before putting equipment in service to be clearly and conspicuously displayed. Store all electrical equipment indoors. Temperature sensitive equipment to be stored in heated spaces.

.7 Store all electrical equipment indoors. Temperature sensitive equipment to be stored in heated spaces.

END OF SECTION

Part 1 Work Included

1.1 RELATED WORK

.1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other parts of the Contract Documents.

1.2 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.

.2 The Seismic Consulting Engineer should be able to provide a proof of professional insurance and the related practice credentials if requested by the Electrical Consultant. The Seismic Consulting Engineer should be familiar with SMACNA, ECABC & NFPA guidelines as well as BCBC and VBBL requirements.

.3 The Contractors Seismic Consultant shall submit original signed BC Building Code “Letters of Assurance” “Schedules B1, B2, and C-B” to the Prime Consultant or Electrical Consultant.

.4 Use the City of Prince George details in the absence of any local requirements.

.5 The above requirements shall not restrict or supplant the requirements of any local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

1.3 SCOPE

.1 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

.2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by Division 01.

.3 Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.

.4 The total electrical seismic restraint design and field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements. Contractor to allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Restraint Engineer. This engineer, herein referred to as the Seismic Consultant, will provide normal engineering functions as they pertain to seismic restraint of electrical installations.

.5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.

.6 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings to be included in the final project manual.

.7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.

.8 The Seismic Consultant shall provide inspections during and after installation. The Contractor shall correct any deficiencies noted without additional cost to the contract.

.9 Include all costs associated with the Seismic installation and certification in the base tender.

1.4 SHOP DRAWINGS & SUBMITTALS

.1 Submit shop drawings of all seismic restraint systems including details of attachment to the structure, either tested in an independent testing laboratory or approved by the seismic consultant.

.2 Submit all the proposed types and locations of inserts or connection points to the building structure or support slabs. Follow the directions and recommendations of the Seismic Consultant.

Part 2 Products

2.1 SLACK CABLE SYSTEMS

.1 Slack cable restraint systems shall be as designed and supplied by Vibra-Sonic Control or equal.

.2 Slack cable restraints shall be provided on suspended and shelf mounted transformers along with associated equipment and assemblies connected to them at the points of vertical support (4 points). The restraint wires shall be oriented at approximately 90o to each other (in plan), and tied back to the ceiling slab or its structure at approximately 45o to the slab or basic structure. The restraints shall be selected for a 1 g earthquake loading, i.e. each wire shall have a working load capacity equal to the weight of the transformer. The anchors in the structure shall be selected for a load equal to the weight of the transformers at a 45o pull.

.3 Slack cable systems to allow normal maintenance of equipment and shall not create additional hazard by their location or configurations. Contractor shall rectify any such installations at no additional cost, all to the satisfaction of the engineer and inspection authority having jurisdiction.

.4 Coordinate requirements of slack cables with suppliers prior to installation.

Part 3 Execution

3.1 GENERAL

.1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.

3.2 REFERENCE STANDARDS

.1 BCBC - British Columbia Building Code.

.2 British Columbia Building Code - British Columbia Building Code.

.3 CEC - California Electrical Code.

.4 VBBL - Vancouver Building By-Law (CB).

3.3 CONDUITS

.1 Provide restraint installation information and details on conduit and equipment as indicated below:

.2 Vertical Conduit:

.1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.

.2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed 9.2 meter (10.06 yard) 30 ft o.c.

.3 Riser joints shall be braced or stabilized between floors.

.4 Horizontal Conduits:

.1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

.2 EMT tubing - shall be installed and supported in accordance with the Canadian Electrical Code (CEC) requirements. Supports shall be provided at intervals not exceeding those specified by the CEC and within 900 mm (35.43 inch) (3 ft) of each outlet box, junction box, cabinet, or fitting.

.5 Provide transverse bracing at 12.2 meter (13.34 yard) 40 ft o.c. maximum unless otherwise noted. Provide bracing at all 90o bend assemblies, and pull box locations.

.6 Provide longitudinal bracing at 24.4 meter (26.68 yard) 80 ft o.c. maximum unless otherwise noted.

.7 Do not brace conduit runs against each other. Use separate support and restraint system.

.8 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.

.9 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.

.10 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.

.11 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.

.12 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with seismic consultant and submit shop drawings to consultants for their reference.

3.4 FLOOR MOUNTED EQUIPMENT

.1 Bolt all equipment, e.g. transformers, switchgear, generators, motor control centres, free standing panelboards, control panels, capacitor banks, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the center of gravity to a seismic force of 0.5g. For equipment which may be subject to resonances, use a nominal 1.0 g seismic force.

.2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.

3.5 LIGHT FIXTURES

.1 Fixtures in suspended ceilings shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by at least two taught cables which are connected to the fixture at diagonal points.

.2 Surface and recessed style fixtures shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by taut cables.

.3 Fixtures which are hung independently of ceiling systems shall have minimum of one seismic cable in addition to the chain or cable used to support the fixture. Seismic restraint cables shall be secured into the concrete or structural deck above.

.4 Cables shall be corrosion resistant and approved for the application.

.5 Fixtures which are rod hung shall have seismic ball alignment fittings at the ceiling and fixture.

END OF SECTION

PART 1 General

1.1 REFERENCE STANDARDS

.1 CAN/ULC S139 - Standard for Fire Test for Circuit Integrity of Fire-Resistive Power, Instrumentation, Control, and Data Cables.

.2 CSA C22.2 No. 0.3 - Test Methods for Electrical Wires and Cables.

.3 CSA C22.2 No. 124 - Mineral-Insulated Cable.

1.2 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Electrical General Requirements Section 26 05 00.11

.3 Refer to Division 27 & 28 for particular Communications, Electronic Safety & Security wiring systems and types.

.4 Refer to “Patient Care Wiring” Section 26 05 23H for additional requirements in Health Care Facilities.

1.3 WORK INCLUDED

.1 Provide a complete system of wiring, making all connections necessary for the installation shown on drawings.

.2 Aluminium conductors only permitted where indicated on drawings and then typically only for feeder conductors larger than 3/0 AWG. All conductor sizes indicated on drawings are based on copper conductors unless otherwise noted.

.3 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-4 flame spread rating.

.4 Flexible armoured cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations.

.5 Cabling indicated to be 2-Hour Fire-Rated shall be Mineral Insulated or compliant to CAN/ULC S139 and CSA 38-95 (Draka Lifeline, Raychem RHW, or Shawflex). Cabling shall be low smoke halogen free. Conduit to be sized and installed as per manufacturers requirements for these specialized cables and assemblies regardless of the size indicated on drawings.

.6 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.

.7 Refer to Equipment Schedule(s) for detailed responsibilities.

.8 Non-metallic sheathed wiring is not to be used on this project.

1.4 REFERENCES, CODES AND STANDARDS

.1 All Codes, Standards, Rules, Regulations, Bulletins, By-laws etc., shall be those that are currently enforced, in particular, the following:

.1 CSA C22.2 No. 0.3 - Test Methods for Electrical Wires and Cables.

.2 Install and rate power cables in accordance with the latest Canadian Electrical Code requirements, or in accordance with the latest ICEA requirements where permissible.

1.5 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00.11 - Electrical General Requirements.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management And Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.7 WARRANTY

.1 In the event of an emergency failure during the warranty period of any product(s), material(s) or system(s) installed under this Section, and the issuer of the warranty is unable or chooses not to respond to a request by the Owner for immediate emergency repair/replacement of the affected product, material or system, then the Owner reserves the right to recover, from the issuer of the warranty, all costs incurred by the Owner engaged forces in effecting the immediate repair/replacement.

PART 2 Products

2.1 BUILDING WIRES

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG.

.2 Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene (XLPE) material rated RW90.

.3 Control circuits: No. 14 AWG or larger as required.

.4 Low voltage systems: size in accordance with manufacturers recommendations for proper operation of the equipment.

.5 Video cable: Ethernet CAT5e or higher.

.6 AC90 (BX) cable may only be utilized for recessed tee bar fixture drops from ceiling mounted outlet boxes. Length of drops not to exceed 3.0 meter (3.28 yard). Do not loop between fixtures.

.7 Fire alarm cable: FAS

2.2 TECK CABLE

.1 Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

.2 Insulation:

.1 Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

.3 Inner jacket: polyvinyl chloride material.

.4 Armour: interlocking galvanized steel or aluminum interlocked armor (AIA)

.5 Overall covering: thermoplastic polyvinyl chloride material.

.6 Fastenings:

.1 One hole zinc straps to secure surface cables 50 mm (1.97 inch) and smaller. Two-hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two or more cables at 600 mm (23.62 inch) centers.

.3 6 mm (0.24 inch) diameter threaded rods to support suspended channels.

.7 Connectors:

.1 Watertight, approved for TECK cable.

2.3 ARMOURED CABLES

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90.

.3 Armour: interlocking type fabricated from aluminium strip.

.4 Type: ACWU90-PVC flame retardant jacket over thermoplastic armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 meter (1.31 yard).

2.4 MINERAL INSULATED CABLES (MI) OR TWO HOUR FIRE RATED CABLE ASSEMBLIES

.1 Mineral-insulated cables shall be manufactured to CSA C22.2 No. 124.

.2 Conductors to be solid, bare, soft-annealed copper, sized as required.

.3 Insulation to be compressed powdered magnesium oxide, to form compact homogeneous mass throughout entire length of cable.

.4 Overall covering to be annealed seamless copper sheath, type LW MI, rated 600 V, 250 °C.

.5 P.V.C. outer jacket shall be applied over sheath.

.6 Two hour fire rating.

.7 Cable end terminations to be done under the direction of the manufacturers supervision or alternatively measured and factory prepared.

.8 Alternately, where indicated 2-Hour Fire-Rated conduit and wire assemblies may be used and shall be compliant to CAN/ULC S139 and CSA 38-95 (Vitalink, Draka Lifeline, Raychem RHW, or Shawflex). Cabling shall be low smoke halogen free. Conduit to be sized and installed as per manufacturers requirements for these specialized cables and assemblies regardless of the size indicated on drawings.

2.5 CONTROL CABLES

.1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of armour of closely wound aluminium wire.

.2 Low energy 300 V control cable: solid annealed copper conductors sized as indicated, with PVC insulation type.

PART 3 Execution

3.1 GENERAL

.1 Minimum conductor size #12 AWG.

3.2 INSTALLATION OF BUILDING WIRES

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 33.

.2 In wireways and auxiliary gutters in accordance with Section 26 05 36.13.

3.3 INSTALLATION OF TECK CABLE 0 - 1000 V

.1 Install cables.

.2 Group cables wherever possible on channels.

.3 Terminate cables in accordance with Section 26 05 19.10 - Wire and Box Connectors - 0 - 1000 V.

.4 Minimum Spacing Requirements: 1 x maximum diameter of largest cable in group.

3.4 INSTALLATION OF ARMOURED CABLES

.1 Group cables wherever possible.

.2 Lay cable in cabletroughs in accordance with Section 26 05 36.12.

.3 Terminate cables in accordance with Section 26 05 19.10 - Wire and Box Connectors - 0 - 1000 V.

.4 For ACWU cable, use non-magnetic connectors, ground armour and ground conductor at supply and only use non-metallic cable entrance plates. Support runs on steel or aluminium channels with spacers and clamps. Space cables to provide free air ampacity ratings unless otherwise shown.

3.5 INSTALLATION OF MINERAL INSULATED CABLES

.1 Run cables exposed, securely supported by metal straps. Plastic tie-wraps are not acceptable.

.2 Make cable terminations by using factory-made kits.

.3 At cable terminations use thermoplastic sleeving over bare conducts.

.4 Do not splice cable.

.5 MI cables shall be used for emergency system feeders and branch circuits requiring a 1 (one) hour fire rating, where rating is not achievable by embedding in poured concrete or enclosing in fire rated spaces.

3.6 INSTALLATION OF CONTROL CABLES

.1 Install control cables in cable troughs.

.2 Ground control cable shield.

3.7 WORKMANSHIP

.1 Before pulling wire, ensure conduit is dry and clean. If moisture is present, thoroughly dry out conduits; vacuum if necessary. To facilitate pulling, recognized specially manufactured wire pulling lubricants may be used. Do not use grease. Employ suitable techniques to prevent damage to wire

when ambient temperature is below the minimum permitted for each insulation type. Do not pull wires into incomplete conduit runs.

.2 Installation to be free of opens and grounds. Before energization, measure insulation resistance and comply with the Canadian Electrical Code. Submit data sheet with values measured.

.3 Do not install any conductor smaller than #12 AWG, except where specifically indicated otherwise, i.e. for fire alarm system station circuits, etc.

.4 Conductor sizes shown on the drawings are the minimum that should be provided. Contractor shall allow for conductor size upgrade based on real site routes. Voltage drop from lighting panels to farthest outlet must not exceed 3% at full load in any case. Advise Consultant if problem is foreseen.

.5 Service and feeders conductor sizes shown on the drawings are the minimum that should be provided. Contractor shall allow for conductor size upgrade based on real site routes. Maximum allowable voltage drop for service and feeders shall not exceed 2%.

.6 Exercise care in stripping insulation from wire. Do not nick conductors.

.7 Conductor length for parallel feeders to be identical.

.8 Lace or clip groups of feeder conductors at all distribution centres, pull boxes, and termination points.

.9 All grounding conductor and straps to be copper. All ground conductors to have green insulation jacket except where specified to be bare copper.

3.8 IDENTIFICATION, CODING AND BALANCING

.1 For branch circuit wiring, follow identification system shown on the drawings and as specified in Section 26 05 00.11 - Electrical General Requirements.

.2 Connect single-phase equipment to minimize imbalance on feeders. Adjust branch circuiting shown as required for optimum balancing. Record all changes on "record" drawings.

.3 Colour code all feeders at all terminations, at all points where taps are made, and at all panelboards, switchboards, motor control centres, etc. Use two wraps of 3M #471 plastic film tape 48 mm (1.89 inch) wide.

.4 Conductors sized No. 10 and smaller are required to be factory coloured, not taped on site.

.5 For direct current wiring use red for positive and black for negative.

3.9 TESTING

.1 Service and all feeders, power and control wiring shall be tested for insulation resistance value with a 1000 V megger. Resistance values shall be as recommended by the cable manufacturer.

.2 Service and all feeders and wires test results shall be properly tabulated, signed, dated, and submitted to the Consultant.

END OF SECTION

PART 1 General

1.1 RELATED REQUIREMENTS

.1 Electrical General Requirements Section 26 05 00.11

1.2 ABBREVIATIONS AND ACRONYMS

1.3 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

1.4 WORK INCLUDED

.1 Provide a complete system of wiring, making all connections necessary for the installation shown on drawings.

1.5 REFERENCES, CODES AND STANDARDS

.1 All Codes, Standards, Rules, Regulations, Bulletins, By-laws etc., shall be those that are currently enforced, in particular, the following:

.1 CSA C22.2 No. 65 - Wire Connectors.

.2 CSA C22.2 No.18, Outlet Boxes, Conduit Boxes and Fittings.

.3 Install and rate power cables in accordance with the Canadian Electrical Code requirements, or in accordance with the ICEA requirements where permissible.

.4 National Electrical Manufacturers Association (NEMA)

1.6 REFERENCE STANDARDS

.1 CSA C22.2 - General requirements — Canadian Electrical Code, Part II.

PART 2 Products

2.1 MATERIALS

.1 Pressure type wire connectors to: with current carrying parts same material as conductors sized to fit the conductors as required.

.2 Fixture type splicing connectors to: with current carrying parts same material as conductors sized to fit the conductors 10 AWG or less.

.3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:

.1 Connector body and stud clamp for stranded copper conductors.

.2 Clamp for copper bar.

.3 Stud clamp bolts.

.4 Bolts for copper bar.

.5 Sized for conductors and bars as indicated.

.4 Clamps or connectors for armoured cable, aluminium sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA C22.2 No.18.

2.2 WIRE CONNECTORS

.1 Use 3M “Scotchlok”, self-insulated connectors for hand twist wire joints for lighting, small power, and control wiring, or approved equal.

.2 Use T & B non-insulated ring type compression lugs for terminating #10 AWG and smaller motor connections. Tape with rubber and scotchtape. Lugs to accept 10-32 x 3/8” machine bolts.

.3 Terminate conductors #8 AWG and larger with Thomas & Betts Colour-Keyed compression connectors Series 54000, or on lugs provided with equipment.

.4 Thomas & Betts “KOPR-SHIELD” compound Series CP8 on all terminations for compression connectors.

PART 3 Execution

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.1 Apply coat of zinc joint compound on aluminium conductors prior to installation of connectors.

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No. 65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

.4 Install bushing stud connectors in accordance with EEMAC 1Y-2.

3.2 WIRE CONNECTORS

.1 Select hand twist connectors for wire size and install tightly on conductors.

.2 Brush “KOPR-SHIELD” compound on terminations for compression connectors as recommended by the manufacturer.

.3 Install compression connectors using methods and tools recommended by manufacturer.

.4 Do not install stranded conductors under screw terminals unless compression lugs are installed.

END OF SECTION

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Electrical General Requirements Section 26 05 00.11

.2 Ground Fault Circuit Interrupts-Class ‘A’ Section 26 05 00.12

.3 Outlet Boxes, Conduit Boxes, and Fitting Section 26 05 32

.4 Conduits, Conduit Fastenings and Conduit Fittings Section 26 05 33

1.2 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 LEED Submittals

.4 Operation and Maintenance Materials

.5 Record Documents

1.3 WORK INCLUDED

.1 Provide and connect all wiring devices for the complete installation.

1.4 HEALTH CARE AND LABORATORY

.1 Use “Hospital Grade” devices in all “Patient Care” areas of the project as defined in the Basic, Intermediate and Critical Care classifications in specification section 26 05 23H “Patient Care Wiring”. Use similar “Hospital Grade” devices in all Laboratory areas unless otherwise noted. Obtain clarification of area classification where not clearly defined.

.2 Provide mechanically fastened (with drive rivets, not screws) lamicoid nameplate for all receptacles in “Patient Care Areas” to comply with section 5.6 of CSA Z32 “Electrical Safety and Essential Electrical Systems in Health Care Facilities”. Nameplates to indicate circuit number and source panel identification and be a minimum size of 12mm x 25mm 1/2” x 1” located above receptacles in patient care areas. In addition clearly and neatly identify the circuit number on the actual receptacle label space with permanent marker. All standard power duplex receptacles not adjacent to beds in patient, examination and treatment rooms to be labelled with lamicoid nameplate: "Housekeeping”.

.3 Use “Heavy Duty Specification Grade” devices in all other areas.

.4 Allow to provide and install temporary construction use “Brown” receptacles as required and directed by the general contractor up to a maximum of 10% of all interior receptacles. Prior to substantial performance, all construction brown receptacles to be replaced with receptacles intended for that area.

1.5 REFERENCE STANDARDS

.1 CSA 22.2 - General Requirements — Canadian Electrical Code, Part II.

.2 CSA C22.2 No. 42 - General Use Receptacles, Attachment Plugs, and Similar Wiring Devices.

.3 CSA Z32 - Electrical Safety and Essential Electrical Systems in Health Care Facilities.

PART 2 PRODUCTS

2.1 MANUFACTURER

.1 Wiring devices to be of one manufacture throughout project.

.2 Manufacturers shall be Hubbell, Bryant, Leviton or Arrow Hart.

2.2 DEVICES

.1 All devices shall be

.1 Heavy duty industrial grade for all process areas and all technical areas such electrical and mechanical rooms

.2 Heavy duty specification grade for offices, meeting rooms and common areas.

.2 Devices to be with stain stainless steel, 1-mm thick cover plates in offices, meeting rooms, common areas and similar areas.

.3 Devices to be with galvanized steel cover plates in process areas, mechanical rooms/areas, and rooms and for all surface mounted devices.

2.3 SWITCHES

.1 Switches shall be 15 or 20 ampere, 120 or 347 volts, single pole, double pole, or three-way and four-way as indicated on the drawings.

.2 Must adhere to CSA 22.2 No 111-18 – General-use Snap Switches, unless specified for use in hazardous areas.

.3 For wet locations use the following switches: 20 ampere, 120 volts, single pole white, side wired press-switch.

.4 Manually operated general purpose AC switches shall have the following features:

.1 Terminal holes approved for AWG #10 wire.

.2 Heavy duty specification grade in offices, meeting rooms, common areas and similar areas. Switches to be white with stain finished stainless steel cover plate.

.3 Heavy duty industrial grade in process areas, electrical room and mechanical rooms/areas. Switched to be brown with a formed stainless galvanized steel cover plate in electrical and mechanical rooms/areas and white elsewhere.

.4 Heavy duty industrial grade in process and similar areas with washdown capabilities. Switches shall be white with a PVC hinged weatherproof cover as per IPEX series VSC or equivalent

.5 Silver alloy contacts.

.6 White urea or melamine molding for parts subject to carbon tracking.

.7 Suitable for back and/or side wiring.

.5 Refer to section 26 09 24 and 26 09 43 for lighting control switch requirements.

2.4 RECEPTACLES

.1 This specification applies to single and duplex receptacles and receptacles of other voltage and ampacity as indicated on the drawings.

.2 Type NEMA 5-15R or 5-20R as the circuit requires, 125 volt, U-ground, heavy duty industrial and specification grade to CSA C22.2 No. 42 – General Use Receptacles.

.1 Heavy duty specification grade in offices, meeting rooms, common areas and similar areas. Receptacles to be white with stain finished stainless steel cover plate.

.2 Heavy duty industrial grade in process areas, electrical room and mechanical rooms/areas. Receptacles to be brown with a formed stainless galvanized steel cover plate in electrical and mechanical rooms/areas and white elsewhere.

.3 Heavy duty industrial grade in process and similar areas with washdown capabilities. Receptacles shall be white with a PVC hinged weatherproof cover as per IPEX series WDR or equivalent.

.4 Heavy duty industrial grade for all outdoor uses. Receptacles shall be white with a thermoplastic hinged weatherproof cover as per HUBBELL series RW57300.

.5 Install tamper resistant receptacles in all areas that children under the age of seven are exposed.

.3 Duplex 15 and 20 ampere, 120 volt, 3 wire, white, U-ground, T-Slot (20A), with the following features:

.1 White urea molded housing.

.2 Specification Grade

.3 Suitable for #10 AWG for back and side wiring.

.4 Eight back wired entrances, four side wiring screws.

.5 Triple wipe contacts and riveted grounding contacts.

2.5 RECEPTACLES – PARTICULAR APPLICATION

.1 Allow a maximum connection of six general use receptacles to one 15 amp circuit.

.2 Utilize NEMA 5-20R 15/20Amp style duplex receptacles for printers / and provide 20A rated dedicated circuits for each printer / copier unless special receptacle type configuration is required to suit the selected equipment.

.3 Utilize NEMA 5-20R 15/20Amp style receptacles for housekeeping receptacles.

.4 Ground Fault Interrupter type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire hospital grade, white face, parallel blade, U ground, impact resistant nylon face, complete with breaker and reset button. Equal to:

.1 Hubbell GFSG8200 series

.2 Leviton 7599HG series

.3 Pass & Seymour HG1595 series (Décor)

.5 For communication and server room racks use L21-30R Industrial grade twist lock receptacles, two (2) per cabinet and equipment rack are to be mounted on the underside the cable runner facing down above the vertical PDU location.

.6 All other single outlet and special purpose receptacles to be similar to the grade and series indicated above. Confirm ampacity, voltage and pin configuration prior to installation.

2.6 COVER PLATES

.1 All cover plates receptacles and light switches shall be stainless steel finish unless noted otherwise specified.

.2 Use sheet steel utility box cover for wiring devices installed in surface mounted utility boxes.

.3 Use stainless steel 1 mm (0.04 inch) thick cover plates on all wiring devices mounted in flush-mounted outlet boxes unless otherwise specified.

.4 Weatherproof extra duty metallic/non-metallic while-in-use covers, complete with gaskets for receptacles or switches.

.5 Weatherproof double lift spring - loaded cast aluminium cover plates, complete with gaskets for double receptacles or switches.

.6 Weatherproof spring - loaded cast aluminium cover plates complete with gaskets for single receptacles or switches.

.7 Use gasketted DS cast covers on FS and FD type boxes.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

.1 Mount wiring devices to height specified in Section 26 05 00 or as indicated.

.2 Upper edge of plates located on separate outlets immediately alongside one another to be at exactly the same height above finished floor.

.3 All plates to be installed parallel or perpendicular to building lines.

3.2 DEVICES LOCATED IN STC 50 OR HIGHER RATE WALLS

.1 Where we have back-to-back electrical wiring devices in STC 50 or higher rated walls (such as patient rooms) the fixtures should be acoustically sealed.

.2 Back-to-back wiring devices can be staggered at least one stud space apart or where one stud space staggering is not feasible the recessed devices can be installed using 3M Fire Barrier Moldable Putty Pads MPP+ (or equivalent) to acoustically seal the device.

3.3 INSTALLATION

.1 Install single throw switches with handle in the "DOWN" position when switch open.

.2 Install three and four way switches so that the load is “OFF” when all switches are in the “DOWN” position.

.3 Install switches vertically in gang type outlet box when more than one switch is required in one location.

.4 Mount switches on the latch side of the doorway as close as possible to door frame unless otherwise indicated on drawings.

.5 Mount switches and receptacles at height specified in Section 26 05 00.11 or as indicated.

.6 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.

.7 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.8 Protect cover plate finish with paper or plastic film until all painting and other work is finished, then remove paper.

.9 Install suitable common cover plates where wiring devices are grouped. Do not distort plates by tightening screws excessively.

.10 Do not use cover plates meant for flush outlet boxes on surface mounted boxes.

.11 Wherever possible, mount equipment in a straight line at a uniform mounting height, coordinated with other equipment and materials.

.12 Mounting dimensions are to the centre of the devices. Final instructions on mounting heights shall be given by the Consultant’s representative at the site. The above shall be used as a guide but shall be subject to final verification prior to installation.

.13 Supply and install a separate neutral conductor from branch circuit panel to devices for all lighting control devices.

.14 Supply and install a separate neutral conductor for each branch circuit that requires a neutral.

END OF SECTION

Part 1 GENERAL

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 27 for grounding and bonding of the communication system.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.2 Transformer grounding shall comply with CSA C22.2 No.41.

.3 All grounding conductors to be stranded soft annealed copper unless otherwise noted.

.4 Install complete grounding and bonding system in accordance with Canadian Electrical Code and local inspection authority requirements.

1.4 TESTING REQUIREMENTS

.1 Provide “Fall of Potential” tests and the corresponding “Touch & Step” calculations for high voltage installations.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions. Measure ground grid resistance.

.3 Any third party testing agency costs for the testing and reporting shall be included in the Electrical Division base tender and shall be carried out by a pre-approved testing agency.

1.5 ADDITIONAL SCOPE

.1 Refer to drawings for extent of grounding in addition to code requirements.

Part 2 PRODUCTS

2.1 MATERIALS

.1 All electrical wires and cables will have a lead content less than 300 parts per million.

.2 Grounding equipment to: CSA C22.2 No.41.

.3 ANSI/IEEE 837, Standard for Qualifying Permanent Connections Used in Substation Grounding.

.4 ANSI/IEEE 80, IEEE Guide for Safety in AC Substation Grounding.

2.2 EQUIPMENT

.1 Clamps for grounding of conductor, size as required.

.2 Copper conductor at least 6m [20'] long for each concrete encased electrode, bare, stranded, soft annealed, size as indicated. If not indicated, use 3/0AWG which is the maximum in Table 43 CEC.

.3 Rod electrodes, copper clad steel 20mm [3/4"] dia by 3m [10'] long or as indicated.

.4 System and circuit, equipment, grounding conductors, bare stranded copper, soft annealed, sized as indicated. Insulation where specified or required to be green.

.5 Ground bus: copper, 750V insulated, UL 94VO self extinguishing, zinc plated threaded steel inserts, size as indicated, complete with stand off insulated supports, fastenings, connectors.

.6 Conductors for Primary Grounding and Bonding

.1 Buried grounding conductors:

.1 bare, stranded, tinned, soft annealed copper,

.2 size #4/0 AWG except where indicated otherwise.

.2 Exposed grounding conductors:

.1 bare, stranded, tinned, soft annealed copper,

.2 size #4/0 AWG except where indicated otherwise.

.3 Insulated bonding conductors:

.1 stranded, soft annealed copper,

.2 green insulation, type RW90,

.3 size #4/0 AWG except where indicated otherwise.

.7 Non-corroding accessories necessary for grounding system, type, size material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.

.2 Protective type clamps.

.3 Bolted type conductor connectors.

.4 Thermit welded type conductor connectors.

.5 Bonding jumpers, straps.

.6 Pressure wire connectors.

.8 Ground rod inspection boxes:

.1 cylindrical with removable lid to provide access to ground rod connections,

.2 250 mm diameter x 300 mm deep (10" diameter x 12" deep),

.3 hot dipped galvanized steel.

2.3 STANDARDS OF ACCEPTANCE

.1 Acceptable manufacturers:

.1 Burndy Corp.

.2 Erico Inc

.3 Cadweld.

Part 3 EXECUTION

3.1 INSTALLATION - GENERAL

.1 System Grounding

- .1 For high resistance grounded systems, install grounding resistor in the circuit between the secondary neutral terminals of transformers and ground and connect with not less than #4/0 bare copper.
- .2 Do not ground the neutral terminals of autotransformers unless specifically shown.
- .3 Install grounding conductors in PVC conduit.

.2 Extend existing building ground to the new electrical room ground bus.

.3 Provide ground wire in EMT conduits installed in grade or below slabs.

.4 Use not less than No. 4/0 AWG bare conductors for ground grid, electrode interconnections, transformers, switchgear, ground grid to perimeter ground bus connections.

.5 Use not less than No. 2/0 AWG bare conductors for lightning arrestors, metal structures, motors, perimeter ground bus to equipment connections.

.6 Use not less than No. 4 AWG insulated conductors for bonding cable sheaths, raceways, pipe work, screen guards, potential transformers.

.7 Install connectors in accordance with manufacturer's instructions.

.8 Protect exposed grounding conductors from mechanical injury.

.9 Make buried connections, and connections to conductive water main, electrodes, using copper welding by thermit process or permanent mechanical connectors approved for the use.

.10 Use mechanical connectors for grounding connections to equipment provided with lugs.

.11 Soldered joints not permitted.

.12 Install bonding wire for flexible conduit, connected at both end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit. Provide a ground conductor in all flexible conduit and secure to system grounding lugs at both the equipment and source.

.13 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.14 Install separate ground conductor to each outdoor lighting standard.

.15 Connect building structural steel and metal siding to ground by welding copper to steel.

.16 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.17 Bond single conductor, metallic armoured cables to cabinet at supply end and provide non-metallic entry plate at load end.

.18 Ground secondary service pedestals.

.19 Coordinate ground rod installation with local soil conditions to assure proper grounding system.

.20 Provide a grounding/bonding bus in each electrical room and in the Generator room. Connect a #2/0cu bonding conductor or as shown on the drawings between grounding/bonding buses.

.21 Provide a bonding conductor appropriately sized within each raceway routed within the building.

.22 All bonding and grounding connections to be compression type unless noted otherwise.

.23 Bond bonding bus of switchboard to the grounding grid with a #3/0 copper conductor.

.24 Ground the secondary winding of potential and current transformers.

.25 Supply and install complete grounding and bonding system as indicated and as required by Canadian Electrical Code and the local electrical inspection authorities.

.26 Provide grounding/bonding bus bars mounted on standoff insulators or as shown on the drawings.

.27 All components shall be securely and adequately bonded and where required to accomplish this, bonding jumpers, grounding studs and bushings shall be used.

.28 Ensure that all raceways, terminal panels, etc. for fire alarm, etc. are securely and adequately bonded and provide grounding conductor to main ground bus where called for or when required.

.29 All interior metallic gas piping which may become energized to be made electrically continuous and to be bonded in accordance with requirements of Canadian Electrical Code.

.30 Bond all low tension equipment with #6 AWG bonding conductor.

.31 Bond all structural steel, all concrete reinforcing steel and all metal systems with a #2 copper bonding conductor. Connect to closest ground bus or bonding point.

.32 All metallic conduits longer than 1m in length, containing a single grounding or bonding conductor, shall be bonded as per the Canadian Electrical Code.

3.2 GROUNDING BUSSES

.1 Provide a ground bus in the main electrical room. Ground bus shall consist of suitable length of 50mm x 6mm [2”x ¼”] copper bus mounted on a 25mm [1”] insulating standoffs. This bus shall be drilled and tapped to receive all the grounding conductors indicated and an engraved nameplate or tag installed above or below individual conductors indicating their function.

.2 Provide similar ground bus in each sub electrical room and major mechanical room. Interconnect to the main ground bus with a 3/0 AWG insulated copper grounding conductor that is typically installed with the power feeders.

.3 Refer to the Section 27 for grounding and bonding of the communication system.

.4 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size 3/0 AWG or as indicated.

.5 Copper or bronze lugs required for termination of all copper conductors at ground busses.

.6 Equipment Grounding or Bonding

.7 Install grounding or bonding connections to typical equipment included in, but not necessarily limited to following list:

.8 Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, UPS, control panels, building steel work, generators, elevators, distribution panels and outdoor lighting.

.9 Provide a grounding conductor from the secondary of every distribution transformer to the grounding system. Ground conductor to be sized and installed in accordance with Canadian Electrical Code.

.10 Provide grounding conductor(s) from all major switchgear to solidly ground the secondary system. This includes equipment located in the main electrical room as well as each sub-electrical room. Grounding conductors to be sized to Canadian Electrical Code and switchgear manufacturer's requirements.

3.3 MECHANICAL EQUIPMENT GROUNDING

.1 Provide a #2 ground conductor from the mechanical room ground bus to each MCC.

.2 Provide a #6 ground conductor from the mechanical room ground bus to each VFD.

.3 Ground wires to be installed in all conduit serving motor feeder circuits and to extend to ground screws on junction and outlet boxes for bonding.

3.4 SERVICE BOXES (MANHOLES)

.1 Install conveniently located fixed and secured corrosion resistant grounding stud in each manhole and terminate the system grounding conductors.

.2 Install ground rod in each manhole where indicated so that top projects through bottom of manhole. Provide with lug to which grounding connection can be made.

3.5 POST MOUNTED LUMINAIRE BONDING

.1 Provide #10 AWG bonding conductor with green RW90 X-link insulation to luminaire standards. Connect to luminaire corrosion resistant ground stud or ground clamp.

3.6 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions.

.3 Carry out all tests required by the Electrical Inspection Authority and provide all required reports and copied to the Consultant. Include all associated costs.

.4 Ensure test results are satisfactory before energizing the electrical system.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Electrical General Requirements Section 26 05 00.11.

1.2 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 LEED Submittals

.4 Operation and Maintenance Materials

.5 Record Documents

1.3 WORK INCLUDED

.1 Supply and install all hangers and supports for the installation shown on the drawings and specified herein, as necessary to fasten electrical equipment securely.

Part 2 PRODUCTS

2.1 FRAMING AND SUPPORT SYSTEM

.1 Materials:

.1 Intermediate duty supporting structures shall employ P1000 Unistrut or equal together with the manufactures connecting components and fasteners for a complete system.

.2 Heavy duty supporting structures to be fabricated and welded from steel structural members and prime painted before installation.

.2 Finishes:

.1 Outdoors, wet locations: Hot dipped galvanized.

.2 Indoors, dry locations: Galvanized when available, prime painted if not available.

.3 Nuts, bolts, machine screws: Cadmium plated.

.3 Strut Channel:

.1 P1000 series or as required for load and span, with mounting screws, or approved. P1000 or equal is a minimum standard for supporting conduits 50 mm and larger.

2.2 CONCRETE AND MASONRY ANCHORS

.1 Materials: Hardened steel inserts, zinc plated for corrosion resistance. All anchor bolts must be galvanized.

.2 Components: non-drilling anchors for use in predrilled holes, sized to safely support the applied load with a minimum safety factor of four.

.3 Manufacturer: Hilti (Canada) Limited or approved equal.

2.3 NON-METALLIC ANCHORS

.1 Material: Plastic anchors for sheet metal screws.

.2 Manufacturer: Fischer or approved equal.

2.4 CONDUIT SUPPORTS

.1 General: Malleable iron one-hole conduit straps where exposed to weather. Stamped steel two-hole straps indoors.

.2 Structural Steel: Beam Clamps.

.3 Masonry, concrete, stone, etc.: Anchors.

.4 Tile: Toggle bolts.

.5 Metal studs, ceiling hangers, etc.:“Caddy-Clips”.

.6 Unistrut: Unistrut conduit clamps.

2.5 CABLE SUPPORTS AND CLAMPS

.1 General: As per conduit supports, except that for single conductor cables, suitable non-ferrous, or approved stainless steel or aluminum clamps shall be used.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Secure equipment to poured concrete with expandable inserts.

.2 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.

.3 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.4 Fasten exposed conduit or cables to building construction or support system using straps.

.1 One-hole malleable iron or steel straps to secure surface conduits and cables 50 mm and smaller.

.2 Two-hole steel straps for conduits and cables larger than 50 mm.

.3 Beam clamps to secure conduit to exposed steel work.

.5 Suspended support systems.

.1 Support individual cable or conduit runs with 6 mm diameter threaded rods and spring clips.

.2 Support 2 or more cables or conduits on channels supported by 6 mm diameter threaded rod hangers where direct fastening to building construction is impractical.

.6 Use plastic anchors for light loads only. Use metal anchors for all other loads.

.7 Shot driven pins may only be used with written approval of the structural engineer.

.8 Use round or pan head screws for fastening straps, boxes, etc.

.9 Do not support heavy loads from the bottom chord of open web steel joists.

.10 Support outlet boxes, junction boxes, panel tubs, etc., independent of conduits running to them. Support conduits within 600 mm of outlet boxes. Support surface mounted panel tubs with a minimum of four 6 mm fasteners.

.11 For surface mounting of two or more conduits use channels at 1.5 m of spacing.

.12 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.13 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.14 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.15 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Consultant.

.16 Support lay-in T-bar ceiling light fixtures to building structure independent of the T-bar ceiling support system.

3.2 GENERAL

.1 Do not cut or drill beams, joists or structural steel unless written permission of the Consultants is obtained.

.2 Distance between conduit or cable supports not to exceed code requirements.

.3 Supports to be suitable for the real loads imposed by equipment.

.4 Supports to be securely fastened, free from vibration and excessive deflection or rotation. Maximum deflections are 4 mm over a 1 meter span and 8 mm over a 2 meter span.

.5 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer’s installation recommendations.

.6 Provide conduit rack with 25% spare capacity for multiple runs.

.7 Provide channel support with fittings for vertical runs of conduit and cables.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Electrical General Requirements Section 26 05 00.11

.2 Wiring Devices Section 26 05 19.11

.3 Conduits, Conduit Fastenings and Conduit Fittings Section 26 05 33

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management And Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 LEED Submittals

.4 Operation and Maintenance Materials

.5 Record Documents

1.4 WORK INCLUDED

.1 Provide a complete system of boxes for the installation of wiring and equipment.

1.5 REFERENCES, CODES AND STANDARDS

.1 All Codes, Standards, Rules, Regulations, Bulletins, By-laws etc., shall be those that are currently enforced, in particular, the following:

.1 CSA C22.1 - Canadian Electrical Codes, Part 1.

.2 CSA C22.2 No. 18.1 – Metallic Outlet Boxes

.3 CSA C22.2 No. 18.2 – Nonmetallic Outlet Boxes

.4 CSA C22.2 No. 85 – Rigid PVC Boxes and Fitting

Part 2 PRODUCTS

2.1 OUTLET AND CONDUIT BOXES GENERAL

.1 Size boxes in accordance with CSA C22.1 – Canadian Electrical code.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 OUTLET BOXES FOR METAL CONDUIT

.1 Materials:

.1 Surface or recessed concealed type: Die formed steel, hot dip galvanized, 1.25 oz/sq. ft. minimum zinc coating.

.2 Surface mounting exposed: Cast ferrous for threaded conduit, with attached lugs, corrosion resistant two coats finish.

.2 Components:

.1 Ceiling outlets, surface mounting, concealed, Model numbers based on Thomas & Betts-Iberville catalog:

.1 101 mm square, depth 54 mm, 52171 series

.2 101 mm octagonal, depth 38 mm, 72171 series

.2 Ceiling outlets, concealed mounting in concrete:

.1 101 mm octagonal concrete rings, depth from 38 mm to 152 mm, 54521 series.

.2 Extension ring to change from recessed conduit to exposed conduit, 101 mm square, 38 mm deep, 53151; 101 mm octagonal, 38 mm deep 55151 or 101 mm octagonal, 54 mm deep, 55171.

.3 Wall boxes, concealed in concrete or masonry: for one and two gang applications shall be 101 mm square, 54 mm deep, 52171 series complete with suitable 52-C-49 series square cornered raised tile wall cover for proper device and wall surface application. Masonry boxes may be used for line voltage switching.

.4 Wall outlets, concealed non-masonry construction, with plaster finish: For one or two gangs used with switches, receptacles, etc., use 54 mm deep 52171 series, with matching plaster covers, depth to suit. Alternately, use 119 mm square boxes, 72171 series and covers as required. (For more than two gangs use solid boxes GSB series with GBC series cover, or special boxes as required).

.5 Wall outlets, surface, exposed mounting or used for outdoor outlets: One or more gang, Crouse-Hinds FS series or FD series, condulet.

.6 Floor Outlets, concealed: Of a type adjustable after box secured, permanently watertight concrete type, 600 Series.

.7 Covers: Unless wiring devices and plates are mounted, provide blank, round canopy covers to match boxes.

.8 For 277V switches: Non-interchangeable with 120V switches through special tapped mounting ears, with top and bottom knockouts only, Iberville 1110-HV Series or Iberville MBSX-1-HV, or MBD-1-HV Series.

2.3 OUTLET BOXES FOR RIGID PVC CONDUIT

.1 Materials:

.1 Rigid PVC boxes and fittings: Unplasticized PVC.

.2 Components:

.1 Floor boxes: Round with threaded hubs for threaded female connectors.

2.4 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi-gang boxes for devices flush mounted in exposed block walls.

2.5 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

.2 Concrete Floor Boxes

.3 Concrete tight electro-galvanized sheet steel floor boxes with brushed aluminum trim faceplate. Device mounting plate to accommodate short or long ear receptacles. Minimum depth: 28 mm for receptacles; 73 mm for communication equipment.

.4 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 12 mm and 19 mm conduit. Minimum size: 73 mm deep.

.5 Floor box to allow matching carpet tile on box lid

.6 Openings cut to allow cables to exit floor box without box lid being raised.

.7 Modules shall allow a minimum of two duplex receptacles, one 3-port faceplate and one 2-port faceplate.

.8 Duplex receptacles to be contained within a grounded metallic box and grounded metallic faceplate

2.6 CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for any surface wiring of switches and receptacle.

2.7 FITTINGS - GENERAL

.1 Bushing and connectors with nylon insulated throats.

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.8 SERVICE FITTINGS

.1 ‘High tension’ receptacle fitting made of 2 piece stainless steel with satin aluminum housing finish for 1 duplex receptacles. Bottom plate with two knockouts for centered of offset installation.

.2 Pedestal type ‘low tension’ fitting made of 2 piece stainless steel with satin aluminum housing finish to accommodate two Amphenol jack connectors.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

.5 Install all outlets flush and surface mounted as required for the installation.

.6 Surface mount above suspended ceilings, or in unfinished areas.

.7 Adjust position of outlets in finished masonry walls to suit course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes.

.8 Do not distort boxes during installation. If boxes are distorted, replace with new boxes.

.9 Use plaster rings to correct depth. Use 30 mm on concrete block.

.10 Do not use sectional boxes.

.11 Provide boxes sized as required by the Canadian Electrical Code.

.12 Install vapour barrier material to surround and seal all outlet boxes located on exterior walls of building. Maintain wall insulation.

.13 Boxes are not to be installed back to back within the same stud cavity. A minimum of one study cavity space shall be provided between back to back outlets. Back to back boxes must never be attached to the same stud even if they are in separate stud cavities. Rigid conduits shall not be used to connect two boxes which are back to back even if they are in a sperate study cavities. Provide minimum spacing of 150mm (6 inch) between boxes in conventional walls and 800mm (31 inch) in acoustic ratio wall.

.14 Provide putty pads for all electrical boxes in STC rated walls. Putty pads to be similar to HILTI CP-617 or 3M Fire Barrier Moldable Putty Pad or equivalent with STC rating not less than 52

.15 Ceiling outlet boxes shall be provided for every surface mounted fixture or row of fixtures installed on suspended "hard" ceilings.

.16 Primary bushings in termination box for cable connection.

.17 Secondary bushings in termination box for bus duct connection.

.18 Control junction box.

.19 Stainless steel nameplate and connection diagram.

.20 Where outlet boxes penetrate throughout a fire or smoke separation, ensure that they are tightly fitted with non-combustible material to prevent passage of smoke or flame.

.21 No sectional or handy boxes to be installed.

.22 Back boxes for all low voltage systems equipment to be provided in accordance with specific manufacturer's recommendations and as specified in the low voltage sections of these specifications.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 Section 26 05 00.11

.2 Division 03

1.2 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 LEED Submittals

.4 Operation and Maintenance Materials

.5 Record Documents

Part 2 PRODUCTS

2.1 MARKERS

.1 Concrete type cable markers: 600 x 600 x 100 mm with words: “cable”, “joint” or “conduit” impressed in top surface, with arrows to indicate change in direction of cable and duct runs.

Part 3 EXECUTION

3.1 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.11 - Testing, Adjusting and Balancing of Electrical Equipment and Systems.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance test.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test.

.3 High Potential (Hipot) Testing.

.1 Conduct hipot testing in accordance with manufacturer’s recommendations.

.4 Provide Consultant with list of test results showing location at which each test was made, circuit tested and result of each test.

.5 Remove and replace entire length of cable if cable fails to meet any of test criteria.

3.2 FIELD TESTING

3.3 CABLE INSTALLATION IN DUCTS

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables properly terminated, seal ends of lead covered cable with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.4 MARKERS

.1 Mark cable every 150 m along duct runs and changes in direction.

.2 Where markers are removed to permit installation of additional cables, reinstall existing markers.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 NFPA 13 - Standard for the Installation of Sprinkler Systems.

.2 NFPA 13 - Standard for the Installation of Sprinkler Systems.

1.2 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 LEED Submittals

.4 Operation and Maintenance Materials

1.3 RECORD DOCUMENTS

.1 Submit seismic force level (Fp) calculations from applicable building code. Submit pre-approved restraint selections and installation details from manufacturer, or engineer approved equal.

.2 Restraint selection and installation details shall be pre-approved by a professionally licensed engineer experienced in seismic restraint design.

.3 Submit manufacturer's product data on strut channels including, but not limited to, types, materials, finishes, gauge thickness, and hole patterns. For each different strut cross-section, submit cross sectional properties including Section Modulus (Sx) and Moment of Inertia (Ix).

1.4 WARRANTIES

1.5 QUALITY ASSURANCE

.1 General:

.1 The contractor shall provide pre-engineered seismic restraint systems to meet total design lateral force requirements for support and restraint of piping, conduit, cable trays and other similar systems and equipment where required by the applicable building code.

.2 Manufacturer:

.1 System Supports/Restraints: Firms regularly engaged in the manufacture of products of the types specified in this section, whose products have been in satisfactory use in similar service for not less than 5 years.

.2 Bolted framing channels and fittings shall have the manufacturers name, part number, and material heat code identification number stamped in the part itself for identification. Material certification sheets and test reports must be made available by the manufacturer upon request.

.3 Installer:

.1 Company experienced in performing the work of this Section.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Deliver strut systems, pipe hangers and components carefully to avoid breakage, denting, and scoring finishes. Do not install damaged equipment.

.2 Store strut systems, pipe hangers and components in original cartons and in clean dry space; protect from weather and construction traffic.

1.7 SEISMIC AND WIND RESTRAINTS

.1 General

.1 Provide positive seismic and wind restraints on systems and components required by the applicable building code and by the local authority having jurisdiction. This section covers design, supply, installation and inspection of complete SFRS (Seismic Force Resisting System) for all systems.

.2 Provide restraint devices as required, specified, and as scheduled for isolated and non-isolated systems and equipment. Provide calculations to determine restraint loadings for all restrained systems and equipment resulting from seismic forces. Certification documents to be signed and sealed by a qualified Professional Engineer with at least 5 years' experience in the design of seismic restraints.

.3 Each contractor shall use a single manufacturer to provide and certify seismically rated isolators and restraints.

.4 At the completion of the project, upon request, there can be a review of the installations on site and a sealed written report, certifying that the installations have been completed in accordance with the specified design(s) and shop drawing(s) can be furnished, by others, upon this request.

1.8 SECTION INCLUDES

.1 It shall be understood that the requirements of this seismic restraint section are in addition to other requirements as specified elsewhere for the support and attachment of equipment and mechanical services, and for the vibration isolation of same equipment. Nothing on the project drawings or specifications shall be interpreted as justification to waive the requirements of this seismic restraint section.

.2 Seismic restraint systems shall be designed to offer seismic restraint in all directions, unless otherwise noted.

.3 Anchor types and sizes are to be per the design data as provided by the seismic restraint manufacturer.

.4 Seismic restraint capacities, seismic cable restraint system, rod stiffener clamps to be verified by an independent test laboratory or certified by a registered design professional to ensure that the design intent of this specification is realized. Verification shall be by one of the following methods:

.1 Certified be a registered design professional with at least 5 years' experience, using industry standard methods of analysis, which employ common engineering practices.

.2 By a nationally recognized agency.

.3 It's the contractors' responsibility to ensure the seismic engineers' requirements have been met.

1.9 REFERENCES, CODES AND STANDARDS

.1 British Columbia Building Code

.2 Canadian Electrical Code Part 1, CSA C22.

.3 National Building Code of Canada (NBCC)

Part 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

.1 Manufacturer: Subject to compliance with these specifications, strut systems, pipe hangers, and accessories to be installed shall be as manufactured by Cooper B-Line, Inc, or approved equal.

2.2 SEISMIC BRACING COMPONENTS

.1 Steel strut shall be 1-5/8” (41mm) wide in varying heights and mig-welded combinations as required to meet load capacities and designs indicated. A material heat code, part number, and manufacturer’s name shall be stamped on all strut and fittings to maintain traceability to material test reports.

.1 Material for epoxy painted strut: ASTM A1011, SS, Grade 33

.2 Material for pre-galvanized strut: ASTM A653, SS, Gr. 33

.3 Material for Hot-Dip Galvanized strut: ASTM A1011, SS, Grade 33 and hot-dip galvanized after fabrication in accordance with ASTM A123.

.4 Material for fittings and accessories: ASTM A907 Gr. 33, Structural Quality or ASTM A1011, SS. Gr.33.

.5 Fittings and accessories: Products shall be of the same manufacturer as strut and designed for use with that product.

2.3 CODE INFORMATION

.1 The seismic bracing shall meet the requirements of the British Columbia Building Code Section 4.1.8, Earthquake Load and Effects.

.2 If this project is governed under the National Building Code, the seismic bracing shall meet the requirements of the National Building Code Section 4.1.8, Earthquake Load and Effects.

.3 Forces shall be calculated for individual supports using the above information

.4 All use of exceptions to the tables shall be noted on submitted seismic bracing plan documents.

2.4 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

.1 General:

.1 Seismic restraint designer shall coordinate all attachments with the structural engineer of record.

.2 Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.

.3 Analysis shall detail anchoring methods, bolt diameter, and embedment depth.

.4 All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.

.2 Friction from gravity loads shall not be considered resistance to seismic forces.

.3 Fire protection systems shall meet the latest requirements of NFPA 13 and NFPA 14 for the building seismic requirements.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Seismic Restraint of Electrical Services

.1 All seismic restraint systems shall be installed in strict accordance with the manufacturer's seismic restraint guidelines manual and all certified submittal data.

.2 Installation of seismic restraints shall not cause any change in position of equipment or piping, resulting in stresses or misalignment.

.3 No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.

.4 Do not install any equipment, piping, duct, or conduit that makes rigid connections with the building unless isolation is not specified.

.5 Prior to installation, bring to the architect's/engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

.6 Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or wedge-type concrete anchors. Consult structural engineer of record.

.7 Overstressing of the building structure shall not occur from overhead support of equipment. Bracing attached to structural members may present additional stresses. The contractor shall submit loads to the structural engineer of record for approval in this event.

.8 Brace support rods when necessary to accept compressive loads. Welding of compressive braces to the vertical support rods is not acceptable.

.9 Provide reinforced clevis bolts where required.

.10 Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.

.11 Do not brace a system to two independent structures such as a ceiling and wall.

.12 Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Electrical General Requirements - Section 26 05 00.11

1.2 REFERENCES, CODES AND STANDARDS

.1 IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations.

.2 IEEE C37.010 - x.

.3 IEEE C37.13 - IEEE Standard for Low-Voltage AC Power Circuit Breakers Used in Enclosures.

1.3 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 LEED Submittals

.4 Operation and Maintenance Materials

1.4 RECORD DOCUMENTS

.1 Submit the first set of complete studies prior to submittal of shop drawing of electrical equipment for review by the engineer.

.2 Submit the second set of complete studies after the studies are updated with actual transformer impedances for review by the engineer along with a sample of the arc flash labels.

.3 Calibration and verification to be conducted after the final studies have been reviewed by the engineer.

1.5 WORK INCLUDED

.1 Provide short circuit, coordination/protective and arc flash hazard analysis, Harmonic studies for the electrical system including all equipment specified herein and submit for review. A set of studies shall be submitted with the equipment shop drawings. If the electrical distribution system has either step-up or step-down transformers, default values for the transformer impedances shall be used unless the actual transformer impedances are available. The same shall be done for the utility transformer if the project is fed from a pad-mounted or overhead utility transformer. The electrical contractor shall provide a table with estimated conductor lengths for these studies. The electrical contractor shall obtain all utility fault data including MVAsc and X/R ratings for the study.

.2 For projects where the electrical distribution systems include either step-up or step-down transformers or the project is fed from a utility pad-mounted transformer, the studies shall be resubmitted after the transformers are on-site. The actual transformer impedances shall be recorded and entered into the studies and a final set of studies shall be submitted for review complete with updated conductor lengths as previously submitted. Conductor lengths that are updated shall be flagged or highlighted. The new studies shall be done with the updated conductor lengths.

.3 Detailed arc flash hazard analysis labels shall be printed according to the requirements of CSA-Z462-18 and installed on all electrical equipment furnished with this contract after the engineer reviews the final studies. A sample label shall be furnished to the engineer for review with the second submission.

.4 Include the following in the studies:

.1 Utility overcurrent and fault protection devices.

.2 600V circuit breaker phase and ground fault devices.

.3 347/600V and 120/208V distribution panelboards, lighting, receptacles, miscellaneous and special panelboards, motor control centers, emergency generators, switchgear and connecting feeder cables.

.4 600V transformer damage curves, magnetizing currents for all transformers 150 kVA and larger.

.5 Locked rotor currents, acceleration times and damage curves for motors 75 kW (100hp) and larger.

.6 Any additional data necessary for successful completion of the studies as identified in the latest IEEE STD 1584 – Guide for performing Arc Flash Hazard Calculations.

.5 Data shall clearly state the operating time in cycles of each breaker and indicate whether the time current curves for relays are inclusive of circuit breaker tripping time or otherwise.

.6 Prepare a summation chart showing all ratings and settings with easy reference to the appropriate curve.

.7 Symmetrical and asymmetrical fault current calculations shall be submitted to verify the correct choice of the protective elements of the system.

.8 Series rating combination shall not be allowed unless otherwise indicated on the drawings

.9 Prepare a systems single line diagram on which the resultant short circuit values, device numbers and equipment ratings are shown.

.10 Include a list of recommended settings for each relay and each circuit breaker that has adjustable settings.

.11 Prepare a system single line diagram on which the resultant arc flash incident energy and hazard category are displayed.

1.6 REFERENCES, CODES AND STANDARDS

.1 All Codes, Standards, Rules, Regulations, Bulletins, By-laws etc., shall be those that are currently enforced, in particular, the following:

.1 IEEE 1584-2018, IEEE Guide for Performing Arc-Flash Hazard Calculations

.2 IEEE C37.13-2015, IEEE Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures

.3 IEEE C37.010 – 2016, IEEE Application Guide for AC High-Voltage Circuit Breakers Rated on a Symmetrical Current Basis

.4 IEEE 3002.3-2018, IEEE Draft Recommended Practice for Conducting Short-Circuit Studies and Analysis of Industrial and Commercial Power Systems

.5 IEEE 3004.5-2014, IEEE Recommended Practice for the Application of Low-voltage Circuit Breakers in Industrial and Commercial power Systems

.6 IEEE 3004.8-2016, IEEE Recommended Practice for Motor Protection in Industrial and Commercial power Systems

.7 IEEE 519-2014, IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems

.8 CSA Z462-2018, Workplace Electrical Safety

1.7 QUALIFICATIONS

.1 These studies shall be provided by the supplier of the distribution equipment.

.2 These studies shall be signed and stamped by professional electrical engineer registered in the province of British Columbia.

Part 2 PRODUCTS

2.1 TRIPPING DEVICES

.1 Relay style, CT ratios, fuse and circuit breaker sizes and types have been selected on a preliminary basis for design purposes. Final selection shall be based on the results of these studies and shall be included at no extra cost.

Part 3 EXECUTION

3.1 DATA

.1 Provide the main switchboard supplier with all relevant data for equipment not provided by that supplier.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)

.1 ANSI C39.1, Requirements, Electrical Analog Indicating Instruments.

.2 Canadian Standards Association, (CSA International)

.1 CAN3-C17, Alternating - Current Electricity Metering.

1.3 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 LEED Submittals

.4 Operation and Maintenance Materials

.5 Record Documents

1.4 QUALITY REQUIREMENTS

.1 All meters to be “Revenue Certified” by Measurement Canada except data loggers for regulated and non-regulated circuits fed from panelboards need only be “Revenue Grade” in accordance with the Output Spec.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00.

.2 Shop drawings to include system riser diagrams and all connections.

Part 2 PRODUCTS

2.1 GENERAL METERING SYSTEM REQUIREMENTS

.1 The meter equipment to be capable of remote communication compatible with the BMS Building Management System.

.2 Provide a software package for meter reading, data storage and generating billing information including printed reports.

.3 System to have backup storage power so that no data is lost during power outages.The system shall continue to function after resumption of power. Data to be retained for 8500 hours with a 20-year shelf life.

.4 Failure of the building electrical normal power system shall not result in loss of data and will not require manual restarting of the metering system.

.5 The system provided will be fully compatible with providing data-transfer and analytics functionality for:

.1 energy performance optimization

.2 power reliability and availability, and

.3 sustainability metrics.

.6 The advanced energy metering must have the following characteristics.

.1 Meters must be permanently installed, record at intervals of one hour or less, and transmit data to a remote location.

.2 Electricity meters must record both consumption and demand. Whole-building electricity meters should record the power factor.

.3 The data collection system must use a local area network, building automation system, wireless network, or comparable communication infrastructure.

.4 The system must be capable of storing all meter data for at least 36 months.

.5 The data must be remotely accessible.

.6 All meters in the system must be capable of reporting hourly, daily, monthly, and annual energy use.

2.2 MINIMUM SYSTEM MEASUREMENTS

.1 Meters to be complete with a Liquid Crystal Display (LCD) to access all billing measurements and phase diagnostics.

.2 Billing Parameters:

.1 kWHr poly phase standard

.2 average demand

.3 reactive consumption

.4 Time of use, up to 4 periods per day

.3 Phase Diagnostics: Parameters to be displayed for each metered load:

.1 Phase to Neutral for each phase.

.2 Phase to Phase for all lines.

.3 Instantaneous amperage for each phase

.4 Frequency

.5 Instantaneous real energy

.6 Instantaneous apparent energy

.7 Instantaneous reactive energy

.8 Instantaneous power factor

.9 Phase angle

.4 Data Logging:

.1 Logging of kW, kVA, kVAR, Total Harmonic Distortion, Sags & Surges, Event Anomalies, Power Factor and Amperage in customized intervals (5,15, 30, 60 minute)

2.3 METERING INSTRUMENT CABINETS

.1 Integral with switchgear or

.2 Sheet steel CSA enclosure finish painted.

2.4 TEST TERMINAL BLOCKS

.1 Test terminal blocks: as required.

2.5 SHOP INSTALLATION

.1 Switchboard Installation: Install meters and instrument transformers in separate compartment of switchboard.

.2 Ensure adequate spacing between current transformers installed on each phase.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources, electrical supplies.

2.6 SOFTWARE

.1 Software shall be “Windows” compatible and able to export meter data into database and spreadsheet programs.

.2 Software shall be capable of providing locked levels of access to various users.

2.7 STANDARD OF ACCEPTANCE

.1 Eaton Foreseer

.2 Schneider PowerLogic

.3 Approved Equal

Part 3 EXECUTION

3.1 METERING INSTALLATION

.1 Install meters and instruments in location free from vibration and shock.

.2 Make connections in accordance with diagrams.

.3 If applicable, ensure power factor corrective equipment connected on load side of meter.

.4 Connect meter and instrument transformer cabinets to ground.

3.2 FIELD QUALITY CONTROL

.1 Conduct tests in accordance with Section 26 05 00 - Common Work Results – Electrical and in accordance with manufacturer's recommendations.

.2 Perform simulated operation tests with metering, instruments disconnected from permanent signal and other electrical sources.

.3 Verify correctness of connections, polarities of meters, instruments, potential and current transformers, transducers, signal sources and electrical supplies.

.4 Perform tests to obtain correct calibration.

.5 Do not dismantle meters and instruments.

3.3 FIELD VERIFICATION, ACCEPTANCE & TRAINING

.1 Provide “Record Drawings” indicating each meter, serial no, address and CT ratio.

.2 The equipment manufacturers representative to verify, adjust and test the system.

.3 Demonstrate operation of the system including software.

.4 Issue a “CERTIFICATE OF ACCEPTANCE”.

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Power studies should be provided with the main power distribution shop drawings to confirm ratings and breaker specifications.

1.2 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 LEED Submittals

.4 Operation and Maintenance Materials

.5 Record Documents

1.3 WARRANTIES

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 16010 (26 05 00).

1.5 COORDINATION OF PROTECTIVE DEVICES AND SHORT CIRCUIT STUDY

.1 This contract includes an addition to an existing power system. The coordination documents to include all the existing power devices upstream and in-line to this installation.

.2 Include all associated costs in this Division for the preparation of a complete system study that shall include of Protective Coordination, Short Circuit, Ground Fault, and Arc Flush. The base and system short circuit study values, electrical coordination curves and breaker settings to be based on the Utility the Manufacturers information. Selective Coordination should be achieved for all essential distributions.

.3 The arc flash study shall analyze the Flash Boundary Distance and the range of incident energy based on the calculated available fault current range at each device. The arc flash analysis, short circuit and coordination study shall be performed using the latest version of SKM system analysis power tools for Windows software, which meets the calculation requirements of IEEE Std 1584a, NFPA 70E, ANSI C.37, and IEEE Std. 399.

.4 The Coordination Study and Curves to be sealed by a practicing professional engineer registered in the jurisdiction of the project installation. (Province, Territory, State, etc).

.5 Documentation to include the following:

.1 Available symmetrical fault current including Utility and large motor contribution.

.2 Symmetrical withstand current rating for bussing.

.3 Transformer damage curves and in-rush for the main power transformers and major distribution transformers.

.4 Large Motor starting and damage curves.

.5 Breaker interrupting capacities including any cascade arrangements.

.6 Transfer switch interrupting or withstand capacity as appropriate.

.7 Relay information, manufacturer and type, sensor ratings and tap setting, relay pickup and delay settings.

.8 Settings for all breakers having adjustable solid-state trips or thermal magnetic trips.

.9 Single line of system illustrated on curves. All curves to be justified using upstream and downstream conditions. Provide alternative scenarios where applicable.

.10 Submit, with the main distribution switchgear and secondary distribution switchboard general arrangement drawings, a complete set of coordination curves. Coordination curves to be submitted prior to selection of primary fuses, main and secondary air circuit breaker trip settings and ground fault relay pick-up and time delay settings.

.11 Coordination curves to include the main primary feeder protective devices in the utility system, the primary fuses in the main switchgear, transformer damage curves, all main and secondary air circuit breakers.

.12 Coordination curves to be plotted on log-log graph paper and shall be accomplished by individual time current trip curves of each device.

.6 The review will not eliminate the responsibility of this Division to provide system coordination and protection.

.7 Circuit protective devices such as overcurrent trips, relays and fuses to be set ito the required values and settings.Prior to final inspection, arrange for the switchgear manufacturer, or the (coordination agency) to visit the site to check all settings to ensure they are in accordance with coordination study values.

.8 Arc Flash Analysis

.1 Perform an arc flash analysis study in conjunction with the previous specified short circuit and protective device coordination study.This arc flash analysis study to be performed in accordance with IEEE Std 1584a.

.2 The study shall be calculated by means of a digital computer, using the latest version of applicable software. Pertinent data and the rational employed in developing the calculations shall be incorporated in the introductory remarks of the student.

.3 Determine the following for each bus analyzed:

.1 Flash Hazard Protection Boundary

.2 Incident Energy Level

.3 Required Personal Protective Equipment Category

.4 Type of Fire Rated Clothing

.5 Limited Approach Boundary

.6 Restricted Approach Boundary

.7 Prohibited Approach Boundary

Part 2 PRODUCTS

2.1 WARNING LABELS

.1 Produce an Arc Flash Warning label for each piece of electrical equipment with a specific equipment ID.Also include the system operating voltage and date of issue. Labels shall be printed in colour on adhesive backed nylon labels..

Part 3 EXECUTION

3.1 ANALYSIS OF SHORT CIRCUIT CALCULATIONS

.1 Analyze the short circuit calculations, protective device coordination, and arc flash calculations and highlight equipment that is determined to be underrated as specified or cause abnormally high incident energy levels. Propose approaches to effectively protect the underrated equipment and to reduce the energy levels. Provide minor modifications to conform with the study (Examples of minor modifications are trip sizes within the same frame, the time curve characteristics of induction relays, CT ranges, etc.). After developing the coordination curves, highlight areas lacking coordination. Present a technical evaluation with a discussion of the logical compromises for best coordination. Proposed major corrective modifications will be taken under advisement by the Engineer, and the Contractor will be given further instructions.

3.2 ARC FLASH ANALYSIS STUDY

.1 Present the data determined by the Arc Flash Analysis Study in a tabular format summary sheet. Include the following for each bus analyzed:

- .1 Flash Bus Name
- .2 Protective Device Name
- .3 Bus Operating Voltage
- .4 Bus Bolted Fault Current
- .5 Protective Device Bolted Fault Current
- .6 Protective Device Arcing Fault Current
- .7 Trip/Delay Time (Sec)
- .8 Breaker Opening Time (Sec)
- .9 Ground
- .10 Equipment Type
- .11 Gap (mm)
- .12 Arc Flash Boundary (in)
- .13 Working Distance (in)
- .14 Incident Energy (cal/cm²)
- .15 Required Protective FR Clothing Category

3.3 FINAL WRITTEN REPORT

.1 The results of the power system study shall be summarized in a final written report. The report shall include the following sections:

- .1 Introduction, executive summary, recommendations, and assumptions
- .2 Electrical One-Line(s) with previously identified specific data values
- .3 Tabulations of equipment ratings versus calculated short circuit values and X/R ratios, arc flash values
- .4 Protective device time versus coordination curves, tabulations of relay and circuit breaker trip settings and fuse selection with commentary
- .5 Engineering analysis, commentary, and recommendations
- .6 The report is to be stamped by a professional engineer.

3.4 INSTALLATION OF ARC FLASH HAZARD LABELS

.1 Clean the surfaces of the electrical equipment before installing the labels.

.2 Install the labels at the same height parallel to the edges of the electrical equipment.

END OF SECTION

Part 1 GENERAL

1.1 SECTION INCLUDES

.1 Materials and installation for low voltage switchgear for controlling relatively large loads - 600 A or larger, this will encompass the main 600V switchgear.

1.2 GENERAL

.1 CAN/CSA C22.2 No. 31-18(R2022), Switchgear Assemblies.

.2 CAN/CSA C22.2 No. 0.19-10(R2020) – Requirements for Service Entrance Equipment.

.3 CSA 22.2 No 244 Switchboards

.4 IEEE 37.20.1-2015 Metal Enclosed Low Voltage Power Circuit Breaker Switchgear

1.3 RELATED REQUIREMENTS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.4 SCOPE OF WORK

.1 Provide a complete system of secondary sub distribution.

.2 Note that the electrical rooms have limited space. Refer to drawings for restrictions. Equipment has to be built to fit available space.

1.5 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 Closeout Submittals

.4 LEED Submittals

.5 Operation and Maintenance Materials

.6 Record Documents

1.6 QUALITY ASSURANCE

.1 Submit 6 copies of certified factory test results.

1.7 EXTRA MATERIALS

.1 Provide maintenance materials in accordance with Section 017800 - Closeout Submittals.

.2 Include:

.1 3 fuses for each unique type above 600 A.

.2 6 fuses for each unique type up to and including 600 A.

.3 6 bulbs for each unique type of indicator light

.4 1 spare racking handle if not built into breakers

1.8 SUMMARY DESCRIPTION

1.9 RELATED SECTIONS

.1 Section 013300 - Submittal Procedures.

.2 Section 017800 - Closeout Submittals.

.3 Section 26 05 00 - Electrical General Requirements.

1.10 SHOP DRAWINGS PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 013300 - Submittal Procedures.

.2 Submit shop drawings in accordance with Section 26 05 00.

.3 Shop drawings units of measurement shall be SI Units

.4 Shop drawings shall be submitted to the Consultant for review prior to the manufacture of the equipment.

.5 Shop drawings shall include:

.1 Bill of Materials (Major Components including any protective relays).

.2 Recommended spare parts including prices, quantities and manufacturer's part numbers.

.3 Single line and schematic wiring diagrams showing the any protective relaying, metering and control wiring.

.4 Cable terminal sizes

.5 Product data sheets

.6 Model and make of protective relay

.7 Sensor rating of each breaker

.8 Breaker and/or fusible-switch layout, type, quantity and ampacity.

.9 AIC rating of all components.

.10 Complete and integrated fuse/breaker co-ordination curves.

.11 Switchboard construction and anchoring method.

.12 Dimensioned cable entry and exit locations.

.13 Dimensioned position and size of bus.

.14 Dimensioned layout of internal and front panel mounted components.

.15 Overall length, height and depth of enclosures.

.6 The following information shall be submitted for record purposes:

.1 Final as-built drawings and information for items listed in the above paragraphs.

.2 Wiring diagrams

.3 Certified production test reports

.4 Installation information

.5 Seismic certification.

.6 Coordination Curve / Time Current Curve provided as to actual settings of Circuit breakers.

.7 The final (as-built) drawings shall include the same drawings as the construction drawings and shall incorporate all changes made during the manufacturing process.

1.11 SWITCHGEAR FUSE/CIRCUIT BREAKER CO-ORDINATION

.1 Switchgear shall be coordinated to ensure that the device nearest to the overload or fault opens first under all overload and fault condition. Verify the ratings and settings of all devices.

1.12 PLANT ASSEMBLY

.1 Install circuit breakers and/or fusible-switches in switchboards before shipment from plant.

.2 Assemble and wire complete secondary switchgear and metering components.

.3 After completion of tests, prepare switchgear for shipment to site, complete with hardware for re-assembly and re-connecting.

.4 In addition to CSA requirements, manufacturer's nameplate must show fault current rating of the switchboard assembly.

1.13 FINISH

.1 Apply finishes in accordance with Section 26 05 00; Cubicle exteriors - grey.

1.14 HOUSEKEEPING PAD

.1 Provide 100 mm [4”] high (nominal) concrete house keeping pads under all floor mounted equipment unless otherwise indicated.

1.15 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for secondary switchgear for incorporation into manual in accordance with Section 017800 - Closeout Submittals.

.2 6 copies maintenance data for complete switchgear assembly including components.

1.16 STORAGE AND PROTECTION

.1 Store switchgear on site in protected, dry location. Cover with plastic to keep off dust.

.2 If not within climate-controlled area, provide energized strip heater in each cell to maintain dry condition during storage.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Switchgear assembly: to CAN/CSA C22.2 No. 31.

2.2 RATING

.1 Secondary switchgear: indoor, 600 V, 2400 A, 3 phase, 3 wire, 60 Hz, minimum interrupting rating 65kA.

2.3 ENCLOSURE

.1 Three cell sections to contain:

.1 Main and Feeder Air circuit breakers sized as indicated.

.2 Tie Breaker cell, sized as indicated.

.3 Digital Metering System.

.4 Surge Suppression Device.

.5 High Resistance Ground Fault Unit

.6 Copper bus, from main section to distribution sections including vertical bussing.

.7 Infrared windows

.2 Shall be Seismically certified.

.3 Blanked off spaces for future units.

.4 Metal enclosed, free standing, floor mounted, dead front, indoor, CSA Enclosure unit.

.5 Ventilating louvres: vermin proof.

.6 Access from front and rear. Provide hinged breaker compartments and hinged rear doors.

.7 Securing Switchgear on floor:

.1 Do not use combustible materials for shims or spacers, steel or concrete preferred.

.2 Mounting surfaces should be clear of all dirt and debris before cells are located.

.3 All cells should be on the same plane.

.4 Do not achieve alignment by tightening or loosening anchor bolts.

.5 If existing or new floor is not level or on a single plane, use steel channel sills for base mounting in single length common to multi-cubicle switchboard.

.6 Supports should be of sufficient strength to support equipment.

.7 Switchgear must be securely lagged into floor with securing fasteners

.8 Minimum Hardware Grade 5

.9 Provide front access to all circuit breaker secondary connections.

.10 Enclosure shall provide sprinkler drip proof construction including 100mm overhang roof at front.

.11 Each cell shall include full height and depth fire retardant and non-hygroscopic barriers and sections, to contain faults and minimize the passage of ionized gasses between vertical sections.

.12 The switchgear line up shall be constructed in shipping splits, not to exceed 72” wide. Each split shall be capable of being lifted overhead or by forklift.

.13 Each shipping split shall have all secondary and control interconnections done using locking pull-apart terminal blocks.

.14 A floor mounted lifter shall be provided for lifting circuit breakers in excess of 75 pounds.

.15 Each circuit breaker shall be mounted in its own barriered compartment.

.16 Feeder breakers rated 2400A or less shall be capable of being mounted in the upper compartment without de-rating.

.17 The breaker’s trip unit, breaker control switch, position indicator lights, and lockout relay switch shall be visible with the breaker compartment door closed.

.18 Prepared spaces shall be totally complete, including the racking mechanism, bussing, and secondary contacts as necessary, so that a circuit breaker of the correct frame size can be installed with no modifications necessary.

.19 Circuit breaker and prepared space compartments shall be 'keyed' such that a breaker cannot be incorrectly installed with respects to frame size, or secondary connections.

.20 All customer secondary control and communications connections shall be made from the front of the switchgear lineup.

.21 All secondary and communication wiring shall be securely fastened to the switchgear without the use of adhesive backed wire anchors.

.22 Provide a complete mimic bus layout on the front of the switchgear. It shall be white (for normal) or red (for emergency) facing of 3mm thick lamacoid type material, securely fastened to the enclosure.

.23 All cover plates for air circuit breakers or moulded case circuit breakers shall include cutouts to allow clear access to all breaker and trip unit settings, nameplates, secondary trip buttons, rating plugs, and other items that may require adjustment or confirmation in the future, but to properly protect against inadvertent access to live parts.

2.4 INFRARED WINDOWS

.1 Each switchgear compartment containing incoming or outgoing cables, or incoming or outgoing bus connections, shall have 4 inch I.R. windows that will support the use of Long Wave and Short Wave I.R. camera systems.

.2 Provide enough windows on each rear door to view each visible incoming or outgoing feeder cable or bus connection, with an acceptable viewing angle to each connection.

.3 The windows shall have 100% transmission of visual wavelengths, 98% of Infrared wavelengths, both short (0.35 to 5.5 µm), medium (5.5 to 8 µm), and long (8 to 12 µm) wave and be made from a clear UL 94 Polymer.

.4 The windows shall have a removable metallic cover plate.

.5 Use standard Field of View calculations to determine where to install windows. FOV = 2 x ((tangent of ½ the angle) x distance), assuming a standard camera FOV of 24°.

.6 Acceptable Products:

- .1 IRISS VPT100
- .2 Hawk IR
- .3 H.VIR Comet
- .4 Fluke
- .5 Or approved Equivalents

2.5 BUSBARS

.1 Three phase bare busbars plus 100% neutral, continuous current rating 1600 A self-cooled, extending full width of multi-cubicle switch board, suitably supported on insulators.

.2 Main connections between bus and major switching components to have continuous current rating to match major switching components.

.3 Busbars and main connections: 99.30% conductivity copper.

.4 Provision for extension of bus on both sides of unit without need for further drilling or preparation in field.

.5 Tin plated joints, secured with non-corrosive bolts and Belleville washers.

.6 Identify phases of busbars by suitable marking.

.7 Busbar connectors, when switchboard shipped in more than one section.

.8 Bus Bracing to 65kA minimum

.9 Blanking Plates over future extension holes

2.6 GROUNDING

.1 Copper ground bus not smaller than 50 x 6 mm extending full width of multi-cubicle switchboard and situated at bottom.

.2 Lugs at each end for No. 4/0 AWG grounding cable.

2.7 GROUND FAULT PROTECTION

.1 As per Section 262818 – Ground Fault Equipment Protection

.2 Where there are multiple individually grounded 3Ph/4W sources and a continuous neutral, and configurations where the 3 or 4 CT residually connected ground fault protection on main and tie breakers may result in the incorrect detection of either ground fault or neutral currents, the application of Modification Ground Differential protection shall be used within the switchgear.

2.8 MOLDED CASE CIRCUIT BREAKERS

.1 Moulded case circuit breakers to CSA C22.2 No. 5.

.2 Bolt-on moulded case thermal magnetic circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.3 Thermal and instantaneous magnetic trip.

.4 Common-trip breakers with single handle for multiple applications with trip free action and “trip” position separate from “on” and “off” positions.

.5 Trip rating clearly visible and legible with finished panel trim installed.

.6 Main breaker shall be:

.1 Moulded case, 3 pole, rated 600 VAC, with solid state overcurrent sensor and ground fault protection function.

.2 Minimum 25,000 amps symmetric interrupting capacity or as indicated on drawings.

.7 Sub circuit breakers shall be:

.1 Moulded case 3 pole with solid state overcurrent sensors.

.2 Minimum 25,000 AIC symmetrical for 600 volt or as indicated on drawings.

2.9 DRAW-OUT CIRCUIT BREAKERS

.1 Circuit Breakers shall be three pole, air break type. All breakers shall be CSA listed for application in their intended enclosures for the required amperage needed. Each breaker shall carry a CSA label.

.2 Draw out interlocks shall be provided to prevent the following:

.1 Racking a closed circuit breaker into or out of the connected position.

.2 Closing a circuit breaker until it is fully racked into the test or connected positions.

.3 Withdrawing the circuit breaker from the cubicle with the closing springs charged.

.4 Insertion of a circuit breaker with incorrect frame size or inadequate interrupting capacity.

.5 Breakers shall be equipped with stored energy operation type operating mechanism. All breakers shall operate without intentional delay on initiation (quick close and quick open). Breakers shall also have provisions for manual operation.

.6 Breakers of the same frame size and control voltage shall be completely interchangeable.

.7 Breaker continuous and fault current ratings shall meet or exceed the ratings noted in this specification.

.8 All contact stabs shall be coated at the factory with approved grease.

.9 Control circuits to be provided by the vendor for each circuit breaker

2.10 SOLID STATE TRIP AND PROTECTIVE RELAY ASSEMBLIES

.1 Voltage: and poles as indicated in schedules.

.2 Interrupting Capacity: 25,000 A symmetrical.

.3 Construction (breaker): bolt-in or draw out (stabs) as indicated.

.4 Mounting: vertical.

.5 Normal operation: 40°C ambient.

.6 Breaker frame: moulded case breaker or air break type design as indicated.

.7 Breakers shall be equipped with electronic solid-state overcurrent relays.

.8 The solid-state trip devices shall include the following adjustments:

.1 Long delay pickup.

.2 Long delay time.

.3 Short delay pickup.

.4 Short delay time.

.5 Instantaneous trip.

.6 Ground fault pickup.

.7 Ground fault delay time

.9 Each solid state unit shall include a LED or LCD display indicating the following:

.1 Cause of trip

.2 Peak level of fault current

.3 Phase current.

.4 Communications capability.

.5 Energy use kWH, kVA, kW, KVARS.

.6 Zone selective instantaneous protection

.10 The solid-state relay shall trip the circuit breaker independent of trip/close control circuits.

.11 Current monitors:

.1 Type: transformer.

.2 Mounting: bus.

.3 Number required: 4 (3 wire and N system).

.12 Sensor Unit:

.1 Type: solid state electronic sensor powered from current monitor source.

.2 Calibration: visible identified trip adjustment-calibration from front of breaker.

.3 Mounting: on or within breaker frame.

.4 Trip Actuation: powered by circuitry within the monitor sensor device.

.5 Trip Actuation: visual On/Off.

.13 The current coils of all relays and meters shall be capable of withstanding momentary current transformer secondary currents of approximately 20 times the coil rating without incurring any damage.

.14 Moulded case circuit breakers to CSA C22.2 No. 5.

.15 Bolt-on moulded case circuit breaker, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40 degrees C ambient.

.16 Stab type draw out circuit breakers where indicated on the project single line drawing.

.17 Common-trip breakers with single handle for multiple applications with trip free action and “trip” position separate from “on” and “off” positions.

.18 Breakers shall be:

.1 Moulded case or air circuit breaker, 3 pole, rated 600 VAC, with solid state overcurrent sensor and ground fault protection function as indicated.

.2 Minimum 25,000 AIC symmetrical for 600 volt or as indicated on drawings.

2.11 GROUNDING

.1 Copper ground bus not smaller than 50 x 6 mm [2”x ¼”] extending full width of cubicle and situated at bottom. Ground bus to be accessible without reaching over the main live bus.

.2 Lugs at each end for size 4/0 AWG grounding cable.

.3 Bond non-current carrying metal parts, including switchgear framework, enclosure and bases to ground bus.

2.12 OWNERS OR MONITORING METERING

.1 As per Section 260923 – Metering and Switchboard Instruments.

.2 Phase metering current transformers shall be located in the circuit breaker compartment on the line and/or load bus as shown on the drawings. The CT’s shall be mechanically and thermally rated to withstand any fault condition.

.3 Secondary windings of phase metering current transformers shall have a nominal rating of 5 A and metering accuracy ratings of 0.6% or better.

.4 Potential transformers if required shall be located in the low voltage control compartments and shall include both primary and secondary HRC fuses. The primary fuses shall be installed in “pull out dead front” fuse holders.

.5 Potential transformers shall have 120 V secondary’s and metering accuracy ratings shall be 0.6%

.6 Microprocessor digital metering equipment to be equal to:

.7 Cutler Hammer IQ Analyzer 6600.

2.13 TRANSIENT VOLTAGE SURGE SUPPRESSORS

.1 As per Section 264300 – Surge Suppression Devices to 600V

2.14 STATUS INDICATOR LIGHTS

.1 Provide Closed and Open Pilot lights for each breaker

.1 Status light: open-green, closed-red.

.2 All indicator lights to be push-to-test, long lasted LED type.

2.15 CONTROL AND LOCKOUT SWITCHES

.1 Provide one open/close control switch for each breaker with clear protective Plexiglas cover to protect against inadvertent operation.

.2 Provide one lockout switch for each breaker to prevent inadvertent re-energization in the event of a fault condition.

.3 Standard of Acceptance: Electroswitch Series 24

2.16 LIFTING DEVICE

.1 Provide switchgear mounted lifting device to be able to lower or lift all breakers into position within switchgear.

2.17 DCS SCADA

.1 Wire all I/O as follows:

.1 Connect all circuit breaker ‘a’ contacts to DCS

.2 Connect TVSS alarm contact to DCS

.3 Connect HRG alarm contact to DCS

.4 Connect Modbus links to digital metering system back to DCS system

2.18 GROUNDING STUDS

.1 Provide grounding studs as per drawings to BC Hydro engineering standards.

.1 Studs to be Cu/AL Bronze, rated for 30,000 amperes for 30 cycles.

.2 Diameter of ball head to be 25mm, overall length to be 78mm.

.3 Provide each stud with a removable insulating cover boot.

2.19 FINISHES

.1 Apply finishes in accordance with Section 26 05 00 - Electrical General Requirements.

.1 Cubicle exteriors gray ASA 61.

.2 Cubicle interiors white.

2.20 MIMIC BUS

.1 Provide equipment identification in accordance with Section 26 05 00 - Electrical General Requirements.

2.21 EQUIPMENT IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00 - Electrical General Requirements.

2.22 SOURCE QUALITY CONTROL

.1 Engineer to have option to witness final factory tests.

.2 Notify Engineer in writing 10 business days in advance that switchgear assembly is ready for testing.

2.23 STANDARD OF ACCEPTANCE

.1 Eaton Cutler Hammer

.2 Schneider

Part 3 EXECUTION

3.1 APPLICATION

3.2 INSTALLATION

.1 Locate switchgear assembly as indicated and bolt to base channels. Any variations to be pre-approved by the Consultant.

.2 Install the switchgear with due care and attention. Ensure that the factory finish is not damaged, dented, scratched or warped. Ensure that the switchgear is not dropped or subjected to excessive vibration. The Contractor shall repair and make good any damage or perceived damage to the switchgear to the satisfaction of the Consultant. There shall be no extra costs to the Owner for restoring or repairing the switchgear to the satisfaction of the Consultant.

.3 Remake sections which have been separated for shipping purposes.

.4 Connect main secondary power supply to main breaker bus.

.5 Connect load side of breakers in distribution cubicles to distribution feeders.

.6 Check factory made connections for mechanical security and electrical continuity.

.7 Run two grounding conductors sized at No. 4/0AWG bare copper in 25 mm conduit from ground bus to ground.

.8 Check trip unit settings against co-ordination study to ensure proper working and protection of components.

.9 The Contractor shall install all equipment per the manufacturer’s recommendations and the contract drawings.

.10 Check factory made connections for mechanical security and electrical continuity. Tighten electrical connectors and terminals, including screws and bolts in accordance with equipment manufacturer's published torque tightening values.

.11 Install switchgear on 100 mm [4”] concrete housekeeping pad unless otherwise detailed.

.12 Provide all necessary hardware to secure the assembly in place. Secure assemblies to foundation or floor channels. The switchgear shall be seismically restrained.

.13 Connect load side of breakers in distribution section to distribution feeders as indicated.

.14 Measuring and record insulation megohm meter readings - phase-to-phase, phase-to-ground, and neutral-to-ground (where applicable).

.15 Install switchgear accessories cabinet in electrical rooms.

.16 Provide conduit and signal communications wire as specified by manufacturer or as indicated in these specifications. Make connection to digital meters and/or networked metering communication system.

3.3 CONNECTIONS

.1 Piping Connections

.2 Duct Connections

.3 Electrical Connections

.4 Control Connections

END OF SECTION

Part 1 GENERAL

1.1 RELATED REQUIREMENTS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 whether indicated on not on the contract drawings.

.3 Provide a complete system of secondary sub distribution.

.4 Note that the electrical rooms have limited space. Refer to drawings for restrictions. Equipment has to be built to fit available space.

1.2 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 Closeout Submittals

.4 LEED Submittals

.5 Operation and Maintenance Materials

.6 Record Documents

1.3 RELATED WORK

.1 Section 26 05 00.11

1.4 WORK INCLUDED

.1 Provide disconnect switches for 347/600 volt and 120/208 volt distribution as indicated on the drawings, as manufactured by Cutler Hammer, EATON, Square D or approved equal.

1.5 REFERENCES, CODES AND STANDARDS

.1 All Codes, Standards, Rules, Regulations, Bulletins, By-laws etc., shall be those that are currently enforced, in particular, the following:

.1 CAN/CSA C22.2 No. 4 – Enclosed and Dead-Front Switches

.2 CAN/CSA C22.2 No. 39 – Fuseholder Assemblies

.2 All disconnect switches to be CSA or cUL certified for the area in which they are mounted.

Part 2 PRODUCTS

2.1 GENERAL DISCONNECT SWITCHES

.1 “Heavy Duty” class, enclosed manual air break switches in non-hazardous locations: to CSA C22.2 No.4

.2 Quick-make, quick-break action.

.3 ON-OFF switch position indication on switch enclosure cover.

.4 Provide an auxiliary switch with dry contacts on all elevator disconnects and as required by the Elevator Code. Review elevator shop drawings to confirm any additional requirements.

.5 Weatherproof as required.

2.2 UNFUSED DISCONNECT SWITCHES

.1 Ratings: 1000 Volts for 347/600 volt distribution, 240 volts for 120/208 volt distribution. Unless otherwise shown, 3 pole for 3 phase, 3 wire distribution, 3 pole and solid neutral for 3 phase 4 wire distribution. Ampere ratings as shown on the drawings or to suit load requirements. For motors, use disconnect switches with HP ratings at least equal to motor HP.

.2 Enclosures: CSA code gauge galvanized steel, hinged doors, external operating handles. Disconnect switches in dry locations shall be CSA Type -1 and CSA Type -3 where exposed to weather. Provide ON-OFF switch position indication on switch enclosure cover.

.3 Finish: One primer coat and one finish coat on all metal surfaces, colours as per Section 26 05 00.11 - Electrical General Requirements.

.4 Switch mechanisms: Quick make and quick break action with self wiping contacts, solderless pressure lug connectors. For switches 100 amperes and over, provide non-tracking arc shrouds. All switch poles to operate together from a common operating bar. Provide for padlocking disconnect switches in "Off" position. Doors to be interlocked and complete with defeat mechanism, to prevent opening when handle in ON position.

.5 Neutral Bars: Where distribution system has grounded neutral conductor, provide neutral bar where required with ampere rating equal to switch rating, in enclosure. Provide ground bar for terminating ground conductors.

2.3 FUSED DISCONNECT SWITCHES

.1 All fuses to be 100,000 ampere (minimum) interrupting capacity of the current limiting type. In addition, fuses feeding motors to be of the time delay type. Provide one full set of spare fuses, three for each different ampere rating used, stored in suitable enclosure.

.2 Fuse Holders: Provide fuse holders (relocatable and suitable without adapters) on load side of switches, ampere rating equal to switch ratings, suitable for fuses specified.

.3 Fuseholder assemblies to CSA C22.2 No.39.

.4 Fusible and non-fusible disconnect switch in CSA enclosure.

.5 Provision for padlocking in off switch position.

.6 Fuses as indicated. Allow for Class J or L for general circuits, Class RK5 for transformer, motor or other high inrush current circuits

.7 Fuseholders in each switch suitable without adaptors, for type of fuse as indicated.

2.4 CONTACTOR EQUIPMENT

.1 Contactors: to CSA C22.2 No.14.

.2 Half size contactors not accepted.

.3 Electrically operated, electrically or mechanically held, multi-pole full voltage type.

.4 Contactors to have 120V operating (and unlatching) coils unless otherwise noted.

.5 Controlled by pilot devices as indicated and rated for type of load controlled.

.6 Breaker or Fused switch combination contactor as indicated.

.7 Complete with 1 normally open and 1 normally closed auxiliary contacts unless indicated otherwise.

.8 Provide CEMA enclosure as required for location unless indicated otherwise.

2.5 EQUIPMENT IDENTIFICATION

.1 Indicate name of load controlled on size 4 name plate to Section 16010 [26 05 00].

2.6 STANDARD OF ACCEPTANCE

.1 Cutler Hammer – Heavy Duty

.2 Schneider - Heavy Duty

.3 Siemens - Heavy Duty

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install disconnect switches complete with fuses where indicated or required.

.2 All disconnect switches for elevator machine rooms shall be fused in accordance with the equipment suppliers requirements.

.3 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 whether indicated on not on the contract drawings.

3.2 DISCONNECT SWITCHES

.1 Mounting: Provide supports independent of conduits. Wall mount where possible, otherwise provide Unistrut frame support. Where switches are grouped, mount in uniform arrangement.

.2 Wiring: Connect line and load cable to all switches.

.3 Fuse Rating: Install so that rating is visible.

.4 Identification: Provide lamacoid plate in accordance with Section 26 05 00.11 - Electrical General Requirements, on each switch showing voltage, source of supply and load being fed, for example:

.1 Door Controller

.2 120/208 Volts

.3 Fed from PPA

3.3 MOTOR PLUG/RECEPTACLE AND QUICK DISCONNECTS

.1 Motor quick disconnects do not negate the requirement for a switched safety disconnect as specified in this Division. A separate disconnect is still required unless the Consultant has given a special pre-approved circumstance.

3.4 CONTACTOR INSTALLATION

.1 Half size contactors not accepted.

.2 Electrically operated, electrically or mechanically held, multi-pole full voltage type.

.3 Contactors to have 120V operating (and unlatching) coils unless otherwise noted.

.4 Controlled by pilot devices as indicated and rated for type of load controlled.

.5 Breaker or Fused switch combination contactor as indicated.

.6 Complete with 1 normally open and 1 normally closed auxiliary contacts unless indicated otherwise.

.7 Provide CEMA enclosure as required for location unless indicated otherwise.

END OF SECTION

Part 1 GENERAL

1.1 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 Closeout Submittals

.4 LEED Submittals

.5 Operation and Maintenance Materials

.6 Record Documents

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00.11 - Electrical General Requirements.

.2 Ground fault protective equipment: product of one manufacturer.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Refer to Section 26 05 00.11 – Electrical General Requirements.

Part 2 PRODUCTS

2.1 EQUIPMENT

.1 Provide ground fault protection on the 347/600V, 4 wire, 3 phase main switchboard.

.2 Ground fault unit to contain:

- .1 Ground sensing relay.
- .2 Ammeter to indicate ground current value.
- .3 Three position sensitivity control switch to select value of leakage current at which relay will operate.
- .4 Indicating lamp illuminated when no ground fault exists, extinguished on ground fault or test.
- .5 Switch:
  - .1 SPDT contacts for alarm and trip.
  - .2 Mechanical target indication.
  - .3 Manually reset.
- .6 Reset button for contacts and target.
- .7 Suitable for panel mounting.

.3 Zero sequence transformer rectangular type.

.4 Neutral:

- .1 Use an artificial neutral and grounding resistor
- .2 Use neutral ground resistor unit.

2.2 FABRICATION

.1 Install following components in equipment specified in other Sections and as indicated.

.1 Zero sequence transformer

.2 Ground fault relay

.3 Ground resistor unit.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Do not ground neutral on load side of sensor.

.2 Install phase conductors including neutral through zero sequence transformer.

.3 Install ground fault protection system.

.4 Make connections as indicated and in accordance with manufacturer's recommendations.

3.2 CONNECTIONS

.1 Piping Connections

.2 Duct Connections

.3 Electrical Connections

.4 Control Connections

3.3 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 08 00 11 - Testing, Adjusting and Balancing of Electrical Equipment and Systems.

.2 Arrange and pay for field testing of ground fault equipment before commissioning service.

.3 Submit report of tests to Consultant and certificate that system as installed meets criteria specified.

.4 Demonstrate simulated ground fault tests.

END OF SECTION

Part 1 GENERAL

1.1 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 Closeout Submittals

.4 LEED Submittals

.5 Operation and Maintenance Materials

.6 Record Documents

1.2 RELATED SECTIONS

.1 Common Work Results for Electrical - Section 26 05 01

.2 Starting of Electrical Equipment and System - Section 26 57 01

.3 Grounding: Secondary - Section 26 05 27

.4 Transient Voltage Suppression - Section 26 43 00

1.3 SYSTEM

.1 This section includes the main switchboard construction, operation and specification requirements.

1.4 REFERENCE STANDARDS

.1 Details indicate components required and general arrangement, busbar spacings, clearances, busbar mountings, cable spaces, etc., to be in accordance with CSA standards, the Consultant and electrical inspection authority.

.2 CSA C22.2 No. 244-05 Switchboards

1.5 COORDINATION WITH OTHER WORK

.1 Co-ordinate with the equipment supplier a composite system for all protection circuits.

Part 2 PRODUCTS

2.1 ACCEPTABLE PRODUCTS

.1 Eaton Cutler Hammer.

.2 Schneider Canada

.3 Siemens.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install main switchboard on 102 mm [4"] concrete housekeeping pad. All concrete work by Division 3.

.2 Coordinate main switchboard delivery and installation with building construction.

.3 Where conduits are installed in the top or sides of the switchboard waterproof fittings shall be utilized.

3.2 CONNECTIONS

.1 Piping Connections

.2 Duct Connections

.3 Electrical Connections

.4 Control Connections

3.3 MAIN SWITCHBOARD NAMETAGS

.1 Provide lamicoid nametags indicating name of building, name of electrical consultant, name of manufacturer, contractor and data installed.

.2 Provide lamicoid nametags for all breakers. Lettering on nametags to be not less than 9.5 mm high.

3.4 SHOP DRAWINGS

.1 Full shop drawings of the distribution equipment to be submitted to the Consultant for review prior to manufacture of equipment specified. Equipment to comply with intended requirements of this specification. Equipment drawings rejected at discretion of the Consultant to be altered so as to comply with requirements and intent of these specifications and to be resubmitted for checking without undue delay.

END OF SECTION

Part 1 GENERAL

1.1 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 Closeout Submittals

.4 LEED Submittals

.5 Operation and Maintenance Materials

.6 Record Documents

1.2 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Section 26 09 24 “Lighting Controls” includes low voltage relays assemblies that are to be factory installed and prewired, within adjoined matching panel tubs and trims that are part of this section. Refer to section 26 09 24 for scope and extent.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00.

.2 Shop drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.3 Shop drawings to include matching tub and trim details for factory installed low voltage relay cabinets where specified.

1.5 PLANT ASSEMBLY

.1 Install circuit breakers in panelboards before shipment from plant.

.2 Install and prewire low voltage relays assemblies where indicated.

.3 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.4 All panelboards to be of a common manufacturer.

1.6 FINISH

.1 Apply finishes in accordance with Section 26 05 00.

.2 Panel finish in electrical and equipment rooms and closets to be standard ASA Grey baked enamel for normal power service and Blue for emergency power service. Confirm with Consultant prior to shop finishing panels.

.3 Panels in finished and/or public areas to be either as clause .2 above or prepared to accept painting to closely match surroundings as directed by the Architect. In the later instance, the final paint coat to be done by Divison 09 but coordinated by the Electrical Division in particular for protection and masking of locks and sensitive parts. Confirm with Consultant prior to paint finishing panels.

Part 2 PRODUCTS

2.1 PANELBOARDS, DOORS AND TRIMS

.1 Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.

.2 Bus and breakers rated for 10 KA symmetrical, minimum, interrupting capacity or as indicated.

.3 Tin plated aluminum bus with full size neutral.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number.

.5 Mains, number of circuits and number and size of branch circuit breakers as indicated.

.6 Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.

.7 Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.

.8 Panelboards to have flush doors. (Gasketted where required).

.9 Provide two keys for each panelboard and key similar voltage panelboards alike.

.10 Panel tubs to be typically 600 mm (20”) wide.

.11 Provide "sprinkler-proof" design in areas where sprinkler fire protection is installed. In any event, all surface mounted enclosures to be complete with sprinkler drip cover.

.12 Provide door within door trims where indicated to facilitate ease of service maintenance Each tub trim cover to be hinged and self supporting and to swing out to expose breaker cable terminations and wireways. Hinged trim shall be secured with cover screws on opening side by concealed machine screws. Hinged breaker cover shall be recessed into the hinged overall tub cover. Breaker cover shall have latch type closures. Submit details on shop drawings prior to manufacturing.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES

.1 Relay section(s) on side(s) of panels as indicated or required for installation of low voltage remote control switching components. Coordinate with lighting controls equipment supplier

.2 Double stack panels as indicated.

.3 Contactors in mains as indicated.

.4 Feed through lugs as indicated.

.5 Provide Isolated ground bus as indicated. Isolated ground bus to be similar to neutral.

2.3 BREAKERS

.1 All breakers to be bolt on type, moulded case, non adjustable and non interchangeable trip, single, two and three pole, 120/208(240)V or 347/600V and with trip free position separate from "On" or "Off" positions.

.2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard. Minimum interrupting rating of breakers to be as follows:

.1 347/600V panelboards - 14,000 Amps at 347 volts.

.2 120/208V panelboards - 10,000 Amps at 250 volts.

.3 Main breaker to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules.

.5 Provide at least 10% spare 15 Amp single pole breakers whether indicated or not.

.6 Provide GFI type breakers as indicated.

.7 Provide Lock-on devices as indicated and in any event for Fire Alarm circuits, Security equipment circuits, EXIT sign circuits and Emergency Battery equipment circuits.

2.4 PANELBOARD IDENTIFICATION

.1 Provide equipment identification in accordance with Section16010. (26 05 00)

.2 Nameplate for each panelboard size 5 (2 line) engraved as indicated and include panel designation and voltage/phase.

.3 Complete circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a “letter sized” paper copy of each directory in the project maintenance manual.

.4 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a “letter sized” paper copy of each information card in the project maintenance manual.

2.5 STANDARD OF ACCEPTANCE

.1 Cutler Hammer Type PRL Door within door trim where indicated.

.2 Schneider, Type NQOD Door within door trim where indicated.

.3 Siemens Canada.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.

.2 Panelboards located in service rooms, mechanical rooms, and electrical rooms to be mounted on unistrut supports.

.3 Mount panelboards to height given in Section 26 05 00 or as indicated.

.4 Connect loads to circuits as indicated.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Install 1” (4x27mm) empty conduits (or equivalent) from each flush mounted panelboard single tub to ceiling space above and 1” (2x27mm) empty conduits (or equivalent) from each flush mounted panelboard single tub down to ceiling or space below where space exists. Refer also to Section 26 05 34 “Conduits”.

3.2 CONNECTIONS

.1 Piping Connections

.2 Duct Connections

.3 Electrical Connections

.4 Control Connections

END OF SECTION

Part 1 GENERAL

1.1 REFERENCE STANDARDS

.1 Units shall be designed, manufactured, tested and installed in compliance with the following standards:

- .1 ANSI/IEEE C62.41
- .2 ANSI/IEEE C62.45
- .3 UL 1449, 2nd edition
- .4 UL 1283
- .5 CSA 22.2

1.2 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 Closeout Submittals

.4 LEED Submittals

.5 Operation and Maintenance Materials

.6 Record Documents

.7 In addition to items specified in Section 26 05 00 submit the following information for review at time of shop drawings submittal:

- .1 ULC1449, 2nd edition listing card for each product submitted.
- .2 Clamping voltage measured and presented in accordance with NEMA LS1-1992 showing clamping voltages for the C62.41 category B3 ring wave, category B3/C1 combination wave, and category C3 combination wave. Clamping voltages shall be measured from the zero reference to the peak of the limited surge and the test surge shall be injected at the 90-degree phase angle (i.e. the positive peak of the sine wave as required by NEMA LS1. All testing shall be independently certified by a nationally accredited test facility.
- .3 High frequency noise attenuation presented in accordance with NEMA LS1 over a spectrum of 100kHz to 10MHz. Attenuation values shall be in a range of 30db to 60db provided at discrete frequencies of 100kHz, 1MHz and 10MHz. Attenuation values provided at a single frequency or no particular frequency will not be acceptable.

1.3 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Section 26 24 16 Panelboards (coordinate with SPD equipment)

.3 Section 26 23 00 Low Voltage Switchgear (coordinate with SPD equipment)

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.5 SOURCE OF SUPPLYGS

.1 All units shall be of one manufacturer.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Operating range: -40C to +40C.

.2 Operation shall be reliable in an environment of 5% to 95% non-condensing relative humidity.

.3 The unit shall be capable of operation in altitudes of up to 1000m above sea level.

.4 This unit shall not generate any audible noise.

.5 No appreciable magnetic fields shall be generated. Unit shall be capable of use directly in computer rooms in any location without danger to data storage systems or devices.

Part 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

.1 Schneider

.2 Eaton

.3 Siemens

.4 Approved alternate

2.2 ELECTRICAL REQUIREMENTS

.1 System Voltage: 347/600V, 277/480V and 120/208V, 3 phase, 4 wire grounded wye as indicated.

.2 Maximum Continuous Operating Voltage of all Suppression Components:

.3 125% of facility's nominal operating voltage for 120 V systems.

.1 115% of facility's nominal operating voltage for 220, 240, 277,480, 347, 600 V systems.

.4 Operating frequency: from 50 to 62 Hz.

.5 Protection Mode: The unit shall provide protection on wye configured systems for:

.1 line to neutral transients.

.2 line to ground transients.

.3 neutral to ground transients.

.6 Single Pulse Surge Current Capacity: Based on ANSI/IEEE C62.41 standard 8 x 20micro-s current waveform, the maximum repetitive surge current capacity of the unit shall be no less than:

Mode of Operation	Panelboards	Main Switchboard
Line to Neutral	80,000A / Phase	200,000A / Phase

Line to Ground	80,000A / Phase	200,000A / Phase
Neutral to Ground	80,000A / Phase	200,000A / Phase

.7 UL 1449, 2nd Edition SVR - The maximum UL 1449, 2nd Edition SVR for the device must not exceed the following:

Mode	208Y/120	480Y/277	600Y/347
L-N, L-G, N-G	400V	800V	1000V
L-L	700V	1500V	1800V

.8 ANSI/IEEE Cat. C3 clamping voltage measured per NEMA LS1-1992 based on IEEE C62.41 and C62.45 recommended procedures for Category C3 combination wave (20kV, 10kA) shall be less than:

Mode	208Y/120	480Y/277	600Y/347
L-N	500V	900V	1300V

.9 ANSI/IEEE Cat. B3 clamping voltage measured per NEMA LS1-1992 based on IEEE C62.41 and C62.45 recommended procedures for the ANSI/IEEE Cat. B3 ringwave (6 kV, 500 A) shall be less than:

Mode	208Y/120	480Y/277	600Y/347
L-N	150V	200V	300V

.10 Life Expectancy: The unit shall be capable of protecting against and surviving at least 8000 ANSI/IEEE C62.41-1991 Category C3 (20 kV open circuit, 10 kA short circuit) surges without failing or degrading the measured limiting voltage (MLV) by more than 10%.

2.3 SPARE PARTS

.1 A list of customer replaceable spare parts shall be included with the installation, operating and maintenance instructions.

2.4 WARRANTY

.1 The manufacturer shall provide a written warranty of no less than ten (10) years against failure. Warranty to be provided directly to the owner and to be valid starting at facility takeover date.

2.5 PERFORMANCE

.1 Unit shall include an engineered solid-state high performance hybrid suppression system utilizing an array of selenium cells and/or non-linear voltage dependent metal oxide varistors and capacitive filter components. The suppression system shall not utilize gas tubes, spark gaps, or silicon avalanche diodes. Clamping voltage shall be measured as per NEMA LS1-1992 guidelines.

2.6 FILTERING

.1 The unit shall contain a high performance EM/RFI noise rejection filter. The filter shall reduce fast rise-time, high frequency, error producing transients and electrical line noise to harmless levels. The filter shall provide minimum insertion loss utilizing MIL-STD-E220A 50 ohm methodology as follows:

Attenuation Frequency	100 kHz	1 MHz	10 MHz

Attenuation (dB)	55	56	54

2.7 STATUS INDICATION

.1 The unit shall include LED indicators, which provide indication of suppression component failure for all modes including neutral to ground. Provide one (1) set of dry contacts for remote monitoring of protection failure by BMS (Building Management System). Contacts to activate upon failure of any one phase or degradation of total surge capacity to less than 75%.

.2 All units shall be testable in the field in order to verify the exact level of protection remaining using either built-in features or a hand-held tester.

2.8 DIAGNOSTIC MONITORING

.1 All units shall provide the following levels of diagnostic monitoring:

.1 Continuous monitoring of internal fuses and be equipped with the ability to alarm.

.2 Internal sensor system for monitoring MOVs including neutral to ground.

.3 Monitoring and adequate protection for temporary over voltage (TOV) monitoring.

2.9 PROTECTION

.1 Integral SPD fusing shall be provided that provides proper fault protection per CEC in the event of MOV failure but does not operate during normal operation where the unit is required to conduct an 8 x 20□s surge current equal to its per mode rating. Vendor shall provide independent single pulse test data verifying that the unit can withstand its advertised per mode surge rating per NEMA LS1-1992 and IEEE/ANSI C62.45.

.1 Fusing shall be rated to 200k AIC

.2 Thermal Protection: MOV’s shall be equipped with thermal protection technology which allows disconnection of the suppression component at the overheated stage common during temporary over voltage condition. For small fault currents between 100mA to 30A, or if the occurrence is over a longer period of time, the thermal protection will disconnect first. Manufacturers that utilize fuse traces only shall not be approved.

.3 All overcurrent protection components shall be tested in compliance with UL 1449-Limited Current Test and AIC rating test.

2.10 ENCLOSURE

.1 Integral to panelboards and/or Distribution Centres.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Install units integral to designated panelboards shown on drawings.

.2 Provide 21mm (0.75”) 2#12-AWG connection from each unit to the nearest BMS system.

.3 Where units are mounted integral with panelboards, status LEDs shall be visible without removing covers.

.4 Where units are mounted remote from the panelboard or distribution centre, ensure that the leads from breaker terminals to SPD unit do NOT exceed150 mm (6”) and the use low impedance wiring methods shall be used. SPD devices shall also be closely coupled to the distribution device when used in the remote form.

3.2 CONNECTIONS

.1 Piping Connections

.2 Duct Connections

.3 Electrical Connections

.4 Control Connections

END OF SECTION

Part 1 GENERAL

1.1 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 Closeout Submittals

.4 LEED Submittals

.5 Operation and Maintenance Materials

.6 Record Documents

1.2 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.3 SCOPE OF WORK

.1 In general the HVAC and the Plumbing/Fire Protection motors and drives will be respectively provided under the Mechanical Division and Plumbing/Fire Protection Divisions;. Refer to the related division of the specifications and drawings for exact locations and requirements.

.2 Provide the following components:

.1 All disconnect switches required.

.2 All starters, contactors, control transformers, except where supplied by the Mechanical or Plumbing/Fire Protection Divisions as noted in the equipment schedule.

.3 Thermostats, solenoid valves, pressure switches, aquastats, flow switches, timeclocks are generally provided by the Mechanical or Plumbing Divisions except as noted in the equipment schedule(s).

.4 Refer to equipment schedule(s) for details of motor controls and devices.

.5 Provide all power wiring from power distribution centre, through starter and control equipment to the motors.

.6 Conduit, wire and connections for all HVAC low voltage control wiring shall be the responsibility of Mechanical Division unless otherwise specified.

.7 Provide, connect and verify all Fire Alarm control wiring and devices.

1.4 CONTROLS - GENERAL

.1 Mechanical and Plumbing Divisions differ both in regard to the particulars of drives, motors, etc. specified. The Mechanical Division typically includes a major section on controls whereas the Plumbing Division typically includes more package equipment requiring power service connection only. Because of these variations the demarcation point between the work of the Electrical Division and the Mechanical and Plumbing Divisions typically differ.

.2 Generally for drives, equipment, etc. detailed in the Mechanical Division, the work of the Electrical Division finishes with the supply of a standard terminal block array for each starter. All further wiring, relays, timers, etc., together with control consoles, are provided under the Mechanical Division.

.3 Generally for the package equipment, drives and special controls detailed in the Plumbing Division, the work of the Electrical Division typically includes the provision of all wiring, devices, etc to complete each system and left ready for commissioning, set up, etc. by the Plumbing Division.

1.5 ELECTRICAL DIVISION RESPONSIBILITIES FOR MECHANICAL DIVISIONS

.1 Provide a ten point terminal block for each starter or contactor.

.2 Provide interwiring between starters or contacts and terminal blocks. Starter to be entirely factory-wired.

.3 Terminals to be as follows:

.4 120 V line from control transformer.

.1 Terminals for remote 3 wire stop/start.

.2 HOA or other control.

.3 120V neutral.

.4 Normally open dry contact.

.5 Common.

.6 Normally closed dry contact.

.7 Normally open dry contact.

.8 Common.

.9 Normally closed dry contact.

.5 Except where otherwise indicated, the work of the Electrical Division shall not extend beyond the control terminal blocks. The Mechanical Division shall provide all conduit, wire, wiring connections and components such as relays, timers, etc. as required to provide the interlocking functions and controls as outlined in the specifications. If the standard terminals supplied by the Electrical Division require supplementation in any way, e.g. by supplying additional N.O. or N.C. contacts, these facilities are included in the Mechanical Division Mech Div scope.

.6 Mechanical Division shall provide the mechanical control consoles complete with pilot controls, indicating lights, etc., as outlined in the specifications.

.7 When an item provided under the Mechanical Division is factory supplied with a starter or contactor and it is necessary to alter or add to the control wiring in order to achieve the method of operation specified in the Mechanical Division, this work shall be included in Mechanical Division.

.8 When control items such as thermostats, float controllers, etc., are connected to power wiring in series with the item being powered (e.g. unit heater motor, fractional HP fans, etc.) the supply and installation of the controller devices are included in Mechanical Division. Power wiring to and from the controllers is included in the Electrical Division. Install line voltage thermostats for single phase motors provided by the Mechanical Division where specifically indicated on the drawings and/or the “Equipment Schedule” of this specification.

.9 When the electrical characteristics of a controlled item exceed the capacity of a specified controller, provision of a contactor and the required wiring shall be included in the Mechanical Division.

1.6 ELECTRICAL DIVISION RESPONSIBILITIES FOR PLUMBING DIVISIONS

.1 When a drive, motor, etc. provided under the Plumbing Divisions is factory supplied with a starter, contactor, alternator, pressure switch, etc., the wiring and installation of these items and controls shall be included in the Electrical Division.

.2 The ten point terminal blocks similar to those specified under the Mechanical Division controls are not mandatory for the Plumbing Division equipment.

.3 The Electrical Division shall provide stop/start or HOA controls as specified for each item except where these stations are factory supplied with equipment.

.4 The Electrical Division shall leave each system fully functional and requiring only minor final adjustments (such as pressure or vacuum settings) by the Plumbing Divisions.

Part 2 PRODUCTS

2.1 MATERIALS

.1 Refer to appropriate section of the Electrical Division(s).

2.2 CONTROL RELAYS

.1 Control relays to be rated minimum 10 A, 300V, with contacts as required and 120 V control coil unless otherwise noted. Relays to be typically mounted in CEMA1 enclosures located in control terminal cabinets and/or MCC.

.2 Provide required fire alarm relays and auxiliary contacts in motor control centres or at the related equipment cabinets to provide activation and deactivation of mechanical fan units as specified in the Mechanical Division.

.3 Relays for Fire Alarm shutdown system control to be approved for Fire Alarm use and powered from the Fire Alarm panel. Fire Alarm relay enclosures to be finished in red and identified “FIRE ALARM RELAY”

.4 Time delay relays to incorporate time delay feature to delay either opening or closing as specified. Time period to be adjustable from 0 to 5 minutes unless otherwise specified.

Part 3 EXECUTION

3.1 INSTALLATION

.1 Provide all labour and materials required to complete power wiring for HVAC, Plumbing and Fire Protection equipment as called for in the project specifications and/or shown on the drawings.

.2 Provide all single and 3 phase motor protection switches, combination starters and disconnects contactors and relays as required for mechanical equipment unless otherwise specifically noted in these specifications or on the drawings.

.3 Terminate all line voltage wiring to the designated equipment terminals.

.4 Obtain a full set of HVAC control shop drawings and have a full understanding of the scope before commencing installation and including any fire alarm interface.

.5 Verify the recommended overcurrent protection and rating of Mechanical and Plumbing and Fire Protection equipment and equipment supplied by the Owner. Change feeder overcurrent protection as required to comply with equipment recommendations. Notify the Consultant of all revisions.

3.2 CONNECTIONS

.1 Piping Connections

.2 Duct Connections

.3 Electrical Connections

.4 Control Connections

3.3 FIELD QUALITY CONTROL

.1 Cooperate with Mechanical Consultant and Contractor and check out the operation of all motor controls with all HVAC systems fully operational. Record all electrical loads. Replace any defective or wrongly sized starter overloads, heaters, fuses or circuit breakers.

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REFERENCES

.1 CAN/CSA C22.1-09, Canadian Electrical Code, Part I.

.2 CAN/CSA C22.2 No.9.0, General Requirements for Luminaires.

.3 Canadian Standards Association C22.2 No. 250.0-08 / (c/CSA/us) ANSI/UL Standard 1598, 3rd Edition - Luminaires.

.4 Canadian Standards Association C22.2 No 250,13-12, (c/CSA/us) 1st Edition - Light Emitting Diode (LED) Equipment for Lighting applications.

1.2 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 Closeout Submittals

.4 LEED Submittals

.5 Operation and Maintenance Materials

.6 Record Documents

.7 Submit shop drawings and product data in accordance with Section 26 05 00.

.8 Where available, shop drawings to include LM-79/80 and TM-21 test data.

.9 Product Data: Manufacturer's data sheets on each product to be used, including:

- .1 Canadian Underwriters' Laboratories labeling.
- .2 Canadian Standards Association labeling.
- .3 Product Data including Wattage, lumen output, CRI, driver type, etc.

.10 Fixture Schedule: Manufacturer's standard fixture schedule, coordinated with project requirements and the fixture schedule on the Drawings.

.11 Sample Luminaires: Full size unit of each fixture type indicated in schedule, including lamps, drivers and supports.

.12 Operation and Maintenance Data: For each fixture and component, including lamps and drivers.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Allow for time for on-site mock-up, specifically of wall wash and ceiling wash adjustable luminaires. A single luminaire will be installed in each area and aimed to confirm exact installation details prior to installing remaining luminaires. Notify consultant 1 week prior to on-site mock up of luminaires.

1.4 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.5 RELATED SECTIONS

.1 Section 26 05 00 - Common Work Results for Electrical.

.2 Section 26 09 43 - Network Lighting Controls.

1.6 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.7 GREEN INITIATIVES AND LEED™ CERTIFCATION

.1 The intent is to follow and comply with green initiatives and LEED certification. Refer to Division 01 “LEED Certification” for additional requirements. Comply with the requirements and assist in achieving the goals and the LEED certification for the work.

.2 All exterior luminaires to have BUG ratings as indicated on luminaire schedule to comply with LEED v4 Light Pollution reduction requirements for lighting zone LZ2. Maximum BUG ratings for exterior luminaires are:

.1 Maximum Uplight Rating: U2

.2 Maximum Backlight Rating:

.1 > 2 mounting heights from lighting boundary: B4

.2 1 to 2 mounting heights from lighting boundary: B3

.3 to 1 mounting height to lighting boundary: B2

.1 mounting height to lighting boundary: B0

.3 Maximum Glare Rating:

.1 > 2 mounting heights from lighting boundary: G2

.2 1 to 2 mounting heights from lighting boundary: G1

.3 to 1 mounting height to lighting boundary: G0

.4 mounting height to lighting boundary: G0

.5 All other luminaires: G2

.3 All exterior lighting is to be IDA dark sky compliant, unless indicated as exempt on drawings and luminaire schedule.

.4 There shall be no light trespass from the building and site. Luminaries to improve night sky access and reduce impact on nocturnal environments.

.1 All exterior luminaries with more than 1000 initial Lamp Lumens are shielded and all luminaries with more than 3500 initial Lamp Lumens meet the full cut-off IESNA classification.

.2 The maximum candela value of all interior lighting shall fall within the building (not out through windows) and the maximum candela value of all exterior lighting shall fall within the property.

.3 Any luminaire within a distance of 2.5 times its mounting height from the property boundary shall have shielding such that no light from that luminaire crossed the property boundary.

1.8 BC HYDRO POWER SMART – HIGH PERFORMANCE BUILDING PROGRAM

.1 The high performance application is an integral part of the project scope. The Contractor cooperation on the submission process is a requirement for substantial completion.

.2 The Contractor shall not order or purchase the luminaries until the application has been reviewed and approved by BC Hydro. When the application is approved the Contractor can purchase and install the lighting as indicated in the contract documents.

.3 As part of the application the Contractor shall submit copies of invoices for all lighting equipment. The invoice shall clearly indicated quantities, luminaire symbols and description of luminaries purchased to correspond with luminaire schedule.

1.9 SAMPLE LUMINAIRES

.1 Submit sample luminaires for review prior to manufacturing where indicated on luminaire schedule.

.2 Sample luminaires to be operable and complete with lamps, accessories and a plug-in power cord.

.3 Deliver samples to the Consultants office or to another location as directed.

1.10 JOB MOCK UP

.1 Allow for time for on-site mock-up, specifically of wall wash and ceiling wash adjustable luminaires. A single luminaire will be installed in each area and aimed to confirm exact installation details prior to installing remaining luminaires. Notify consultant 2 weeks prior to on-site mock up of luminaires.

1.11 PROJECT CONDITIONS

.1 Coordinate locations of lighting fixtures with ceilings, ceiling mounted components, fire protection and mechanical components, and partitions.

.2 Maintain environmental conditions within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.

1.12 INTENT

.1 Provide lighting luminaires and accessories for all locations as listed in the Luminaire Schedule and as shown on drawings.

.2 Lighting luminaires shall be structurally well designed and constructed, using new parts and materials of the high quality commercial grade.

.3 Ground all lighting equipment to grounding system.

.4 Verify all ceiling types and finishes before ordering luminaires and provide luminaires suitable for mounting in or on ceilings being installed in each area, as specified. Where luminaire types specified are not suitable for ceiling being installed, obtain written instructions from the Consultant before ordering luminaires.

.5 Luminaires of the same or similar type shall be supplied by the same manufacturer.

1.13 ADDITION OF ACCEPTABLE MANUFACTURERS

.1 Refer to Section 26 05 00 and as noted below.

.2 Material/products considered to satisfy the specification, but of a manufacturer other than those named may be submitted to the Consultant for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.

.3 Alternate approvals will be given by written addendum only. No other substitution will be permitted after closing of tenders.

.4 Alternate approvals granted before the closing of tenders will be limited to a manufacturer's system and/or series only. This limited approval will not preclude substitute equipment/material from complying with specific features included with equipment/material specified. Determine that the alternate product meets the specification intent before basing a tender on the product

PART 2 PRODUCTS

2.1 LUMINAIRES

.1 Provide lighting fixtures as identified in project luminaire schedule and in compliance with drawings. Provide luminaires and accessories, complete and ready for service, in compliance with relevant CSA and ULc Standards.

.2 Clearly mark fixtures, in locations not visible after installation, with manufacturer's name and catalog number, voltage, acceptable lamp type, and maximum wattage.

.3 Luminaires to be ULc listed for the intended application.

.1 Fixtures in outdoor locations exposed directly to weather to be listed for wet locations.

.2 Fixtures in soffits and other protected outdoor locations, and fixtures exposed to water and extreme humidity indoor to be listed for damp locations.

.4 All luminaires and lighting design installations shall include easy access to the luminaire and driver for maintenance or replacement of the driver or luminaire in its entirety.

.5 Luminaire RFI/EMI Emissions and Operations

.1 Lighting system operations shall not compromise the operations of any Communication or Control System.

.6 Recessed downlight luminaires shall be of the approved prewired type with junction box forming an integral part of the luminaire assembly and so located in relation to the luminaire that the junction box is CSA approved for 60 degree C wire. The electrical trade shall supply and install all necessary plaster rings, supports, etc., required for complete and proper installation.

.7 Except where otherwise noted in the Luminaire Schedule, depth of recessed linear and troffer luminaires shall not exceed 150 mm, including mounting yokes, or bridges and the distance from the back face of the diffuser or lens to the centre of the lamp shall be not less than 75 mm. Design of reflector and lamp position shall be to provide high efficiency, uniform brightness and shall not have visible lamp lines unless otherwise specified.

.8 Recessed troffers luminaires shall be constructed of not less than code gauge steel or equivalent quality aluminium. All metal parts shall be thoroughly cleaned and finished in high reflectance baked white enamel over corrosion-resistant primer or equivalent. Reflecting surfaces and exposed surface

shall have not less than two coats of baked white enamel or equivalent finishing with reflectance of not less than 85%.

.9 All luminaire diffusers, lens panels, lens frames, etc., shall be securely and adequately supported.

.10 Luminaires shall incorporate adequate gasketing, stops and barriers to form light traps and prevent light leaks.

.11 Luminaires shall be designed for adequate dissipation of driver and lamp heat to avoid short life, nuisance thermal tripping and decreased lumen output. Heat test reports by independent laboratories shall be provided where required by the Consultant.

.12 Construction of all luminaires shall be such as to provide a rigid well aligned luminaire. Formed or ribbed backplates, end plates, reinforcing channel, straps, etc., shall be used where required to accomplish this.

.13 The construction and performance of all luminaires shall be subject to the acceptance of the Consultant. Full photometric data from an independent testing laboratory shall be provided when requested by the Electrical Consultant.

.14 Incandescent/Fluorescent luminaires with retro-fit LED lamps are not acceptable.

.15 LED tape light is to be installed in extruded aluminum channel. No LED tape should be mounted directly to building structure or finishes. Provide aluminum extruded channel and frosted acrylic lens (to minimize projected lamp image), complete with mounting clips for all LED tape light. Provide all wiring, adequately sized power supplies and control interfaces as required for a fully functioning lighting system.

.16 All LED product to meet the following minimum specifications:

.1 General: Color Rendition – CRI > 80

.2 Patient Care Areas: Color Rendition – CRI > 90

.3 Efficacy – Minimum 100 LPW for linear luminaires, Min 65 LPW for all other luminaires over 5W. No minimum requirement for luminaires 5W or less.

.4 Lamp Life – Minimum 50,000 HR L70 lamp life.

2.2 DRIVERS

.1 Drivers intended for indoor use shall have a rating of IP20.

.2 Drivers intended for outdoor use shall have a rating of IP67 and be suitable for installation and use in temperatures down to -35C.

.3 Dimming performance:

.1 1-10V Drivers to achieve a range from 10-100% dimming. Electrical contractor to confirm dimmer and driver compatibility to ensure specified dimming range is achieved.

.2 DALI Drivers to achieve range from 1%-100%

.4 Class 2 per UL1310

.5 Power Factor Correction >0.9.

.6 Must be cUL Listed.

.7 Provide DALI addressable drivers for all luminaires where available. For low voltage light sources provide DALI controlled dimming power supplies. For luminaires not available with a DALI driver, provide DALI Digital to Analogue converter (DAC Module) for interface with the LCS.

PART 3 EXECUTION

3.1 INSTALLATION AND SUPPORTS

.1 Provide complete and proper support for all luminaires, luminaire hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and luminaire hanger assemblies.

.2 Support luminaires as shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted luminaire housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.

.3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.

.4 Self aligning seismically rated ball joint hangers shall be used for rod suspended luminaires. Ceiling canopies or hood assemblies intended to cover the suspension attachments shall be installed to fit tightly to the ceiling without restricting the alignment of the hanger. Support luminaires by hangers and mounting arrangements which will not cause the luminaire frame, housing, sides or lens frame to be distorted; or prevent complete alignment of several luminaires in a row.

.5 The suspension length of all ceiling mounted suspended types of lighting luminaires as listed in the Luminaire Schedule or annotated drawings shall be the overall length from the ceiling to the lowest point of the luminaire body, reflector or glassware in its hanging position. Mounting heights listed as AFF to be above finished floor to the center point of the luminaire.

.6 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems.

.7 Where luminaires are surface mounted on the underside of an inverted tee bar ceiling, the luminaire shall be supported either directly from the building structure by means of rod hangers and inserts or by means of metal angle headers, supported from the tee bar framing structure above the tile. Luminaires shall be supported from the quarter points.

.8 Wiring from outlet boxes to luminaires and wiring through luminaire channels shall be rated for 90 degrees C.

.9 All recessed luminaires to be installed so that they are removable from below to gain access to outlet box or prewired luminaire box. Connect all recessed luminaires to boxes with flexible conduit and approved luminaire wire. Provide approved drywall enclosures in insulated ceilings. Volume of enclosure to comply with Electrical Code.

.10 Install luminaire lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Consultant.

.11 Where drivers and power supplies are to be remotely located, they shall be racked together and labelled with size 3 lamicoid. Label shall bear the driver number which has a corresponding location on an adjacent floor plan reference drawing. Labels and floor plans shall be provided by electrical contractor.

.12 For LED tape light luminaires, allow for all labour associated installation of pre-cut and wired sections into extruded aluminum channel, installation of lens, mounting, adjustment and aiming of luminaire, as well as all power supplies, control devices and associated 120V and low voltage DC wiring.

3.2 CONNECTIONS

.1 Piping Connections

.2 Duct Connections

.3 Electrical Connections

.4 Control Connections

END OF SECTION

PART 1 GENERAL

1.1 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 Closeout Submittals

.4 LEED Submittals

.5 Operation and Maintenance Materials

.6 Record Documents

1.2 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00.

.2 Shop drawings to include a load schedule on each battery pack and spare capacity.

1.5 GUARANTEE

.1 Provide a written guarantee, stating that the battery for emergency lighting is guaranteed against defects in material and workmanship for a period of ten years, with a no-charge replacement during the first five years and a pro-rate charge on the second five years, from the date of the Final Certificate of Completion.

PART 2 PRODUCTS

2.1 BATTERY UNIT EQUIPMENT

.1 Unit equipment for emergency lighting: to CSA C22.2 No.141.

.2 LED adjustable heads (two per battery unit).

.3 Decorative and vandal resistant.

.4 Supply voltage: 120 Vac.

.5 Output Voltage: 12Vdc

.6 Operating time: 2 hours including remote heads.

.7 No maintenance sealed Nickel Cadmium battery.

.8 18m of emergency egress path coverage.

.9 -30°C to 50°C temperature range

.10 Nominal size – 200 watt, or as indicated on drawings.

.11 Battery: No maintenance sealed Nickel Cadmium battery..

.12 Charger: solid state, multi-rate, voltage/current regulated, inverse temperature compensated, short circuit protected, modular constructed.

.13 Solid state transfer.

.14 Low voltage disconnect: solid state, modular, operates at 80% battery output voltage.

.15 Signal lights: solid state, life expectancy 100,000 h minimum, for 'AC Power ON' and 'High Charge'.

.16 Cabinet: suitable for direct or shelf mounting to wall and c/w knockouts for conduit. Provide shelf mounting brackets.

.17 Provide integral self diagnostic testing feature which exercises the unit every 30days.

.18 Auxiliary equipment:

- .1 Test switch.
- .2 Time delay relay.
- .3 Shelf bracket.
- .4 Cord and plug connection for ac.
- .5 Double LED fixtures integral or mounted on unit where noted on plans.

.19 Standard of Acceptance:

- .1 Aimlite EBST
- .2 ABB Ready-Lite LDX
- .3 Beghelli EST
- .4 Approved Equal Alternate

2.2 REMOTE LAMP HEADS

.1 LED lamps.

.2 12V DC operation.

.3 3W LED.

.4 360 degree adjustable rotation without tools.

.5 Decorative vandal-resistant frosted cube fixtures (double head) in high risk areas or where indicated.

.6 Remote lamps to match lamps on battery units and to be of same manufacturer and product series.

- .1 Aimlite RMSM
- .2 ABB Ready-Lite RP-BLD
- .3 Beghelli BRW
- .4 Approved Equal Alternate

2.3 WIRING FOR REMOTE EQUIPMENT

.1 Conduit to Section 26 05 34

.2 Wiring 12V battery standby circuits to all EXIT signs and remote heads.

.3 Low voltage wiring to be installed so that the maximum volt drop does not exceed 5%. The following wiring/load sizes shall not be exceeded for the 12-volt system:

.1 #8 AWG not to exceed 6500 watt feet per run.

.2 #10 AWG not to exceed 4000 watt feet per run (minimum size).

2.4 RELAY EQUIPMENT

.1 Provide 120V relays to control battery packs as required by BC Building code to operate in the event of power failure to the related area lighting circuits.

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install unit equipment for emergency lighting in accordance with CSA C22.1, Section 46.

.2 Install unit equipment and remote mounted fixtures as indicated.

.3 Direct heads as indicated.

.4 Provide a junction box adjacent to the battery pack for the purpose of splicing the separate wiring runs together.

.5 Provide direct connection from battery units for all exit signs in the CUP building and Tunnels.

3.2 CONNECTIONS

.1 Piping Connections

.2 Duct Connections

.3 Electrical Connections

.4 Control Connections

END OF SECTION

PART 1 GENERAL

1.1 GENERAL REFERENCES

.1 Canadian Standards Association:

.1 CSA C22.2 No. 141, Unit Equipment for Emergency Lighting.

.2 CSA C860, Performance of Internally-Lighted Exit Signs.

.2 BC Building Code, Part 3, Section 3.4.5

1.2 SUBMITTALS

.1 Action Submittals

.2 Informational Submittals

.3 Closeout Submittals

.4 LEED Submittals

.5 Operation and Maintenance Materials

.6 Record Documents

1.3 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.4 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00.

PART 2 PRODUCTS

2.1 SCHEDULE

.1 Refer to drawings for location and types. Provide directional arrows as indicated.

2.2 EXIT SIGNS GENERAL

.1 Green running man EXIT sign.

.2 Universal mounting.

.3 Wall, end, or ceiling mounted as shown on drawings.

.4 Single or double-faced as indicated

.5 Light Emitting Diode (LED) light source for 120 volt operation.

.6 Provide 12VDC standby lamps/system and connection points to accommodate standby power from an external 12VDC source.

.7 Faceplate and housing to have no visible unused knockouts.

.8 Provide weatherproof exit signs for all exterior installations.

.9 CSA 860-01 approved.

2.3 THIN PROFILE STEEL EXIT SIGNS

.1 Baked enamel steel faceplate, housing and canopy.

.2 Nominal 25mm 1” deep (thin profile).

.3 Faceplate c/w "hidden" universal knock-outs.

.4 Matte white finish or as indicated.

.5 Rounded corners.

.6 Standard of acceptance:

.1 Ready-series

.2 Uniglo series

.3 Emergi-lite series

.4 Pre-approved equivalent.

2.4 THIN PROFILE EXTRUDED ALUMINUM EXIT SIGNS

.1 Extruded aluminum faceplate, housing and canopy.

.2 Nominal 25mm 1” deep (thin profile).

.3 Brushed finish on faceplate c/w "hidden" universal knock-outs.

.4 Standard finish or as indicated.

.5 Rounded corners.

.6 Standard of acceptance:

.1 Ready-Lite RX 5000 series

.2 Uniglo 300 series

.3 Emergi-lite LPEX50 series

.4 Pre-approved equivalent.

2.5 THIN PROFILE EXTRUDED ALUMINUM EXIT SIGNS – PICTOGRAM TYPE

.1 Extruded aluminum faceplate, housing and canopy.

.2 Nominal 25mm 1” deep (thin profile).

.3 Brushed finish on faceplate c/w "hidden" universal knock-outs.

.4 Standard finish or as indicated.

.5 Rounded corners.

.6 Standard of acceptance:

.1 Ready-Lite RA series

.2 Emergi-lite EA series

.3 Pre approved equivalent.

2.6 THIN PROFILE HIGH IMPACT PLASTIC EXIT SIGNS

.1 High Impact plastic faceplate, housing and canopy.

.2 Nominal 25mm 1” deep (thin profile).

.3 Faceplate c/w "hidden" universal knock-outs.

.4 Matte white finish or as indicated.

.5 Rounded corners.

.6 Standard of acceptance:

.1 Ready-Lite series

.2 Uniglo series

.3 Emergi-lite series

.4 Pre approved equivalent.

2.7 EDGE LIT EXIT SIGNS

.1 Extruded aluminum cylindrical housing and canopy.

.2 White baked powder coat finish or as indicated.

.3 High clarity solid acrylic faceplate.

.4 Field removable directional chevron arrows.

.5 Universal mounting (ceiling, wall, end).

.6 Rounded corners.

.7 Standard of acceptance:

.1 Beghelli Ottica series,

.2 Pre approved equivalent.

2.8 SELF POWERED EXIT SIGNS

.1 Exit sign unit(s) to be complete with self contained battery system to maintain illumination during a mains power failure.

.2 Sealed maintenance free batteries.

.3 Recharge time 24 hours.

.4 Solid state charger and transfer technology (no relay contacts)

.5 Status LED to indicate “AC on”

.6 Push button test switch.

.7 Operating time for minimum as required by Building Code. 2hr} 1h

PART 3 EXECUTION

3.1 INSTALLATION

.1 Install Exit Signs as indicated.

.2 Connect Exit Signs to dedicated circuits and breakers as required by the Canadian Electrical Code.

.3 Provide circuit breaker locks for Exit Sign circuits.

.4 Power to exit lights to be sourced from emergency power were available.

.5 Provide at least one Exit Sign circuit for each floor level except as noted.

.6 All Exit Sign wiring to be installed in separate conduit and boxes.

.7 All conductors to be minimum #12 AWG with RW90 X-link insulation.

.8 Provide Exit Sign 12VDC standby lighting and separate connection points where standby emergency lighting battery packs are used for the emergency lighting. For remote connections low voltage cable sizing refer to the battery systems specification section.

.9 Support Exit Signs from ceiling tile in tee bar installation locations so as to provide a flush/neat installation and minimize tile lift.

.10 Provide approved support hardware to the tee bar rail assembly to minimize tile stress and provide independent seismic cable(s) restraint from building structure.

.11 Wall mounted exit lights to be mounted 2290mm 7’ 6” to underside or as detailed.

.12 Ceiling mounted exit lights in all service spaces to be suspended to 2290mm 7’ 6” to the underside.

3.2 CONNECTIONS

.1 Piping Connections

.2 Duct Connections

.3 Electrical Connections

.4 Control Connections

END OF SECTION