

INVITATION TO BID

Tenders marked Haida Gwaii Pharmacy Renovation Project - project No. N672430003 will be received electronically through bids&tenders, up to **3:00 pm local time on April 4th, 2025.**

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 bids&tenders to receive notification of Addenda.

The work to be undertaken generally includes the following:

1. Interior alterations to existing pharmacy compounding suite to suit NAPRA standards:
 - a. Mechanical ventilation and plumbing upgrades
 - b. Electrical power and lighting upgrades
 - c. Architectural interior upgrades

A virtual site visit will be held on Tuesday, March 18th to review the project. A power point presentation will be presented. Attendance will be optional, but all interested bidders will be required to confirm viewing of the meeting recording which will be made available in an addendum. Contractors that are attending the Teams conference call are to confirm their attendance to Jay.Dupras@northernhealth.ca by 2:00 pm on March 12th. Registered contractors will then be sent the meeting invite.

An optional in-person site visit will be held on Tuesday, March 25th. Contractors that would like to attend the optional in-person walk through are to confirm their attendance to Jay.Dupras@northernhealth.ca by 2:00 pm on March 19th.

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&tenders.



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.

All inquiries should be submitted on bids&tenders.



HAIDA GWAI PHARMACY RENOVATION PROJECT

3209 Oceanview Drive, Daajing Giids BC, V0T 1S0

KRA Project No: 2024-025

SPECIFICATION – ISSUED FOR TENDER

March 03, 2025

PROJECT Haida Gwaii Pharmacy Renovation Project
ADDRESS 3209 Oceanview Drive, Daajing Giids, BC V0T 1S0
KRA PROJECT NO. 2024-025
LEGAL DESCRIPTION Parcel A; Block 5; District Lot 15; District Plan 934A
AUTHORITY HAVING JURISDICTION Village of Queen Charlotte
PO Box 580, 903A Oceanview Drive
Daajing Giids, BC V0T 1S0
Tel: 250-559-4765

CLIENT ("OWNER") Northern Health Authority

Contact: Jay Dupras, Project Manager
Email: jay.dupras@northernhealthn.ca

CONSULTANTS

Architect / Prime Consultant KRA (Kirsten Reite Architecture)
939 East Hastings Street
Vancouver, BC V6A 0H1

Contact: James Madley
Email: james@krarchitecture.ca

Structural Bush Bohlman and Partners LLP
Suite 1550, 1500 West Georgia Street
Vancouver, BC V6G 2Z6

Contact: Brett Halicki, P.Eng
Email: bhalicki@bushbohlman.com

Mechanical Rocky Point Engineering
211 East Georgia Street, #102
Vancouver, BC V6A 1Z6

Contact: Stuart Adamson, P.Eng
Email: stuart.adamson@rpeng.ca

Electrical AtkinsRealis
745 Thurlow Street, #1100
Vancouver, BC V6E 0C5

Contact: Eduardo Cabrera
Email: Eduardo.cabrera@atkinsrealis.com

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Part 1.1: DIVISION 00 **Procurement and Contracting Requirements**

For use with CCDC 2-2020 Stipulated Price Contract

00 11 13 - ADVERTISEMENT FOR BIDS

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1. BID CALL

- .1 Northern Health Authority
will receive bids for this *Project* on or before 15:00 (PST) on April 4th, 2025
(unless modified by addendum) at:

☒ .1a

☐ .1b BC Bid

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

~~.3 ☒ 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.~~

- .4 Bid Opening Process:

Bids will be opened privately, immediately after the time for receipts of Bids.

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- .5 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

- .1 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:

BC Bid

- ~~.2 ☒ 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 :~~

3. PROJECT DESCRIPTION

Interior alterations to existing pharmacy suite and exterior works to suit NAPRA standards.

END OF SECTION

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00 21 13 INSTRUCTIONS TO BIDDERS

1. DOCUMENTS

1.1 DOCUMENTS

- .1 Carefully examine the following information. Failure to follow these instructions may result in bid disqualification.
- .2 Project information:
 - .1 Project / Contract Name: Haida Gwaii Pharmacy Renovation Project
 - .2 Project / Contract No.: NHA: N671370001; KRA: 2024-025
 - .3 Owner: Northern Health Authority
 - .4 Project Address: 3209 Oceanview Drive
Daajing Giids, BC
VOT 1S0
- .3 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) BCDC 2 - 2022, Part 1.1 Division 00 11 13 Advertisement for Bids;
- (b) BCDC 2 - 2022, Part 1.1 Division 00 21 13 Instructions to Bidders; 00 73 16 Insurance Requirements; 00 73 63 Contract Security Requirements;
- (c) BCDC 2 - 2022, Part 1.1 Division 00 41 13 Bid Form and Appendices;
- (d) CCDC 2 - 2020, Articles of Agreement;
- (e) CCDC 2 - 2020, General Conditions;
- (f) BCDC 2 – 2022, Part 1.2 Supplementary Conditions;
- (g) BCDC 2 – 2022, Part 1.3 Project Specific Amendments, if any;
- (h) General Requirements;
- (i) Drawings and Specifications;
- (j) Appendices, if any;
- (k) Addenda.

1.3 CONTRACT DOCUMENTS

- .1 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:

Jay Dupras
Project Manager, Northern Health Authority
Telephone: 250-617-3805
E-mail: Jay.Dupras@northernhealth.ca

- .2 Submit inquiries as early as possible in the bid period and not less than 7 Working Days before the bid closing time. Inquiries received after this time may not receive a response.

3. PRE-BID SITE VISIT

☒ .1 ~~There will not be a pre-bid site visit for the Project.~~

☐ .2 There will be pre-bid site visit for the Project.

☒ ~~2.1 Mandatory Site Visit~~

~~Failure of a Bidder's representative to attend and sign the attendance sheet will cause the Bid to be rejected as non-compliant.~~

☐ 2.2 Optional Site Visit

A pre-bid site visit has been scheduled for 10:00 local time on March 18th and 25th, 2025. Attendees will meet at

Virtual Site Visit on Tuesday, March 18th: Teams conference call for opportunity to review the project. A power point presentation will be presented. Attendance will be optional, but all interested bidders will be required to confirm viewing of the meeting recording which will be made available in an addendum.

Optional in-person site visit on Tuesday, March 25th: Main Entrance of the existing Hospital.

Bidders will be required to sign an attendance sheet during the meeting. 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

Contractors that are attending the Teams conference call are to confirm their attendance to Jay.Dupras@northernhealth.ca by 2:00 pm on March 12th. Registered contractors will then be sent the meeting invite.

Contractors that would like to attend the optional in-person walk through are to confirm their attendance to Jay.Dupras@northernhealth.ca by 2:00 pm on March 19th.

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4. PARTICULARS AFFECTING BID PRICE

4.1 MATERIALS

- .1 Establish the Bid Price based on the use of materials specified in Drawings and Specifications.
- .2 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 7 Working Days before the bid closing date.
- .3 Approved substitutions will be incorporated in the Drawings and Specifications by issuance of an Addendum.

4.2 CONDITIONS RELATED TO THE WORK

- .1 Become familiar with the site and existing conditions prior to submitting a bid and make allowances for conditions related to the Work.
- .2 Claims for an increase in Contract Price or Contract Time arising from observable conditions will be rejected by the *Owner*.

4.3 TAXES

- .1 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

- .1 Addenda may be issued to modify the Bid Documents in response to Bidder inquiries or as may be considered necessary.
- .2 All addenda issued during the bid period will become part of the Bid Documents.
- .3 No addenda will be issued later than 3 Working Days before the bid closing time, unless absolutely necessary.
- .4 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. 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. 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.



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.~~

☐ ~~2a. 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: ONLINE BIDDING SYSTEM SUBMISSIONS

8E. COMPLETION OF BID FORM

- .1 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.
- .2 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.
- .3 If required, state the number of weeks within which the Bidder will achieve *Ready-for-Takeover*.
- .4 If required, indicate receipt of Addenda.

9E. EXECUTION OF THE BID

- .1 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

- .1 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.
- .2 The time as indicated on the On-line Bidding System will be the official time for the On-line Bidding System closing.
- .3 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.
- .4 Bid documents become the property of the *Owner*.

11E. BID MODIFICATION AND WITHDRAWAL

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

12E. BID SECURITY REQUIREMENTS

- .1 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.
- .2 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.
- .3 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*.



- .4 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.
- .5 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.

00 21 13 (con't) INSTRUCTION TO BIDDERS

13. BID ACCEPTANCE

- .1 The lowest or any bid will not necessarily be accepted.
- .2 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.
- .3 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.
- .4 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.
- .5 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.
- .6 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.
- .7 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

- .1 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.
- .2 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.
- .3 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.



15. WORKSAFE BC LETTER

- .1 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



00 41 13 BID FORM - STIPULATED PRICE

Project/Contract: Haida Gwaii Pharmacy Renovation Project

Project/Contract No.: NHA: N671370001; KRA: 2024-025

From (Bidder): _____
company name

street address or postal box number city/town

province and postal code

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

Bidders Email _____

To (Owner): Northern Health Authority

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/or 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. We have arrived at this bid without collusion with any competitor,

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

d. 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: Haida Gwaii Pharmacy Renovation Project

Project/Contract No.: NHA: N671370001; KRA: 2024-025

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:

☐ <u>Item of Work</u>	<u>Name of Subcontractor</u>
1. [_____]	[_____]
2. [_____]	[_____]
3. [_____]	[_____]
4. [_____]	[_____]
5. [_____]	[_____]

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

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

All parties should refer to the BCDC Guide.

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☑ **Appendix 'B' – ALTERNATIVE PRICES**

Project/Contract: Haida Gwaii Pharmacy Renovation Project

Project/Contract No.: NHA: N671370001; KRA: 2024-025

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

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

Effect on Bid Price

<u>Description of Alternative</u>	<u>Add</u>	<u>Deduct</u>	<u>Change to Listed Subcontractor</u> (if applicable)

Alternate Price No. 1 _____

N/A

	\$ _____	\$ _____
	_____	_____
Time (in Days)	_____	_____

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Alternate Price No. 2 _____

N/A _____

_____ \$ _____ \$ _____

_____ Time (in Days) _____

Alternate Price No. 3 _____

N/A _____

_____ \$ _____ \$ _____

_____ Time (in Days) _____

Alternate Price No. 4 _____

N/A _____

_____ \$ _____ \$ _____

_____ Time (in Days) _____

Alternate Price No. 5 _____

N/A _____

_____ \$ _____ \$ _____

_____ Time (in Days) _____

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□ **Appendix 'D' – LIST OF CASH ALLOWANCES**

Project/Contract: Haida Gwaii Pharmacy Renovation Project

Project/Contract No.: NHA: N671370001; KRA: 2024-025

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.

<u>Description of Cash Allowance</u>	<u>Amount \$</u>

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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: Haida Gwaii Pharmacy Renovation Project

Project/Contract No.: NHA: N671370001; KRA: 2024-025

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.

<u>Item of Work</u>	<u>Itemized Price</u>
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	
N/A	

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Appendix 'F' - BID MODIFICATION

(To be used where required)

Project/Contract: Haida Gwaii Pharmacy Renovation Project

Project/Contract No.: NHA: N671370001; KRA: 2024-025

Owner: Northern Health Authority

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

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

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

Reset



AMENDMENT TO SCHEDULE

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

Add _____ calendar days/weeks; Subtract _____ calendar days/weeks.
*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

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 Work

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 *Contractor* 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 *Owner* 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 of any 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.



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".

2.3.4 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

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



PART 4 ALLOWANCES

GC 4.1 CASH ALLOWANCES

- 4.1.2 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*.



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 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.



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:

- 6.5.7 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 *Contractor* 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.



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:

10.2.8 The *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.



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.



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



00 73 63 CONTRACT SECURITY REQUIREMENTS

PERFORMANCE BONDS AND LABOUR AND MATERIAL PAYMENT BONDS

- .1 The successful Bidder agrees to:
 - .1 Provide a Performance Bond and a Labour and Material Payment Bond each in the amount of fifty percent (50%) of the Contract Price.
 - .2 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.
 - .3 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*.
 - .4 Include bonding costs in the Bid Price.
 - .5 Ensure the obligee on the bonds is the *Owner*.

END OF SECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Documents.
- .2 Associated requirements.
- .3 Work expectations.
- .4 Work by other parties.
- .5 Premises usage.

1.2 RELATED REQUIREMENTS

- .1 Section 01 19 00 - Specifications and Documents.
- .2 Section 01 21 00 - Allowances.
- .3 Section 01 78 00 - Closeout Submittals.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DESCRIPTION OF THE WORK

- .1 Work of this Contract comprises of the renovation of the Pharmacy within an existing building, located at 3209 Oceanview Drive, Daajing Giids, BC; and identified as Haida Gwaii Pharmacy Renovation Project.
- .2 Project description:
 - .1 Minor interior alterations to existing Pharmacy suite to suit NAPRA standards.
- .3 Division of the Work among Subcontractors is solely the Contractor's responsibility. Neither the Owner nor Consultant assumes any responsibility to act as an arbiter to establish subcontract terms between sectors or disciplines of work.
- .4 The Hospital will be operational during regular business hours. The welfare of Staff, Patients and Visitors, and preservation of Hospital operations is always a priority. The Contractor must be prepared to stop work if requested by the Owner.
- .5 CSA Z317.13 (current edition) infection control during construction, renovation and maintenance of health care facilities is to be implemented.

1.4 CONTRACT METHOD

- .1 Construct Work under single, stipulated price contract, CCDC 2 2020.
- .2 Relations and responsibilities are between the Contractor and the Owner.
- .3 Provide the required liability insurance and bonds to ensure such specified assurances to the Owner.
- .4 Assigned Subcontractors are required to provide requested bonds covering faithful performance of subcontracted work, to the Owner plus payment of related obligations.
- .5 Refer to Section 01 21 00 for cash allowance amounts applicable to assignable contracts.
- .6 Assume responsibility for assigned contracts as Subcontracts forming part of the Work.
- .7 Contract Documents were prepared by the Consultant for the Owner. Any use which a third party makes of the Contract Documents, or any reliance on or decisions to be made based on them, are the responsibility of such third parties. The Consultant accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions based on the Contract Documents.

- .8 For purposes of reference in these Contract Documents, the term "Contractor" shall mean the party in contract with the Owner.

1.5 DOCUMENTS PROVIDED

- .1 Owner will supply the Contractor with a digital copy and two printed sets of Contract Documents for construction purposes, which includes two (2) printed sets for record "as-built" purposes.
- .2 The Contractor may obtain additional sets of Contract Documents at the cost of printing, handling and shipping.
- .3 An electronic set of documents will be provided near the end of the Project for purposes of transferring changed information recorded on as-built documents to the electronic Record Documents.

1.6 PERFORMANCE OF THE WORK

- .1 Substantial Performance of the Work is required for Owner occupancy before October 31st, 2025.

1.7 READY-FOR-TAKEOVER

- .1 Ready-for-Takeover is required for Owner occupancy before November 14th, 2025.
- .2 Perform all prerequisite activities identified in the General Conditions, including a list of incomplete items, before applying for Ready-for-Takeover.

1.8 WORK SEQUENCE

- .1 Construct Work in phases during the construction period, coordinate construction schedule and operations with Owner and Consultant.
 - .1 Refer to drawings for phasing plans.
- .2 Coordinate Progress Schedule with Owner use during construction.
- .3 Maintain fire access and control of fire protection equipment.

1.9 WORK BY OWNER

- .1 Items noted NIC (Not in Contract), and minor equipment will be supplied and installed prior to occupancy of the space.

1.10 OWNER-SUPPLIED PRODUCTS

- .1 Obtain the necessary Shop Drawings from the Owner and proceed to coordinate details for installation, expedite, receive, unload, install, connect and test the specified equipment, and be responsible for warranty.
- .2 Receive Owner-supplied Products and equipment F.O.B. and store and process Products and equipment until installation.
- .3 Owner Responsibilities:
 - .1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor.
 - .2 Deliver supplier's bill of materials to Contractor.
 - .3 Arrange and pay for delivery to the Place of the Work in accordance with Progress Schedule.
 - .4 Inspect deliveries jointly with Contractor.
 - .5 Submit claims for transportation damage.
 - .6 Arrange for replacement of damaged, defective or missing items.

- .7 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.
- .4 Contractor Responsibilities:
 - .1 Designate submittals and delivery date for each Product in progress schedule.
 - .2 Review shop drawings, product data, samples, and other submittals. Submit to Consultant, notification of any observed discrepancies or problems anticipated due to non-conformance with Contract Documents.
 - .3 Receive and unload Products at site.
 - .4 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.
 - .5 Handle Products at site, including uncrating and storage.
 - .6 Protect Products from damage, and from exposure to elements.
 - .7 Assemble, install, connect, adjust, and finish Products.
 - .8 Arrange for installation inspections required by public authorities.
 - .9 Repair or replace items damaged by Contractor or Subcontractor on site (under their control).

1.11 CONTRACTOR USE OF PREMISES

- .1 Construction Operations: Limited to areas noted on Drawings.
- .2 Contractor's traffic movement, lay-down area for materials and mobilization / storage area for the various components will be agreed with all parties (Contractor, Consultant, and Owner) prior to commencement of the Work. Such use will meet all necessary safety and Worksafe BC regulations.
- .3 Solid and poly hoarding, sticky mats, and air scrubbers will be required.
- .4 Utility Outages and Shutdown: Coordinate with consultant and owner. 4 weeks notice required.

1.12 MATERIAL RECYCLING AND WASTE REDUCTION

- .1 Material recycling is required. Hazardous waste is controlled by the Provincial Government, and transportation of same on some roads is controlled by the Federal Government.
- .2 Material recycling and waste reduction measures should result in the majority of materials being recycled.

1.13 OWNER OCCUPANCY

- .1 Owner will occupy premises during entire construction period for execution of normal operations.
- .2 Cooperate with Owner in scheduling operations to minimize conflict and to facilitate Owner usage.
- .3 Maintain fire and life safety systems and public access to exits during all stages of the Work.

1.14 CASH ALLOWANCE

- .1 See Section 01 21 00 - Allowances.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Connecting to existing services.
- .2 Special scheduling requirements.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 51 00 - Temporary Utilities.
- .3 Section 01 52 00 - Construction Facilities.
- .4 Section 01 53 00 - Temporary Construction.
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Where security is reduced by work provide temporary means to maintain security.
- .3 Existing sanitary facilities may be used by Contractor on agreement with the Owner.
- .4 Closures: protect work temporarily until permanent enclosures are completed.
- .5 Any deliveries/offloading of materials/equipment is to be coordinated through Facilities Maintenance or the NHA Project Manager.

1.4 EXISTING BUILDINGS

- .1 Public spaces and accommodation immediately adjacent and connecting to the Work will be occupied during the Work. As operations progress execute work with least possible interference or disturbance to site operations, building operations and occupants of existing buildings and suites. This includes interferences or disturbances such as:
 - .1 Noise, dust, fumes, vibrations, traffic.

1.5 EXISTING SERVICES

- .1 Notify Owner and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Owner minimum 4 weeks notice for necessary interruption of mechanical or electrical service throughout course of work.
 - .1 Keep duration of interruptions minimum.
 - .2 Perform interruptions after normal working hours of occupants, preferably on weekends.
 - .3 Shutdown request forms are to be submitted to the NHA Project Manager 4 weeks prior to shutdown to allow for adequate coordination.
 - .4 Final dates for shutdowns are at the discretion of FM staff and may be adjusted depending on staffing availability/workload.

1.6 SPECIAL REQUIREMENTS

- .1 Perform most work:
 - .1 From Monday to Friday from 07:00 to 16:00 hours.

- .2 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.
- .3 Noisy work is to be coordinated through Facilities Maintenance and the NHA PM prior to commencing.
 - .1 Comply with municipal by-laws for Noise generating work.
- .2 Submit schedule of special requirements or disruptions in accordance with Section 01 33 00.
- .3 Contractor to provide fire watch during Hot Work and Sprinkler Shut down. Contractor to apply for a Hot Work Permit through FM

1.7 PARKING

- .1 Parking will be permitted on site. Exact location and quantity of parking stalls to be agreed in advance with the Owner.

1.8 SMOKING

- .1 Smoking or vaping is not permitted anywhere within the limits of the site.

1.9 HEALTH & SAFETY MEETING ATTENDANCE

- .1 Mandatory meetings will be held prior to the commencement of physical work on the project. The meeting will be chaired by the Prime Contractor, will include the Owner's representative, representatives from all contracting companies and other affected groups. Sub-contractors must all designate a person as the "Sub-Trade Safety Co-ordinator" (OH&S Reg. 20.3(3b)). This person is responsible for the sub-contractors site health and safety activities. This person must be in full attendance at this meeting and sign off on the Contractor's OH&S document. This document will be completed in full and a completed copy will be provided to each attendee.

1.10 CONTRACTOR ACCESS

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

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Words and terms.
- .2 Complementary documents.
- .3 Precedence of Documents.
- .4 Specification grammar.

1.2 RELATED DOCUMENTS

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

1.3 WORDS AND TERMS

- .1 Conform to definitions and their defined meanings in the Agreement and Definitions portion of CCDC 2 for supplementary words and terms.
- .2 The following words and terms are applicable to the Contract Documents for this project:
- .3 Addendum: A document that amends the Bid Documents during the Bidding Period and becomes part of the Contract Documents when a Contract is executed. (Plural: Addenda).
- .4 Agreement: The signed and sealed legal instrument binding parties in a Contract, describing in strict terms their mutual arrangement, roles and responsibilities, commencement, and completion responsibilities.
- .5 Alternative Price: The amount stipulated by a Bidder for an Alternative and stated as an addition, a deduction, or no change to the Bid Price.
- .6 Bid: To offer as a Bid stating for what price a Contractor will assume a Contract.
- .7 Bid Documents: A set of documents consisting of the Instructions to Bidders, Bid Form, Contract Documents, and other information issued for the benefit of Bidders to prepare and submit a Bid.
- .8 Bid Form: The specific and detailed form used to collect information about a Bid.
- .9 Bidding: The process of preparing and submitting a Bid.
- .10 Construction Documents: The Drawings and Project Manual. When combined with a Contract and Contract conditions, these documents form the Contract Documents.
- .11 Contingency Allowance: An additional monetary amount added to a Project cost estimate and designated to cover unpredictable or unforeseen items of Work. The amount is usually based on some percentage of the estimated cost and expended and adjusted by Change Order. It is not intended to cover additions to the scope of Work.
- .12 Cost Plus Contract: A Contract under which a Contractor is reimbursed for the direct and indirect costs for the performance of a Contract and, in addition, is paid a Fee for services. The Fee is usually stated as a stipulated price or as a percentage of cost.
- .13 General Conditions: That part of the Contract Documents which sets forth many of the rights, responsibilities and relationships of the parties involved in a Contract.
- .14 Instructions To Bidders: Instructions contained in the Bid Documents to convey an Owner's expectations and criteria associated with submitting a Bid.
- .15 Section: A portion of a Project Specification covering one or more segments of the total Work or requirements. Sections are included in a Project manual as required to meet Project requirements.
- .16 Standard: A document describing a grade or a level of quality, which has been established by a recognized agency or organization, utilizing an internal voting process.
- .17 Separate Price: A separate price for work to be added to the base price if selected by the Owner. This price type is not a part of the base bid price.

- .18 Stipulated Price: An amount set forth in a Stipulated Price Contract as the total payment for the performance of the Work. Sometimes referred to as a stipulated sum or a lump sum stipulated price.
- .19 Tender: A term that was formally abandoned by CCDC and the Canadian Construction industry in the early 1980's in favour of the preferred term Bid.
- .20 Unit Price: The amount payable for a single unit of Work as stated in a Schedule of Prices.
- .21 Install: To remove from site storage, move or transport to intended location, install in position, connect to utilities, repair site caused damage, and make ready for use.
- .22 Supply: To acquire or purchase, ship or transport to the site, unload, remove packaging to permit inspection for damage, re-package, replace damaged items, and safely store on-site.

1.4 COMPLEMENTARY DOCUMENTS

- .1 Generally, drawings indicate graphically, the dimensions and location of components and equipment. Specifications indicate specific components, assemblies, and identify quality.
- .2 Drawings, specifications, diagrams and schedules are complementary, each to the other, and what is required by one, to be binding as if required by all.
- .3 Should any conflict or discrepancy appear between documents, which leaves doubt as to the intent or meaning, apply the Precedence of Documents article below or obtain guidance or direction from Consultant.
- .4 Examine all discipline drawings, specifications, schedules, diagrams and related Work to ensure that Work can be satisfactorily executed.
- .5 All specification sections of the Project Manual and Drawings are affected by requirements of Division 01 sections.

1.5 PRECEDENCE OF DOCUMENTS

- .1 In the event of conflict within and between the Contract Documents, the order of priority within specifications and drawings for this project are - from highest to lowest:
 - .1 the Agreement and Definitions between the Owner and the Contractor;
 - .2 the Defined Terms;
 - .3 Supplementary Conditions;
 - .4 the General Conditions;
 - .5 Sections of Division 01 of the specifications;
 - .6 Sections of Divisions 02 through 49 of the specifications.
 - .7 Schedules and Keynotes:
 - .1 Material and finishing schedules within the specifications, then;
 - .2 Material and finishing schedules on drawings, then;
 - .3 Keynotes and definitions thereto, then;
 - .8 Diagrams.
 - .9 Drawings:
 - .1 Drawings of larger scale shall govern over those of smaller scale of the same date, then;
 - .2 Dimensions shown on drawings shall govern over dimensions scaled from drawings, then;
 - .3 Location of utility outlets indicated on architectural detail drawings takes precedence over positions or mounting heights located on mechanical or electrical Drawings.

- .10 Later dated documents shall govern over earlier documents of the same type.
- .2 In the event of conflict between documents, the decision of the Consultant shall be final.

1.6 SPECIFICATION GRAMMAR

- .1 Specifications are written in the imperative (command) mode, in an abbreviated form.
- .2 Imperative language of the technical sections is always directed to the Contractor identified as a primary constructor, as sole executor of the Contract, unless specifically noted otherwise.
 - .1 This form of imperative (command) mode statement requires the primary constructor to perform such action or Work.
 - .2 Perform all requirements of the Contract Documents whether stated imperatively or otherwise.
- .3 Division of the Work among subcontractors, suppliers, or others is solely the prime constructor's responsibility. The Consultant(s) and specification authors assume no responsibility to function or act as an arbiter to establish subcontract scope or limits between sections or divisions of Work.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Cash allowances.

1.2 RELATED REQUIREMENTS

- .1 Section 01 25 00 - Substitution Procedures.
- .2 Section 01 29 00 - Payment Procedures.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 CASH ALLOWANCES

- .1 Costs Included in Cash Allowances: Cost of Product to Contractor less applicable trade discounts; delivery to site, and applicable taxes.
- .2 If a Cash Allowance item described in the Allowances Schedule below indicates the inclusion of installation, include in the Cash Allowance amount, provision for Product handling at the site, including unloading, uncrating, storage, protection of Products from elements and from damage, labour for installation and finishing, insurance, labour costs, taxes, bonding if applicable, equipment rental, overhead and profit.
- .3 If a Cash Allowance item described in the Allowances Schedule below indicates supply only, include in the Contract Price costs not included in Cash Allowances but included in the Contract Price: Product handling at the site including unloading, uncrating, storage, protection of Products from elements and from damage, labour for installation and finishing, insurance, labour costs, taxes, bonding if applicable, equipment rental, overhead and profit.
- .4 Consultant Responsibilities:
 - .1 Consult with Contractor for consideration and selection of Products, suppliers, and installers.
 - .2 Owner and Consultant to select Products.
 - .3 Prepare Change Order.
- .5 Contractor Responsibilities:
 - .1 Assist Consultant in selection of Products, suppliers and installers.
 - .2 Obtain proposals from suppliers and installers and offer recommendations.
 - .3 On notification of selection by Consultant or Owner, execute purchase agreement with designated supplier and installer.
 - .4 Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
 - .5 Promptly inspect Products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.
- .6 Differences in costs will be adjusted by Change Order.
- .7 Allowances Schedule:
 - .1 Cash Allowance 01: Include the stipulated sum of \$15,000.00 for forming new shaft if existing cannot be used.
 - .2 Cash Allowance 02: Include the stipulated sum of \$5,000.00 for firestopping upgrades to existing base building fire rated partitions and doors not able to be identified at time of Tender.
 - .3 Cash Allowance 03: Include the stipulated sum of \$10,000.00 for scanning / x-raying to determine core locations, and any revisions required following this.

- .4 Cash Allowance 04: Include the stipulated sum of \$5,000.00 for new door hardware if existing Anteroom cannot be used.
- .5 Cash Allowance 05: Include the stipulated sum of \$5,000.00 for new hygienic wall protection in HD Clean Room if existing stock cannot be used.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Substitutions.

1.2 RELATED REQUIREMENTS

- .1 Section 01 21 00 - Allowances.
- .2 Section 01 29 00 - Payment Procedures.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SUBSTITUTIONS

- .1 Instructions to Bidders specify time restrictions for submitting requests for Substitutions during the bidding period to requirements specified in this section.
- .2 Consultant will consider requests for Substitutions only within fifteen (15) days after date of established Notice to Proceed.
- .3 Substitutions may be considered when a Product becomes unavailable through no fault of the Contractor.
- .4 Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- .5 A request constitutes a representation that the Contractor:
 - .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.
- .6 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.
- .7 Substitution Submittal Procedure:
 - .1 Submit digital copies 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.

End of Section

PART 1 GENERAL

1.1 INTENT

- .1 Read this Section in conjunction with the conditions governing changes in the Work and valuation of changes in the General Conditions of Contract.

1.2 DEFINITIONS

- .1 "Actual cost of material and labour" as used in the valuation of changes article in the General Conditions of Contract, means the sum of costs directly related to or necessarily and properly incurred by Contractor, Subcontractors and Sub subcontractors in the performance of a change in the Work. Direct costs shall include:
 - .1 Materials cost,
 - .2 total labour cost,
 - .3 travel and subsistence cost,
 - .4 temporary work cost,
 - .5 construction equipment cost,
 - .6 and shall exclude overhead cost and profit.
- .2 "Material cost" means cost of all Materials, including transportation and storage thereof. All rebates, refunds, returns from sale of surplus Materials, and trade discounts other than prompt payment discounts, shall be credited to Minister.
- .3 "Total labour cost" means sum of direct labour cost and payroll burden cost.
- .4 "Direct labour cost" means base wage costs of employees, excluding payroll burden cost.
- .5 "Payroll burden cost" means costs statutory charges and fringe benefit costs additional to direct labour cost and includes unemployment insurance, workers' compensation, vacation pay, statutory holiday pay, health and welfare, pension plan, training fund, and other payroll costs which are hourly wage dependent and are paid by the employer.
- .6 "Travel and subsistence cost" means travel and subsistence costs incurred by employees when working beyond a reasonable commuting distance from their normal place of residence.
- .7 "Temporary work cost" means cost of temporary structures, facilities, services, controls, and other temporary items used in the performance of a Change in the Work, including maintenance, dismantling and removal, less any residual value after dismantling and removal.
- .8 "Construction equipment cost" means the cost of rented or owned equipment, including cost of loading, transportation, unloading, erection, maintenance, dismantling and removal.
- .9 "Overhead cost" means Contractor's, Subcontractors' and Sub-subcontractors' costs related to:
 - .1 operation and maintenance of head offices, branch offices, and site offices,
 - .2 administration at head offices, branch offices, and site offices,
 - .3 general management, legal, audit, and accounting services,
 - .4 buying organization, corporate tax,
 - .5 financing and other bank charges,
 - .6 bonding and insurance,
 - .7 salaries and other compensation of off-site personnel,
 - .8 salaries and other compensation of on-site superintendents and other supervisory personnel,
 - .9 planning, estimating, and scheduling of work,

- .10 expendable and non-expendable small tools, including maintenance thereof,
- .11 recruitment and training of on-site staff, and
- .12 all other costs not defined as direct costs.

1.3 CHANGE ORDER PROCEDURES - LUMP SUM METHOD OF VALUATION

- .1 Consultant will issue a Request for Proposal to Contractor.
- .2 Contractor shall submit a Contractor Proposal stipulating:
 - .1 a lump sum increase, decrease, or no change in the Contract Price, and
 - .2 an increase, decrease, or no change in the Contract Time, on account of the proposed change in the Work.
- .3 Include in Contractor Proposal a detailed breakdown of lump sum increase or decrease, indicating Contractor's, and where applicable Subcontractors' and Sub subcontractors':
 - .1 itemized direct costs applicable to the proposed change in the Work, and
 - .2 applicable amounts for overhead and profit, in accordance with percentages specified in the General Conditions of Contract.
 - .3 Do not include costs that would otherwise be incurred in the normal performance of the Work.
- .4 Include in detailed breakdown of Contractor Proposal a further breakdown of the total labour cost component indicating, for each applicable trade and trade classification, the labour rate(s) and the number of hours from which the total labour cost is derived.
- .5 Upon Owner's approval and acceptance of Contractor Proposal, a "Change Order" signed by the Owner will be issued to Contractor to be signed by the Contractor.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Applications for progress payments.
- .2 Substantial performance procedures.
- .3 Release of hold-back procedures.
- .4 Ready-For-Takeover procedures.
- .5 Price adjustments.

1.2 RELATED REQUIREMENTS

- .1 Refer to CCDC 2-2020 for specific requirements.

1.3 RELATED REQUIREMENTS

- .1 Section 01 25 00 - Substitution Procedures.

1.4 APPLICATIONS FOR PROGRESS PAYMENT

- .1 Submit a CCDC 24 electronic form using an authorized electronic signature.
- .2 Make applications for payment on account as provided in Agreement as Work progresses.
- .3 Accompany applications with a CCDC 9A-2018 Statutory Declaration form.
- .4 Date applications for payment last day of agreed payment period and ensure amount claimed is for value, proportionate to amount of Contract, of Work performed and Products delivered to Place of Work as of that date.
- .5 Submit to Consultant for review, minimum fourteen (14) days before first application for payment, schedule of values for parts of Work, aggregating total amount of Contract Price, so as to facilitate evaluation of applications for payment.
- .6 Submit required support documentation with applications for payment, including statutory declarations and workers' compensation clearance certificates.

1.5 PROGRESS PAYMENT CERTIFICATE

- .1 Consultant will issue to Owner, no later than ten (10) days after receipt of an application for payment, certificate for payment in amount applied for or in such other amount as Consultant determines to be properly due.
- .2 If Consultant amends application, Consultant will give notification in writing giving reasons for amendment.

1.6 SCHEDULE OF VALUES

- .1 Provide schedule of values supported by evidence as Consultant may reasonably direct and when accepted by Consultant, be used as basis for applications for payment.
- .2 Include statement based on schedule of values with each application for payment.
- .3 Support claims for products delivered to Place of Work but not yet incorporated into Work by such evidence as Consultant may reasonably require to establish value and delivery of products.

1.7 PROGRESSIVE RELEASE OF HOLD-BACK

- .1 Where legislation permits, if Consultant has certified that Work has been performed prior to Substantial Performance of the Work, Owner will pay hold-back amount retained for such Work, or products supplied, on day following expiration of hold-back period for such Work stipulated in lien legislation applicable to Place of the Work.

- .2 Notwithstanding provisions of preceding paragraph, and notwithstanding wording of such certificates, ensure that Subcontract Work or Products is protected pending issuance of final certificate for payment and be responsible for correction of defects or Work not performed regardless of whether or not such was apparent when such certificates were issued.

1.8 SUBSTANTIAL PERFORMANCE OF THE WORK

- .1 Submit a schedule of payments on CCDC 24 electronic form using an authorized electronic signature.
- .2 Accompany applications with a CCDC 9A-2018 Statutory Declaration form.
- .3 Prepare and submit to Consultant a comprehensive list of items to be completed or corrected. Failure to include an item on the list does not alter responsibility to complete the Contract.
- .4 Request Consultant review to establish Substantial Performance of the Work.
- .5 Where permitted by local lien legislation, Contractor may apply for substantial performance of a designated portion of the Work, subject to Owner acceptance of that portion of the Work being substantially performed.
- .6 No later than ten (10) days after receipt of list and application, Consultant will review Work to verify validity of application, and no later than seven (7) days after completing review, will notify Contractor if the Work, or the designated portion of the Work, is substantially performed.
- .7 Consultant will state in their certificate the date of Substantial Performance of the Work, or the date of the designated portion of the Work, as applicable.
- .8 Immediately following issuance of certificate of Substantial Performance of the Work, in consultation with Consultant, establish reasonable date for finishing Work.

1.9 PAYMENT OF HOLD-BACK ON SUBSTANTIAL PERFORMANCE OF THE WORK

- .1 After issuance of Certificate of Substantial Performance of the Work:
 - .1 Submit an application for payment of hold-back amount.
 - .2 Submit sworn statement that all accounts for labour, subcontracts, products, construction machinery and equipment, and other indebtedness which may have been incurred in Substantial Performance of the Work and for which Owner might in any way be held responsible have been paid in full, except for amounts properly retained as hold-back or as identified amount in dispute.
- .2 After receipt of application for payment and sworn statement, Consultant will issue certificate for payment of hold-back amount.
- .3 Where hold-back amount has not been placed in a separate hold-back account, Owner will, within ten (10) days prior to expiry of hold-back period stipulated in lien legislation applicable to Place of the Work, place hold-back amount in bank account in joint names of Owner and Contractor.
- .4 Amount authorized by certificate for payment of hold-back amount is due and payable on day following expiration of hold-back period stipulated in lien legislation applicable to Place of the Work.
 - .1 Where lien legislation does not exist or apply, hold-back amount is due and payable in accordance with other legislation, industry practice, or provisions which may be agreed to between parties.
 - .2 Owner may retain out of hold-back amount any sums required by law to satisfy any liens against Work or, if permitted by lien legislation applicable to Place of the Work, other third party monetary claims against Contractor which are enforceable against Owner.

1.10 READY-FOR-TAKEOVER

- .1 Verify that prerequisite conditions for Ready-For-Takeover have been satisfied.
- .2 Prepare and submit to Consultant a comprehensive list of items to be completed or corrected. Failure to include an item on the list does not alter responsibility to complete the Contract

- .3 Request Consultant review to establish Ready-For-Takeover.
- .4 Consultant will verify the validity of the application within ten (10) calendar days
- .5 Immediately following confirmation of Ready-For-Takeover, in consultation with Consultant, establish reasonable date for finishing Work.

1.11 FINAL PAYMENT

- .1 Submit an application for final payment on a CCDC 24 electronic form using an authorized electronic signature.
- .2 Consultant will, no later than ten (10) days after receipt of an application for final payment, review Work to verify validity of application. Consultant will give notification that application is valid or give reasons why it is not valid, no later than seven (7) days after reviewing Work.
- .3 Consultant will issue final certificate for payment when application for final payment is determined valid.

End of Section

PART 1 GENERAL

1.1 RELATED REQUIREMENTS SPECIFIED ELSEWHERE

- .1 Particular requirements for inspection and testing to be carried out by testing laboratory designated by Consultant are specified under various sections.

1.2 APPOINTMENT AND PAYMENT

- .1 Owner will appoint and pay for services of testing laboratory except follows:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing, adjustment and balancing of conveying systems, mechanical and electrical equipment and systems.
 - .4 Mill tests and certificates of compliance.
 - .5 Tests specified to be carried out by Contractor under the supervision of Consultant.
- .2 Where tests or inspections by designated testing laboratory reveal Work not in accordance with contract requirements, pay costs for additional tests or inspections as required by Consultant to verify acceptability of corrected work.

1.3 CONTRACTOR'S RESPONSIBILITIES

- .1 Provide labour, equipment and facilities to:
 - .1 Provide access to Work for inspection and testing.
 - .2 Facilitate inspections and tests.
 - .3 Make good Work disturbed by inspection and test.
 - .4 Provide storage on site for laboratory's exclusive use to store equipment and cure test samples.
- .2 Notify Consultant sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .3 Where materials are specified to be tested, deliver representative samples in required quantity to testing laboratory.
- .4 Pay costs for uncovering and making good Work that is covered before required inspection or testing is completed and approved by Consultant.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Coordination Work with other contractors and work by Owner under administration of Consultant.
- .2 Scheduled progress meetings.

1.2 RELATED REQUIREMENTS

- .1 Section 01 32 00 - Construction Progress Documentation.
- .2 Section 01 33 00 - Submittal Procedures.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 COORDINATION

- .1 Perform coordination of progress schedules, submittals, use of site, temporary utilities, construction facilities and construction Work, with progress of Work of others and Work by Owner, under instructions of Consultant.

1.4 CONSTRUCTION ORGANIZATION AND START-UP

- .1 Within ten (10) days after award of Contract or LOI, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Senior representatives of the Consultant, Senior representatives of the Owner, Contractor, major Subcontractors, field inspectors and supervisors are to be in attendance.
- .3 Establish time and location of meeting and notify parties concerned minimum five (5) days before meeting.
- .4 Incorporate mutually agreed variations to Contract Documents into Agreement, prior to signing.
- .5 Agenda to include following:
 - .1 Appointment of official representative of participants in Work.
 - .2 Schedule of Work, progress scheduling as specified in Section 01 32 00.
 - .3 Schedule of submission of shop drawings, samples, colour chips as specified in Section 01 33 00.
 - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences as specified in Section 01 51 00.
 - .5 Delivery schedule of specified equipment as specified in Section 01 32 00.
 - .6 Site safety and security as specified in Section 01 35 29.
 - .7 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, and administrative requirements.
 - .8 Owner-furnished Products.
 - .9 Itemize and inspect items stored on site for reinstallation. Advise Consultant team if any items cannot be reinstated.
 - .10 Record drawings as specified in Section 01 78 23.
 - .11 Maintenance material and data as specified in Section 01 78 23.
 - .12 Take-over procedures, acceptance, and warranties as specified Section 01 78 23.
 - .13 Monthly progress claims, administrative procedures, photographs, and holdbacks.
 - .14 Appointment of inspection and testing agencies or firms as specified in Section 01 43 00 & 01 45 00.

- .15 Insurances and transcript of policies.
- .6 Comply with Consultant's allocation of mobilization areas of site; for field offices and sheds, for Contractor, access, traffic, and parking facilities.
- .7 During construction, coordinate use of site and facilities through Consultant's procedures for intra-project communications: Submittals, reports and records, schedules, coordination of drawings, recommendations, and resolution of ambiguities and conflicts.
- .8 Comply with instructions of Consultant for use of temporary utilities and construction facilities.
- .9 Coordinate field engineering and layout work with Consultant.

1.5 ON-SITE DOCUMENTS

- .1 Maintain at job site, one copy each of the following:
 - .1 Contract drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Reviewed shop drawings.
 - .5 Change orders.
 - .6 Other modifications to Contract.
 - .7 Field test reports.
 - .8 Copy of approved Work schedule.
 - .9 Manufacturers' installation and application instructions.
 - .10 Labour conditions and wage schedules.
 - .11 Applicable current editions of municipal regulations and by-laws. Current building codes, complete with addenda bulletins applicable to the Place of the Work.

1.6 SCHEDULES

- .1 Submit preliminary construction progress schedule as specified in Section 01 32 00 to Consultant coordinated with Consultant's project schedule.
- .2 After review, revise and resubmit schedule to comply with revised project schedule.
- .3 During progress of Work update showing work progress against baseline project schedule and resubmit at bi-weekly meetings.

1.7 CONSTRUCTION PROGRESS MEETINGS

- .1 Schedule, preside and administer bi-weekly project meetings throughout progress of Work as determined by Consultant.
- .2 Schedule and administer pre-installation meetings when specified in sections and when required to coordinate related or affected Work.
- .3 Contractor, major subcontractors involved in Work, Consultant and Owner are to be in attendance.
- .4 Notify parties minimum 3 days prior to meetings.
- .5 Provide online video conference via TEAMS meetings.
- .6 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 days after meeting. Include significant proceedings and decisions. Identify action by parties.
- .7 Prepare agenda for meetings.
- .8 Agenda to include 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 delivery schedules.
- .6 Corrective measures and procedures to regain projected schedule.
- .7 Revision to construction schedule.
- .8 Progress schedule, during succeeding work period.
- .9 Review submittal schedules: expedite as required.
- .10 Maintenance of quality standards.
- .11 Review proposed changes for affect on construction schedule and on completion date.
- .12 Review site safety and security issues.
- .13 Other business.

1.8 SUBMITTALS

- .1 Prepare and issue submittals to Consultant for review.
- .2 Submit preliminary Shop Drawings, product data and samples as specified in Section 01 33 00 for review for compliance with Contract Documents; for field dimensions and clearances, for relation to available space, and for relation to Work of other contracts. After review, revise and resubmit for transmittal to Consultant.
- .3 Submit requests for payment for review, and for transmittal to Consultant.
- .4 Submit requests for interpretation of Contract Documents, and obtain instructions through Consultant.
- .5 Process substitutions through Consultant.
- .6 Process change orders through Consultant.
- .7 Deliver closeout submittals for review and preliminary inspections, for transmittal to Consultant.

1.9 COORDINATION DRAWINGS

- .1 Provide information required by Consultant for preparation of coordination Drawings.
- .2 Review and approve revised Drawings for submittal to Consultant.

1.10 CLOSEOUT PROCEDURES

- .1 Notify Consultant when Work is considered ready for Substantial Performance.
- .2 Accompany Consultant on preliminary inspection to determine items listed for completion or correction.
- .3 Comply with Consultant's instructions for correction of items of Work listed in executed certificate of Substantial Performance and for access to Owner-occupied areas.
- .4 Notify Consultant of instructions for completion of items of Work determined in Consultant's final inspection.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Schedules, form, content, submission.
- .2 Submittals schedule.

1.2 RELATED REQUIREMENTS

- .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 Cash Allowance Schedule for acquiring Products only or Products and Installation, or Installation only.
 - .6 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 first Working Day of each week.
 - .5 Format for listings: Chronological order of start of each item of work.
 - .6 Identification of listings: By specification Section numbers.
- .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 as *.pdf 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 Owner.
 - .2 Job site office.
 - .3 Subcontractors.
 - .4 Other concerned parties.
 - .5 Owner.
 - .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 of Owner-Contractor Agreement.
- .2 Revise and resubmit as required.
- .3 Submit revised schedules 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 Special Subcontractor Work.
 - .2 Equipment Installations.
 - .3 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 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 submittals and delivery will be required for Owner-furnished products.
- .4 Include dates when reviewed submittals will be required from Consultant.

End of Section

PART 1 GENERAL

1.1 DEFINITIONS

- .1 Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
- .2 Bar Chart (GANTT Chart): graphic display of schedule-related information. Generally Bar Chart should be derived from commercially available computerized project management system such as Microsoft Office Projects and must be made available to the Owner and Consultants in electronic format as well as hard copy.
- .3 Baseline: original approved plan (for project, work package, or activity), plus or minus approved scope changes.
- .4 Construction Work Week: Monday to Friday, inclusive, will provide five day work week and define schedule calendar working days as part of Bar (GANTT) Chart submission.
- .5 Duration: number of work periods (not including holidays or other nonworking periods) required to complete activity or other project element. Usually expressed as workdays or workweeks.
- .6 Master Plan: summary-level schedule that identifies major activities and key milestones.
- .7 Milestone: significant event in project, usually completion of major deliverable.
- .8 Project Schedule: planned dates for performing activities and the planned dates for meeting milestones. Dynamic, detailed record of tasks or activities that must be accomplished to satisfy Project objectives. Monitoring and control process involves using Project Schedule in executing and controlling activities and is used as basis for decision making throughout project life cycle.
- .9 Project Planning, Monitoring and Control System: overall system operated by Consultant to enable monitoring of project work in relation to established milestones.

1.2 REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedules are practical and remain within specified Contract duration.
- .2 Plan to complete Work in accordance with prescribed milestones and time frame.
- .3 Limit activity durations to maximum of approximately 10 working days, to allow for progress reporting.
- .4 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Interim Certificate and Final Certificate as defined times of completion are of essence of this contract.

1.3 SUBMITTALS

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit to Consultant within 15 working days of Award of Contract Bar (GANTT) Chart as Master Plan for planning, monitoring and reporting of project progress.

1.4 PROJECT SCHEDULES

- .1 The Preliminary Schedule used for bidding purposes at time of award is not considered an approved schedule.
- .2 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.

- .3 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.
- .4 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.
- .5 Develop detailed Project Schedule derived from Master Plan.
- .6 Ensure detailed Project Schedule includes as minimum milestone and activity types as follows:
 - .1 Award.
 - .2 Shop Drawings, Samples.
 - .3 Permits.
 - .4 Mobilization.
 - .5 Exterior Work for new openings.
 - .6 Interior Architecture (Walls, Floors and Ceiling).
 - .7 Plumbing.
 - .8 Lighting.
 - .9 Electrical.
 - .10 Piping.
 - .11 Controls.
 - .12 Heating, Ventilating, and Air Conditioning.
 - .13 Millwork.
 - .14 Fire Systems.
 - .15 Testing and Commissioning.
 - .16 Supplied equipment long delivery items.
 - .17 Engineer supplied equipment required dates.

1.5 PROJECT SCHEDULE REPORTING

- .1 Update Project Schedule every two weeks reflecting activity changes and completions, as well as activities in progress.
- .2 Include as part of Project Schedule, narrative report identifying Work status to date, comparing current progress to baseline, presenting current forecasts, defining problem areas, anticipated delays and impact with possible mitigation.

1.6 PROJECT MEETINGS

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

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 REQUIREMENTS

- .1 Section 01 32 00 - Construction Progress Documentation.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Other sections requesting submittals.
- .4 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 Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review of submittals.
- .10 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Consultant review.
- .11 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 Contractor to illustrate details of a portion of Work.
- .2 Where specified in individual sections submit shop drawings bearing stamp and signature of qualified professional engineer registered or licensed in Province of British Columbia, Canada.
- .3 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have

- been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
- .4 Allow ten (10) days for Consultant's review of each submission.
 - .5 Adjustments made on Shop Drawings by Consultant are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Consultant prior to proceeding with Work.
 - .6 Make changes in Shop Drawings as Consultant may require, consistent with Contract Documents. When resubmitting, notify Consultant in writing of any revisions other than those requested.
 - .7 Accompany submissions with duplicate transmittal letter, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Identification and quantity of each shop drawing, product data and sample.
 - .5 Other pertinent data.
 - .8 Submissions shall include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name and address of:
 - .1 Subcontractor.
 - .2 Supplier.
 - .3 Manufacturer.
 - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
 - .5 Details of appropriate portions of Work as applicable:
 - .1 Fabrication.
 - .2 Layout, showing dimensions, including identified field dimensions, and clearances.
 - .3 Setting or erection details.
 - .4 Capacities.
 - .5 Performance characteristics.
 - .6 Standards.
 - .7 Operating weight.
 - .8 Wiring diagrams.
 - .9 Single line and schematic diagrams.
 - .10 Relationship to other parts of the Work.
 - .9 After Consultant's review, distribute copies.
 - .10 Submit electronic copy of Shop Drawings for each requirement requested in specification Sections and as consultant may reasonably request.
 - .11 Submit electronic copy of product data sheets or brochures for requirements requested in specification sections and as requested by Consultant where Shop Drawings will not be prepared due to standardized manufacture of product.
 - .12 Submit electronic copy of test reports for requirements requested in specification Sections and as requested by Consultant.

- .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
- .2 Testing must have been within 3 years of date of contract award for project.
- .13 Submit electronic copy of certificates for requirements requested in specification Sections and as requested by Consultant.
 - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
 - .2 Certificates must be dated after award of contract complete with project name.
- .14 Submit electronic copy of manufacturer's instructions for requirements requested in specification Sections and as requested by Consultant.
 - .1 Pre-printed material describing installation of product, system or material, including special notices and Safety Data Sheets concerning impedances, hazards and safety precautions.
- .15 Submit electronic copy of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Consultant.
 - .1 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.
- .16 Submit electronic copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Consultant.
- .17 Delete information not applicable to project.
- .18 Supplement standard information to provide details applicable to project.
- .19 If upon review by Consultant, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If Shop Drawings are rejected, noted copy will be returned and re-submission of corrected Shop Drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.
- .20 The review of shop drawings is for sole purpose of ascertaining conformance with general concept.
 - .1 This review shall not mean that the Consultant approves detail design inherent in shop drawings, responsibility for which shall remain with Contractor submitting same, and such review shall not relieve Contractor of responsibility for errors or omissions in shop drawings or of responsibility for meeting requirements of construction and Contract Documents.
 - .2 Without restricting generality of foregoing, Contractor is responsible for dimensions to be confirmed and correlated at job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for co-ordination of Work of sub-trades.

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 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 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Safety Data Sheets (SDS).
- .2 Province of British Columbia
 - .1 Occupational Health and Safety Act
- .3 BC Fire Code.
- .4 See also Section 01 35 33 Infection Control Measures and Section 01 35 34 Infection Control Cleaning Requirements.
- .5 See also Section 01 14 00 Work Restrictions, item 1.9 Health & Safety Meeting Attendance.

1.2 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit site-specific Health and Safety Plan: Within 7 days after date of Notice to Proceed and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Site access and material storage proposal.
 - .3 Noise and dust control measures.
- .3 Submit 2 copies of Contractor's authorized representative's work site health and safety inspection reports to Consultant and authority having jurisdiction, weekly or as pre-agreed with the Consultant.
- .4 Submit copies of incident and accident reports.
- .5 Submit WHMIS SDS - Safety Data Sheets.
- .6 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.3 FILING OF NOTICE

- .1 File Notice of Project with Work Safe BC prior to beginning of Work.

1.4 SAFETY ASSESSMENT

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

1.5 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Consultant prior to commencement of Work (see Section 01 14 00 – item 1.9).

1.6 REGULATORY REQUIREMENTS

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

1.7 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Consultant may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable Federal, Provincial, and Local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

- .1 Comply with Occupational Health and Safety Act, General Safety Regulation, British Columbia Reg.

1.10 UNFORESEEN HAZARDS

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

1.11 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have site-related working experience specific to activities.
 - .2 Have working knowledge of occupational safety and health regulations.
 - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
 - .5 Be on site during execution of Work and report directly to and be under direction of site supervisor.

1.12 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Consultant.
- .2 Post the Fire Safety Plan at the Site Supervisor's Workstation, and with the Owner's site representative prior to commencement of Work.

1.13 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Consultant.
- .2 Provide Consultant with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Consultant may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 POWDER ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of written permission from Consultant.

1.15 WORK STOPPAGE

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

- .2 For Organized Labour stoppages/concerns immediately contact the Owner's site representative, and the Consultant.

1.16 RISK MANAGEMENT

- .1 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.
- .2 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.
- .3 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.

End of Section

PART 1 GENERAL

1.1 SUMMARY

- .1 This Section specified infection prevention and control measures is to be maintained for the duration of the project. This project is entitled " Haida Gwaii Pharmacy Renovation Project".
- .2 CAN / CSA Z317.13-22: "Infection control during construction, renovation, and maintenance of health care facilities" will be followed for all work on this project.
- .3 Noise and vibration are a concern on this site and the Contractor is not permitted to use impact tools unless written permission is received from the Owner.
- .4 Evidence from several health care projects demonstrates that patients, staff and visitors can face serious health risks from exposure to contaminated dust particles released into the air long after the construction process is complete. It is therefore critical that strict measures be taken by the Contractor to ensure the building is left free of dust and other contamination from the construction process including all enclosed and interstitial spaces and that potable water systems are protected and disinfected prior to commissioning or re-instatement.
- .5 Conformance to these specifications is intended to avoid the spread of bacterial and fungal contamination through waterborne and airborne routes by the following identified mechanisms. Note that this list is not a comprehensive list:
 - .1 Contaminated dust being drawn into adjacent areas through the ventilation systems, doors and windows.
 - .2 Spread of waterborne bacteria through installation of non-sterile piping and associated interruptions in water supply, including adjacent buildings.
 - .3 Exhaust ducts may carry dust and spore particles. Dust and spores, residing in these ducts may be discharged to the exterior with the air mass created within these ducts.
 - .4 Entrapment of moisture through installation of wet building materials.
- .6 Installation of building materials that have been contaminated through improper handling, transport and / or storage.
- .7 Releasing entrapped dust or mould spores into the facility, post construction, through:
 - .1 Workers accessing contaminated service and mechanical spaces for scheduled and unscheduled maintenance,
 - .2 Modification and renovation processes requiring the opening of contaminated ceiling spaces and wall cavities, and
 - .3 Management of water intrusion events where moisture enters ceiling spaces or wall cavities.
- .8 All hoardings and enclosures shall conform to current Building and Fire Codes.
- .9 **Class III Preventative Measures** are required for construction work on this project.
- .10 All ductwork not servicing other areas of the building will be disconnected and sealed by the sheet metal tradesperson with sheet metal and 6 mil polyethylene sheeting secured with duct tape at locations where the ductwork enters the work area(s).
- .11 All return air ductwork that passes through the work area(s) and services adjacent areas of the building shall be protected by wrapping with 6 mil polyethylene sheeting and sealing with duct tape to prevent the infiltration and dispersion of dust into the air handling system. Associated return air grilles in the work area will be removed and sealed by the sheet metal tradesperson with sheet metal and 6 mil polyethylene sheeting secured with duct tape.
- .12 All supply and exhaust air ductwork that passes through the work area(s) and services adjacent areas of the building shall have all diffusers and grilles removed and openings sealed by the sheet metal tradesperson with sheet metal and 6 mil polyethylene sheeting secured with duct tape.

- .13 Water shut-offs to the work site must be identified by the Contractor on a drawing and location known by supervisors and foreman in case of emergency.

1.2 RELATED WORK

- .1 Section 01 35 34 - Cleaning Requirements.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA Z317.13-22: "Infection control during construction, renovation, and maintenance of health care facilities".
 - .2 CAN/CSA Z317.1-21: "Special requirements for plumbing installations in health care facilities".
 - .3 CAN/CSA Z317.2-19: "Special requirements for Heating, Ventilation, and Air Conditioning (HVAC) in Health Care Facilities".
 - .4 CAN/CSA-Z318.0-05 - Commissioning of health care facilities.
- .2 American Society of Heating Refrigeration and Air-Conditioning Engineers:
 - .1 ASHRAE 52.2-2007: "Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size".
 - .2 ASHRAE 62.1-2007: "Ventilation for Acceptable Indoor Air Quality".
- .3 ANSI/ASHRAE (American National Standards Institute / American Society of Heating, Refrigerating and Air-Conditioning Engineers) 62.1-2004 - Ventilation for Acceptable Indoor Air Quality.
- .4 Health Canada, Construction-related Nosocomial Infections in Patients in Health Care Facilities: Decreasing the Risk of Aspergillus, Legionella and Other Infections. Canada Communicable Disease Report Supplement, Volume 27S2, July 2001.
- .5 IICRC (Institute of Inspection, Cleaning and Restoration Certification):
 - .1 S500 (2015), Standard and Reference Guide for Professional Water Damage Restoration and
 - .2 S520 (2015), Standard and Reference Guide for Professional Mould Remediation.
- .6 New York City Department of Health, Bureau of Environmental and Occupational Disease Epidemiology, Guidelines on Assessment and Remediation of Fungi in Indoor Environments, April 2000
- .7 SMACNA (Sheet Metal and Air Conditioning Constructors' National Association),
 - .1 Duct Cleanliness for New Construction Guidelines, 2000
 - .2 IAQ Guidelines for Occupied Buildings Under Construction, 1995
- .8 NADCA (National Air Duct Cleaners Association): General Specifications For The Cleaning of Commercial Heating, Ventilation And Air Conditioning Systems.
- .9 U.S> Department of Health and Human Services, Centers for Disease Control and Prevention, Guidelines for Environmental Infection Control in Health-Care Facilities, 2003.
- .10 WorkSafeBC Occupational Health and Safety Regulations.

1.4 OCCUPANCY AND CONSTRUCTION SCHEDULE

- .1 Apply special procedures specified under this section to suit Owner's occupancy and construction schedule under Division 1 and 2 and the following.
- .2 Maintain special procedures in effect to protect adjacent occupied areas:
 - .1 During construction and clean-up operations.
 - .2 Until substantial completion of the Work.

- .3 After substantial completion when any additional work is being done.

1.5 CO-ORDINATION AND CO-OPERATION WITH THE OWNER'S INFECTION CONTROL PROFESSIONAL

- .1 Co-operate with Infection Prevention and Control (IPC) Consultant and MDT to coordinate any special procedures work.
- .2 Immediately modify any special procedures operations as necessary to ensure continued compliance with the requirements of this section.
- .3 The IPC Consultant:
 - .1 will recommend to the project authority that the site be closed down in the event of non-conformance with the requirements of this section;
 - .2 will review and, if conforming to this specification, approve all Infection Control Measures taken by the Contractor.
 - .3 is empowered by the Owner to periodically and unannounced, inspect site conditions, and work procedures inside and outside of the work area.
 - .4 shall undertake, at their discretion, the following milestone inspections which shall be included as critical events in the construction schedule.
 - .1 Milestone Inspection A - Pre-contamination: inspection of each work area preparation and set up prior to deconstruction, construction and / or refurbishment activities.
 - .2 Milestone Inspection B - Visual clearance: inspection of each work area following clean up procedures but prior to final tear down procedures and includes wall cavity inspections before boarding is permitted and above T-Bar Grid system (ceiling spaces) prior to installation of ceiling tiles.
 - .3 Milestone Inspection C - Air clearance: inspection and air monitoring of each work area following a satisfactory Milestone Inspection B in the work area but prior to final tear down procedures.
 - .4 Milestone Inspection D - Enclosure Tear Down: inspection following final tear down procedures.

1.6 TRAINING

- .1 The Contractor's workers and sub-contractors shall be trained and knowledgeable in the provisions of CSA Z317.13-22.
- .2 All visitors to the site or others performing work shall be given an orientation by the Contractor on all preventive measures in place at the worksite prior to commencing their work activity.
- .3 The IPC Consultant will provide a two-hour orientation session for the contractor and sub trades after the project start up meeting and prior to commencement of the work on the site. Attendance will be mandatory for the Contractor's site superintendent and the site supervisors of all sub trades.

1.7 INFECTION CONTROL PLAN

- .1 Within 7 days of award and prior to commencement of the Work, submit to MDT for review and acceptance, the Constructor's (Contractor's) Site-Specific Infection Control Plan, outlining in detail, the methods, operations and controls which shall be used during the construction to meet the requirements specified under this Section. Refer to: CSA Z317.13-22 Annex E (informative) *Sample table of contents for an infection control plan*.
- .2 Acceptance by the MDT, of the Constructor's Infection Control Plan, indicates only that the Contractor has indicated an understanding and knows the requirements of these special procedures specified for infection control during the Work.
- .3 Testing: The Owner reserves the right to challenge the efficacy of the infection control measures.

- .4 A copy of the site-specific infection control plan shall be kept on the site at all times and made available to all parties upon request. The Contractor shall provide a location for daily infection control review log to be maintained at the entrance to the construction zone.
- .5 No work will be permitted to progress on the site until such time as the infection control plan has been reviewed and accepted by the MDT.

1.8 PROJECT CONDITIONS

- .1 Where conflict between this Section and the references CSA standard occurs, this Section will prevail.
- .2 Class III Work Areas
 - .1 **Class III Preventive Measures** (includes classes I, II, and III) are required for the work in accordance with CAN/CSA Z317.13-22 and as indicated:
 - .1 New materials are being kept clean and dry.
 - .2 Methods are being used that minimize the generation and dispersion of dust (e.g. HEPA vacuums, air handling units or drills, poly barriers, drop sheets)
 - .3 Water and / or ventilation systems have been identified that could be impacted.
 - .4 HVAC system supply and return / exhaust air ducts are sealed or isolated.
 - .5 Work areas are HEPA vacuumed and / or wet mopped as necessary throughout project and upon completion.
 - .6 Plumbing is in accordance with Z317.1.
 - .7 Doors and openings are sealed with tape or poly.
 - .8 Walk off / sticky mats are provided and maintained at entrance / exit to site. To be changed as needed.
 - .9 Safe route is in place for transportation of clean / sterile supplies.
 - .10 Proper debris removal procedures are in place (e.g. after hours removal, covered carts, carts wiped down before leaving site)
 - .11 Water lines in construction area are flushed for 10 min. before patient occupancy.
 - .12 Terminal clean is performed prior to patient occupancy.
- .3 Total particulate counts in the Work area after construction and in occupied areas during or after construction are not to exceed preconstruction levels or an adjacent control sample as deemed appropriate by the IPC Consultant and MDT.

1.9 EXISTING CONDITIONS

- .1 Hazardous materials are not thought to be present in the work areas on this project.
- .2 Work must **STOP** if hazardous materials are encountered during renovations and / or demolition activities that contain or are suspected of containing hazardous materials not previously identified. These suspect materials must be left undisturbed until testing determines the presence or absence of asbestos or other hazardous materials. In addition, work must also STOP in the event these suspect materials are disturbed inadvertently.
- .3 Waste is to be removed from the site at times approved by the MDT and in a manner that does not interfere with existing building activities. Location of bins approved by Owner will be in designated areas only.
- .4 Equipment powered with internal combustion engines such as liquid or gas fueled mobile equipment is not permitted inside the building.
- .5 The existing building fire protection system must be maintained operational at all times for the duration of the project.

1.10 WORKER AND VISITOR PROTECTION

- .1 Provide protective clothing to workers and authorized visitors, as necessary.
- .2 Instruct workers and authorized visitors in use of protective clothing.
- .3 Instruct workers and authorized visitors in proper procedures to be followed in entering and existing from the Work area.
- .4 Provide posted notice at all entrances to the construction area indicating proper procedures and requirements for specialized protective equipment.

1.11 CONTROL PROCEDURES FOR VENTILATION

- .1 It is expected that the Work of this Contract could generate significant concentrations of airborne dust particles during the Contractor's work. The Contractor shall ensure that all ventilation systems within their work areas are protected against the infiltration of construction dust and debris.
- .2 The Owner will monitor the building ventilation system and notify the MDT if any issues arise.
- .3 The Owner will adjust the building systems to provide positive air pressure in rooms deemed sensitive for infection control, as required and where possible.

1.12 WORK REQUIRED IN EXISTING OPERATING BUILDING

- .1 To ensure aspects of the existing building operations are not negatively impacted by the construction the following shall be done:
 - .1 Provide certified HEPA filtered vacuums, booties (during final construction clean activities), germicidal spray and walk-off sticky mats.
 - .2 Use designated entrance(s), access and egress routes (only) as indicated at the start up meeting for access to existing building.
 - .3 Restrict noise and vibration activities throughout the work.
 - .4 Contractor's staff shall minimize access to common areas of the building. Where access is required, the Contractor shall ensure that appropriate cleaning procedures are followed.
 - .5 Hours of work will be determined by the Owner.
 - .6 All Contractor's equipment and supplies shall remain within enclosure at all times.
- .2 Work in adjacent departments is to be done to minimize disruption. Infection control measures are required and 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.
 - .1 Depending on scope of work, a containment cube may be a suitable solution in this location.
 - .2 No work is to happen in this area without prior coordination through Facilities Maintenance and the NHA Project Manager, who would coordinate with any impacted departments.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Provide construction materials and assemblies to meet requirements of this Section.

2.2 EQUIPMENT

- .1 Construction Air Handling Units (CAHUs) shall be DOP/PAO tested onsite at start of project. CAHUs will provide portable air filtration and isolation control equipment with minimum peak airflow of 1800 cfm and multi-stage filtration as follows:
 - .1 First stage - coarse particulate pre-filter

- .2 Second stage - pleated pre-filter
- .3 Third stage - carbon filter for odours (when required)
- .4 Final stage - 99.97% at 0.3 micrometer level HEPA filter
- .2 Acceptable Equipment: Hepa-Aire PA2000 HC as manufactured by Abatement Technologies Inc. ", (800-827-6443) or approved equivalent.
- .3 Provide fans, filters and ductwork to provide air movement and maintain negative pressure as indicated.
- .4 HEPA vacuums will be DOP/PAO tested at start of project.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Verify established travel patterns within the facility and on the site grounds for construction workers with the MDT. A drawing of worker access and egress approved MDT route will be shown on a drawing in the Constructor's Infection Control Plan.

3.2 DUST AND PARTICULATE CONTROL

- .1 Execute the Work by methods to minimize raising dust from construction operations.
- .2 Use dust barriers erected from floor to the true ceiling, consisting of two layers of 6 mil poly and gypsum wallboard protective layer to control dust.
- .3 Control dust by water-misting with amended water while cutting.
- .4 Ensure that windows, doors, plumbing penetrations, electrical outlets and intake and exhaust vents are properly sealed with 6 mil plastic and duct taped within the Work area to prevent the infiltration of dust.
- .5 For exterior work adjacent to windows in an existing facility, test window openings for air tightness and seal windows that leak and co-ordinate all activities with the Owner.
- .6 Verify that all window-mounted air conditioning units facing construction operations are shut down and protected against dust infiltration.
- .7 Dust barriers to be maintained and remain in place until the Work is completed and removal has been approved by the Project Manager and the ICP Consultant.
- .8 Verify that workers wear protective clothing.
- .9 Place walk-off mats (sticky mats) at entrance(s) to the work areas. Peel away and discard sheets when visibly soiled and / or no longer sticky to reveal a fresh sheet below to trap dust from worker's shoes and from equipment and debris that leaves the Work area.

3.3 VENTILATION

- .1 Coordinate shutdown of ventilation systems in the Work area with the Owner's Representative.
- .2 Seal and make air tight all duct openings in the Work area until completed.
- .3 Maintain negative pressure between the Work area and adjacent accommodation by using HEPA equipped CAHUs.
- .4 CAHU equipment to be equipped with pressure gauges.
- .5 Verify that air is exhausted directly outside and away from intake vents.
- .6 Maintain equipment filters to manufacturer's specifications.
- .7 The building's air handling system shall be disconnected from use in areas of renovation work. This will require cutting and capping of existing duct work on both the supply and return air systems by qualified trades personnel.

- .8 Upon disconnection of the building air handling system, the Contractor shall verify critical pressure relationships of remaining rooms services by the impact of this disconnection.

3.4 PLUMBING

- .1 Do not use collection tanks or long pipes that allow water to stagnate.
- .2 Maintain a dry work environment. Report water leaks to the Owner immediately.
- .3 Where plumbing work exceeds planned shutdown time, notify the Owner immediately. Do not re-pressurize water systems until instruction is received from the Infection Control Practitioner or designate.
- .4 Coordinate with MDT to determine if hyper chlorinating or superheating stagnant domestic water is required. Water lines in the Work area and adjacent building areas to be flushed before reuse anytime bacterial growth is deemed possible or if the water system is out of service in excess of one half hour and at the direction of the Owner.
- .5 Any shutdown of the plumbing system is to be coordinated with the Owner. Minimize shutdowns of the water systems in the existing building.
- .6 MDT will determine if testing of the water systems for Legionella is required. Turnaround time for laboratory sample analysis is 10 working days.

3.5 WATERMAIN WATER QUALITY PROCEDURES

- .1 Contractor to provide procedure for flushing, chlorination and bacteriological testing to CSA Z317.1-21 standards clause 6.3.5 for review and approval from Mechanical Engineer and Owner's representative, prior to commencement of any work that may impact the existing site watermain. Procedure to include:
 - .1 Building occupants shall be alerted and measures shall be taken to prevent the use of the plumbing system during this treatment.
 - .2 Chlorine shall be introduced into the system.
 - .3 At least 25 ppm chlorine concentration shall be measured at all outlets.
 - .4 The system shall not be used for 24 h.
 - .5 Based on pH adjusted to 7.5 to 8.0, the system shall have a stable residual chlorine concentration of greater than 10ppm.
 - .6 After 24 h, the system shall be flushed until not more than 5 ppm chlorine concentration is measured at all outlets and they are free of turbidity.
 - .7 Water samples shall be taken at the most remote points of the system and tested for growth of micro-organisms.
 - .8 Usage precautions shall remain in place for the system until the test results are within the acceptable range.
 - .9 The date, time, and results of the hyperchlorination process shall be documented.
- .2 Contractor to consult and coordinate with the Owner's representative and MDT for any watermain depressurization and tie in plans.
- .3 Provide results of legionella testing to the MDT immediately upon receipt.

3.6 PROGRESS CLEANING

- .1 Exposure of occupants to debris to be minimized.
- .2 Use work methods that minimize the generation of construction dust and debris wherever practicable.
- .3 Remove debris at the end of each shift.

- .4 Place supplies and equipment in covered and clean containers when transporting through the facility. Transport debris through facility only when alternate routes are not available and with prior written approval from the MDT.
- .5 Clean the Work area with HEPA filter-equipped vacuums and wet mop, at the end of each work shift and as necessary.

3.7 REINSTATEMENT

- .1 Barriers to be vacuumed with HEPA-filter equipped vacuum cleaners and wiped down with disinfectant before removal. Remove dust barriers carefully to minimize spreading dust and other debris particles associated with the Work.
- .2 Clean the Work area with HEPA-filter equipped vacuums and wet mop.
- .3 Before the Work area is occupied coordinate clearance sampling with the IPC Consultant or Designate.
- .4 Where clearance sampling fails to meet baseline sampling, maintain ventilation and air cleaning equipment until acceptable levels are achieved.
- .5 Ensure ventilation system is functioning properly and is cleaned if contaminated by soil or dust after the Work is complete.

End of Section

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

- .1 The work specified herein shall be the removal of all visible dust, debris and waste from all surfaces within the work area from the floor to the true ceiling by competent persons trained, knowledgeable and qualified in the handling and disposal of dust and waste materials within a Healthcare setting, following infection and dust control procedures as defined in these specifications and CSA-Z317.13-22 standards.
- .2 The Contractor's cleaning supplies to be utilized onsite must be approved in writing in advance.
- .3 Any platforms, scaffolds, swing stages, or miscellaneous stages used in the cleaning will be constructed or used in accordance with the requirements of the BC Occupational Health & Safety Regulations.
- .4 All necessary documentation will be the responsibility of the Contractor.
- .5 The health and safety of all contract employees is the sole responsibility of the Contractor.
- .6 All cleaning work is to be carried out as per these specifications, CSA and IPC requirements.
- .7 The Contractor will provide all necessary labour, materials and equipment necessary to carry out the work in accordance with all applicable regulations, standards and this documentation.
- .8 All electrical and water connections necessary to the Building's supply system will be the responsibility of the Contractor through co-ordination and approval by the Owner.
- .9 The Contractor will not demobilize from an area of cleaning until the IPC Consultant has inspected and tested the completed area. The Contractor is to allow 24 Hours advance inspection notification in project schedule.
- .10 If the Owner permits the Contractor to use any of their equipment, tools or facilities, such use will be gratuitous, and the Contractor will absolve the Owner from any responsibility arising from claims for personal injury, including death, arising out of the use of such items irrespective of the condition thereof or any negligence on the part of the Owner in permitting their use.

1.2 RELATED WORK

- .1 Section 01 35 33 Infection Control Measures

1.3 PROJECT CONSULTING

- .1 The Contractor will work under direction of the IPC Consultant.
- .2 All inspections will be conducted by the IPC Consultant.
- .3 The IPC Consultant will have full access to all documentation.
- .4 No work will be undertaken without the express written permission of the IPC Consultant and Owner's Representative.

PART 2 PRODUCTS

2.1 PERSONAL PROTECTIVE REQUIREMENTS

- .1 Training:
 - .1 Prior to commencement of work activities all personnel who will be required to enter the work area must be fully versed in all aspects of dust control and hazards associated with the work.
 - .2 Training in emergency response and evacuation procedures shall be provided to strategic personnel.

PART 3 EXECUTION

3.1 INSPECTIONS

- .1 The IPC Consultant is empowered by the Owner to periodically inspect site conditions and work procedures inside and outside the work area.
- .2 The IPC Consultant is empowered by the Owner to order the construction to stop work at any time the conditions of CSA infection control standards and/or the specifications have not been complied with or if there are violations to the WCB OH&S Regulations.
- .3 The Owner or his representative will not be held responsible for any work stoppages, delays or any other disruptions occurring due to the conditions of the specifications not being complied with.

3.2 PERSONNEL ENTRY AND EXIT

- .1 All workers and authorized personnel shall enter the interior work areas through the designated entrance.
- .2 All personnel who enter the work area shall read and be familiar with all posted regulation, personal protective requirements (including work place entry and exit procedures) and emergency procedures. The Contractor sign-off sheet shall be used to acknowledge that these have been received and understood by all personnel prior to entry.
- .3 All personnel shall wear designated PPE as deemed suitable for the project conditions by the Contractor. Hard hats, eye protection and gloves shall be utilized if required.
- .4 Before leaving the work area all personnel shall clean bottoms of protective footwear on the walk-off mat.
- .5 These procedures or the Contractor's equivalent shall be posted in a visible location to those entering and exiting the work area.

3.3 CLEAN UP AND AIR CLEARANCE SAMPLING

- .1 Cleaning products used on site will be pre-approved by the Owner's representative.
- .2 The General Contractor's cleaning contractor will clean all visible dust, debris and waste from all wall cavities opened during the work. Following the completion of wall cavity cleaning, the IPC Consultant will conduct a visual inspection. If the inspection is satisfactory the Contractor will install the wall board.
- .3 The Contractor's cleaning contractor will clean all visible dust, debris and waste from all surfaces from the T-Bar Grid and ceiling cavities to the true ceiling. Following the completion of above T-Bar and ceiling cavity cleaning operations, the IPC Consultant will conduct a visual inspection. If the inspection is satisfactory the Contractor will install the ceiling tiles / ceiling board.
- .4 The General Contractor's cleaning contractor will upon installation of the T-Bar ceiling tiles clean all visible dust, debris and waste from all surfaces within the work area from the T-Bar to the floor. A visual inspection will be carried out upon completion of the below T-bar cleaning.
- .5 The General Contractor is responsible to carry out a Construction Clean to a Healthcare Facility standard in compliance with CSA Infection Control requirements.
- .6 Upon a satisfactory final construction cleaning inspection, the IPC consultant will conduct clearance particulate air monitoring. Work areas found to be in excess of air clearance criteria for total particles which are higher than the adjacent areas shall be re-cleaned.
- .7 Following the satisfactory completion of air clearance sampling and with written approval; the Contractor will be directed to proceed with work area enclosure tear down activities.
- .8 The Owner will carry out Terminal Cleaning.

3.4 WASTE DISPOSAL PROCEDURES

- .1 Waste materials stored on site will be stored in a sealed locked container.

- .2 Containers will not be filled to capacity for transport.
- .3 Waste will continue to be containerized for transportation out of the work area.

End of Section

PART 1 GENERAL

1.1 DEFINITIONS

- .1 Environmental Pollution and Damage: presence of chemical, physical, biological elements or agents which adversely affect human health and welfare.
- .2 Environmental Protection: prevention/control of pollution and habitat or environment disruption during deconstruction or construction.

1.2 SUBMITTALS

- .1 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prior to commencing construction activities or delivery of materials to site, submit Environmental Protection Plan which may be combined with a Health and Safety Plan for review and approval by Consultant. Environmental Protection Plan is to present overview of known or potential environmental issues which must be addressed during construction. This will be reviewed at the Health and Safety Meeting Attendance – Section 01 14 00, item 1.9.
- .3 Environmental Protection Plan/Health & Safety Plan, include:
 - .1 Names of persons responsible for ensuring adherence to Environmental Protection Plan.
 - .2 Names and qualifications of persons responsible for manifesting hazardous waste to be removed from site.
 - .3 Names and qualifications of persons responsible for training site personnel.
 - .4 Drawings showing locations of material storage areas, sanitary facilities, and stockpiles of excess or spoil materials including methods to control runoff and to contain materials on site.
 - .5 Air pollution control plan detailing provisions to assure that dust, debris, materials, and trash, do not become air borne and travel off project site.
 - .6 Waste water management plan that identifies methods and procedures for management and/or discharge of waste waters which are directly derived from deconstruction and construction activities, such as clean-up water, disinfection water, hydrostatic test water, and water used in flushing of lines.

1.3 FIRES

- .1 Fires and burning of rubbish on site not permitted.

1.4 DISPOSAL OF WASTES

- .1 Remove all materials off site except salvaging of any components identified in the Specification.
- .2 Do not bury rubbish and waste materials on site.
- .3 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers. Remove off site.

1.5 POLLUTION CONTROL

- .1 Maintain temporary pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities' emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air and waterways beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris.

1.6 NOTIFICATION

- .1 Consultant will notify Contractor in writing of observed noncompliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of Contractor's Environmental Protection plan.
- .2 Contractor: after receipt of such notice, inform Consultant of proposed corrective action and take such action for approval by Consultant.
- .3 Consultant will issue stop order of work until satisfactory corrective action has been taken.
- .4 No time extensions granted or equitable adjustments allowed to Contractor for such suspensions.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Laws, notices, permits and fees.
- .2 Discovery of hazardous materials.

1.2 RELATED REQUIREMENTS

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

1.3 REFERENCES AND CODES

- .1 Perform Work in accordance with British Columbia Building Code (2024) including amendments up to tender closing date and other codes of provincial or local application provided that in the case of conflict or discrepancy, more stringent requirements apply.
- .2 Meet or exceed requirements of:
 - .1 Contract documents
 - .2 Specified standards, codes and referenced documents.

1.4 LAWS, NOTICES, PERMITS AND FEES

- .1 The laws of the Place of the Work shall govern the Work.
- .2 Perform Work in accordance with the by-laws and ordinances of the Village of Daajing Giids, Provincial and Federal requirements.
- .3 The Owner shall obtain and pay for permits, permanent easements and rights of servitude as required. The Contractor shall be responsible for permits, licenses or certificates necessary for the performance of the Work which were in force at the date of executing the Agreement.
- .4 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.
- .5 If the Contractor knowingly performs or allows work to be performed that is contrary to any laws, ordinances, rules, regulations or codes, the Contractor shall be 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.
- .6 A Fire Safety Plan is to be provided to the Fire Department by the Contractor prior to work commencing on site as per "Construction and Demolition Sites" Section of the BC Fire Code.

1.5 HAZARDOUS MATERIAL DISCOVERY

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

1.6 BUILDING SMOKING ENVIRONMENT

- .1 Comply with regulatory and Owner imposed smoking restrictions during execution of the Work within or outside the premises.
 - .1 There is no smoking or vaping on NHA property.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Common abbreviations used in the Specifications and their definitions.

1.2 RELATED SECTIONS

- .1 All sections - refer to Table of Contents.

1.3 DESIGNATION EXPLANATION

- .1 National Standard of Canada designation (CAN): The number following the CAN designation represents the agency under whose auspices the standard is issued.
 - .1 CAN1 designates CGA
 - .2 CAN2 designates CGSB
 - .3 CAN3 designates CSA
 - .4 CAN4 designates ULC
- .2 AAMA - American Architectural Manufacturers Association
- .3 AMA - Acoustical Materials Association
- .4 AMCA - Air Movement & Control Association International Inc.
- .5 AA - The Aluminum Association
- .6 AISI - American Iron & Steel Institute
- .7 ASTM - American Society for Testing & Materials
- .8 ASHRAE - American Society of Heating, Refrigerating & Air Conditioning Engineers
- .9 ASME - American Society of Mechanical Engineers
- .10 ASA - American Standards Association
- .11 AMS - American Welding Society
- .12 AWPA - American Wood Preservers' Association
- .13 AWMAC - Architectural Woodwork Manufacturers Association of Canada
- .14 AWCC - Association of Wall & Ceiling Contractors of B.C.
- .15 BCBC - British Columbia Building Code
- .16 BHMA - Builders Hardware Manufacturers Association
- .17 CCMC - Canadian Construction Materials Centre
- .18 CEPA - Canadian Environmental Protection Act
- .19 CGA - Canadian Gas Association
- .20 CGSB - Canadian General Standards Board
- .21 CISC - Canadian Institute of Steel Construction
- .22 CITC - Canadian Institute of Timber Construction
- .23 CLSAB - Canadian Lumber Standards Accreditation Board
- .24 CLA - Canadian Lumbermen's Association
- .25 CPMA - Canadian Paint Manufacturers Association
- .26 CPCA - Canadian Painting Contractors Association
- .27 CSSBI - Canadian Sheet Steel Building Institute
- .28 CSA - Canadian Standards Association (CSA Group)

- .29 CSDFMA - Canadian Steel Door and Frame Manufacturing Association
- .30 CWB - Canadian Welding Bureau
- .31 CWC - Canadian Wood Council
- .32 CRP - Certified Registered Professional - Architect
- .33 CO - Change Order
- .34 CMB - Construction Materials Board
- .35 CSC - Construction Specifications Canada
- .36 CCN - Contemplated Change Notice
- .37 CSPI - Corrugated Steel Pipe Institute
- .38 CPM - Critical Path Method
- .39 DDC - Direct Digital Control
- .40 EEMAC - Electrical and Electronic Manufacturers Association of Canada
- .41 ECP - Environmental Choice Program
- .42 EPA - Environmental Protection Agency
- .43 FM - Factory Manual
- .44 FCC - Fire Commission of Canada
- .45 FSC - Forest Stewardship Council
- .46 GC - General Contractor
- .47 GC-03 - Green Seal Standard GC-03 Anti-Corrosive Paints
- .48 GC-11 - Green Seal Standard GS-11 Paints
- .49 GC-36 - Green Seal Standard for Commercial Adhesives 36
- .50 HRAI - Heating, Refrigerating and Air-Conditioning Institute of Canada
- .51 HVAC - Heating, Ventilation and Air Conditioning
- .52 HI - Hydronics Institute
- .53 IAQ - Indoor Air Quality
- .54 ICC - International Code Council
- .55 IEQ - Indoor Environmental Quality
- .56 MMCD - Master Municipal Construction Documents Association
- .57 MPDA - Master Painters and Decorators Association
- .58 MPDABC - Master Painters & Decorators Association of British Columbia
- .59 MPI - Master Painter's Institute
- .60 MSDS - Material Safety Data Sheet
- .61 MERV - Minimum Efficiency Reporting Value
- .62 NAAMM - National Association of Architectural Metal Manufacturers
- .63 NBC - National Building Code
- .64 NAIMA - North American Insulation Manufacturer's Association
- .65 NEMA - National Electrical Manufacturer's Association
- .66 NFCA - National Floor Covering Association
- .67 NFPA - National Fire Protection Association
- .68 NGA/GANA - National Glass Association with Glass Association of North America
- .69 NHLA - National Hardwood Lumber Association

- .70 NLGA - National Lumber Grades Authority
- .71 NRC - National Research Council
- .72 OHSR - Occupational Health and Safety Regulations
- .73 O&M - Operating and Maintenance
- .74 RPR - Registered Professional of Record
- .75 RFCI - Resilient Floor Covering Institute
- .76 SMACNA - Sheet Metal and Air Conditioning National Contractors Association
- .77 SSPC - Society for Protective Coatings (aka Steel Structures Painting Council)
- .78 SAE - Society of Automotive Engineers
- .79 SDS - Safety Data Sheet
- .80 SCAQMD 1113 - South Coast Air Quality Management District, Architectural Coatings
- .81 SCAQMD 1168 - South Coast Air Quality Management District Rule 1168, VOC Limits
- .82 SCC - Standards Council of Canada
- .83 SI - Supplemental Instructions
- .84 SI Units - International System of Units
- .85 TBCBC - The British Columbia Building Code
- .86 UL - Underwriters Laboratories Inc. (USA)
- .87 cUL - Underwriters Laboratories Inc. (USA) approved for use in Canada
- .88 ULC - Underwriters Laboratories of Canada
- .89 EPA - U.S. Environmental Protection Agency
- .90 VOC - Volatile Organic Compound
- .91 WH - Warnock Hersey
- .92 WCLIB - West Coast Lumber Inspection Bureau
- .93 WRCLA - Western Red Cedar Lumber Association
- .94 WWPA - Western Wood Products Association
- .95 WHMIS - Workplace Hazardous Materials Information System
- .96 WSBC - WorkSafeBC

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Quality assurance criteria.

1.2 RELATED REQUIREMENTS

- .1 Section 01 45 00 - Quality Control.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCE STANDARDS

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

1.4 QUALITY ASSURANCE

- .1 Cooperate with 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 Have someone on site with deconstruction experience throughout project for consultation and supervision purposes.
 - .3 Have someone on site with restoration experience throughout 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-ups.
- .4 Mill tests.
- .5 Written and electronic reports.
- .6 Equipment and system adjust and balance.

1.2 RELATED REQUIREMENTS

- .1 Section 01 21 00 - Allowances.
- .2 Section 01 43 00 - Quality Assurance.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCE STANDARDS

- .1 ISO/IEC 17025-2005 - General Requirements for the Competence of Testing and Calibration Laboratories.
- .2 Canadian Construction Documents Committee (CCDC).
- .3 SCC (Standards Council of Canada)

1.4 REVIEW BY CONSULTANT

- .1 Allow Consultant access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .2 Consultant may order any part of the Work to be reviewed or inspected if Work is suspected to be not in accordance with Contract Documents.
- .3 If, upon review such work is found not in accordance with Contract Documents, correct such Work and pay cost of additional review and correction.
- .4 If such Work is found in accordance with Contract Documents, Owner will pay cost of review and replacement.

1.5 INDEPENDENT INSPECTION AGENCIES

- .1 Independent Inspection and Testing Agencies will be engaged by Owner for purpose of inspecting and testing portions of Work. Cost of such services will be borne by Owner.
- .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.

1.6 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.

1.7 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.

1.8 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant 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 Consultant it is not expedient to correct defective Work or Work not performed in accordance with Contract Documents, Owner may deduct from Contract Price the difference in value between Work performed and that called for by Contract Documents, amount of which shall be determined by Consultant.

1.9 REPORTS

- .1 Submit one (1) electronic copy of signed inspection and test reports to Consultant.
- .2 Provide copies to subcontractor of work being inspected or tested and manufacturer or fabricator of material being inspected or tested.

1.10 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 Place of Work shall be appraised by Consultant and may be authorized as recoverable.

1.11 MOCK-UPS

- .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 and Owner'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, Consultant will assist in preparing a schedule fixing dates for preparation.
- .6 Remove mock-up at conclusion of Work or when acceptable to Consultant. Repair any damage and clean-up at place of mock-up.
- .7 Approved mock-up may remain as part of Work.
- .8 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed.

1.12 MILL TESTS

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

1.13 EQUIPMENT AND SYSTEMS

- .1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.
- .2 Owner to be notified once steel studs are in place to confirm the locations of wall mounted devices such as washroom accessories.

End of Section

PART 1 GENERAL

1.1 SUBMITTALS

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

1.2 INSTALLATION AND REMOVAL

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

1.3 TEMPORARY HEATING AND VENTILATION

- .1 Heating is not a requirement for the scope of the Work.
- .2 Temporary heaters are not permitted unless permission is granted by the Owner, in which case they must be electric.
- .3 Provide temporary ventilation in enclosed areas as required to:
 - .1 Facilitate progress of Work.
 - .2 Provide adequate ventilation to meet health regulations for safe working environment.
 - .3 Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction or deconstruction.
 - .4 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .5 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .6 Ventilate storage spaces containing hazardous or volatile materials.
 - .7 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
- .4 Maintain strict supervision of operation of temporary ventilating equipment to:
 - .1 Conform to applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
- .5 Be responsible for damage to Work due to failure in providing adequate ventilation and protection during construction.

1.4 TEMPORARY POWER AND LIGHT

- .1 Provide temporary power during the course of Work for temporary lighting and operating of power tools.
- .2 Provide and maintain temporary lighting throughout project.

1.5 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by Insurance companies, Building Code and Fire Code.

PART 2 PRODUCTS

2.1 NOT USED

PART 3 EXECUTION

3.1 NOT USED

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Construction aids.
- .2 Office.
- .3 Parking.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittals.
- .2 Section 01 51 00 - Temporary Utilities.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 REFERENCES

- .1 Canadian Construction Documents Committee (CCDC)
- .2 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-Z321, Signs and Symbols for the Occupational Environment.

1.4 INSTALLATION AND REMOVAL

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

1.5 ELEVATORS/LIFTS

- .1 Designated existing elevators/lifts may be used by construction personnel and transporting of materials. Co-ordinate use with Consultant.
- .2 Provide protective coverings for finish surfaces of cars and entrances.

1.6 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.

1.7 CONSTRUCTION PARKING

- .1 Parking will be permitted on site provided it does not disrupt continuing operation of the facility.
- .2 Provide and maintain adequate access to project site.

1.8 OFFICE

- .1 Contractor is not required to provide an office. The Owner will provide a meeting room within hospital of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide a clearly marked and fully stocked first-aid case in a readily available location.

1.9 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

1.10 SANITARY FACILITIES

- .1 Existing permanent facilities may be used on approval of Owner.
- .2 Make good any damage caused to same or better condition on completion of project.
- .3 Keep sanitary facilities clean and fully stocked with the necessary supplies at all times.
- .4 Contractor to pay for ongoing cleaning and supplies and a final deep clean at end of project.

1.11 CLEAN-UP

- .1 Remove construction debris, waste materials, packaging material from work site daily.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Weather enclosures.
- .2 Dust tight barriers.
- .3 Protection of applied finishes.
- .4 Protection of surrounding Work.

1.2 RELATED REQUIREMENTS

- .1 Section 01 51 00 - Temporary Utilities.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 INSTALLATION AND REMOVAL

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

1.4 WEATHER ENCLOSURES

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

1.5 DUST TIGHT BARRIERS

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

1.6 PROTECTION OF APPLIED FINISHES

- .1 Provide protection for finished and partially finished surfaces and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Consultant locations and installation schedule three (3) days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

1.7 PROTECTION OF SURROUNDING WORK

- .1 Provide protection for finished and partially finished Work from damage.
- .2 Provide necessary cover and protection.
- .3 Be responsible for damage incurred due to lack of or improper or inappropriate protection.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Implementation of a construction Indoor Air Quality (IAQ) Management Plan, on site.
- .2 IAQ testing.

1.2 RELATED REQUIREMENTS

- .1 Section 01 74 10 - Cleaning.
- .2 Section 01 75 19 - Testing, Adjusting and Balancing.

1.3 DEFINITIONS

- .1 IAQ: Indoor Air Quality.
- .2 MERV: Minimum Efficiency Reporting Value.

1.4 REFERENCE STANDARDS

- .1 ASHRAE 52.2-2007 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size
- .2 SMACNA 008-2008 - IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition.
- .3 Indoor Air Quality - Health Canada.

1.5 SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Provide three (3) copies of submittals requested in this section.
- .3 Provide within fourteen(14) days of date established for Implementation of the Construction IAQ Management Plan.
- .4 Concurrent with each Application for Payment, provide the following:
 - .1 Weekly inspection record of damage or deficiencies and maintenance of IAQ management measures.

PART 2 PRODUCTS

2.1 AIR FILTRATION MEDIA

- .1 Pleated Synthetic Filtration Media: MERV of 8 as determined by ASHRAE 52.2.

PART 3 EXECUTION

3.1 INDOOR AIR QUALITY DURING CONSTRUCTION

- .1 Implement and maintain an Indoor Air Quality (IAQ) Management Plan during construction and facility pre-occupancy:
 - .1 Meet or exceed SMACNA 008.
 - .2 Protect building materials stored and installed on site from damage caused by exposure to moisture.
 - .3 Prohibit smoking at all indoor locations and adjacent to door openings.
 - .1 There is no smoking or vaping on NHA property.

- .4 For use of permanent heating, cooling, and ventilating systems during the construction phase as specified in Section 01 51 00, install air filtration media at each inlet to a return air duct for the air handling system used during construction.
- .5 Regularly inspect conditions on site to ensure that IAQ Management measures are being correctly implemented and maintained:
 - .1 Verify filtration media is intact.
 - .2 Observe materials are adequately protected from exposure to moisture and debris.
 - .3 Ensure spaces and voids to be concealed by construction are free of debris prior to enclosing them.
 - .4 Remove standing water which accumulated on surfaces or within components.
- .6 Photograph six (6) different SMACNA approaches implemented on site, at three (3) different periods during the construction.

3.2 IAQ TESTING

- .1 IAQ testing prior to occupancy.
 - .1 After construction and interior finishes and furnishings have been installed, but prior to the building being occupied, engage a qualified independent testing and inspecting agency to conduct baseline indoor air quality testing.
 - .2 Provide testing consistent with protocols outlined by the U.S. EPA and demonstrate that contaminants listed below do not exceeded the limits indicated.
 - .1 Particulate matter (PM10): Maximum 50 micrograms per cu m.
 - .2 Formaldehyde: Maximum 50 parts per billion.
 - .3 Total Volatile Organic Compounds (VOCs): Maximum 500 micrograms per cu m.
 - .4 Carbon monoxide: Maximum 9 parts per million, and no greater than 2 parts per million above outdoor levels.
 - .5 4-Phenylcyclohexene (4-PC): Maximum 6.5 micrograms per cu m.
 - .3 Complete testing in one (1) day, over a minimum four (4) hour period for each sample, and during times when the building would normally expect to be occupied.
 - .4 Collect one (1) sample for each 2,300 sq m, or part thereof of floor area, collect a minimum of one (1) sample for each occupied floor.
 - .5 Collect samples from a height between 1.2 m and 2.1 m above the finished floor elevation.
 - .6 Building ventilation systems and equipment should be operational prior to, and during the collection of test samples. Indoor climate conditions should be similar to conditions expected when the building is occupied.

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 REQUIREMENTS

- .1 Section 01 25 00 - Substitution Procedures.
- .2 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 TERMINOLOGY

- .1 New: Produced from new materials.
- .2 Re-newed: 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 Procurement policy is to acquire in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of Work.
- .3 Defective Products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective Products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Should any dispute arise as to quality or fitness of Products, decision rests strictly with Consultant.
- .5 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .6 Permanent labels, trademarks and nameplates on Products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.5 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 Provide equipment and personnel to store Products by methods to prevent soiling, disfigurement, or damage.
- .7 Arrange storage of Products to permit access for inspection. Periodically inspect to verify Products are undamaged and are maintained in acceptable condition.
- .8 Remove and replace damaged products at own expense and to satisfaction of Consultant.

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.
- .4 Pay costs of transportation of products required in performance of Work.

1.8 PRODUCT CHANGES

- .1 Change in Product/Products: Submit request for substitution or alternative in accordance with Section 01 25 00.

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

1.2 RELATED REQUIREMENTS

- .1 Section 01 11 00 - Summary of Work: Work by Owner.
- .2 Section 01 25 00 - Substitution Procedures: Product options and substitutions.
- .3 Section 01 33 00 - Construction Progress Documentation: Submittals and scheduling.
- .4 Section 01 61 00 - Common Product Requirements.
- .5 Section 07 84 00 - Firestopping.
- .6 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 Submittals: in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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.
- .3 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.
- .2 Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 25 00.

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.

3.3 CUTTING

- .1 Execute cutting and fitting as required 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 air tight 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.
- .9 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 Progressive cleaning.
- .2 Cleaning prior to acceptance.

1.2 RELATED REQUIREMENTS

- .1 Section 01 74 19 - Construction Waste Managing and Disposal.
- .2 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, other than that caused by Owner or other Contractors.
- .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 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .4 Containers:
 - .1 Provide on-site steel framed, hinged lid containers for collection of waste materials and debris.
 - .2 Provide and use clearly marked, separate bins for recycling.
 - .3 Refer to Section 01 74 19.
- .5 Remove waste material and debris from site and deposit in waste container at end of each working day.
- .6 Dispose of waste materials and debris off site.
- .7 Clean interior areas prior to start of finish work, and maintain areas free of dust and other contaminants during finishing operations.
- .8 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .9 Provide adequate ventilation during use of volatile or noxious substances. Use of enclosure ventilation systems is not permitted for this purpose.
- .10 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .11 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 other than that caused by others, and leave Work clean and suitable for occupancy.
- .3 Prior to final review, remove surplus products, tools, construction machinery and equipment.
- .4 Remove waste products and debris other than that caused by Owner or other Contractors.
- .5 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Consultant.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 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.
- .8 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors.
- .9 Clean lighting reflectors, lenses, and other lighting surfaces.
- .10 Vacuum clean and dust building interiors, behind grilles, louvres and screens.
- .11 Clean and polish surface finishes, as recommended by manufacturer.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Clean equipment and fixtures to a sanitary condition; replace filters of mechanical equipment.
- .14 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

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 carpeted and soft 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.

3.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction Waste Management and Disposal.

End of Section

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 10 - Cleaning.
- .3 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.2 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Consultant to review and discuss Waste Management Plan and Goals.
- .2 Waste Management Goal is to divert all materials considered recyclable from landfill sites.
- .3 Accomplish maximum control of solid construction waste.
- .4 Preserve environment and prevent pollution and environment damage.
- .5 Owner has established this Project is to generate the least amount of waste possible. This requires that construction processes ensure as little waste as possible, either due to error, poor planning, breakage, mishandling, contamination, or other factors.
- .6 Minimize waste disposal to landfills.

1.3 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation waste.
- .2 Clean Waste: Untreated and unpainted; not contaminated with oils, solvents, sealants or similar materials.
- .3 Construction and Demolition Waste: Solid wastes typically including but not limited to, building materials, packaging, trash, debris, and rubble resulting from construction, re-modelling, repair and demolition operations.
- .4 Hazardous: Exhibiting the characteristics of hazardous substances including, but not limited to, ignitability, corrosiveness, toxicity or reactivity.
- .5 Non-hazardous: Exhibiting none of the characteristics of hazardous substances, including, but not limited to, ignitability, corrosiveness, toxicity, or reactivity.
- .6 Non-toxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- .7 Recyclable: The ability of a product or material to be recovered at the end of its life cycle and re-manufactured into a new product for reuse by others.
- .8 Recycle: To remove a waste material from the Project site to another site for re-manufacture into a new product for reuse by others.
- .9 Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .10 Return: To give back reusable items or unused products to vendors for credit.
- .11 Reuse: To reuse a construction waste material in some manner on the Project site.
- .12 Salvage: To remove a waste material from the Project site to another site for resale or reuse by others.
- .13 Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- .14 Toxic: Poisonous to humans either immediately or after a long period of exposure.

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- .15 Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- .16 Volatile Organic Compounds (VOC's): Chemical compounds common in and emitted by many building products over time through outgassing:
 - .1 Solvents in paints and other coatings.
 - .2 Wood preservatives; strippers and household cleaners.
 - .3 Adhesives in particle board, fibreboard, and some plywood; and foam insulation.
 - .4 When released, VOC's can contribute to the formation of smog and can cause respiratory tract problems, headaches, eye irritations, nausea, damage to the liver, kidneys, and central nervous system, and possibly cancer.
- .17 Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.
- .18 Waste Management Plan: A Project-related plan for the collection, transportation, and disposal of the waste generated at the construction site. The purpose of the plan is to ultimately reduce the amount of material being landfilled.

1.4 WASTE MANAGEMENT PLAN

- .1 Draft Waste Management Plan: Within ten (10) days after receipt of Notice of Award of Bid, or prior to any waste removal, whichever occurs sooner.
- .2 Submit a Draft Waste Management Plan to Consultant for review, refer to sample at the end of this Section.
- .3 Draft Plan to contain the following:
 - .1 Analysis: Proposed site waste generated, including types and quantities.
 - .2 Landfill Options: Name of landfill where trash will be disposed, applicable landfill fees, and projected cost of disposing of Project waste in landfill.
 - .3 Alternatives to Landfill: List of each material proposed to be salvaged, reused, or recycled during course of the Project, proposed local market for each material, and estimated net cost savings or additional costs resulting from separating and recycling, versus landfill each material; "net" means that the following have been subtracted from the cost of separating and recycling:
 - .1 Revenue from sale of recycled or salvaged materials.
 - .2 Landfill tipping fees saved due to diversion of materials from landfill. List of materials to include the following materials:
 - .1 Cardboard.
 - .2 Clean dimensional wood.
 - .3 Beverage containers.
 - .4 Land clearing debris.
 - .5 Concrete.
 - .6 Metals from banding, steel stud trim, ductwork, piping, rebar, roofing, other trim, steel, iron, galvanized sheet steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - .7 Gypsum board.
 - .8 Plastic buckets - waste reduced by using plastic lined cardboard dry packed materials instead of premixed moist packed materials where this option is available.
 - .9 Paint.

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- .10 Plastic sheeting and packaging, where recycling programs are available.
- .11 Rigid plastic foam insulation, where recycling programs are available.
- .4 Resources for Development of Waste Management Plan:
 - .1 Recycling Haulers and Markets: Investigate local haulers and markets for recyclable materials, then incorporate into Waste Management Plan.
- .5 Final Waste Management Plan: Once the Owner has determined which of the recycling options addressed in the draft Waste Management Plan are acceptable, submit, within ten (10) calendar days, a Final Waste Management Plan, containing the following:
 - .1 Analysis of proposed jobsite waste to be generated, including types and quantities.
 - .2 Landfill options: The name of landfill site where trash will be disposed of, the applicable landfill tipping fees, and the projected cost of disposing of all Project waste at the landfill.
 - .3 Alternatives to Landfill: A list of waste materials from Project that will be separated for reuse, salvage, or recycling.
 - .4 Meetings: A description of regular meetings held to address waste management, refer to Section 01 31 00.
 - .5 Materials Handling Procedures: A description of the means any waste materials identified above will be protected from contamination, and a description of the means to be employed in recycling materials consistent with requirements for acceptance by designated facilities.
 - .6 Transportation: A description of the means of transportation of recyclable materials, whether materials will be site-separated and self-hauled to designated centres, or whether mixed materials will be collected by waste hauler and removed from site, and destination of materials.

1.5 THIRD PARTY RESPONSIBILITY

- .1 Cooperate with all parties on site to implement a Waste Diversion Plan.

1.6 STORAGE, HANDLING AND PROTECTION

- .1 Store, materials to be reused, recycled and salvaged in locations as directed by Consultant.
- .2 Unless specified otherwise, materials for removal do not become Contractor's property.
- .3 Protect, stockpile, store and catalogue salvaged items.
- .4 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.
- .5 Protect structural components not removed for demolition from movement or damage.
- .6 Support affected structures. If safety of building is endangered, cease operations and immediately notify Consultant.
- .7 Protect surface drainage, storm sewers, sanitary sewers, and utility services from damage and blockage.

1.7 SCHEDULING

- .1 Coordinate work with other activities at site to ensure timely and orderly progress of the work.

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PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 DISPOSAL OF WASTE

- .1 Burying of rubbish and waste materials is prohibited unless approved by authority having jurisdiction.
- .2 Disposal of waste, volatile materials, mineral spirits, oil, and paint thinner into waterways, storm, or sanitary sewers is prohibited.
- .3 Keep records of construction waste including:
 - .1 Number and size of bins.
 - .2 Waste type of each bin.
 - .3 Reused or recycled waste destination.
- .4 Remove materials from deconstruction as deconstruction / disassembly Work progresses.

3.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Maintain security measures established by existing facility.

3.3 APPLICATION

- .1 Do Work in compliance with Waste Diversion Plan and bylaw requirements.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.
- .3 Maintain at job site, one (1) copy of following documents:
 - .1 Waste Diversion Plan.

3.4 CLEANING

- .1 Remove tools and waste materials on completion of work, leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Starting equipment in preparation for adjusting and commissioning.
- .2 To bring the facility to a fully operational state, free of deficiencies, in the most efficient and timely manner achievable.
- .3 Contractor's and Owner's responsibilities during each of the following successive sub phases of facility start-up:
 - .1 Contractor start-up which leads to Interim Acceptance of the Work.
 - .2 Performance Testing which leads to Practical Completion of the Work.

1.2 RELATED REQUIREMENTS

- .1 Section 01 75 19 - Testing, Adjusting and Balancing.
- .2 Section 01 79 00 - Demonstration and Training.
- .3 Section 01 91 00 - Commissioning.
- .4 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 SUBMISSIONS

- .1 Advise Commissioning Agent of report forms required for equipment and systems but not yet supplied by the commissioning agent.
- .2 Provide a sample of manufacturer's start-up forms for equipment or systems not included.
- .3 Submit and completed and verified commissioning manual to the Owner with all data entered and sign-offs, prior to Substantial Completion of the Work.

PART 3 EXECUTION

3.1 STARTING SYSTEMS

- .1 Coordinate schedule for start-up of various equipment and systems.
- .2 Notify Consultant and Owner, seven (7) days prior to start-up of each item.
- .3 Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.
- .4 Verify tests, metre readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- .5 Verify that wiring and support components for equipment are complete and tested.
- .6 Execute start-up under supervision of applicable manufacturer's representative in accordance with manufacturers' written instructions.
- .7 When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- .8 Submit a written report in accordance with Section 01 33 00 that equipment or system has been properly installed and is functioning correctly.

3.2 START-UP REPORT

- .1 Commissioning agent will provide start up report forms (check sheets) with the exception of controls.

- .2 Contractor to develop, complete and provide the report forms for all control points, software and hardware.
- .3 Submit completed report forms to commissioning agent for review within ninety (90) days of award of contract.
- .4 Commissioning agent will assemble completed report forms into a "commissioning manual" on the following subjects:
 - .1 Each mechanical system (except for controls).
 - .2 Each electrical system.
- .5 Refer to Owner for a sample of the commissioning report form.
- .6 Include manufacturer's equipment start-up reports and test certificates as an appendix to the commissioning manual.
- .7 The commissioning manual will be kept on site for use by appropriate contractors and the commissioning agent.
 - .1 Maintain this manual current.
 - .2 Maintain a schedule for work of the commissioning agent in conjunction with the commissioning schedule.
- .8 The report forms are divided into three parts:
 - .1 Technical Data.
 - .2 Static Checks.
 - .3 Operational Checks.
- .9 Contractor is to complete each part prior to verification by the commissioning agent.
- .10 Contractor is responsible for completing the report forms as follows and as indicated on the attached sample:
 - .1 Technical Data.
 - .1 Specified: Commissioning Agent.
 - .2 Shop Drawing: Contractor.
 - .3 Installed: Contractor.
 - .4 Verified: Commissioning Agent.
 - .5 Date/Checked By: Contractor to sign when all shop drawing and installed information is completed.
 - .2 Static Checks.
 - .1 Confirmation of Completion: Contractor to confirm all items listed are completed prior to verification by the commissioning agent.
 - .2 Date / Checked By: Contractor to sign when the installation of the equipment and or systems are complete and ready for the commissioning agent to verify.
 - .3 Operational Checks.
 - .1 Operational checks will be performed by the commissioning agent using the balancing report and control's forms.

3.3 CONTRACTOR START UP

- .1 Contractor to perform the following during start-up:
 - .1 Start equipment and systems.
 - .2 Test, adjust and balance equipment and systems as specified in Section 01 75 19.
 - .3 Demonstrate equipment and systems as specified in Section 01 79 00.

- .2 Complete and submit start-up reports including:
 - .1 Contractor's system and equipment start up reports.
 - .2 Manufacturers' equipment start up reports.
- .3 Review Contract Documents and inspect the Work to ensure completeness of the Work and compliance with requirements of Contract Documents.
- .4 Correct Contract deficiencies and defects identified as a result of the foregoing and as may be identified by the owner.
- .5 Execute and complete approved Change Orders.
- .6 Perform other work and activities required for fulfillment of prerequisites to Interim Acceptance of the Work.
- .7 Commissioning Agent will perform the following during start-up:
 - .1 Perform preliminary interim inspections as necessary.
 - .2 Witness manufacturers' equipment start-up.
 - .3 Verify starting, testing, adjusting and balancing by Contractor.
 - .4 Provide start-up reports for all systems and equipment and review and approve Contractor start-up reports.
 - .5 Cooperate in systems and equipment demonstration and instruction.
 - .6 Initiate Change Orders as required.
 - .7 Verify correction of Contract deficiencies and defects by Contractor.
 - .8 Verify execution of Change Orders performed by Contractor.
 - .9 Perform other activities related to Substantial Completion of the Work as specified in Section 01 91 00.
- .8 The following will be performed to an on-going cycle of:
 - .1 Owner's inspections.
 - .2 Documentation of results.
 - .3 Diagnosis of problems.
 - .4 Correction of Contract Deficiencies and execution of Change Orders as required.
 - .5 Verification of results.

3.4 PERFORMANCE TESTING

- .1 Performance testing will be performed by the Commissioning Agent and:
 - .1 Completed prior to Substantial Completion.
 - .2 Completed when all systems have been balanced and tested and are operating to the satisfactory of the Commissioning Agent.
- .2 Contractor to perform the following during Performance Testing:
 - .1 Correct Contract deficiencies and defects previously outstanding and those identified during performance testing.
 - .2 Execute Change Orders.
- .3 The following will be performed to an on-going cycle of:
 - .1 Performance testing.
 - .2 Documentation of results.
 - .3 Diagnosis of problems.
 - .4 Correction of Contract deficiencies, defects and execution of Change Orders as required.

.5 Verification of results.

3.5 SEASONAL CONSTRAINTS

- .1 Notwithstanding requirements in this section, additional separate cycles of Contractor start-up, performance testing and fine tuning may be necessitated at a later time on equipment and systems whose full operation is dependent on seasonal conditions.
- .2 Contractor's responsibilities with respect to later facility start-up activities are specified in this section.

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 REQUIREMENTS

- .1 Section 01 74 10 - Cleaning.
- .2 Section 01 75 16 - Startup Procedures.
- .3 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 in contract by an agency that will be selected by the Owner and consigned to this Contract:
- .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 effect the balancing or noted during testing, adjusting and balancing, which cannot be promptly corrected.

PART 2 PRODUCTS - 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 SECTION INCLUDES

- .1 Operating and Maintenance Manuals
- .2 Electronic Copies of Manuals

1.2 REVIEW AND DECLARATION

- .1 Contractor's Review: Contractor and Subcontractors: conduct review 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 Review and that corrections have been made.
 - .2 Request Consultant's Review.
 - .3 Consultant's Review: Consultant and Contractor will perform review of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
- .2 Completion: submit written certificate that the following have been performed:
 - .1 Work has been completed and review for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required by Boiler Inspection Branch, Fire Commissioner, and Utility companies have been submitted.
 - .5 Operation of systems have been demonstrated to Owner's personnel.
 - .6 Work is complete and ready for final review.
- .3 Final Review: when items noted above are completed, request final review of Work by Owner, Consultant, and Contractor. If Work is deemed incomplete by Owner and Consultant complete outstanding items and request another review.
- .4 Declaration of Substantial Performance: when Owner and Consultant consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.
- .5 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .6 Final Payment: when Owner and Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request another review.
- .7 Payment of Holdback: after issuance of certificate of Substantial Performance of Work, submit an application for payment of holdback amount.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

End of Section

PART 1 GENERAL

1.1 RELATED REQUIREMENTS

- .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.

1.2 CLOSEOUT 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, three (3) 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.

1.3 OPERATION AND MAINTENANCE MANUAL FORMAT

- .1 Refer to 01 77 00 - Closeout Procedures.
- .2 Organize data in the form of an instructional manual.
- .3 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .4 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .5 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .6 Arrange content by systems, process flow under Section numbers and sequence of Table of Contents.
- .7 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .8 Text: Manufacturer's printed data, or typewritten data.
- .9 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- .10 Provide 1:1 scaled CAD files in *.dwg AutoCAD Release Latest Release format on USB.
- .11 Provide electronic copy on three USB sticks upon completion (scan documents to suit).

1.4 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.

1.5 RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

- .1 In addition to requirements in General Conditions, maintain at the site for Owner, 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.

1.6 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.

1.7 RECORD DOCUMENTS

- .1 Prior to Substantial Performance of the Work, electronically transfer the marked up information from the as-built documents to a master set of Drawing and specification files provided by the Consultant, as follows:
 - .1 Drawings: PDF.
 - .2 Specifications: PDF.
- .2 Mark revised documents as RECORD DOCUMENTS. Include all revisions, with special emphasis on structural steel electrical mechanical and reinforced concrete.
- .3 Employ a competent computer draftsman to indicate changes on the electronic set of record drawings. Provide updated Record Drawings in PDF.
- .4 Submit completed record documents to Consultant on a USB, accompanied by three (3) hard copy sets.

1.8 STORAGE, HANDLING AND PROTECTION

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

1.9 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Assemble approved information in binder and submit upon acceptance of work. Organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.

- .6 Retain warranties and bonds until time specified for submittals.
- .3 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Consultant.
- .4 Respond in a timely manner to oral or written notification of required construction warranty repair work.
- .5 Written verification will follow oral instructions. Failure to respond will be cause for the Consultant to proceed with action against Contractor.

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 REQUIREMENTS

- .1 Section 01 45 00 - Quality Control
- .2 Section 01 91 00 - Commissioning.

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 Sections .
- .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 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.

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 SECTION INCLUDES

- .1 Procedures for demonstration and instruction of Products, equipment and systems to Owner's personnel.
- .2 Seminars and demonstrations.

1.2 RELATED REQUIREMENTS

- .1 Section 01 91 00 - Commissioning.
- .2 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.

1.6 CONDITIONS FOR DEMONSTRATIONS

- .1 Equipment has been inspected and put into operation in accordance with:
 - .1 Section 01 75 16: Start-up Procedures.
 - .2 Section 01 75 19: Testing, adjusting and balancing.
- .2 Testing, adjusting, and balancing have been performed in accordance with Section 01 91 00, and equipment and systems are fully operational.
- .3 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

PART 2 PRODUCTS - 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 designated 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.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Commissioning, testing and documentation.
- .2 Audit testing and the commissioning auditor.

1.2 RELATED REQUIREMENTS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 75 16 - Startup Procedures.
- .3 Section 01 75 19 - Testing, Adjusting and Balancing: Mechanical systems.
- .4 Section 01 79 00 - Demonstration and Training.
- .5 This section describes requirements applicable to all Sections within Divisions 02 to 49.

1.3 DEFINITIONS

- .1 Commissioning: The process for achieving, verifying, and documenting that the facility and its systems are planned, designed, installed, and tested to ensure that they meet the original project requirements established by the Owner.
- .2 Commissioning Team:
 - .1 Owner's Representative: Representative of the Owner, as defined in the Agreement.
 - .2 Consultant: Consultant, as defined in the Agreement.
 - .3 Commissioning Manager: Party engaged by the Owner to lead commissioning activities, and coordinate other team members.
 - .4 Contractor Representatives: Representatives of the Contractor, including any sub-contractors whose scope of work includes items requiring commissioning.
 - .5 Commissioning Auditor: Party engaged by the Owner to audit or verify results assembled by the Commissioning Team.
 - .6 Testing Agency: Specialty agency engaged by the Owner to perform tests on components or systems to verify conformance to Owner's requirements or specified requirements.
- .3 Commissioning Documents:
 - .1 Commissioning Plan: A project-specific document which defines the scope and approach to commissioning of this facility.
 - .2 Submittal: Contract submittal, as specified in Contract Documents.
 - .3 Static check certificate: A document used to verify equipment data actually installed, prior to startup or operation.
 - .4 Operating check certificate. A document used to verify equipment operation, including performance statistics.
 - .5 Startup Reports: Report prepared by equipment startup personnel, including start-up sequence, and performance statistics. Refer to Section 01 75 16.
 - .6 Balancing Report: Report prepared by the balancing agency, indicating initial and final system performance, to Section 01 75 19.
 - .7 Maintenance Manual: A document containing detailed descriptions and technical information about start-up, operation and maintenance of equipment, to Section 01 78 23.

1.4 METHODOLOGY

- .1 The Commissioning Manager shall develop a Commissioning Plan, including as a minimum the management of commissioning meetings, and the management of project-specific commissioning documents.
- .2 Commissioning Plan to include:
 - .1 Assembly of owner's requirements, including design criteria, performance goals, budgets, and schedules.
 - .2 Scheduling and chairing of commissioning meetings between team members.
 - .3 Development of static and operating check certificates for individual equipment.
 - .4 Assembly of commissioning reports, including testing and balancing reports, maintenance manuals, startup reports, and testing reports.
 - .5 Verification of data by testing agency.
 - .6 Audit procedure, to be performed in the event of dispute or failure.
- .3 Execute the commissioning plan.

1.5 REGULATORY REQUIREMENTS

- .1 Arrange for regulatory authorities to witness those commissioning start up procedures which are also required by regulatory authorities.
- .2 Obtain certificates of approval and for compliance with regulations from Authorities Having Jurisdiction; include copies of certificates with start up reports.

1.6 CONTRACT COMMISSIONING REQUIREMENTS

- .1 Witnessing: Allow commissioning team members to witness starting, testing, adjusting, and balancing procedures.
- .2 Allow Commissioning Manager and Auditor free access to the site.
- .3 Costs: Pay costs associated with starting, testing, adjusting, and relevant instruments and supplies required to perform those duties.
- .4 Employ experienced personnel for equipment startup and commissioning, who are able to interpret results of readings and tests, and report the system status in a clear and concise manner.
- .5 Provide all equipment required to perform testing, balancing, and commissioning of systems. Calibrate instruments used in start up as accurate; provide calibration certificates if requested by the Commissioning Manager.
- .6 Utilize equipment check certificates and other commissioning documents required by the Commissioning Manager.
- .7 Verify that equipment is installed in accordance with Contract Documents, and reviewed shop drawings. Sign and date static check certificates.
- .8 Do not start up equipment unless static check sheets have been completed and submitted.
- .9 Complete in detail, and sign operating check certificates.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 COMMISSION TESTING

- .1 Allow for work, effort, and associated costs necessary to assist an Owner appointed and remunerated Commissioning Manager, for fulfilment of a commission testing process of the facility and Work.

- .2 Coordinate, cooperate, and harmonize efforts with the Commissioning Manager.
- .3 Commission testing will include a random testing and evaluation process as determined by the Commissioning Manager.
- .4 System and device checks to be suitably logged, tabulated, signed, and incorporated into project Operating and Maintenance Manuals:
 - .1 Prior to start of testing, provide two (2) complete sets of up-to-date contract drawings and specifications including addenda to the Commissioning Manager.
 - .2 Provide one (1) copy of each approved notice of change and clarification.
 - .3 Coordinate site visits by the Commission Manager and the affected parties during warranty periods.
- .5 The commissioning process will not:
 - .1 Preclude the duties and responsibilities described in the Contract Documents nor the requirements and obligations of the Contract.
 - .2 Circumvent any required warranties.
 - .3 Relieve the Contractor from warranty requirements, responsibilities, or obligations.
- .6 Prior to commission testing, perform the following and provide copies to the Commissioning Manager, of component and assembly Contract Document compliance:
 - .1 Static test certificates.
 - .2 Equipment operating certificates.
 - .3 Three (3) copies of valve tag list.
 - .4 Inspection certificates from authorities having jurisdiction.
 - .5 Required copies of shop drawings.
 - .6 Manufacturer's operating and maintenance brochures of all major equipment.
- .7 Ensure all systems have been started, adjusted to design criteria, and are functionally operational, ready for independent testing.
- .8 Cooperate with the Commissioning Manager in advance of activating operating systems.
- .9 Test results that reveal failure to conform to the Contract Documents, will result in a second series of tests performed by an Auditor.

3.2 AUDIT TESTING AND THE COMMISSIONING AUDITOR

- .1 In the event on non-compliance or test failure described in the commission testing process above, comply with the following requirements.
- .2 Allow for work, effort, and associated costs necessary to assist an Owner appointed and remunerated Auditor, for fulfilment of a further audit testing of the facility and Work.
- .3 Coordinate, cooperate, and harmonize efforts with the Auditor.
- .4 Audit testing will include further random testing and evaluation as determined by the Owner, the Auditor, and the Commissioning Manager.
- .5 Suitably log, tabulate, and incorporate signed system and device check certificates into Operating and Maintenance Manuals.
- .6 Coordinate site visits by the Auditor, Commission Manager and the affected parties during warranty periods.
- .7 The audit process will not:
 - .1 Preclude the duties and responsibilities described in the Contract nor the requirements and obligations of the Contract.
 - .2 Circumvent any required warranties.

- .3 Relieve the Contractor from warranty requirements, responsibilities, or obligations.
- .8 Cooperate with the Auditor prior to testing of operating systems.
- .9 Test results that demonstrate failure to conform to the Contract Documents, may result in the following, at the Owner's sole discretion:
 - .1 Complete rejection of the subject component, assembly, or system.
 - .2 Removal of defective items from the Work.
 - .3 An adjustment credit to the Contract Price for the Owner's estimated value of the subject item plus remuneration for associated damages and inconvenience.
 - .4 Provision of a suitable substitute Product in place of the defective Product.
 - .5 Substituted Products will be required to be commissioned and audited and undergo the same scrutiny as described for commission testing and audit testing described above.

End of Section

PART 1 GENERAL

1.1 SUMMARY

- .1 This Section includes the following:
 - .1 Demolition of interior building components and finishes.
 - .2 Demolition of mechanical and electrical equipment.
 - .3 Repair procedures for selective demolition operations.
- .2 This Section does not include the following: -
 - .1 Removal of hazardous materials or asbestos abatement.
- .3 Alteration project procedures.
- .4 Removal of designated building equipment and fixtures.
- .5 Removal of designated construction.
- .6 Disposal of materials.
- .7 Identification of utilities.

1.2 REFERENCE STANDARDS

- .1 Comply with applicable Municipal, Provincial, and National codes, standards, and bylaws.
- .2 Unless otherwise noted, editions of Codes, References, and Standards referenced in project Specifications and Drawings are to be those most current at the time of tender closing. This includes associated amendments and revisions to these Codes, References, and Standards.
- .3 CSA Group (CSA):
 - .1 CSA S350 - Code of Practice for Safety in Demolition of Structures.
- .4 National Fire Protection Association (NFPA):
 - .1 NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.

1.3 DEFINITIONS

- .1 Demolish: Detach items from existing construction and legally dispose of them off site, unless indicated to be removed and salvaged or removed and reinstated.
- .2 Remove and Salvage: Detach items from existing construction and deliver them to Owner ready for reuse.
- .3 Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- .4 Existing to Remain: Existing items of construction that are not removed and that are not otherwise indicated as being removed, removed and salvaged, or removed and reinstalled.
- .5 Hazardous Substances: Dangerous substances, dangerous goods, hazardous commodities and hazardous products may include asbestos, mercury and lead, PCB's, poisons, corrosive agents, flammable substances, radioactive substances, or other material that can endanger human health or wellbeing or environment if handled improperly as defined by the Federal Hazardous Products Act (RSC 1985) including latest amendments.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Coordinate selective demolition work so that work of this Section adheres to aesthetic criteria established by the Drawings and specified dimensions with all elements in planes as drawn, maintaining their relationships with all other building elements.

- .2 Coordinate with Consultant for the material ownership as follows:
 - .1 Except for items or materials indicated to be reused, salvaged, reinstalled or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.
- .3 Pre Demolition Meeting: Conduct a pre demolition meeting at Project site to confirm extent of salvaged and demolished materials.
- .4 Sequencing: Sequence work to requirements of Section 01 11 00.
- .5 Scheduling: Schedule work to requirements of Section 01 31 00.

1.5 ALTERATION PROJECT PROCEDURES

- .1 Materials: As specified in Product sections; match existing Products and work for patching and extending work.
- .2 Employ skilled and experienced installer to perform alteration work.
- .3 Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.
- .4 Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring Products and finishes to specified condition.
- .5 Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.
- .6 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.
- .7 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.
- .8 Where a change of plane of 6 mm or more occurs, submit recommendation for providing a smooth transition; to Consultant for review.
- .9 Patch or replace portions of existing surfaces which are damaged, lifted, discoloured, or showing other imperfections.
- .10 Finish surfaces as specified in individual Product sections.

1.6 ACTION AND INFORMATION SUBMITTALS

- .1 Action Submittals: Provide the following submittals before starting any work of this Section:
 - .1 Schedule of Selective Demolition Activities:
 - .1 Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
 - .2 Coordinate with Owner's building manager and user group ongoing site operations, and limit the number of interruptions during regular business hours.
 - .3 Interruption of utility services.
 - .4 Coordination for shutoff, capping, and continuation of utility services.
 - .5 Locations of temporary partitions and means of egress, including for others affected by selective demolition operations.
 - .6 Coordination with continuing occupancy and site operations of portions of existing building.
 - .2 Demolition Plan: Submit a plan of demolition area indicating extent of temporary facilities and supports, methods of removal and demolition prepared by a professional engineer in accordance with requirements of Authority Having Jurisdiction, and as follows:

- .1 Proposed Dust Control and Noise Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Consultant reserves the right to make modifications where proposed methods interfere with the Owner's ongoing operation.
 - .2 Inventory: Submit a list of items that have been removed and salvaged after selective demolition is complete.
 - .3 Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.
 - .4 Pre demolition Photographs: Submit photographs indicating existing conditions of adjoining construction and site improvements prior to starting Work. Include finish surfaces that may be misconstrued as damage caused by selective demolition operations.
- .2 Information Submittals: Provide the following submittals when requested by the Consultant:
- .1 Qualification Data: Submit information for companies and personnel indicating their capabilities and experience to perform work of this Section including but not limited to lists of completed projects with project names and addresses, names and addresses of architects and owners, for work of similar complexity and extent.

1.7 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and reconnection.
- .2 Do not close or obstruct egress width to any building or site exit.
- .3 Do not disable or disrupt building fire or life safety systems without seven (7) days prior written notice to Owner.
- .4 Conform to applicable regulatory procedures when discovering hazardous or contaminated materials.

1.8 QUALITY ASSURANCE

- .1 Demolition Firm Qualifications: An experienced firm that has specialized in demolition work similar in material and extent to that indicated for this Project, with a minimum of five (5) years experience.

1.9 SITE CONDITIONS

- .1 Portions of the building adjacent and above selective demolition area will be occupied:
 - .1 Conduct selective demolition so that operations will not be disrupted.
 - .2 Provide not less than seventy-two (72) hours notice to Consultant of activities that will affect operations.
- .2 Maintain access to existing walkways, corridors and other adjacent occupied or used facilities as follows:
 - .1 Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- .3 Consultant assumes no responsibility for condition of areas to be selectively demolished:
 - .1 Conditions existing at time of Pre Bid Site Review will be maintained by Owner as far as practical.
- .4 Storage or sale of removed items or materials on site will not be permitted.
- .5 Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
- .6 Maintain fire protection facilities in service during selective demolition operations.
- .7 Conduct demolition to minimize interference with adjacent and occupied building areas.

- .8 Cease operations immediately if structure appears to be in danger and notify Consultant. Do not resume operations until directed.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Use repair materials identical to existing materials:
 - .1 If identical materials are unavailable or cannot be used for exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 - .2 Use materials whose installed performance equal or surpasses that of existing materials.
 - .3 Comply with material and installation requirements specified in individual technical specification Sections.
 - .4 Retain original installer or fabricator to patch exposed Work that has been damaged during selective demolition, if possible. Engage another recognized experienced and specialized firm where it is not possible to retain original installer.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify that utilities have been disconnected and capped.
- .2 Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- .3 Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- .4 Notify the Consultant where existing mechanical, electrical, or structural elements conflict with intended function or design:
 - .1 Investigate and measure the nature and extent of conflict and submit a written report to Consultant.
 - .2 Consultant will issue additional instructions or revise drawings as required to correct conflict.
- .5 Engage a professional engineer to survey condition of building when removing elements that may result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective demolition operations.
- .6 Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.2 UTILITY SERVICES

- .1 Coordinate existing services indicated to remain and protect them against damage during selective demolition operations.
- .2 Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.
 - .1 Arrange to shut off affected utilities with utility companies.
 - .2 If utility services are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary utilities that bypass area of selective demolition and that maintain continuity of service to other parts of building.
 - .3 Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.
 - .4 Cut off pipe or conduit to a minimum of 25mm below slab, and remove concrete mound.

- .3 Coordinate with Mechanical and Electrical Divisions for shutting off, disconnecting, removing, and sealing or capping utilities.
- .4 Do not start selective demolition work until utility disconnecting and sealing have been completed and verified in writing.
- .5 Existing Utilities:
 - .1 Demolish existing utilities that are within 1500 mm outside of footprint indicated for new construction; abandon utilities outside this area.
 - .1 Piping: Disconnect piping at unions, flanges, valves, or fittings.
 - .2 Wiring Ducts: Disassemble into unit lengths and remove plug in and disconnecting devices.

3.3 PREPARATION

- .1 Drain, purge, or otherwise remove, collect, and dispose of chemicals, gases, explosive, acids, flammables, or other dangerous materials before proceeding with selective demolition operations.
- .2 Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain in accordance with Section 01 51 00 - Temporary Utilities, and as follows:
 - .1 Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - .2 Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - .3 Cover and protect furniture, furnishings, and equipment that have not been removed.
- .3 Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise in accordance with Section 01 51 00 - Temporary Utilities.
- .4 Protect existing materials which are not to be demolished.
- .5 Provide and maintain bracing, or structural support to preserve stability and prevent movement, settlement, or collapse of construction to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished:
 - .1 Strengthen or add new supports when required during progress of selective demolition.
- .6 Notify affected utility companies before starting work and comply with their requirements.
- .7 Mark location and termination of utilities.
- .8 Provide appropriate temporary signage including signage for exit or building egress.

3.4 POLLUTION CONTROLS

- .1 Dust Control: Provide water mist and temporary enclosures or other suitable methods reviewed or accepted by the Owner to limit spread of dust and dirt. Comply with governing environmental protection regulations, and as limited below:
 - .1 Do not use water when it may damage existing construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.
 - .2 Wet mop floors to eliminate tracking of dirt, wipe down walls and doors of demolition enclosure.
- .2 Remove and transport debris to prevent spillage on adjacent surfaces and areas.
- .3 Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

3.5 SELECTIVE DEMOLITION

- .1 Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
 - .1 Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remaining or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - .2 Cut or drill from the exposed or finishes side into concealed surfaces to avoid marring existing finished surfaces.
 - .3 Do not use cutting torches.
 - .4 Remove decayed, vermin infested, or otherwise dangerous or unsuitable materials and promptly dispose of off site.
 - .5 Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 - .6 Dispose of demolished items and materials promptly.
 - .7 Return elements of construction and surfaces that are to remain to condition existing before selective demolition operations began.
- .2 Comply with Owner's requirements for using and protecting elevators, stairs, walkways, building entries, and other building facilities during selective demolition operations.
- .3 Removed and salvaged items:
 - .1 Clean salvaged items.
 - .2 Pack or crate items after cleaning.
 - .3 Identify contents of containers.
 - .4 Store items in a secure area until delivery to Owner.
 - .5 Transport items to Owner's storage area designated by Owner.
 - .6 Protect items from damage during transport and storage.
- .4 Existing items to remain:
 - .1 Protect construction indicated to remain against damage and soiling during selective demolition.
 - .2 Items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.
- .5 Concrete:
 - .1 Demolish in small sections.
 - .2 Cut concrete to a depth of at least 19mm at junctures with construction to remain, using power driven saw.
 - .3 Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete indicated for selective demolition.
 - .4 Neatly trim openings to dimensions indicated.
- .6 Concrete slab reinforcing:
 - .1 Locate location of reinforcing steel in concrete slabs prior to cutting or coring using non destructive, non ionizing radio frequency locators.

- .2 Core concrete slabs to avoid reinforcing steel, electrical conduit or water pipes; adjust core location and coordinate with Consultant where slab features interfere with core drilling.
- .3 Notify the Consultant immediately for future instructions where coring or cutting will damage existing slab features.
- .7 Disconnect and identify designated utilities within demolition areas.
- .8 Air conditioning equipment: remove equipment without releasing refrigerants.
- .9 Demolish in an orderly and careful manner. Protect existing supporting structural members.
- .10 Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.
- .11 Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.
- .12 Remove temporary Work.

3.6 CLOSEOUT ACTIVITIES

- .1 Patching and Repairs: Promptly repair damage to adjacent construction caused by selective demolition operations and as follows:
 - .1 Patch to produce surfaces suitable for new materials where repairs to existing surfaces are required.
 - .2 Restore exposed finishes of patched areas and extend restoration into adjoining construction in a manner that eliminates evidence of patching and refinishing.
- .2 Demolition Waste Disposal: Arrange for legal disposal and remove demolished materials to accredited provincial landfill site or alternative disposal site (recycle centre) and as follows:
 - .1 Promptly dispose of demolished materials.
 - .2 Do not allow demolished materials to accumulate onsite.
 - .3 Do not burn demolished materials.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Polymer modified cementitious self-leveling floor underlayment.

1.2 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide physical characteristics, product limitations.

1.3 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Manufacturer's Instructions: Indicate mix instructions.
- .3 Certificate: Certify that Products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.5 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.6 SITE CONDITIONS

- .1 Do not install underlayment until floor penetrations and peripheral work are complete.
- .2 Maintain minimum ambient temperatures of 10 degrees C and maximum temperatures of 35 degrees C, 24 hours before, during and 72 hours after installation of underlayment.
- .3 During the curing process, ventilate spaces to remove excess moisture.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Sika; Product: Level-125.
- .2 Substitutions: Refer to Section 01 25 00.

2.2 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to applicable code for combustibility or flame spread requirements.

2.3 MATERIALS

- .1 Underlayment: Cementitious based mix.
- .2 Water: Potable and not detrimental to underlayment mix materials.
- .3 Primer: Manufacturer's recommended type.
- .4 Joint and Crack Filler: Latex based.

2.4 MIXING

- .1 Site mix materials in accordance with manufacturer's written instructions.

- .2 Mix to achieve following characteristics:
 - .1 Density: 2.02 kg/l minimum dry density.
 - .2 Compressive Strength: ASTM C109, minimum 27 MPa after 28 days.
 - .3 Fire Hazard Classification: Flame Spread/Smoke Developed rating of 0/0.
 - .4 Maximum water content should not exceed 4.1 liters per 22.7 kg bag.
- .3 Mix to self-leveling consistency.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that substrate surfaces are clean, dry, unfrozen, do not contain petroleum byproducts, or other compounds detrimental to underlayment material bond to substrate.

3.2 PREPARATION

- .1 Remove substrate surface irregularities. Fill voids and deck joints with filler. Finish smooth.
- .2 Vacuum clean surfaces.
- .3 Prime substrate to manufacturer's written instructions. Allow to dry.
- .4 Close floor openings.

3.3 APPLICATION

- .1 Install underlayment to manufacturer's instructions.
- .2 Place to thickness indicated.
- .3 Place to minimum 3 mm thickness and maximum 38 mm thickness.
- .4 Place after partition installation.
- .5 Strictly follow the surface preparation, mixing and application instruction published on product datasheet.

3.4 CURING

- .1 Air cure to manufacturer's written instructions.

3.5 APPLICATION TOLERANCE

- .1 Section 01 73 29: Tolerances.
- .2 Top Surface: Level to 3 mm in 3 m.
- .3 Install underlayment to tolerances listed in CSA-A23.1/A23.2.

3.6 FIELD QUALITY CONTROL

- .1 Inspection and Testing:
 - .1 Section 01 45 00: Field inspection and testing.
 - .2 Placed Material: Inspecting and testing for conformance to specification requirements.

3.7 PROTECTION

- .1 Do not permit traffic over unprotected floor underlayment surfaces.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Shop fabricated miscellaneous metal items.

1.2 RELATED REQUIREMENTS

- .1 Section 09 91 00 - Painting: Paint finish.

1.3 REFERENCE STANDARDS

- .1 AAMA 2603-17a - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels..
- .2 AAMA 2604-17a - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels
- .3 AAMA 2605-17a - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- .4 ASTM A53/A53M-18 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
- .5 ASTM A153/A153M-16a - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .6 ASTM A307-14e1 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
- .7 ASTM A500/A500M-18 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- .8 ASTM A501/A501M-14 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- .9 ASTM B177/B177M-11(2017) - Standard Guide for Engineering Chromium Electroplating.
- .10 ASTM B209M-14 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .11 ASTM B209-14 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- .12 ASTM ASTM B210/B210M-19a - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
- .13 ASTM B210/B210M-19a - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes.
- .14 ASTM B211/B211M-19 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
- .15 ASTM B211/B211M-19 - Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.
- .16 ASTM B221M-13 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .17 ASTM B221-14 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- .18 CSA-G40.20-13/G40.21-13 (R2018) - General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
- .19 CSA-W47.1-19 - Certification of Companies for Fusion Welding of Steel.
- .20 CSA-W47.2-11 (R2015) - Certification of Companies for Fusion Welding of Aluminum.
- .21 CSA-W48-18 - Filler Metals and Allied Materials for Metal Arc Welding.

- .22 CSA-W55.3-08 (R2018) - Certification of Companies for Resistance Welding of Steel and Aluminum.
- .23 CSA-W59-18 - Welded Steel Construction (Metal Arc Welding).
- .24 CSA-W59.2-18 - Welded Aluminum Construction.
- .25 MPI (Master Painters Institute) – Architectural Painting Specifications Manual and Maintenance Repainting Manual.
- .26 SSPC (The Society for Protective Coatings) - Steel Structures Painting Manual.

1.4 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Shop Drawings:
 - .1 Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - .2 Indicate welded connections using standard welding symbols. Indicate net weld lengths.

1.5 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.

1.6 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.7 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Welders' Certificates: Submit to Section 01 33 00 requirements, certifying welders employed on the Work, verifying qualification within the previous twelve (12) months to CSA-W47.1 (steel).
- .3 Welded Steel Construction: CSA-W59.
- .4 Welded Aluminum Construction: CSA-W59.2.
- .5 Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed at the place where the Project is located.
 - .1 Shop Drawings to be signed and sealed by same Professional Structural Engineer.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

- .1 Steel Sections and Plates: CSA-G40.20/G40.21, Grade 350W.
- .2 Steel Pipe: ASTM A53/A53M, Grade A, Schedule 40, standard weight, galvanized finish.
- .3 Steel Tubing: ASTM A501/A501M, galvanized finish.
- .4 Bolts, Nuts, and Washers: ASTM A307, galvanized to ASTM A153/A153M for galvanized components.
- .5 Welding Materials: Type required for materials being welded.
- .6 Welding Filler Material: CSA-W48.
- .7 Shop and Touch-Up Primer: MPI #79, anti-corrosive alkyd.
- .8 Primer: As specified in Section 09 91 00.
- .9 Touch-Up Primer for Galvanized Surfaces: MPI #19, inorganic zinc-rich primer.

2.2 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.

2.3 FABRICATION TOLERANCES

- .1 Squareness: 3 mm maximum difference in diagonal measurements.
- .2 Maximum Offset Between Faces: 1.6 mm.
- .3 Maximum Misalignment of Adjacent Members: 1.6 mm.
- .4 Maximum Bow: 3 mm in 1.2 m.
- .5 Maximum Deviation From Plane: 1.6 mm in 1.2 m.

2.4 FINISHES - STEEL

- .1 Remove welding slag and spatter. Grind, fill and sand smooth all sharp edges and welds.
- .2 Prepare surfaces to be primed in accordance with SPCC SP 2.
- .3 Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- .4 Clean metal surfaces prior to application of shop primer and finish paint system using following two cleaning procedures, in accordance with SSPC Manual. Clean metal surfaces to be galvanized in accordance with galvanizing plant and ASTM A123/A123M requirements. Unless otherwise indicated:
 - .1 SSPC-SP1 - Solvent Cleaning followed by,
 - .2 SSPC-SP6 - Commercial Blast Cleaning.
- .5 Do not prime surfaces in direct contact with concrete or where field welding is required.
- .6 Prime paint items with one (1) coat.
- .7 Structural Steel Members: Galvanize after fabrication appropriate grade for type and size of steel material indicated, with zinc coating thickness ASTM A123/A123M.
 - .1 Omit galvanizing on exposed steel to be painted. Epoxy paint system will be used to protect architecturally exposed structural steel items.
- .8 Non-structural Items: Galvanized after fabrication to appropriate grade for type and size of steel material indicated, with zinc coating thickness ASTM A123/A123M.
 - .1 Omit galvanizing on exposed steel to be painted. Epoxy paint system will be used to protect architecturally exposed structural steel items.
- .9 Shop primers for all exterior and interior painted steel work shall be of types specified in the painting specification section. Where noncomplying primers are used by the steel fabricator, the fabricator shall completely remove same from all surfaces and prepare and prime surfaces in accordance with the requirements of Section 09 91 00 for painted steel work at no additional cost to the Owner or the painter.
- .10 A third-party independent inspection agency may periodically inspect all steel work to be painted for finish, surface preparation and application of required primers.

- .11 Prime painting: all prime painting (except members called for pre-galvanizing or hot dip galvanizing) to be done after fabrication. Do not alter metal fabrications after prime painting without touching up damaged primer. Prime paint all interior steel fabrications.
 - .1 Prime paint non-galvanized metal fabrications. Do not apply primer to surfaces to be field welded or items to be concrete encased.
 - .2 Apply primer to obtain full and even coverage at rates recommended by manufacturer.
 - .3 Use primer unadulterated, as prepared by manufacturer. Do not paint when temperature is lower than 7°C [44.6°F]. Paint on dry clean surfaces only.
 - .4 Remove non-complying primers completely from all surfaces and prepare and prime surfaces in accordance with requirements noted herein.
 - .5 Apply separation membrane to surfaces that will contact concrete and unlike metals.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: 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 PREPARATION

- .1 Clean and strip primed steel items to bare metal where site welding is required.

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 or galvanized, except surfaces to be in contact with concrete.

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 SCHEDULES

- .1 The following Schedule is a list of principal items only. Refer to Drawing details for items not specifically scheduled.
- .2 Door Frames for Wall Openings: Channel, Angle sections; prime paint finish.
- .3 Under-Counter Steel Supports:
 - .1 Framing: Continuous channel / angle welded construction.
 - .2 Drill 6mm diameter holes at each cross support for fastening of counter.
 - .3 Provide concealed steel section posts to support channels at front of counter, for building into wall.

- .4 Provide posts with drilled anchor plates and 9mm diameter bolts for attachment to structure.
- .5 Unless otherwise indicated, provide intermediate posts to support long counter spans.
- .6 Conceal framing from view to greatest extent possible.
- .7 Prime paint finish.
- .4 Miscellaneous Framing and Supports:
 - .1 General: Provide steel framing and supports not specified in other Sections as needed to complete the Work, including:
 - .1 Framing and supports for mechanical and electrical equipment.
 - .2 Anchor plates and angles concealed in hollow walls to support wall-mounted items.
 - .3 Anchor plates attached to solid walls, for supporting other work.
 - .2 Fabricate items from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - .1 Include brackets, clips, anchors and fasteners for installation.
 - .3 Finishes: Prime paint interior items.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Miscellaneous rough carpentry, including:
 - .1 All wood blocking, nailing strips, framing anchors.
 - .2 Installation of washroom accessories
- .2 Fasteners.
- .3 Fire retardant treatment.

1.2 RELATED REQUIREMENTS

- .1 01 74 19 Construction waste management and disposal.
- .2 07 84 00 Firestopping
- .3 07 92 00 Joint sealants
- .4 09 91 00 Painting

1.3 REFERENCE STANDARDS

- .1 ASTM A123/A123M-17 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A153/A153M-16a - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- .3 ASTM A653/A653M-15e1 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .4 CAN/CGSB 11.3-M87 - Hardboard.
- .5 CANPLY (Canadian Plywood Association) - Canadian Plywood Handbook.
- .6 CAN/CSA-O80 Series-15 - Wood Preservation.
- .7 CSA-O121-17 - Douglas Fir Plywood.
- .8 CSA-O151-17 - Canadian Softwood Plywood.
- .9 NLGA (National Lumber Grades Authority) - Standard Grading Rules for Canadian Lumber, 2014 Edition.

1.4 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide technical data on wood preservative materials and application instructions.

1.5 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.

1.6 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.7 QUALITY ASSURANCE

- .1 Perform Work in accordance with the following agencies:
 - .1 Lumber Grading Agency: Certified by NLGA Grading Rules.
 - .2 Plywood Grading Agency: Certified by CANPLY.

- .3 Wood Based Panel Products: Marked with a recognized, visible grade stamp showing Grade or span rating as required.
- .2 Pressure Preservative Treated Wood: Marked with certification mark authorized by the Canadian Wood Preservers Bureau (CWPB) indicating producer, preservative type, retention and Use Category (UC).

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Store plywood panels flat and level.
- .3 Keep finish faces inward and cover stacks to protect from bumping and abrasion.
- .4 Protect panels from sunlight, water or excessive humidity.
- .5 Store materials [off the ground, covered with weatherproof tarps] [indoors in dry, well-ventilated area].

PART 2 PRODUCTS

2.1 LUMBER MATERIALS

- .1 Dimension Lumber: CSA-O141, softwood lumber unless indicated otherwise, S4S, maximum moisture content 19%; graded to NLGA Grading Rules Standard Grading Rules for Lumber. Finger jointed lumber not acceptable.
 - .1 Blocking, Nailing Strips: Grade No. 2, species: any species; exterior wood pressure preservative treated.
- .2 Beetle Kill/Blue stained Lumber: to CAN/CSA-0122, as an alternative to standard dimension lumber.
- .3 Western softwood plywood: to CSA 0151, sheathing grade unless exposed. Exposed areas to be good exposed sides, waterproof glue
- .4 High density overlaid plywood: exterior Douglas fir with medium density resin impregnated fibre overlay; Canfor "Guardmaster", MacMillan Bloedel "Permashield", or Crown Zellerbach "Crezon".
- .5 Medium Density Fibreboard (MDF) interior, panels dados and trims where called to be painted shall be "Medite II", or approved equal, formaldehyde-free to profiles and dimensions shown.
- .6 Wood preservative: copper naphthenate water based solution, water repellent wood preservative. Cuprinol, or Pentox, or equal.
- .7 Nails, spikes and staples: to CSA B111, hot dip galvanized for damp interior and all exterior locations and treated lumber, plain finish elsewhere. Screws in MDF shall be parallel core type.
- .8 Bolts, nuts, washers, lags, pins, screws, hot dip galvanized to CSA G164.
- .9 General Construction Adhesive: Henkel QB-350 Latex (VOC content 22g/l).

2.2 PANEL MATERIALS

- .1 Plywood: CSA-O121, CSA-O151 CSA-O153 as indicated in schedule below, certified and graded by CANPLY, meeting the requirements of CSA-O325.

2.3 FASTENERS AND ANCHORS

- .1 Screws and Nails: Galvanized steel, Stainless steel Type 304 or Electroplated steel; type and size suitable for application.
- .2 Anchors: Galvanized steel, Stainless steel Type 304 or Electroplated steel; 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.

- .3 Galvanized Coating for Interior High Humidity Areas: Hot dip galvanized to ASTM A153/A153M.
- .4 Galvanized Coating for Treated Wood: Hot dip galvanized to ASTM A153/A153M, Class A or B1 (G185) zinc coating.

2.4 MISCELLANEOUS ACCESSORIES

- .1 Adhesives: Waterproof adhesive, approved for use with type of construction panel indicated by manufacturers of both adhesives and panels.

2.5 PRESERVATIVE TREATMENT

- .1 Wood Preservative (Pressure Treatment): CAN/CSA-O80, and in accordance with Table 2 - Use Categories for Specific Products, Uses, and Exposures.
 - .1 UC1: Interior construction, above-ground and dry applications; use inorganic boron (SBX) preservative.
 - .2 UC2: Interior construction, above-ground and potentially damp applications; use waterborne alkali-based, type ACQ or waterborne alkali-based, type CA.
- .2 Wood Preservative (Surface Application): CAN/CSA-O80, copper naphthenate.
- .3 Fire Retardant (FRT): CAN/CSA-O80, chemically treated and pressure impregnated; capable of providing a maximum flame spread/smoke development rating of CAN/ULC-S102, to the following.
 - .1 Flame Spread Classification: 25 or less.
 - .2 Smoke Developed Index: 450 or less.
 - .3 Each bundle of fire retardant treated lumber and each panel to bear ULC label indicating Flame Spread Classification (FSC) and Smoke Developed Index.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that site conditions are ready to receive work and opening dimensions are as indicated on Shop Drawings.

3.2 INSTALLATION

- .1 Set members level and plumb, in correct position. Place horizontal members, crown side up.

3.3 SITE APPLIED WOOD TREATMENT

- .1 Apply preservative treatment to manufacturer's written instructions.
- .2 Brush apply two (2) coats of preservative treatment on wood requiring cutting or drilling after treatment and on wood in contact with cementitious materials.
- .3 Allow preservative to dry prior to erecting members.

3.4 ERECTION TOLERANCES

- .1 Framing Members: 6 mm from true position, maximum.
- .2 Surface Flatness of Floor: 2 mm in 1 m maximum, and 13 mm in 9 m maximum.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Tested and listed firestopping systems.

1.2 RELATED REQUIREMENTS

- .1 Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.
- .2 Division 23 – Heating, Ventilating, and Air-Conditioning (HVAC): Mechanical work requiring firestopping.
- .3 Section 26 - Electrical: Electrical work requiring firestopping.

1.3 REFERENCE STANDARDS

- .1 ASTM E84-17 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- .2 ASTM E119-16a - Standard Test Methods for Fire Tests of Building Construction and Materials.
- .3 ASTM E814-11a - Standard Test Method for Fire Tests of Penetration Firestop Systems.
- .4 ASTM E1966-15 - Standard Test Method for Fire-Resistive Joint Systems.
- .5 CAN/ULC-S101-14 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.
- .6 CAN/ULC-S102-10 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .7 CAN/ULC-S102.2-10 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.
- .8 CAN/ULC-S115-11 (R2016) - Standard Method of Fire Tests of Firestop Systems.
- .9 FM (Factory Mutual) - FM 4991-2001, Approval Standard for Approval of Firestop Contractors.
- .10 FCIA (Firestop Contractors International Association) - Manual of Practice.
- .11 NFPA 251 - Standard Methods of Tests of Fire Endurance of Building Construction and Materials, 2006 edition.
- .12 OPL (Omega Point Laboratories).
- .13 UL 263-2011 - Standard for Fire Tests of Building Construction and Materials (14th Edition).
- .14 UL 1479-2015 - Standard for Fire Tests of Through-Penetration Firestops (4th Edition).
- .15 UL 1709-2011 - Standard for Rapid Rise Fire Tests of Protection Materials for Structural Steel (4th Edition).
- .16 UL 2079-2015 - Standard for Tests for Fire Resistance of Building Joint Systems (5th Edition).
- .17 ULC-FR-17 - Fire Resistance Directory (2017 Edition).
- .18 WHI (Intertek/Warnock Hershey).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination: Coordinate with other work having a direct bearing on work of this section.
- .3 Pre-Installation Meeting: Convene one (1) week before starting work of this section.
- .4 Sequencing: Coordinate and sequence firestopping installation with all affected trades.

1.5 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.

- .2 Product Data: Provide manufacturer's written data on product characteristics, performance.
- .3 System Design Listings: Submit system design listings including illustrations from a qualified nationally recognized testing and inspection agency applicable to each firestop configuration.
- .4 Unlisted Firestopping Systems: Obtain an Engineering Judgment (EJ) or Equivalent Fire Resistance Rated Assembly (EFRRA) from firestop manufacturer where no specific third party tested, listed and classified firestop system is available for a particular firestop configuration.

1.6 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's written special preparation and installation requirements and tested and listed firestop systems designs.
- .3 Contractor's Certificates:
 - .1 Provide FCIA Member in Good Standing letter or certificate for the current year, on FCIA letterhead.
 - .2 Current ULC Qualified Firestop Contractor Certificate and individual Designated Responsible Individual Certificate.
- .4 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 and ISO 14000 certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience and FCIA Manufacturer Member in good standing.
- .3 Contractor Qualifications: Company specializing in performing the work of this section and as follows:
 - .1 FCIA Member in good standing.
 - .2 Minimum one (1) person employed at the firm who has passed the ULC Firestop Exam.
 - .3 ULC Qualified Firestop Contractor Program.
 - .4 FM approved in accordance with FM standard 4991 - Approval of Firestop Contractors.
 - .5 FCIA Member in good standing.
 - .6 Licensed by the province or local authority where applicable.
 - .7 Completed not less than five (5) comparable scale projects.
- .4 Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer. Obtain firestop systems for complete project, from a single primary firestop systems manufacturer, to the greatest extent possible.

1.9 FIELD QUALITY CONTROL

- .1 Professional Engineer's Inspections: Provide professional engineer's inspections for Letters of Assurance in accordance with applicable code, including the following:
 - .1 Perform timely and regular inspections.
 - .2 Verify fabrication and installation is provided according to design.
 - .3 Prepare inspection reports, Letters of Assurance and associated Schedule documents.
- .2 Manufacturer's Field Services:

- .1 Firestopping system manufacturer and system installer to provide field surveillance of the installation of their Products.
- .2 Monitor and report installation procedures and unacceptable conditions.

1.10 MOCK-UPS

- .1 Section 01 45 00: Requirements for mock-up.
- .2 Provide mock-up of applied firestopping assemblies.
- .3 Apply 1 sq m to a representative substrate surface.
- .4 Apply firestop material to a representative penetrated stud wall substrate surface.
- .5 Obtain Consultant's acceptance of mock-up before start of Work.
- .6 Retain and maintain accepted mock-ups during construction in undisturbed condition as a standard for judging completed work.
- .7 Locate where directed by Consultant.
- .8 Approved mock-up may remain as part of the Work.

1.11 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Deliver firestopping products in original, unopened containers with labels intact and legible, identifying product and manufacturer.
- .3 Store and handle firestopping materials to manufacturer's instructions.

1.12 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Do not apply materials when temperature of substrate material and ambient air is below 15 degrees C.
 - .2 Maintain this minimum temperature before, during, and for three (3) days after installation of materials.
 - .3 Provide ventilation to manufacturer's instructions in areas to receive solvent cured materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Acceptable Manufacturers:
 - .1 3M Fire Protection Products.
 - .2 BALCO, Inc.
 - .3 HILTI, Inc.
 - .4 Specified Technologies, Inc
 - .5 Thermal Ceramics, Inc.
 - .6 Thermafiber, Inc.
- .2 Substitutions: Not permitted.

2.2 MATERIALS

- .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN 4-S115-M and not exceeding intended opening sizes.

- .2 Firestopping components compatible with each other, substrates forming openings and items penetrating the firestopping under conditions of service and application.
- .3 Firestop System Rating:
 - .1 For penetrations through a fire wall or horizontal fire separation provide a firestop system with a 'FT' rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.
 - .2 For combustible pipes, tubing, ducts, chimneys, optical fibre cables, electrical wires and cables, totally enclosed non-combustible raceways, electrical outlet boxes and similar building services that penetrate through a fire separation provide a firestop system with a 'F' Rating as determined by ULC or cUL as indicated below:
 - .1

Separation	Fire Resistance Rating	Firestopping Required	ULC or cUL	'F' Rating
30	minutes	/	20	minutes
45	minutes	/	45	minutes
1	hour	/	45	minutes
1.5	hours	/	1	hour
2	hours	/	1.5	hours
3 hours	2 hours			
 - .3 For joints provide a firestop system with an Assembly Rating as determined by CAN4-S115-M, ULC-S115-M or UL 2079 which is equal to the fire resistance rating of the construction being penetrated.

2.3 DESCRIPTION

- .1 System Description:
- .2 Tested and listed firestopping systems consisting of a material or materials, the wall or floor assembly, and penetrating items or gaps, assembled or placed in spaces, gaps, joints and building perimeters, to restore the fire resistance rating and or smoke resistant properties of a fire resistance rated assembly or smoke resistant assembly.
- .3 Regulatory Requirements:
 - .1 Conform to applicable code for fire resistance ratings and surface burning characteristics.
 - .2 Provide certificate of compliance from authority having jurisdiction indicating approval of materials, tested and listed systems or engineering judgments used.

2.4 PERFORMANCE / DESIGN CRITERIA

- .1 Materials, accessories and application procedures listed by ULC, or tested to CAN/ULC-S115 to comply with applicable building code requirements.
- .2 Firestopping Materials: CAN/ULC-S101, to achieve a fire rating as noted on Drawings.
- .3 Surface Burning Characteristics: CAN/ULC-S102 or CAN/ULC-S102.2, as applicable.
- .4 Smoke Resistance: For areas where smoke resistance is required, provide firestop systems with L-ratings of maximum 25.4l/sec/sq m opening area.
- .5 Environmental Resistance: Systems to be resistant to environmental conditions they will be exposed to, as apparent at design stage.

2.5 MATERIALS

- .1 Fire Stopping Systems and Materials: Tested and listed by ULC, and conforming to construction type, penetrant type, annular space requirements and fire rating involved in each separate instance.

2.6 ACCESSORIES

- .1 Primer: Type recommended by firestopping manufacturer for specific substrate surfaces.
- .2 Forming/Packing Material: Permanent type, suitable for application.

- .3 Installation Accessories: Clips, collars, fasteners, temporary stops or dams, and other devices required to position and retain materials in place.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping are ready to receive the work of this section.
- .3 Verify tested and listed systems selected are applicable to the conditions encountered.
- .4 Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- .1 Clean substrate surfaces as recommended in manufacturer's written instructions, of dirt, dust, grease, oil, loose material, or other matter which may affect bond of firestopping material and performance of firestop system for fire or smoke resistant situations.
- .2 Remove incompatible materials which may affect bond.
- .3 Install backing materials to arrest liquid material leakage.

3.3 APPLICATION

- .1 Apply primer and firestopping materials to manufacturer's written instructions.
- .2 Install material at walls or partition openings which contain penetrating sleeves, piping, ductwork, conduit and other items, requiring firestopping to tested and listed system or engineering judgment.
- .3 Apply firestopping material, thickness sufficient to achieve rating, to uniform density and texture.
- .4 Compress fibred material to achieve a density of 40% of its uncompressed density.
- .5 Place intumescent coating in sufficient coats to achieve rating required.
- .6 Dam Material: Dam material to remain.

3.4 CLEANING

- .1 Section 01 74 10: Cleaning installed work.
- .2 Clean adjacent surfaces of firestopping materials.

3.5 PROTECTION

- .1 Section 01 78 23: Protecting installed work.
- .2 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 REQUIREMENTS

- .1 Section 07 84 00 - Firestopping: Sealants required in conjunction with firestopping.
- .2 Section 08 11 13 - Metal Doors and Frames: Sealants required in conjunction with door frames.
- .3 Section 08 80 00 – Glass and Glazing: Sealants required in conjunction with glazing methods.

1.3 REFERENCE STANDARDS

- .1 ASTM C834-10 - Standard Specification for Latex Sealants.
- .2 ASTM C920-14a - Standard Specification for Elastomeric Joint Sealants.
- .3 ASTM C1193-16 - Standard Guide for Use of Joint Sealants.
- .4 ASTM C1311-10 - Standard Specification for Solvent Release Sealants.
- .5 ASTM C1330-02(2007) - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
- .6 ASTM C1481-12 - Standard Guide for Use of Joint Sealants with Exterior Insulation and Finish Systems (EIFS).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 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.

1.5 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations and colour availability.
- .3 Shop Drawings: Indicate sealant joints and dimensions, materials, structural bite, glue-line thickness, joint profile, and support framing.
- .4 Shop Drawings: Indicate sealant joints and dimensions, materials, joint profile, and support framing.

1.6 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.
 - .1 Indicate special procedures, surface preparation, perimeter conditions requiring special attention.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 and ISO 14000 certification requirements.
- .2 Perform work to sealant and material manufacturer's requirements for preparation of surfaces and material installation instructions.
- .3 Perform sealant application work to ASTM C1193.
- .4 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .5 Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.9 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

1.10 WARRANTY

- .1 Section 01 78 00: Warranties.
- .2 Warranty: Provide a five (5) year warranty for failure to meet specified requirements including coverage for installed sealants and accessories which fail to achieve air tight seal, exhibit loss of adhesion or cohesion, or do not cure.
- .3 Manufacturer's Warranty: Provide manufacturer's twenty (20) year material warranty for installed silicone sealant.

PART 2 PRODUCTS

2.1 SEALANTS - INTERIOR

- .1 Joints at Framed Openings: Use one of the following.
 - .1 CAN/CGSB-19.13, Type 2, single-component polyurethane conforming to
 - .2 Single-component, medium-modulus, primerless silicone sealant.
 - .1 Product: CWS Contractors Weatherproofing Sealant by Dow Corning.
- .2 Joints in Vertical and Horizontal Surfaces of Non-Traffic and Non-Wet Areas, other than Framed Openings:
 - .1 CAN/CGSB-19.17 or ASTM C834, single-component acrylic latex water-based sealant, maximum VOC content of 42 g/L.
 - .2 Provide paintable acrylic latex where painting is indicated or scheduled; non-sagging, non-staining, non-bleeding; colour as selected.
- .3 Joints in Vertical and Horizontal Surfaces of Non-Traffic and Wet Areas: Including but not limited to junctions of plumbing fixtures at walls and floors, junctions of walls, joints between plumbing escutcheons and flooring, and joints between counters and walls or between counters and backsplashes.
 - .1 CGSB 19-GP-22M, single-component, mildew-resistant silicone rubber.
 - .2 Product: 786 Mildew Resistant Silicone Sealant by Dow Corning; SCS 1702 Sanitary Sealant by General Electric, or approved equivalent.

2.2 ACCESSORIES

- .1 Primer: Non-staining type, as 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% larger than joint width.
 - .1 Product: Ethafoam Rod, manufactured by Dow Chemical.
 - .2 Product: Stenson's Backer Rod, manufactured by Stenson.
 - .3 Product: Joint Backing, manufactured by Tremco Inc.
- .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.
- .6 Setting Blocks and Spacers: Compatible with silicone sealant and recommended by sealant manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: 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 materials.

3.2 PREPARATION

- .1 Remove loose materials and foreign matter which might impair adhesion of sealant.
- .2 Perform preparation to sealant manufacturer's written instructions.
- .3 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.
- .2 Install sealant to sealant manufacturer's written instructions.
- .3 Measure joint dimensions and size materials to achieve required width/depth ratios.
- .4 Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.
- .5 Install bond breaker where joint backing is not used.
- .6 Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- .7 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- .8 Tool joints concave.

3.4 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Field inspection.
- .2 Joint Sealants: Perform adhesion tests to manufacturer's written instructions and ASTM C1193, Method C - Field-Applied Sealant Joint Hand Pull Flap.
 - .1 Perform test seven (7) days after installation at a rate of one test every 300 m of installed sealant.
- .3 Remove sealants failing adhesion test, clean substrates, reinstall sealants and perform retesting.
- .4 Maintain test log and submit report to Consultant indicating tests, locations, dates, results, and remedial actions.

3.5 MANUFACTURER'S SERVICES

- .1 Section 01 78 00: Prepare and start components.
- .2 Monitor and report installation procedures and unacceptable conditions.

3.6 CLEANING

- .1 Section 01 74 10: Cleaning installed work.
- .2 Clean adjacent soiled surfaces.

3.7 PROTECTION

- .1 Section 01 78 23: Protecting installed work.
- .2 Remove masking tape and excess sealant.
- .3 Protect sealants until cured..

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Hollow metal steel frames.
- .2 Pressed steel doors.
- .3 Interior glazed light frames; glass and glazing.

1.2 RELATED REQUIREMENTS

- .1 Section 08 71 00 - Door Hardware - General: Hardware, silencers.
- .2 Section 08 80 00 - Glazing.
- .3 Section 09 91 00 - Painting: Field painting of doors.

1.3 REFERENCE STANDARDS

- .1 ANSI 250.10-11 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
- .2 ASTM A653/A653M-15e1 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM E90-09 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .4 ASTM E413-16 - Classification for Rating of Sound Insulation.
- .5 CAN/CGSB-1.181-99 - Ready-Mixed Organic Zinc-Rich Coating.
- .6 CSA-G40.20-13/G40.21-13 - General Requirements for Rolled or Welded Structural Quality Steel/ Structural Quality Steel.
- .7 CSA-W59-13 - Welded Steel Construction (Metal Arc Welding).
- .8 FM (Factory Mutual).
- .9 CSDMA (Canadian Steel Door Manufacturers Association).
 - .1 Recommended Dimensional Standards for Commercial Steel Doors and Frames, 2009.
 - .2 Recommended Selection and Usage Guide for Commercial Steel Doors and Frame Products, 2009.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate the work with frame opening construction, door, and hardware installation.
- .3 Sequencing: Sequence installation to ensure wire connections are achieved in an orderly and expeditious manner.

1.5 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Indicate door and frame configurations and finishes, location of cut-outs for hardware reinforcement.
- .3 Shop Drawings:

- .1 Indicate frame elevations, reinforcement, anchor types and spacing, location of cut-outs for hardware, and finish.
- .2 Indicate door elevations, internal reinforcement, closure method, and cut-outs for glazing.
- .4 Samples:
 - .1 Submit one (1) samples of frame, 100mm x 100 mm in size illustrating factory finished frame colours and surface texture.
 - .2 Submit one (1) samples of door face metal, 100mm x 100mm in size illustrating pre-finished door colours and surface texture.

1.6 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.
- .3 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Conform to requirements of CSDMA. Maintain one (1) of document on site.
- .3 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.
- .3 Store in vertical position, spaced with blocking to permit air circulation between components.
- .4 Store materials on planks or dunnage, out of water and covered to protect from damage.
- .5 Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Sheet Steel: Galvanized steel to ASTM A653/A653M, commercial grade (CS), Type B.
 - .1 Interior Doors: Coating designation ZF180, satin finish, face sheets surface-ready for field painting.
- .2 Reinforcement Channel: CSA-G40.20/G40.21, Type 44W, ZF75 coating designation to ASTM A653/A653M.

2.2 DOOR CORE MATERIALS

- .1 Fibreglass Core: ASTM C665, loose batt type, density; 24 kg/cu m minimum.

2.3 DOOR FRAMES

- .1 Construct hollow metal frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances as specified.
- .2 Interior Frames: At locations indicated in the Door and Frame Schedule.

- .1 Materials: Metallic coated steel sheet, minimum thickness of 0.067 inch (1.7 mm).
- .2 Construction: Full profile welded.
- .3 Exposed Finish: Factory Prime.

2.4 STEEL FINISHES

- .1 Prime Finish: Clean, pre-treat, and apply manufacturer's standard primer.
- .1 Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

2.5 ADHESIVES

- .1 Cores and Steel Components: Heat resistant, structural reinforced epoxy, resin based adhesive.
- .2 Lock Seam: Reinforced epoxy resin, high viscosity, thixotropic sealant.

2.6 PRIMERS

- .1 Primer: Rust inhibitive touch-up only.

2.7 ACCESSORIES

- .1 Door Silencers: Single stud rubber/neoprene.
- .2 Glazing Stops: Formed galvanized steel channel, minimum 16 mm (5/8 inch) high, accurately fitted, butted at corners and fastened to frame sections with counter-sunk tamper proof sheet metal screws.
- .3 Bituminous Coating: Fibred asphalt emulsion.
- .4 Glass: As specified in Section 08 80 00, tempered laminated glass.

2.8 FABRICATION - DOORS

- .1 Fabricate doors and frames as detailed, to CSDMA Specifications for Commercial Steel Doors and Frames, except where specified otherwise.
- .2 Interior Doors: Welded stiffener construction.
- .3 Longitudinal Edges: Continuously welded, filled and sanded with no visible edge seams.
- .4 Mortised, blanked, reinforced, drilled and tapped for templated hardware, in accordance with templates provided by hardware supplier.
- .5 Reinforce for surface mounted hardware, anchor hinges, thrust pivots, pivot reinforced hinges, or non-templated hardware.
- .6 Top and Bottom Channels: Inverted, recessed, welded steel channels.
- .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

2.9 WELDED STIFFENER CONSTRUCTION

- .1 Interior Doors: Both face sheets 16 ga steel.
- .2 Reinforce doors with vertical stiffeners, welded to each face sheet at 150 mm on center maximum.
- .3 Fill voids between vertical stiffeners with fibreglass batt insulation.

2.10 FABRICATION - FRAMES

- .1 Interior Frames: 16 ga thick base metal thickness.
- .1 Door Frames and Window Assemblies: Welded type construction.

- .2 Mortised, blanked, reinforced, drilled and tapped for templated hardware, in accordance with templates provided by hardware supplier. .
- .3 Prepare frames for silencers. Provide three (3) single silencers for single doors on strike side.

2.11 FINISHES

- .1 Coat inside of frame profile with bituminous coating to a thickness of 1.5 mm.
- .2 Remove weld slag and spatter from exposed surfaces.
- .3 All tool marks, abrasions and surface blemished shall be filled and sanded to present smooth and uniform surfaces.
- .4 On exposed surfaces where zinc has been removed during fabrication, frame product shall receive a factory applied touch-up primer.
- .5 All bottom and top of doors shall be painted.

2.12 SIZES AND TOLERANCES

- .1 Measure widths of door openings from inside of frame jamb rabbet with a tolerance of +1.6mm - 0.8mm.
- .2 Measure heights of door openings from the finished floor (exclusive of floor coverings) to the head rabbet of the frame with a tolerance of $\pm 1.2\text{mm}$.
- .3 Unless builders' hardware dictates otherwise, size doors to fit the above openings and allow a 3mm clearance at jambs and head. Provide a clearance of 19mm between the bottom of the door and the finished floor (exclusive of floor coverings). Tolerances on door sizes of $\pm 1.2\text{mm}$.
- .4 Manufacturing tolerances on formed frame profiles of $\pm 0.8\text{mm}$ for faces, door stop heights and jamb depths. Tolerances for throat openings and door rabbets of $\pm 1.6\text{mm}$ and $\pm 0.4\text{mm}$ respectively. Hardware cutout dimensions shall be as per template dimensions, +0.4mm, - 0.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that opening sizes and tolerances are acceptable; check floor area within path of door swing for flatness.
- .3 Verify doors and frames are correct size, swing, rating and opening number.
- .4 Remove temporary shipping spreaders.

3.2 INSTALLATION

- .1 Install doors and frames to CSDMA.
- .2 Coordinate with gypsum board wall construction for anchor placement.
- .3 Coordinate installation of glass and glazing.
- .4 Coordinate installation of doors and frames with installation of hardware specified in Section 08 71 00.
- .5 Set frames plumb, square, level and at correct elevation.
- .6 Secure anchorages and connections to adjacent construction.
- .7 Brace frames rigidly in position while building-in. Install wood spreaders at third points of frame rebate height to maintain frame width.
- .8 Remove wood spreaders after frames have been built-in.
- .9 Make allowance for deflection to ensure structural loads are not transmitted to frame product.

- .10 Install doors, and hardware in accordance with hardware templates and manufacturer's instructions.
- .11 Adjust operable parts for correct clearances and function.
- .12 Install glazing and door silencers.
- .13 Finish paint as specified in Section 09 91 00.

3.3 ERECTION TOLERANCES

- .1 Maximum Diagonal Distortion: 1.5 mm measured with straight edges, crossed corner to corner.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Access door and frame units.

1.2 RELATED REQUIREMENTS

- .1 Section 09 21 16 - Gypsum Board Assemblies: Openings in partitions and ceilings.
- .2 Section 09 91 00 - Painting: Field paint finish.

1.3 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination: Coordinate with other work having a direct bearing on work of this section.
 - .1 Coordinate the work with other work requiring access doors.

1.4 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- .3 Shop Drawings: Indicate exact position of all access door units.

1.5 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements, rough-in dimensions.

1.6 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.
- .2 Record Documentation: Record actual locations of all access units.

1.7 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 and ISO 14000 certification requirements.

1.8 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for fire rated access doors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Subject to compliance with requirements provide products of one of the following manufacturers:
 - .1 Bauco Access Panel Solutions Inc.
 - .2 Maxam Metal Products.
 - .3 Acudor Products Inc.
 - .4 Nystrom Inc.

2.2 GASKETED NON-RATED ACCESS DOORS, FLUSH PANEL - WALL AND CEILING

- .1 Product: Model NGP by Maxam Metal Products.
- .2 Door Panel:

- .1 Form of 1.61 mm (16 ga) thick steel sheet.
- .2 Reinforce to maintain flat surface.
- .3 Frame:
 - .1 Form of 1.61 mm (16 ga) thick steel sheet of depth and configuration to suit material and type of construction where installed.
 - .2 Provide surface mounted units having 19mm frame flange at perimeter where installed in gypsum board construction.
 - .3 Grind smooth exposed joints in flange.
 - .4 Provide expanded galvanized metal lath perimeter wings when installed in plaster except veneer plaster.
 - .5 Gasketed on all four sides.
- .4 Hinge:
 - .1 Continuous stainless steel piano hinge (opens to 180 degrees).
- .5 Latch:
 - .1 Flush, screwdriver operated cylinder cam latch.
- .6 Flange:
 - .1 19mm exterior flange.

2.3 FABRICATION - WALL AND CEILING UNITS

- .1 Weld, fill, and grind joints to ensure flush and square unit.

2.4 FINISHES

- .1 Base Metal Protection: Rust-inhibitive prime coat (off-white).
- .2 Finish: Refer to section 09 91 00 - Painting. Two (2) coats baked enamel, colour to match adjacent surface.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that rough openings for door and frame are correctly sized and located.

3.2 LOCATION

- .1 Provide access panels or doors wherever valves, traps, dampers, cleanouts, and other control items of mechanical, electrical and conveyor work are concealed in wall or partition, or are above ceiling of gypsum board or plaster.
- .2 Use flush panels in partitions and gypsum board ceilings.

3.3 INSTALLATION

- .1 Install units to manufacturer's written instructions.
- .2 Install frames plumb and level in opening. Secure rigidly in place.
- .3 Position unit to provide convenient access to concealed work requiring access.

3.4 ADJUSTMENT

- .1 Adjust hardware so that door panel will open freely.
- .2 Adjust door when closed so door panel is centered in the frame.

3.5 CLEANING

- .1 Clean as work progresses, clean up and remove any rubbish resulting from the work.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Hardware for doors.

1.2 RELATED REQUIREMENTS

- .1 Section 08 11 13 - Hollow Metal Doors and Frames.
- .2 Section 08 31 13 - Access Doors and Frames.
- .3 Division 28 – Electronic Safety and Security: Power supply to electric hardware devices security equipment.

1.3 REFERENCE STANDARDS

- .1 CSDMA (Canadian Steel Door Manufacturers Association).
- .2 DHI (Door and Hardware Institute Canada) - AHC and EHC certification programs.
- .3 DHI (Door Hardware Institute) - A115 series.
- .4 BHMA (Builders Hardware Manufacturers Association) - A156 Series Standards.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination: Coordinate with other work having a direct bearing on work of this section.
 - .1 Coordinate the work with other directly affected sections involving manufacture or fabrication of internal reinforcement for door hardware and recessed items.
 - .2 Coordinate Owner's keying requirements during the course of the Work.
- .3 Sequencing: Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.5 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Shop Drawings:
 - .1 Indicate locations and mounting heights of each type of hardware, schedules, catalogue cuts, electrical characteristics and connection requirements.
 - .2 Submit manufacturer's parts lists and templates.

1.6 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.
- .2 Operation and Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- .3 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.
- .4 Record Documentation:
 - .1 Record actual locations of installed cylinders and their master key code.

- .2 Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- .1 Section 01 78 23: Maintenance and extra material requirements.
- .2 Extra Stock Materials:
 - .1 Provide ten (10) extra key lock cylinders for each master keyed group.
- .3 Tools:
 - .1 Provide special wrenches and tools applicable to each different or special hardware component.
 - .2 Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.9 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.
- .4 Hardware Supplier Personnel: Employ a qualified person to assist in the work of this section.
- .5 Hardware Supplier Personnel: Employ a qualified person to assist in the electronics and controls work of this section.

1.10 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.11 WARRANTY

- .1 Section 01 78 00: Warranties.
- .2 Provide five (5) year manufacturer warranty for door closers.

PART 2 PRODUCTS

2.1 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to applicable code for Products requiring electrical connection. Listed and classified by CSA as suitable for the purpose specified and indicated.

2.2 KEYING

- .1 Coordinate Owner's keying requirements during the course of the Work.

2.3 FINISHES

- .1 Finishes: Identified in Door Hardware Schedule.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that doors and frames are ready to receive work and dimensions are as indicated on Shop Drawings.
- .3 Verify that electric power is available to power operated devices and is of the correct characteristics.

3.2 INSTALLATION

- .1 Install hardware to manufacturer's written instructions.
- .2 Use templates provided by hardware item manufacturer.

3.3 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Field inspection, testing, and adjusting.
- .2 Architectural Hardware Consultant will inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's written instructions and as specified.

3.4 ADJUSTING

- .1 Adjust hardware for smooth operation.

3.5 PROTECTION

- .1 Section 01 78 23: Protecting installed work.
- .2 Do not permit adjacent work to damage hardware or finish.

3.6 SCHEDULES

- .1 Refer to Hardware Schedule on Architectural drawings.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Glass and glazing for doors and sections referencing this section for Products and installation.

1.2 RELATED REQUIREMENTS

- .1 Section 07 92 00 - Joint Sealants: Sealant and back-up materials.
- .2 Section 08 11 13 - Standard Metal Doors and Frames: Glazed metal vision panels.
- .3 Section 10 28 00 - Washroom Accessories: Prefabricated mirrors.

1.3 REFERENCE STANDARDS

- .1 ANSI Z97.1-2015 - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.
- .2 ASTM C542-05(2017) - Standard Specification for Lock-Strip Gaskets.
- .3 ASTM C864-05(2015) - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- .4 ASTM C920-14a - Standard Specification for Elastomeric Joint Sealants.
- .5 ASTM C1036-16 - Standard Specification for Flat Glass.
- .6 ASTM C1048-12e1 - Standard Specification for Heat-Treated Flat Glass—Kind HS, Kind FT Coated and Uncoated Glass.
- .7 ASTM C1172-14 - Standard Specification for Laminated Architectural Flat Glass.
- .8 ASTM C1193-16 - Standard Guide for Use of Joint Sealants.
- .9 ASTM C1503-08(2013) - Standard Specification for Silvered Flat Glass Mirror.
- .10 ASTM D412-19 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension.
- .11 ASTM D1149-18 - Standard Test Methods for Rubber Deterioration-Cracking in an Ozone Controlled Environment.
- .12 ASTM D2240-15 - Standard Test Method for Rubber Property - Durometer Hardness.
- .13 ASTM E84-17 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- .14 ASTM E119-16a - Standard Test Methods for Fire Tests of Building Construction and Materials.
- .15 CAN/CGSB 12.1-2017 - Safety Glazing.
- .16 CAN/CGSB 12.1-M90 - Tempered or Laminated Safety Glass.
- .17 CAN/CGSB 12.3-M91 (R2017) - Flat, Clear Float Glass.
- .18 CAN/CGSB 12.10-M76 - Glass, Light and Heat Reflecting.
- .19 CAN/ULC-S101-14 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.
- .20 CPSC - 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- .21 Glazing Contractors Association of BC (FENBC)
 - .1 Glazing Systems Specification Manual
- .22 GANA Glazing Manual (50th Anniversary Edition).
- .23 GANA Laminated Glazing Reference Manual (2009).
- .24 GANA Sealant Manual (2008).

- .25 NFPA 251 - Standard Methods of Tests of Fire Endurance of Building Construction and Materials, 2006 edition.
- .26 UL 263-2011 - Standard for Fire Tests of Building Construction and Materials (14th Edition).

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Pre-Installation Meeting: Convene one (1) week before starting work of this section.

1.5 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data:
 - .1 Glass Sheets: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
 - .2 Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colours.
- .3 Shop Drawings: For glass indicated to comply with performance requirements, prepare Shop drawings under direct supervision of a Professional Structural Engineer registered in province of British Columbia, Canada, with experience in work of this Section. Engineer to provide signed and sealed shop drawings along with supporting Letter of Assurance (Schedule S-B).
 - .1 Clearly indicate glass types, configurations, thicknesses, translucent finishes, treatments, coatings, gaskets, hardware and accessories.
 - .2 Indicate forces applied to connections at structure and analysis data.
 - .3 Each shop drawing to bear seal and signature of the professional engineer.
- .4 Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated or scheduled.
- .5 Samples:
 - .1 Submit two (2) samples 150 mm x 150mm in size, exemplifying glass units and colouration.

1.6 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Certificates: Certify that Products meet or exceed specified requirements.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.
- .2 Upon completion of work of this Section provide Letter of Assurance (Schedule S-C) from same Engineer who provided signed and sealed shop Drawings and Schedule S-B.

1.8 MAINTENANCE MATERIAL SUBMITTALS

- .1 Section 01 78 23: Maintenance and extra material requirements.

1.9 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 and ISO 14000 certification requirements.
- .2 Perform Work in accordance with Glazing Contractors Association of BC (FENBC) Glazing Systems Specification Manual, supplemented by GANA Glazing Manual and GANA Laminated Glazing Manual for glazing installation methods. Maintain one (1) copy of document on site.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience ..

- .4 Labelling:
 - .1 Label glass including mirrors with manufacturer's labels identifying glass type and thickness.
 - .2 Safety Glazing: Permanently mark glazing with certification label of the manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- .2 Minimize storage time of materials at site.
- .3 Minimize handling. Install glass as soon as possible after delivery.
- .4 Store glass at a constant temperature, vertically, blocked off the floor and in a designated clean, dry and dust-free and corrosive contaminant-free interior storage area with adequate air circulation.
- .5 Protect glass from contact with contaminants.

1.11 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Do not install glazing when ambient temperature is less than 10 degrees C.
 - .2 Maintain minimum ambient temperature before, during and twenty-four (24) hours after installation of glazing compounds.

1.12 WARRANTY

- .1 Section 01 78 00: Warranties.
- .2 Provide a five (5) year warranty to include coverage for sealed glass units from seal failure, interpane dusting or misting, and replacement of same.
- .3 Provide a five (5) year warranty to include coverage for delamination of laminated glass and replacement of same.

PART 2 PRODUCTS

2.1 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to applicable code for impact safety rating requirements.

2.2 PERFORMANCE / DESIGN CRITERIA

- .1 Limit glass deflection to 1/200 with full recovery of glazing materials, whichever is less.
- .2 Provide tempered, laminated, laminated-tempered glass and related fittings and hardware in doors in accordance with applicable codes and as indicated or scheduled.
 - .1 Unless otherwise specified or indicated, use tempered glass where glass is less than 1800 mm above finished floor.

2.3 FLAT GLASS MATERIALS

- .1 Heat Treated Glass (Type FG-C): CAN/CGSB 12.1, fully tempered, clear, for uncoated glass; minimum 6 mm glass thickness.
- .2 Silvered Flat Glass Mirrors (Type FG-G): ASTM C1503, annealed monolithic clear glass, as scheduled, nominal glass thickness Mirror Glazing Quality; cut size 6 mm.

- .3 Safety Glass:
 - .1 Laminated Safety Glass (Type FG-L1): CAN/CGSB 12.1, consisting of two (2) plies glass bonded with complying interlayer material; clear, fully tempered; minimum two layers of 6 mm glass thickness.

2.4 GLAZING COMPOUNDS

- .1 Compatibility: Provide glazing sealants that are compatible with one another and with other materials they will contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- .2 Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
- .3 Silicone Sealant (Type GC-F): ASTM C920, Type S, Grade NS, Class , Use silicone sealant; single component; moisture curing; capable of water immersion without loss of properties; non-bleeding, non-staining cured Shore A hardness of 15 to 25; colour as selected.
 - .1 Product: Proglaze, manufactured by Tremco.
- .4 Colours of Exposed Sealants: To match colour of adjacent surfaces.

2.5 GLAZING ACCESSORIES

- .1 Lock Strip Gaskets: ASTM C542, ozone-resistant neoprene compound, with lock-strip (zipper) component that friction-fits into position to retain glass pane/unit, reglet type, tensile strength of 14 MPa, Durometer hardness of 75 tested to ASTM D2240, sized to accommodate glass thickness.
- .2 Setting Blocks: ASTM C864, EPDM; 80 to 90 Shore A durometer hardness tested to ASTM D2240, length of 25 mm for each sq m of glazing or minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height to suit glazing method and pane weight and area.
- .3 Spacer Shims: ASTM C864, Silicone 50 to 60 Shore A durometer hardness tested to ASTM D2240, minimum 75 mm long x one half the height of the glazing stop x thickness to suit application self adhesive on one face.
- .4 Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness tested to ASTM D2240; coiled on release paper; to suit size; black colour.
- .5 Glazing Clips: Manufacturer's standard type.
- .6 Glazing Gaskets: ASTM C864, silicone extruded shape to suit glazing channel retaining slot; Clear colour.

2.6 SOURCE QUALITY CONTROL AND TESTS

- .1 Section 01 45 00: Provide testing of glass.
- .2 Test safety glass samples to ANSI Z97.1, ASTM E546, ASTM E576.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that openings for glazing are correctly sized and within tolerance.
- .3 Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

3.2 PREPARATION

- .1 Clean contact surfaces with solvent and wipe dry.

- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.
- .4 Install sealant in accordance with manufacturer's written instructions.

3.3 INSTALLATION - GLAZING

- .1 Perform work in accordance with GANA Glazing Manual for glazing installation methods.
- .2 Interior Dry Method (Tape and Tape):
 - .1 Cut glazing tape to length and set against permanent stops, projecting 1.5 mm above sight line.
 - .2 Place setting blocks at 1/4 points with edge block no more than 150 mm from corners.
 - .3 Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
 - .4 Place glazing tape on free perimeter of glazing in same manner described above.
 - .5 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
 - .6 Knife trim protruding tape.
- .3 Interior Wet/Dry Method (Tape and Sealant):
 - .1 Cut glazing tape to length and install against permanent stops, projecting 1.5 mm above sight line.
 - .2 Place setting blocks at 1/4 points with edge block no more than 150 mm from corners.
 - .3 Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
 - .4 Install removable stops, spacer shims inserted between glazing and applied stops at 600 mm intervals, 6 mm below sight line.
 - .5 Fill gaps between pane and applied stop with compatible sealant to depth equal to bite on glazing, to uniform and level line.
 - .6 Trim protruding tape edge.
- .4 Interior Wet Method (Compound and Compound):
 - .1 Install glazing resting on setting blocks. Install applied stop and centre pane by use of spacer shims at 600 mm centres, kept 6 mm below sight line.
 - .2 Locate and secure glazing pane using glazers' clips.
 - .3 Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.4 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Field inspection and testing.
- .2 Inspection will monitor quality of glazing.

3.5 MANUFACTURER'S SERVICES

- .1 Section 01 78 00: Prepare and start components.
- .2 Glass and glazing product manufacturers to provide field surveillance of the installation of their Products.
- .3 Monitor and report installation procedures and unacceptable conditions.

3.6 CLEANING

- .1 Section 01 74 10: Cleaning installed work.
- .2 Remove glazing materials from finish surfaces.
- .3 Remove labels after Work is complete.
- .4 Clean glass and adjacent surfaces.

3.7 PROTECTION

- .1 Section 01 78 23: Protecting installed work.
- .2 After installation, mark pane with an 'X' by using removable plastic tape or paste. Do not mark heat absorbing or reflective glass units.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Gypsum board.
- .2 Acoustic insulation.
- .3 Light gauge metal stud wall framing.
- .4 Metal channel ceiling framing.

1.2 RELATED REQUIREMENTS

- .1 Section 06 10 53 - Miscellaneous Rough Carpentry: Wood blocking for support of equipment.
- .2 Section 07 84 00 - Firestopping.
- .3 Section 08 31 13 - Access Doors and Frames: Metal access panels and frames.

1.3 REFERENCE STANDARDS

- .1 ASTM C475/C475M-15 - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- .2 ASTM C514-04(2009)e1 - Standard Specification for Nails for the Application of Gypsum Board.
- .3 ASTM C645-14e1 - Standard Specification for Nonstructural Steel Framing Members.
- .4 ASTM C754-15 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .5 ASTM C840-16 - Standard Specification for Application and Finishing of Gypsum Board.
- .6 ASTM C1002-07 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .7 ASTM C1047-10a - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .8 ASTM C1396/C1396M-17 - Standard Specification for Gypsum Board.
- .9 ASTM E90-09 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- .10 CAN/ULC-S101-14 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.
- .11 CAN/ULC-S102-10 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .12 CAN/ULC-S702-14 - Standard for Mineral Fibre Thermal Insulation for Buildings.
- .13 Gypsum Association GA-214-2015 - Recommended Levels of Gypsum Board Finish.
- .14 Gypsum Association GA-216-2016 - Application and Finishing of Gypsum Panel Products.
- .15 Gypsum Association GA-600-2015 - Gypsum Fire Resistance Design Manual.
- .16 Gypsum Association GA-801-2007 - Handling and Storage of Gypsum Panel Products.
- .17 UL - Fire Resistance Directory.
- .18 ULC-FR-17 - Fire Resistance Directory (2017 Edition).

1.4 DEFINITIONS

- .1 Delegated Design Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to design specialty elements, produce Delegated Design Submittals to meet

requirements of authorities having jurisdiction; and registered or licensed in the Province of British Columbia, Canada.

1.5 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data:
 - .1 Provide data on metal framing, gypsum board, joint tape and compound.
- .3 Shop Drawings: Indicate special details associated with fireproofing, acoustic seal for openings and at wall junctions, firestopping seal for openings..
 - .1 Provide Shop Drawings indicating details for anchorage and bracing for seismic restraint, stamped and signed by a Professional Engineer registered or licensed in the province where the project is located.
 - .2 Shop drawings shall show dimensions, sizes, thicknesses, alloys, tempers, finishes, joining, attachments, and relationship of adjoining work.

1.6 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.

1.7 DELEGATED DESIGN SUBMITTALS

- .1 Delegated Design Submittals: Submit the following, as specified in Section 01 33 00.
 - .1 Letter of Assurance (Schedule S-B): Submit concurrently with Shop Drawings.
 - .2 Letter of Assurance (Schedule S-C): Submit after completion of Work of this Section.

1.8 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.9 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Perform Work in accordance with ASTM C840, GA-214, GA-216 GA-600. Maintain one (1) copy of document on site.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.
- .4 Handling Gypsum Board: Comply with GA-801.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Transport, handle, store, and protect products in accordance with Section 01 61 00 Common Product Requirements, ASTM C840, and Manufacturer's written recommendations.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Metal Framing:
 - .1 Bailey Metal Products Ltd.; www.bmp-group.com
 - .2 CGC Inc., www.cgcinc.com
 - .3 Dietrich Metal Framing; www.dietrichmetalframing.com
- .2 Gypsum Board:

- .1 CertainTeed Gypsum Canada Inc.; www.certainteed.com
- .2 CGC Inc., www.cgcinc.com
- .3 Georgia-Pacific Canada, Inc.; www.gpgypsum.com
- .3 Substitutions: Refer to Section 01 25 00.

2.2 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to applicable code for fire rated assemblies in conjunction with Section 09 22 16 as follows:
 - .1 Fire Rated Partitions: ULC Listed Assembly Design No. as indicated.
 - .2 Conform to applicable code for seismic requirements.

2.3 PERFORMANCE / DESIGN CRITERIA

- .1 Acoustic Attenuation for Identified Interior Partitions: 42 STC to ASTM E90.
- .2 Seismic Restraints: Design anchorages, bracing and suspension systems to withstand seismic loads and sway displacement as calculated in accordance with applicable code for post disaster facilities, and to ASTM E580/E580M.

2.4 FRAMING MATERIALS

- .1 Studs and Tracks: ASTM C645; galvanized sheet steel, 20-gauge thick, C shape, with knurled faces.
- .2 Furring, Framing, and Accessories: ASTM C645.
- .3 Fasteners: GA-216.
- .4 Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- .5 Adhesive: GA-216.

2.5 GYPSUM BOARD MATERIALS

- .1 Gypsum Board: ASTM C1396/C1396M, paper-faced; 1220 mm wide, maximum available length in place; tapered edges, ends square cut.
 - .1 Fire rated core, "Type X" 16 mm thick.
- .2 Water Resistant Gypsum Board: ASTM C1278/C1278M, glass fibre-reinforced, paperless face; maximum available length in place; tapered edges, ends square cut.
 - .1 Fire rated core, "Type X" 16 mm thick.
- .3 Abuse-Resistant Gypsum Board: ASTM C1396/C1396M, paper-faced, impact resistant; maximum available length in place; tapered edges, ends square cut.
 - .1 Fire rated core, "Type X" 16 mm thick.

2.6 ACCESSORIES

- .1 Acoustic Insulation: CAN/ULC-S702, ASTM E136, ASTM E90, ASTM C665.
 - .1 Mineral wool batt insulation, friction fit type, unfaced, thickness as indicated. Use in fire rated wall assemblies as required by ULC assembly description. Non-combustible to CAN/ULC S114.
 - .1 Product: AFB manufactured by Rockwool (Roxul).

- .2 Fiberglass batt Insulation: CAN/ULC-S702, ASTM C665; preformed glass fibre, friction fit type, unfaced, thickness as indicated. Use in non-fire rated wall assemblies unless acceptable by ULC assembly description for fire rated wall type.
 - .1 Product: Quiet Zone Acoustical Batt by Owens Corning.
- .2 Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
 - .1 Product: Hilti CP506 Smoke and Acoustic sealant, manufactured by Hilti.
- .3 Corner Beads: GA-216, metal corner bead.
- .4 Edge Trim: GA-216; Type U casing bead.
- .5 Joint Materials: GA-216.
 - .1 Reinforcing tape, adhesive, and water.
 - .2 Joint compound: Asbestos-free dust-controlled.
- .6 Gypsum Board Fasteners: ASTM C1002, Type S.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that site conditions are ready to receive work and opening dimensions are as indicated on shop drawings.

3.2 METAL STUD INSTALLATION

- .1 Install studs to ASTM C475/C475M and manufacturer's written instructions.
- .2 Install wall framing requiring seismic restraint to meet requirements of applicable building code.
- .3 Metal Stud Spacing: 400 mm / 600mm on centre, refer to architectural construction assemblies drawing.
- .4 For partitions extending stud framing to ceiling only. Attach ceiling runner securely to ceiling framing to manufacturer's written instructions.
- .5 Refer to Drawings for indication of partitions extending stud framing through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- .6 Door Opening Framing: Install double studs at door frame jambs. Install stud tracks on each side of opening, at frame head height, and between studs and adjacent studs.
- .7 Blocking: Nail or screw wood blocking to studs. Bolt or screw steel channels to studs. Install blocking for support of plumbing fixtures, wall cabinets, accessories, and hardware.

3.3 CEILING FRAMING INSTALLATION

- .1 Install to GA-216 and manufacturer's written instructions.
- .2 Install metal suspension system requiring seismic restraint to meet requirements of applicable building code.
- .3 Coordinate location of hangers with other work.
- .4 Install ceiling framing independent of walls, columns, and above ceiling work.
- .5 Reinforce openings in ceiling suspension system which interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 600 mm past each end of openings.
- .6 Laterally brace entire suspension system.

3.4 ACOUSTIC ACCESSORIES INSTALLATION

- .1 Install resilient channels at maximum 600 mm on centre. Locate joints over framing members.
- .2 Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.
- .3 Install acoustic sealant within partitions in accordance with manufacturer's written instructions.
- .4 Install acoustic sealant at gypsum board perimeter at:
 - .1 Metal Framing: Two (2) beads.
 - .2 Base Layer: Seal with 10 mm bead.
 - .3 Face Layer: Seal with 10 mm bead.
 - .4 Caulk all penetrations of partitions by conduit, pipe, duct work, rough-in boxes, and rough-in boxes.

3.5 GYPSUM BOARD INSTALLATION

- .1 Install gypsum board to GA-216 and manufacturer's written instructions.
- .2 Erect single layer standard gypsum board horizontal, with ends and edges occurring over firm bearing.
- .3 Erect single layer fire rated gypsum board as required by tested assembly, with edges and ends occurring over firm bearing.
- .4 Use screws when fastening gypsum board to metal furring or framing.
- .5 Treat cut edges and holes in moisture resistant gypsum board with sealant.
- .6 Place control joints consistent with lines of building spaces as indicated.
- .7 Place corner beads at external corners as indicated. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials as indicated.
- .8 Install backing board over metal studs to manufacturer's written instructions.

3.6 JOINT TREATMENT

- .1 Finish to GA-214, Level as indicated below:
 - .1 Above finished ceiling: Level 01
 - .2 Walls and Ceilings exposed to view: Level 04
 - .3 Walls and Ceilings with special finishes: Level 05
- .2 Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
- .3 Feather coats on to adjoining surfaces so that camber is maximum 0.8 mm.

3.7 TOLERANCES

- .1 Maximum Variation of Finished Gypsum Board Surface from True Flatness: 3 mm in 3 m in any direction.

3.8 FIELD QUALITY CONTROL

- .1 Inspections: Provide professional engineer's inspections for Letters of Assurance in accordance with applicable code, including the following:
 - .1 Perform timely and regular inspections.
 - .2 Verify fabrication and installation is provided according to design.
 - .3 Prepare inspection reports, Letters of Assurance and associated Schedule documents.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Formed metal framing of studs and furring, at interior locations.
- .2 Framing accessories.

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: Metal fabrications attached to stud framing.
- .2 Section 06 10 53 - Miscellaneous Rough Carpentry: Rough wood blocking within stud framing.
- .3 Section 08 31 13 - Access Doors and Frames.
- .4 Section 09 21 16 - Gypsum Board Assemblies: Gypsum board on metal studs for partitioning.

1.3 REFERENCE STANDARDS

- .1 ASTM A123/A123M-17 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A653/A653M-15e1 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .3 ASTM C645-14e1 - Standard Specification for Nonstructural Steel Framing Members.
- .4 ASTM C754-15 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .5 ASTM C1002-07 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .6 MPI (Master Painters Institute) – Architectural Painting Specifications Manual and Maintenance Repainting Manual.
- .7 SSPC (The Society for Protective Coatings) - Steel Structures Painting Manual.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.

1.5 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data:
 - .1 Provide data describing standard framing member materials and finish, product criteria, load charts, and limitations.
 - .2 Provide MSDS information for all products.
- .3 Shop Drawings:
 - .1 Indicate prefabricated work component details, stud layout, framed openings, bearing, anchorage to structure, loading, welds, type and location of fasteners and accessories or items required of other related work.
 - .2 Describe method for securing studs to tracks, splicing and for blocking and reinforcement to framing connections.
 - .3 Provide calculations for loadings and stresses of specially fabricated framing under the Professional Structural Engineer's seal.

1.6 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

- .1 Perform Work to ASTM C754. Maintain one (1) copy of document on site.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

PART 2 PRODUCTS

2.1 DESCRIPTION

- .1 System Description:
 - .1 Interior Walls: Metal stud framing assembly with batt type acoustic insulation specified in Section 09 21 16, interior gypsum board specified in Section 09 21 16.

2.2 PERFORMANCE / DESIGN CRITERIA

- .1 Maximum Allowable Deflection: 1:180 span.
- .2 Wall Assembly:
 - .1 Design to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
 - .2 Design assembly to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

2.3 STUD FRAMING MATERIALS

- .1 Framing Assembly Components: ASTM C645.
- .2 Studs: ASTM A653/A653M, non-load bearing rolled steel, channel shaped, punched for utility access, as scheduled:.
- .3 Tracks and Headers: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.
- .4 Ceiling Runners: With extended leg retainer.
- .5 Furring and Bracing Members: Of same material as studs; thickness to suit purpose.
- .6 Fasteners: ASTM C1002, self drilling, self tapping screws.
- .7 Anchorage Devices: Drilled expansion bolts, screws with sleeves, power actuated; hot-dip galvanized to minimum requirements of CSSBI.
- .8 Acoustic Sealant: As specified in Section 09 21 16.
- .9 Touch-Up Primer for Galvanized Surfaces: MPI #18, organic zinc-rich, MPI #19, inorganic zinc-rich primer.

2.4 FABRICATION

- .1 Fabricate assemblies of framed sections to sizes and profiles required.

- .2 Fit, reinforce, and brace framing members to suit design requirements.
- .3 Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that rough-in utilities are in proper location.

3.2 ERECTION

- .1 Align and secure top and bottom runners at maximum 600 mm on centre.
- .2 Place one (1) beads of acoustic sealant between runners and substrate studs and adjacent construction to achieve an acoustic seal.
- .3 Place one (1) beads of acoustic sealant between studs and adjacent vertical surfaces to achieve an acoustic seal.
- .4 Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- .5 Install studs vertically at 400 / 600 mm on centre.
- .6 Align stud web openings horizontally.
- .7 Secure studs to tracks using fastener method. Do not weld.
- .8 Stud Splicing: Not permissible.
- .9 Fabricate corners using a minimum of three studs.
- .10 Double stud at wall openings, door and window jambs, not more than 50 mm from each side of openings.
- .11 Brace stud framing assembly rigid.
- .12 Coordinate erection of studs with requirements of door frames; install supports and attachments.
- .13 Coordinate installation of wood bucks, anchors, and wood blocking with electrical and mechanical work to be placed within or behind stud framing.
- .14 Blocking: Install blocking for support of plumbing fixtures, wall cabinets, hardware, opening frames, washroom accessories, equipment and other accessories.
 - .1 Secure wood blocking to studs.
 - .2 Once steel stud installation is complete, notify Owner and Architect so that site visit can be arranged to confirm location of all wall mounted accessories, devices and equipment.
- .15 Refer to Drawings for indication of partitions extending to finished ceiling only and for partitions extending through the ceiling to the structure above. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.
- .16 Coordinate placement of insulation in stud spaces after stud frame erection.

3.3 ERECTION TOLERANCES

- .1 Maximum Variation From True Position: 3 mm in 3 m.
- .2 Maximum Variation From Plumb: 3 mm in 3 m.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Suspension System Framing and Furring for Plaster and Gypsum Board Assemblies
- .2 Wire hangers, fasteners, main runners, cross tees, and wall angle moldings.

1.2 RELATED SECTIONS

- .1 Section 09 21 16 - Gypsum Board Assemblies.
- .2 Section 09 51 13 - Acoustical Panel Ceilings.

1.3 REFERENCES

- .1 American Society for Testing and Materials (ASTM):
 - .1 ESR 2311- Screw-attached Ceiling Panel Suspension Assemblies (ShortSpan Drywall Grid System)
 - .2 OTCR 32-16 ShortSpan Drywall Ceiling Framing System
 - .3 ASTM A 641 Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire.
 - .4 ASTM A 653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 - .5 ASTM A 1003 Standard Specification for Steel, Sheet, Cold Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability"
 - .6 ASTM B 117 Standard Practice for Operating Salt Spray (Fog) Apparatus
 - .7 ASTM C 635 Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - .8 ASTM C 636 Recommended Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 - .9 ASTM C 645 Standard Specification for Nonstructural Steel Framing Members
 - .10 ASTM C 754 Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board
 - .11 ASTM C 840 Specification for Application & Finishing of Gypsum Board
 - .12 ASTM C 1858 Standard Practice for Design, Construction, and Material Requirements for Direct Hung Suspended T-bar Type Ceiling Systems Intended to Receive Gypsum Panel Products in Areas Subject to Earthquake Ground Motions
 - .13 ASMT C 1925, Standard Test Method for Strength properties of Direct Hung, Suspended T bar ceilings system intended to receive gypsum board.
 - .14 ASTM C 1002 Standard Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
 - .15 ASTM D 610 Standard Test Method for Evaluating Degree of Rusting on Painted Steel Surfaces
 - .16 ASTM E 119 Standard Test Method for Fire Tests of Building Construction and Material (if applicable).
 - .17 ASTM E 3090, Standard Test Method of Metal Ceiling Suspension Systems
- .2 ESR-1289 ICC-ES Evaluation Report.
- .3 Cisca Ceiling Systems Installation Handbook
- .4 Underwriters Laboratories Inc. (UL) Fire Resistance Directory

1.4 SUBMITTALS

- .1 Product Data: Submit manufacturer's technical literature.
- .2 Samples: 8 inch long samples of suspension system components, including main runner, cross tees and angle molding.
- .3 Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.

1.5 QUALITY ASSURANCE

- .1 Single-Source Responsibility: To ensure proper interface, all drywall furring components shall be produced or supplied by a single manufacturer.
- .2 All accessory components from other manufacturers shall conform to ASTM standards.
- .3 Fire Resistance Ratings: As indicated by reference to design designations in UL Fire Resistance Directory, for types of assemblies in which drywall ceilings function as a fire protective membrane and tested per ASTM E 119. Installation in accordance with the UL Design being referenced.
- .4 Coordination of Work:
 - .1 Coordinate drywall furring work with installers of related work including, but not limited to acoustical ceilings, building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.
 - .2 All work above the ceiling line should be completed prior to installing the drywall sheet goods. There should be no materials resting against or wrapped around the suspension system, hanger wires or ties.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials to project site in original, unopened packages and store them in a fully enclosed space where they will be protected against damage from moisture, direct sunlight, surface contamination, and other causes.

1.7 WARRANTY

- .1 Suspensions System: Submit a written limited warranty executed by the manufacturer, agreeing to repair or replace grid components that are supplied with a hot-dipped galvanized coating or aluminum base material. Failures include, but are not limited to:
 - .1 The occurrence of 50% red rust as defined by ASTM D 610 test procedures as a result of defects in materials or factory workmanship.
- .2 Warranty Period:
 - .1 Grid: Ten years from date of installation.
- .3 The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Suspension Systems: Armstrong World Industries, Inc.

2.2 SUSPENSION SYSTEMS

- .1 Components:
 - .1 ShortSpan Beam: Shall be double-web construction (minimum 0.0179 inch prior to protective coating, ASTM C645), hot dipped galvanized (per ASTM A653).

- .1 Product reference: S7708P: 96 inch x 1-13/16 inch web height, 1-1/2 inch flange, available with G40 or G90 hot dipped galvanization.
- .2 StrongBack Support for spans over 6 feet.
 - .1 SB12P: 144 inch x 2 inch, Knockouts 8" on center, available with G40 or G90 hot dipped galvanization.
- .3 Wall Molding:
 - .1 Product reference: KAM151020: 10 foot Knurled Angle molding, 1-1/2 inch x 1-1/2 inch, knurled surface, screw stop hem, pre-punched holes in top flange 4" O.C., .033 mil. 20g
- .4 Transition Molding: Drywall to Acoustical ceiling. Pre-Painted Armstrong Global White integral acoustical flange and drywall taping flange, hot dipped cold rolled steel.
 - .1 Product reference: 7903: 120 inch with 1 inch acoustical flange.
- .5 Axiom Aluminum extrusion Pre-Painted Armstrong Global White integral acoustical flange and drywall taping flange.
 - .1 Product reference: AXTR2STR: 120 inch x 2 inch x 1-1/2 inch Straight.
- .6 Clips:
 - .1 QSUTC: Uptight Clip for direct attach to structure
- .7 Screws for wallboard application shall be bugle head screws in accordance with thickness of material used.
- .2 Structural Classification:
 - .1 Main Beam shall be heavy duty per ASTM C 635.
 - .2 Classification can require wires to be closer together for additional loading when used to support double layer gypsum, verticals, slopes, domes, half barrels, circles, soffits, canopies, and step conditions which call for loading or unusual designs and shapes in drywall construction. Using cross tees in the construction of circles, barrels, etc. is common in order to hold the radius.
 - .3 Deflection of fastening suspension system supporting light fixtures, ceiling grilles, access doors, verticals and horizontal loads shall have a maximum deflection of 1/360 of the span.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

- .1 Install suspension system and panels in accordance with the manufacturer's instructions, in compliance with ASTM installation standard, and with applicable codes as required by the authorities having jurisdiction.
- .2 To secure to metal clips, concrete inserts, steel bar joist or steel deck, use power actuated fastener, or insert. Coordinate placement for hanger wire spaced as required for expected ceiling loads and layout.
- .3 Install hanger wire as required with necessary on center spacing to support expected ceiling load requirements, following local practices, codes and regulations. Provide additional wires at light fixtures, grilles, and access doors where necessary. A pigtail knot shall be used with three tight wraps at top and bottom fastening locations.
- .4 Add additional wire as needed when using compatible clips and accessories.
- .5 StrongBack shall be suspended from the overhead construction with hanger wire or framing, spaced as required for expected ceiling loads, along the length of the ShortSpan beams.
- .6 Install ShortSpan Beams at on center spacing as specified by the drywall manufacturer. Typical drywall tee spacing:

- .1 16 inches on center with 5/8 or 1/2 inch gypsum board
- .7 Other items such as wood, sheet metal, or plastic panels should be screwed to comply with deflection limit equivalent to that of the ceiling installation.
- .8 Use channel molding or angle molding to interface with Drywall Grid System to provide perimeter attachment or to obtain drop soffits, verticals, slopes, etc.
- .9 To suspend a second ceiling beneath a new or existing drywall ceiling, without breaching the integrity of the upper ceiling, use the Drywall Clip. To form a transition from a drywall ceiling to an acoustical ceiling, use the Drywall Transition Clips spaced as required for expected loads.
- .10 For light fixtures (Type G, Type F) use secondary framing cross tees as required to frame opening.
- .11 Single cross tees in a rout hole to be secured by 7/16 inch framing screw or alternative methods

3.2 INSTALLATION - INTERIOR APPLICATIONS

- .1 Install main beams and cross tees at the on center spacing required for ceiling loading, and location of in-ceiling services.
- .2 Additional bracing as required by code.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Suspended metal grid ceiling system and perimeter trim.
- .2 Acoustic tile.

1.2 RELATED REQUIREMENTS

- .1 Section 09 21 16 - Gypsum Board Assemblies: Acoustic partition system.
- .2 Division 21 - Fire Suppression: Sprinkler heads in ceiling system.
- .3 Division 23 - Heating, Ventilating, and Air-Conditioning (HVAC): Air diffusion devices in ceiling system.
- .4 Division 26 – Electrical: Light fixtures in ceiling system.
- .5 Division 27 - Communications: Speakers in ceiling system.
- .6 Division 28 – Electronic Safety and Security: Fire alarm components in ceiling system.

1.3 REFERENCE STANDARDS

- .1 ASTM C635/C635M-12 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
- .2 ASTM C636/C636M-08 - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- .3 ASTM E580/E580M-11b - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions.
- .4 ASTM E1264-14 - Standard Classification of Acoustical Ceiling Products.
- .5 CAN/ULC-S102-10 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .6 AWCCBC (Association of Wall and Ceiling Contractors of British Columbia).
- .7 UL - Fire Resistance Directory.
- .8 ULC-FR-17 - Fire Resistance Directory (2017 Edition).

1.4 DEFINITIONS

- .1 Delegated Design Engineer: The professional engineer hired or contracted to the fabricator or manufacturer to design specialty elements, produce Delegated Design Submittals to meet requirements of authorities having jurisdiction; and registered or licensed in the Province of British Columbia, Canada.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Sequencing:
 - .1 Sequence work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
 - .2 Install acoustic units after interior wet work is dry.

1.6 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.

- .2 Product Data: Provide data on metal grid system components and acoustic units.
- .3 Shop Drawings:
 - .1 Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system.
 - .2 Provide Shop Drawings indicating details for anchorage and bracing for seismic restraint, stamped and signed by Delegated Design Engineer.
- .4 Samples:
 - .1 Submit two (2) samples, 150 mm in size, illustrating material and finish of acoustic units.
 - .2 Submit two (2) samples each, 150 mm long, of suspension system main runner, cross runner and perimeter molding.

1.7 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements, including perimeter conditions requiring special attention.

1.8 DELEGATED DESIGN SUBMITTALS

- .1 Delegated Design Submittals: Submit the following:
 - .1 Letters of Assurance (Schedule S-B): Submit concurrently with Shop Drawings.
 - .2 Letters of Assurance (Schedule S-C): Submit after completion of Work of this Section.

1.9 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.10 MAINTENANCE MATERIAL SUBMITTALS

- .1 Section 01 78 23: Maintenance and extra material requirements.
- .2 Extra Stock Materials: Provide 2% of total acoustic unit area of extra tile to Owner.

1.11 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Conform to AWCCBC requirements.
- .3 Grid Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .4 Acoustic Unit Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.

1.12 DELIVERY, STORAGE AND HANDLING

- .1 Transport, handle, store, and protect products in accordance with Section 01 61 00 Common Product Requirements and Manufacturer's written recommendations.

1.13 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Maintain uniform temperature of minimum 16 degrees C, and maximum humidity of 40% prior to, during, and after acoustic unit installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS - CEILING SYSTEM

- .1 Suspension Grid:
 - .1 CGC Inc.; www.cgcinc.com
- .2 Acoustic Panels
 - .1 CGC Inc.; www.cgcinc.com
- .3 Substitutions: Refer to Section 01 25 00.

2.2 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to applicable code for seismic restraint of non-structural building components.

2.3 PERFORMANCE / DESIGN CRITERIA

- .1 Suspension System: Maximum deflection of 1:240 for acoustic ceiling system including integral mechanical and electrical components.
- .2 Seismic Restraints: Design anchorages and suspension systems to withstand seismic loads and sway displacement as calculated in accordance with British Columbia code for post disaster facilities, and to ASTM E580/E580M.

2.4 MATERIALS

- .1 Non-fire Rated Grid: ASTM C635/C635M, intermediate duty; exposed, downward access removable T; components die cut and interlocking.
- .2 Grid Materials: Commercial quality cold rolled steel with galvanized coating.
- .3 Exposed Grid Surface Width: 24 mm.
- .4 Grid Finish: Colour White.
- .5 Suspension Wires: Galvanized soft-annealed, mild steel, to meet seismic requirements thickness.
- .6 Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- .7 Accessories: Stabilizer bars, clips, splices, perimeter moldings, and splices required for suspended grid system.
 - .1 Perimeter Moulding: L profile, colour to match grid.

2.5 MATERIALS - PANELS

- .1 Acoustic Tile: ASTM E1264, conforming to the following:
 - .1 Size: 1220 x 610 mm (48 inches x 24 inches)..
 - .2 Thickness: 19 mm (3/4 inches)..
 - .3 Fire Hazard Classification: ASTM E84 Class A and CAN/ULC S102, Flame Spread of 25 or less, smoke developed of 50 or less..
 - .4 Edge: Square.
 - .5 Surface Colour: White.
 - .6 Trim: Perimeter L moulding.
 - .7 Acoustical: NRC 0.70 CAC min. 35
 - .8 Surface Finish: Non-directional fissured.

- .9 Product: Ultima with AlrGuard Coating, 1903, manufactured by Armstrong, or Mars ClimaPlus # 86985 HRC by USG.
- .10 Grid Profile: Donn DX.

2.6 ACCESSORIES

- .1 Acoustic Sealant: For perimeter moldings, as specified in Section 07 92 00.
- .2 Touch-up Paint: Type and colour to match acoustic and grid units.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

- .1 Install suspension system to ASTM C636/C636M and manufacturer's written instructions, and as supplemented in this section.
- .2 Install ceiling suspension systems requiring seismic restraint to ASTM E580/E580M.
- .3 Install system capable of supporting imposed loads to a deflection of 1/360 maximum.
- .4 Lay out system to a balanced grid design with edge units no less than 50% of acoustic unit size.
- .5 Locate system on room axis according to reflected plan.
- .6 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.
- .7 Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.
- .8 Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers to span the extra distance.
- .9 Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability. Support fixture loads by supplementary hangers located within 150 mm of each corner; or support components independently.
- .10 Do not eccentrically load system, or produce rotation of runners.
- .11 Perimeter Molding:
 - .1 Install edge molding at intersection of ceiling and vertical surfaces into bed of acoustic sealant.
 - .2 Use longest practical lengths.
 - .3 Mitre corners.
 - .4 Provide concealed molding at junctions with other interruptions.

3.3 INSTALLATION - ACOUSTIC UNITS

- .1 Install acoustic units to manufacturer's written instructions.
- .2 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.
- .3 Lay directional patterned units one way with pattern parallel to longest room axis. Fit border trim neatly against abutting surfaces.
- .4 Install units after above ceiling work is complete.
- .5 Install acoustic units level, in uniform plane, and free from twist, warp, and dents.

- .6 Cutting Acoustic Units:
 - .1 Cut to fit irregular grid and perimeter edge trim.
 - .2 Cut square reveal edges to field cut units.
- .7 Where round obstructions occur, provide preformed closures to match perimeter molding.

3.4 ERECTION TOLERANCES

- .1 Maximum Variation from Flat and Level Surface: 3 mm in 3 m.
- .2 Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.5 FIELD QUALITY CONTROL

- .1 Inspections: Provide professional engineer's inspections for Letters of Assurance in accordance with applicable code, including the following:
 - .1 Perform timely and regular inspections.
 - .2 Verify fabrication and installation is provided according to design.
 - .3 Prepare inspection reports, Letters of Assurance and associated Schedule documents.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Resilient sheet flooring.
- .2 Resilient base.

1.2 RELATED REQUIREMENTS

- .1 Section 09 21 16 - Gypsum Board Assemblies: Wall materials to receive application of base.

1.3 REFERENCE STANDARDS

- .1 ASTM D2047-17 - Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine.
- .2 ASTM E84-17 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- .3 ASTM F1861-08(2012)e1 - Standard Specification for Resilient Wall Base.
- .4 ASTM F1913-04(2014) - Standard Specification for Vinyl Sheet Floor Covering Without Backing.
- .5 ASTM F141-12(2020) - Standard Terminology Relating to Resilient Floor Coverings.
- .6 ASTM F386-17 - Standard Test Method for Thickness of Resilient Flooring Materials Having Flat Surfaces.
- .7 ASTM F710-21 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
- .8 ASTM F970-17 - Standard Test method for Measuring Recovery Properties of Floor Coverings After Static Loading.
- .9 Floor Covering Reference Manual issued by National Floor Covering Association of Canada.
- .10 CAN/ULC-S102.2-10 - Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.4 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data on specified products, describing physical characteristics; sizes, and patterns and colours available.
- .3 Shop Drawings: Indicate seaming plan and cove base detail.
- .4 Samples:
 - .1 Submit two (2) samples, 150 x 150 mm in size illustrating colour and pattern for each floor material for each colour specified.
 - .2 Submit two (2) long samples of base material for each colour specified.

1.5 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements including special procedures, perimeter conditions requiring special attention and transitions.

1.6 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.
- .2 Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- .1 Section 01 78 23: Maintenance and extra material requirements.
- .2 Extra Stock Materials: Provide a minimum of 2% total area or 9 sq m (whichever is greater) of flooring, 6.1 lin m of base of each material specified.

1.8 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 and ISO 14000 certification requirements.
- .2 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .3 Installer Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience and approved by the manufacturer.

1.9 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for flame/smoke rating requirements of applicable building code to CAN/ULC-S102.2.

1.10 DELIVERY, STORAGE, AND HANDLING

- .1 Transport, handle, store, and protect products in accordance with Section 01 61 00 Common Product Requirements, NFCA Manual, and Manufacturer's written recommendations.
- .2 Protect roll materials from damage by storing as indicated in manufacturers written instructions.

1.11 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Store materials for three (3) days prior to installation in area of installation to achieve temperature stability.
 - .2 Maintain ambient temperature required by adhesive manufacturer three (3) days prior to, during, and twenty-four (24) hours after installation of materials.

PART 2 PRODUCTS

2.1 MATERIALS - SHEET FLOORING

- .1 Sheet Vinyl Flooring: homogeneous sheet vinyl flooring. To ASTM F-1913:
 - .1 Thickness: 2.0 mm
 - .2 Sheet width: 2.0 m
 - .3 Wear Layer: 2.0 mm
 - .4 Static Load Limit: 52.73kg/cm² to ASTM F970..
 - .5 Slip Resistance: Static Coefficient of Friction of 0.5 on level surfaces, to ASTM F2047.
 - .6 Critical Radiant Flux: 0.45 watts/cm² - Class 1, to ASTM E648.
 - .7 Smoke: 450 or less to ASTM E662.
 - .8 Colour: To match existing.
 - .9 Rod for heat-welding seams: product of floor covering manufacturer in colour matching field colour of sheet vinyl floor covering.
 - .10 Manufacturer's guarantee: 10-year limited product warranty
 - .11 Basis of design:
 - .1 Tarkett Granit, by Johnsonite Inc.
- .2 Cove Base: Rubber, top edge smooth rounded bottom coved and topset over resilient flooring:

- .1 Conforming to ASTM F1861.
- .2 Thickness: 3mm.
- .3 Height: 150mm.
- .4 Colour: To match existing.
- .5 Exterior corners: Butterfly joint.
- .6 Interior Corners: Mitre on site.
- .7 Exposed Ends: Round off corners on site provide in longest lengths possible

2.2 ACCESSORIES

- .1 Self leveling compound: refer to 03 54 00, and as approved by flooring Manufacturer.
- .2 Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- .3 Primers and Adhesives: Waterproof; types recommended by flooring manufacturer.
- .4 Edge Strips: Vinyl per manufacturer recommendations.
- .5 Cant Strip: for integral cove base fully support flooring on cove filler strip CFS-00-A forming 32mm radius as manufactured by Johnsonite or approved alternate.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify concrete floors are dry to a maximum moisture content of 7%, and exhibit negative alkalinity, carbonization, or dusting.
- .3 Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.2 PREPARATION

- .1 Flatness and levelness tolerance for institutional and commercial floor:
 - .1 3/16" over 10', smooth machine trowel finish (Concrete Surface Profile 1-2), unless otherwise required by resilient flooring Manufacturer.
- .2 Method: combination of grinding of the existing slab down and addition of a self-levelling grout.
- .3 Remove sub-floor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- .4 Remove existing-flooring, grout, mortar, ridges and bumps. Shot blasting and/or diamond polishing may be required to prepare the slab surface to sub floor filler.
- .5 Use self leveling grout sub-floor filler to achieve smooth, flat, hard surface at required elevation.
- .6 Prepare existing surface to manufacturers written instructions and ASTM F710, including performing required testing for substrate alkalinity and moisture content as required by Manufacturer.
- .7 Flooring Contractor is responsible for ensuring substrate flatness and surface tolerances (including any required grinding and leveling) are within flooring Manufacturers written recommendations.
- .8 Refer to Section 03 54 00.
- .9 Prohibit traffic until filler is cured.
- .10 Vacuum clean substrate.
- .11 Apply primer to appropriate surfaces.

3.3 INSTALLATION - SHEET FLOORING

- .1 Install sheet flooring to manufacturer's written instructions.
- .2 Spread only enough adhesive to permit installation of materials before initial set.
- .3 Set flooring in place, press with heavy roller to attain full adhesion.
- .4 Lay flooring with joints and seams in accordance with seaming plan and as follows.
 - .1 Install sheet flooring parallel to length of room.
 - .2 Provide minimum of one third (1/3) full roll width. Double cut sheet; provide continuously heat welded seal.
 - .3 Maintain uniformity of floor covering direction.
 - .4 Terminate flooring at centreline of door openings where adjacent floor finish is dissimilar.
- .5 Install edge strips at unprotected or exposed edges, and where flooring terminates.
 - .1 Secure metal strips before installation of flooring with stainless steel screws.
 - .2 Secure resilient strips by adhesive.
- .6 Integral-Flash-Cove Base: Cove floor coverings, dimension as indicated, up vertical surfaces. Support floor coverings at horizontal and vertical junction by cant strip. Butt at top against cap strip.
 - .1 Install corners using half or full butterfly method at inside and outside corners. Mitred corners are not acceptable.
- .7 Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- .8 Install feature strips where indicated. Fit joints tightly.

3.4 INSTALLATION - BASE

- .1 Fit joints tight and vertical. Maintain minimum measurement of 450 mm between joints.
- .2 Mitre internal corners. At external corners, "V" cut back of base strip to 2/3 of its thickness and fold. At exposed ends, use premoulded units.
- .3 Install base on solid backing. Bond tight to wall and floor surfaces.
- .4 Scribe and fit to door frames and other interruptions.

3.5 CLEANING

- .1 Section 01 74 10: Cleaning installed work.
- .2 Remove access adhesive from floor, base, and wall surfaces without damage.
- .3 Clean, seal, and wax (if permitted) floor and base surfaces in accordance with manufacturer's written instructions.

3.6 PROTECTION

- .1 Section 01 78 23: Protecting installed work.
- .2 Prohibit traffic on floor finish for forty-eight (48) hours after installation.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Surface preparation.
- .2 Painting.

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: Shop primed items.
- .2 Heating, Ventilation, and air-Conditioning (HVAC) - Mechanical Identification.
- .3 Electrical - Electrical Identification.

1.3 REFERENCE STANDARDS

- .1 MPI (Master Painters Institute) – Architectural Painting Specifications Manual and Maintenance Repainting Manual.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination: Coordinate with other Work having a direct bearing on Work of this section.
- .3 Scheduling:
 - .1 Schedule painting operations to prevent disruption of and by other trades.
 - .2 Schedule painting operations to prevent disruption of occupants in and about building.

1.5 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data:
 - .1 Submit Product data on all specified finishing products.
- .3 Samples:
 - .1 Submit two (2) samples, 150mm in size illustrating selected colours and textures for each colour selected.

1.6 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements including special surface preparation procedures and substrate conditions requiring special attention.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.
- .2 Record Documentation: Upon completion, provide itemized list of products used including the following:
 - .1 Manufacturer's name.
 - .2 Product name, type and use.
 - .3 Colour coding number.
 - .4 Manufacturer's Material Safety Data Sheets (MSDS).

1.8 MAINTENANCE MATERIAL SUBMITTALS

- .1 Section 01 78 23: Maintenance and extra material requirements.
- .2 Extra Stock Materials: Provide properly packaged maintenance material as follows.
 - .1 Four 1 gal of each coating type and colour to Owner.
 - .2 Label each container with colour, type, texture and room locations in addition to manufacturer's label.

1.9 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum five (5) years documented experience.
- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years documented experience.
- .3 Conform to MPI Painting Manual requirements for materials, preparation and workmanship.
- .4 Paint Products: Paint manufacturers and paint Products listed under the Approved Product List section of the MPI Painting Manual.
- .5 Special Systems: Where special coating system applications are used, provide manufacturer's certification of all surfaces and conditions for specific paint or coating system application including inspection and approval of their system application at no additional cost to Owner.

1.10 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Deliver products to site in sealed and labeled containers showing 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 dry, ventilated area and as required by manufacturer's written instructions.
- .4 Provide adequate fireproof storage lockers and warnings as required by authorities having jurisdiction for storing toxic and volatile/explosive/flammable materials.

1.11 SITE CONDITIONS

- .1 Ambient Conditions:
 - .1 Do not perform painting or decorating Work when ambient air and substrate temperatures are below 10 degrees C for both interior and exterior work, or as required by paint product manufacturer.
 - .2 Do not perform painting or decorating Work when relative humidity is above 85% or when dew point is less than 3 degrees C variance between the air/surface temperature required by paint Product manufacturer.
 - .3 Do not perform painting and decorating Work when maximum moisture content of substrate exceeds:
 - .1 Wood: 15%.
 - .2 Plaster and Gypsum Wallboard: 12 %.
 - .3 Masonry, Concrete, and Concrete Unit Masonry: 12%.
 - .4 Concrete Floors: 8%.
 - .4 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple cover patch test.
 - .5 Test concrete, masonry and plaster surfaces for alkalinity as required.

- .6 Provide minimum lighting level of 323 lux is provided on surfaces to be painted or decorated.

1.12 WASTE MANAGEMENT AND DISPOSAL

- .1 Dispose of waste materials in accordance with Local authorities having jurisdiction.
- .2 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .3 Place non-reusable materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .4 To reduce contaminants entering waterways, sanitary/storm drain systems or into the ground, adhere to the following procedures:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out. In no case shall equipment be cleaned using free draining water.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
 - .5 Dry out empty paint cans prior to disposal or recycling.
 - .6 Close and seal tightly partly used cans of materials including sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.
- .5 Set aside and protect surplus and uncontaminated finish materials and deliver or arrange collection for verifiable re-use or re-manufacturing.

1.13 WARRANTY

- .1 Provide local MPI Accredited Quality Assurance Association two year guarantee warranting that Work has been performed in accordance with MPI Painting Manual.

PART 2 PRODUCTS

2.1 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to applicable code for flame and smoke rating requirements for finishes, storage, mixing, application and disposal of paint and related waste materials.

2.2 MATERIALS

- .1 Use only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers) listed in the latest edition of the MPI Approved Product List (APL) on this project.
- .2 Ancillary materials such as linseed oil, shellac, thinners, solvents to be of highest quality product and provided by an MPI listed manufacturer, and compatible with paint materials being used.
- .3 Where required, use only materials having a minimum MPI "Environmentally Friendly" E3 rating based on VOC (EPA Method 24) content levels.
- .4 Where indoor air quality (odour) is an issue, use only MPI listed materials having a minimum E3 rating.
- .5 Where possible, all materials to be lead and mercury free with low VOC content.
- .6 Provide all material for each system from a single manufacturer.
- .7 Fire Hazard: Flame spread and smoke developed ratings in accordance with applicable code.

- .8 Patching Materials: Latex filler.
- .9 Fastener Head Cover Materials: Latex filler.

2.3 MIXING AND TINTING

- .1 Coatings: Ready-mixed and pre-tinted; re-mix all paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.
- .2 Paste, Powder or Catalyzed Paint: Mixed in accordance with manufacturer's written instructions.
- .3 Accessory Materials: Linseed oil, shellac, turpentine, paint thinners and other materials not specifically indicated but required to achieve the finishes specified, of commercial quality.
 - .1 Do not exceed paint manufacturer's recommendations for addition of thinner. Do not use kerosene or any such organic solvents to thin water-based paints.
 - .2 Thin paint for spraying in accordance with paint manufacturer's instructions.

2.4 FINISH AND COLOUR

- .1 Finish: To MPI Premium Grade finish requirements.
- .2 Colours and Finishes: Refer to Finish Schedule on Drawings.

2.5 GLOSS/SHEEN RATINGS

- .1 Paint gloss is defined as the sheen rating of applied paint with the following values:
- .2

Gloss Level Description		Gloss @ 60 degrees Sheen @ 85 degrees	
G1	Matte Finish (flat)	0 to 5	10 max.
G2	Velvet-Like Finish	0 to 10	10 to 35
G3	Eggshell Finish	10 to 25	10 to 35
G4	Satin-Like Finish	20 to 35	35 min.
G5	Traditional Semi-Gloss Finish	35 to 70	
G6	Traditional Gloss	70 to 85	
G7	High Gloss Finish	More than 85	

- .3 Gloss level ratings of painted surfaces as specified.

2.6 MANUFACTURERS

- .1 The following articles are for descriptive/proprietary specifying, listing one (1) or more manufacturers. If specifying to MPI (Approved Products List) or by reference to a standard only, delete this article.
- .2 Paint Manufacturers:
 - .1 Benjamin Moore & Co. Ltd.,.
 - .2 PPG Architectural Coatings, Dulux Paints.
 - .3 Sherwin-Williams of Canada Ltd.
 - .4 Pittsburgh Paints .

- .5 Para Paints, Sico Inc.
- .6 Cloverdale Paint Inc.
- .7 Pratt & Lambert, Sherwin-Williams
- .8 Substitutions: Refer to Section 01 25 00.

2.7 INTERIOR PAINT SYSTEMS

- .1 Paint interior surfaces in accordance with the following MPI Painting Manual requirements.
- .2 Structural Steel and Metal Fabrications: (columns, beams, joists, etc.).
 - .1 INT 5.1S: Institutional low odor/low VOC, G4 finish.
- .3 Galvanized Metal: (doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.).
 - .1 INT 5.3M: High performance architectural latex, G5 finish.
- .4 Metal Mechanical and Electrical Cabinets, Sprinkler Pipes and Conduit:
 - .1 INT 5.3K: Water-based, light industrial coating over water-based primer.
 - .2 Covered and insulated pipes and ducts: three coats; one coat PVA sealer, two coats enamel semi-gloss.
 - .3 Other Items: One coat red oxide primer; use galvanized primer where applicable. Two coats enamel semi gloss in accordance with INT. 5.1E or INT. 5.3C alkyd.
 - .4 Match room colour in which piping or ductwork is exposed, unless otherwise directed or scheduled.
- .5 Plaster and Gypsum Board: (gypsum wallboard and textured finishes).
 - .1 INT 9.2P: Epoxy high build (over latex sealer), high gloss finish.
 - .1 On ceiling and walls in all areas.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that substrate conditions 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.
 - .1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
 - .3 Apply paint when previous coat of paint is dry or adequately cured.

3.2 PREPARATION

- .1 Prepare surfaces in accordance with MPI requirements.
- .2 Remove and store or mask miscellaneous hardware and surface fittings such as electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to painting. Clean and replace upon completion of painting Work in each area. Remove doors before painting to paint bottom and top edges and re-hang.
- .3 Protect adjacent surfaces and areas, including rating and instruction labels on doors, frames, equipment, piping, from painting operations with drop cloths, shields, masking, templates, or other suitable protective means.

- .4 Correct defects and clean surfaces which affect work of this section. Start of finish painting of defective surfaces indicates acceptance of substrate and making good defects will be at no cost to Owner.
- .5 Confirm preparation and primer used with fabricator of steel items.
- .6 Seal with shellac and seal marks which may bleed through surface finishes.
- .7 Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- .8 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.
- .9 Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.
- .10 Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- .11 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.
- .12 Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool 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.
- .13 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.
- .14 Interior Wood Items Scheduled to Receive Paint Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats.
- .15 Wood and Metal Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 APPLICATION

- .1 Apply paint or stain in accordance with MPI Painting Manual Premium Grade finish requirements.
- .2 Apply products to adequately prepared surfaces, within moisture limits and acceptable environmental conditions.
- .3 Apply paint finish in areas where dust is no longer being generated or when wind or ventilation conditions will not affect quality of finished surface.
- .4 Apply each coat to uniform finish.
- .5 Tint each coat of paint progressively lighter to enable confirmation of number of coats.
- .6 Unless otherwise approved, apply a minimum of four (4) coats of paint where deep or bright colours are used to achieve satisfactory results.
- .7 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000 mm.
- .8 Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.
- .9 Allow applied coat to dry before next coat is applied.
- .10 Continue paint finish behind wall-mounted items such as washroom accessories.
- .11 Prime concealed surfaces of interior woodwork with primer paint.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- .1 Refer to Mechanical and Electrical for schedule of colour coding and identification banding of equipment, duct work, piping, and conduit.

- .2 Unless otherwise specified, paint all unfinished conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and texture to match adjacent surfaces in the following areas:
 - .1 Exposed-to-view exterior and interior areas.
 - .2 High humidity interior areas.
 - .3 Boiler room, mechanical and electrical rooms.
- .3 In unfinished areas leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish; touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Paint inside of ductwork , where visible behind louvers, grilles and diffusers for a minimum of 460 mm or beyond sight line, whichever is greater, with primer and one (1) coat of matt black (non-reflecting) paint.
- .7 Paint the inside of light valances gloss white.
- .8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .9 Paint red or band all fire protection piping and sprinkler lines in accordance with mechanical specification requirements. Keep sprinkler heads free of paint.
- .10 Paint yellow or band all natural gas piping in accordance with mechanical specification requirements.
- .11 Backprime and paint face and edges of plywood service panels for telephone and electrical equipment before installation to match adjacent wall surface. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.
- .12 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings that were removed prior to finishing.

3.5 FIELD QUALITY CONTROL

- .1 Section 01 45 00: Field inspection.
- .2 Acceptable Surfaces:
 - .1 No visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm.
 - .2 No visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm.
 - .3 No visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles.
 - .4 Uniformity of colour, sheen, texture, and hiding across full surface area.

3.6 CLEANING

- .1 Section 01 74 10: Cleaning installed work.
- .2 Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Overhead metal curtain track and guides.
- .2 Curtains.

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: Above ceiling supports for track.
- .2 Section 06 10 53 - Miscellaneous Rough Carpentry: Above ceiling supports for track.
- .3 Section 09 51 13 - Acoustical Panel Ceilings: Suspended ceiling system to support track.

1.3 REFERENCE STANDARDS

- .1 AATC 16a - Colorfastness to Light: Carbon-Arc Lamp, Continuous Light.
- .2 AATC 147-16e - Test Method for Antibacterial Activity of Textile Materials: Parallel Streak.
- .3 AATCC 30-17 - Test Method for Antifungal Activity, Assessment on Textile Materials: Mildew and Rot Resistance of Textile Materials.
- .4 ASTM E84-21a - Standard Test Method for Surface Burning Characteristics of Building Materials.
- .5 CAN/ULC-S102-10 - Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .6 NFPA 701 - Standard Methods of Fire Tests for Flame Propagation of Textiles and Films, 2015 Edition.
- .7 ULC-FR-17 - Fire Resistance Directory (current edition).
- .8 UL - Fire Resistance Directory.

1.4 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide data for curtain fabric characteristics.
- .3 Shop Drawings: Indicate a reflected ceiling plan view of curtain track, hangers and suspension points, attachment details, schedule of curtain sizes.
 - .1 Field Measurements: Where cubicles are indicated to fit to existing construction, verify dimensions by field measurements before fabrication. Indicate measurements on Shop Drawings
- .4 Samples:
 - .1 Submit two (2) fabric samples, 150 mm in size illustrating fabric colour.
 - .2 Submit 300 x 300 mm sample patch of curtain cloth with representative hem stitch detail, heading with reinforcement, and carrier attachment to curtain header.
 - .3 Submit 300 mm (12 inch) sample length of curtain track including typical splice and wall and ceiling hanger and escutcheon.

1.5 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements including special procedures and perimeter conditions requiring special attention.

1.6 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.
- .2 Operation and Maintenance Data: Include recommended cleaning methods and materials and stain removal methods.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- .1 Section 01 78 23: Maintenance and extra material requirements.
- .2 Extra Stock Materials:
 - .1 Provide two (2) of each curtain size.
 - .2 Provide ten (10) extra carriers.

1.8 REGULATORY REQUIREMENTS

- .1 Conform to applicable building code for flame/smoke rating requirements of CAN/ULC-S102 for curtain fabric.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Accept curtain materials on site and inspect for damage.
- .3 Store curtain materials on site and deliver to the Owner for installation when requested.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Products of the following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - .1 Cubicle Track Manufacturers:
 - .1 InPro Corporation; www.inprocorp.com
 - .2 Silent Gliss Canada Limited; www.silentgliss.ca
 - .3 A.R.Nelson Co; www.arnelson.com
 - .2 Cubicle Fabric Manufacturers:
 - .1 Maharam.
- .2 Substitutions: Refer to Section 01 25 00.

2.2 DESCRIPTION

- .1 System Description:
 - .1 Track: Suspended.
- .2 Regulatory Requirements:
 - .1 Flammability: Ensure fabric meets British Columbia Building Code flammability requirements, NFPA-701 and CAN/ULC S109 Small Scale vertical burn requirements
Flame Resistance: Meet requirements of CAN/ULC-S-109-M Flame Tests of Flame Resistant Fabrics and Films. Pass Flame Match test NFPA-701.
 - .1 When tested by independent testing and inspecting agency acceptable to authorities having jurisdiction.
 - .2 Light fastness: AATCC Method 16A exceeding 60 hours. Class 5.
 - .3 Antibacterial and antifungal resistance:
 - .1 AATC Test Method 147: Pass

- .2 AATC Test Method 30: Pass
- .4 Provide fabric washable in temperatures of 71 deg C (160 deg F).
- .2 Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with requirements of British Columbia Building Code and CAN/CSA S832.
- .3 Design independent suspension system to accommodate rigidity and strength with flexibility in layout to meet design requirements indicated complete with clean unbroken cubicle curtain in each location indicated.
- .4 Provide lateral stability to prevent weakening of wall and ceiling fixtures by lateral movement; Provide lateral stability to straight track to suit design layout.

2.3 PERFORMANCE / DESIGN CRITERIA

- .1 Track: Support vertical test load of 23 kg without visible deflection of track or damage to supports.
- .2 Track Size: Safely support moving loads.
- .3 Track and Mounting: Sufficiently rigid to resist visible deflection and without permanent set.

2.4 TRACK MATERIALS

- .1 Cubicle Track and Carriers: Suspended mount.
 - .1 Provide extruded aluminum alloy 6063-T42 track, white finish, minimum size 14mm wide x 36mm high x 1.27mm thick, suspended track, fixed through exposed tee grid system faces for acoustic tile ceilings.
 - .2 Provide track complete with accessories including end sleeves, stops, and nylon carriers at 150mm oc.
 - .3 Where required, factory form curved sections to radius indicated on Drawings and Supply in 1 piece without joints up to 7200mm. Provide high strength nylon cone carriers with stainless steel curtain hooks. Quantity: 2 carriers per lineal foot.
 - .4 Track suspension: Where indicated provide accessories for suspended track.
 - .5 Tie Backs: Provide curtain tie back to hold curtain back.
 - .6 End Cap: Provide end caps for cushioning of impact. Provide dust cover strips to suit track profile.
 - .7 Fasteners: Stainless Steel.
 - .8 Acceptable Product:
 - .1 UltraCube Cubicle Track by InPro Corporation complete with glider, stainless hooks, carriers and dust cover. Provide dust cover strips to suit track profile.

2.5 CURTAIN MATERIALS

- .1 Privacy Curtain Fabric: Provide 1830mm (72") wide curtain fabric with stain resistant and antimicrobial treatment meeting performance requirements specified herein. Provide netting fabrics in heights indicated herein. Provide netting and fabrics in heights indicated herein.
 - .1 100% polyester fabric with VISA finish. Reinforced button 19 mm (3/4 inch) button holes. Anti-microbial coating to inhibit the growth of bacteria.
 - .2 Colour and pattern: Selected by Consultant from manufacturer's standard range.
 - .3 Product: Refer to finishes schedule on drawings.
 - .4 Open Mesh Top: 70% or greater open netting fabric manufactured from 100% Trevira, fire resistant polyester with 13 mm openings.

2.6 FABRICATION

- .1 Manufacture curtains of one piece, sized 10% wider than track length. Terminate curtain 305 mm from floor.
- .2 Curtain Heading: Double thickness 50 mm wide, with stitched button holes for carriers spaced at 150 mm on centre, double fold bottom hem 50 mm wide including lead weights. Lock stitch seams in two rows. Turn seam edges and lock stitch.
- .3 Header/Top Hem: Provide curtains with matching header of fabric, 50mm wide top hem, triple width, and double stitched to body of curtain, or to mesh. Reinforce with pella stiffening.
- .4 Side Hems: Provide curtains with minimum side hem of 25mm, double width and lock stitched. Provide french seams at panel seams and match fabric pattern and weave at adjacent panels. Ensure fabric is not railroaded unless otherwise indicated by Consultant.
- .5 Bottom Hem: Ensure hems are double 25mm in width and double stitched.
- .6 Stitching: Provide stitching of first quality to produce best appearance against shrinkage. Provide drapery free from creases and wrinkles.
- .7 Allowance for Stretching and Sag: Allow for nature of material being fabricated and Provide allowances for stretching and sag.
- .8 Provide grommets at maximum 150mm on centre and not further than 13mm from each end.
- .9 Netting Fabric (Mesh): Provide netting fabric manufactured from 100% Trevira, fire resistant polyester with 13mm openings in following heights:
 - .1 610mm high at top of curtain for rooms with ceilings at 2750mm
- .10 Source Quality Control: Supply fabric without flaws and/or defects. Inspect for flaws using a light source table and on an unlit flat table.
- .11 Fabricate track bend with minimum 300 mm radius, without deforming track section, or impeding movement of carriers.

2.7 FINISHES

- .1 Exposed Surfaces: Enamel finish.
 - .1 Colour: White.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that field measurements are as indicated on Shop Drawings.
- .3 Verify that surfaces and above ceiling supports are ready to receive work.

3.2 INSTALLATION

- .1 Install curtain track to manufacturer's written instructions.
- .2 Install curtain track secure and rigid, true to ceiling line.
- .3 Install stop device.
- .4 Secure track to ceiling system.
- .5 Install curtains on carriers ensuring smooth operation.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Corner guards.
- .2 Wall protection sheet.
- .3 Hygienic wall protection sheet

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: Concealed in wall plates for attachment of work of this section.
- .2 Section 06 10 53 - Miscellaneous Rough Carpentry: Support blocking for wall and corner guard anchors.
- .3 Section 09 21 16 - Gypsum Board Assemblies: Adjacent wall finish.

1.3 REFERENCE STANDARDS

- .1 CSA-B651-12 - Accessible Design for the Built Environment.
- .2 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .3 ASTM D-635-14, Standard Test Method for Rate of Burning and/or Extent and Time of Burning Self-Supporting Plastics in a Horizontal Position.
- .4 ASTM D-256-10e1, Impact Resistance of Plastics.

1.4 PERFORMANCE REQUIREMENTS

- .1 Installed Component Assembly: Resist lateral force of 333 N (75 lbs) at any point without damage or permanent set.
- .2 Corner Guards: Resist lateral impact force of 445 N (100 lbs) at any point without damage or permanent set.

1.5 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination:
 - .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.

1.6 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Indicate physical dimensions, features, and anchorage details.
- .3 Samples: Submit two (2) sections of each product, 200 mm long, illustrating component design, configuration, colour and finish.

1.7 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements including special procedures, perimeter conditions requiring special attention, and and transition to adjacent finishes.

1.8 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.9 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 certification requirements.
- .2 Perform Work to CSA-B651 requirements for the physically handicapped.
- .3 Installer Qualifications: Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project with a minimum of 3 years experience.

1.10 WARRANTY

- .1 Provide manufacturer's warranty against material and manufacturing defects for a period of five (5) years from Date of Substantial Performance.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Corner Guards: Surface mounted, 16 gauge Type 304 stainless steel 90 deg. corner guard, 89mm wings, sharp nose edge configuration, adhesive tape mounted;
 - .1 CG - Corner Guard: full height, mounted immediately above base. Top of corner guard to underside of ceiling.
 - .1 Acceptable Products:
 - .1 CS Construction Specialties Ltd. "Model CO-8".
 - .2 Approved equivalent from IPC (Inpro Corporation)
 - .2 EG - End Guard: full height, mounted immediately above base. Top of corner guard to underside of ceiling.
 - .1 Acceptable Products;
 - .1 CS Construction Specialties Ltd. "Model SCO-8".
 - .2 Approved equivalent from IPC (Inpro Corporation)
 - .2 WP2 - Wall Protection: Adhesive mounted, 1.02mm thick, rigid PETG sheet wall protection panels, colours as indicated in finishes plan. Butt join panels with caulking. Seal top and base with caulking. Colour of caulking to be confirmed by architect.
 - .1 Full height; to underside of ceiling.
 - .2 Acceptable Products;
 - .1 Acrovyn High Impact Wall Covering by Construction Specialties Ltd.
 - .2 Palladium G2 BioBlend by IPC (Inpro Corporation).
 - .3 WP1 - Hygienic Wall Protection: Adhesive mounted semi-rigid homogeneous PVCu sheet wall protection panel with heat welded butt joints.
 - .1 Thickness: 2.5 mm
 - .2 Panel Size: 1220 mm x full height, mounted immediately above base, top of panel to underside of ceiling.
 - .3 Colours as indicated on finishes plan.
 - .4 Welding rod as recommended by manufacturer.
 - .5 Internal and external pencil radius corners shall be made on site with Altro Thermoformer following the methods detailed in the Altro Whiterock Installation Guide.
 - .6 Acceptable Products:

- .1 Whiterock by Altro.

2.2 ACCESSORIES

- .1 Fasteners: self-tapping stainless steel, concealed mounting.
- .2 Adhesive: water resistive type as recommended by manufacturer for the applicable substrate.
- .3 Sealant: mildew-resistant coloured caulk by manufacturer. Sealant shall be of a complementing solid color from manufacturer's standard selection.
- .4 Corner mold, prefabricated: Altro 38mm Cove Former (CF38R).
- .5 Cap, trim, gaskets: Altro, as recommended by manufacturer.

2.3 FABRICATION

- .1 Fabricate components with tight joints, corners and seams.
- .2 Pre-drill holes for attachment.
- .3 Form end trim closure by capping and finishing smooth.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that field measurements are as indicated on Drawings.
- .3 Verify that rough-in for components are correctly sized and located.

3.2 INSTALLATION

- .1 Install components to manufacturer's written instructions.
- .2 Install components level and plumb, secured rigidly in position to wall framing members only.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Washroom accessories including but not limited to following:
 - .1 Clothing hook.
 - .2 Glove Dispenser (Owner Supplied, Contractor Installed)
 - .3 Hand Sanitizer Dispenser (Owner Supplied, Contractor Installed)
 - .4 Mirror.
 - .5 Paper Towel Dispenser (Owner Supplied, Contractor Installed)
 - .6 Soap Dispenser (Owner Supplied, Contractor Installed)
 - .7 Sharps Container (Owner Supplied, Contractor Installed)
 - .8 Stainless Steel Shelf.
 - .9 Miscellaneous reinforcing components including concealed sheet reinforcing and plywood backing.
- .2 Owner Supplied Items: Items noted as "Owner Supplied" have been included for coordination purposes. These are items that the Owner will supply and the Contractor is responsible to install in accordance with this specification section. Contact Owner at time of installation to confirm types and locations.

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: In wall framing and plates for support of accessories.

1.3 REFERENCE STANDARDS

- .1 ASTM A123/A123M-17 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- .2 ASTM A167-99(2009) - Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
- .3 ASTM A269/A269-15a - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
- .4 ASTM A1008/A1008M-16 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
- .5 ASTM B456-11e1 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
- .6 CSA-B651-12 - Accessible Design for the Built Environment.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

1.5 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.

- .2 Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.

1.6 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements including special procedures and perimeter conditions requiring special attention.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

PART 2 PRODUCTS

2.1 DESCRIPTION

- .1 Regulatory Requirements:
 - .1 Conform to CSA-B651 and applicable code for accessibility requirements for the handicapped.

2.2 MANUFACTURERS

- .1 Products of the following manufacturers are acceptable subject to conformance to requirements:
 - .1 ASI/Watrous, Inc. A division of ASI; www.americanspecialties.com
 - .2 Bobrick Washroom Equipment of Canada Ltd.; www.bobrick.com
 - .3 Bradley Corporation; www.bradleycorp.com
- .2 Substitutions: Refer to Section 01 25 00.

2.3 MATERIALS

- .1 Sheet Steel: ASTM A1008/A1008M.
- .2 Stainless Steel Sheet: ASTM A167, Type 304.
- .3 Tubing: ASTM A269, stainless steel.
- .4 Chrome and nickel plating: to ASTM B456-91, polished finish.
- .5 Adhesive: Contact type, waterproof.
- .6 Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof.
- .7 Expansion Shields: Fibre, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.4 FABRICATION

- .1 Weld and grind joints of fabricated components, smooth.
- .2 Form exposed surfaces from single sheet of stock, free of joints. Form surfaces flat without distortion. Maintain surfaces without scratches or dents.
- .3 Shop assemble components and package complete with anchors and fittings.
- .4 Provide steel anchor plates, adapters, and anchor components for installation.

2.5 PRODUCTS

- .1 Refer to equipment schedule on drawings for equipment responsibility.
- .2 Clothing Hook: Satin finished type 304 stainless steel, coat hook type supplied with 19mm diameter post with 6.4mm diameter hook pin, backplates and screws; concealed mounting flange. Provide one of the following as scheduled and in locations shown on drawings:

- .1 Model No. B-542 by Bobrick;
- .2 Model No. 7308 by ASI;
- .3 Or acceptable equivalent.
- .3 Mirror: Fixed tilt mirror assembly shall consist of a mirror and a separate wall frame with built-in wall hanger. Wall frame furnished with tumbler lock for securing mirror to wall frame. Tilt mirror frame shall be type 304, 20 gauge stainless steel with beveled front to hold frame tightly against mirror; corners shall be welded, ground, and polished smooth. Wall frame shall be type 304, 20 gauge stainless steel designed with horizontal locking bars to secure mirror to wall frame. All exposed surfaces shall have satin finish with vertical grain. Mirror shall be of first quality 1/4" float glass guaranteed for 15 years against silver spoilage. All edges shall be protected by plastic filler strips. Back shall be protected by full-size, shock-absorbing, water-resistant, nonabrasive, 1/8" (3mm) thick polystyrene padding and protective finish. Provide one of the following as scheduled and in locations shown on drawings:
 - .1 Model No. 740-024300 by Bradley;
 - .2 Model No. 0535-2430 by ASI;
 - .3 Model No. B-293 2430 by Bobrick.
- .4 Stainless Steel Shelf: Surface-mounted shelf shall be fabricated of 18 gauge stainless steel with exposed surfaces in satin finish and integral end brackets. Shelves over 24" long shall have 16 gauge intermediate support brackets of matching stainless steel. Provide the following:
 - .1 Shelf 1: Model No. 756-24 by Bradley
 - .2 Shelf 2: Model No. 758-24 by Bradley
 - .3 Or acceptable equivalent.

2.6 FINISHES

- .1 Galvanizing: Hot-dip galvanized to appropriate grade for type and size of steel material indicated, coating thickness ASTM A123/A123M. Galvanize ferrous metal and fastening devices.
- .2 Shop Primed Ferrous Metals: Pre-treat and clean, spray apply one coat primer and bake.
- .3 Enamel: Pre-treat to clean condition, apply one (1) coat primer and minimum two (2) coats electrostatic baked enamel.
- .4 Chrome/Nickel Plating: ASTM B456, Type SC 2, satin finish.
- .5 Stainless Steel: No. 4 Satin finish.
- .6 Back paint components where contact is made with building finishes to prevent electrolysis.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Section 01 73 29: Verify existing conditions before starting work.
- .2 Verify that field measurements are as indicated.
- .3 Verify that site conditions are ready to receive work and dimensions are as indicated on Shop Drawings.
- .4 Verify exact location of accessories for installation.

3.2 PREPARATION

- .1 Deliver inserts and rough-in frames to site for timely installation.
- .2 Provide templates and rough-in measurements as required.

3.3 INSTALLATION

- .1 Install accessories to CSA-B651 and manufacturer's written instructions.
- .2 Install plumb and level, securely and rigidly anchored to substrate.

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 Metal Cabinets and bases.
- .2 Counter tops , stainless steel.
- .3 Casework hardware.

1.2 RELATED REQUIREMENTS

- .1 Section 05 50 00 - Metal Fabrications: Metal countertop framing.
- .2 Section 06 10 53 - Miscellaneous Rough Carpentry
- .3 Section 08 71 00 - Door Hardware - Common Requirements: Casework hardware.
- .4 Section 07 92 00 - Joint Sealants.
- .5 Section 09 91 00 - Painting: Field painting of exposed metal components.

1.3 REFERENCE STANDARDS

- .1 ASTM A240/A240M-19 - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
- .2 [ASTM A653/A653M-23 Standard specification for steel sheet, zinc-coated \(galvanized\) or zinc-iron alloy-coated \(galvannealed\) by the hot-dip process](#)
- .3 [ANSI/BHMA A156.9-2015 Cabinet hardware](#)
- .4 AWS D1.6/D1.6M-2017 - Structural Welding Code - Stainless Steel.
- .5 NPA A208.1-2016 - Particleboard.
- .6 CSA-O121-17 - Douglas Fir Plywood.
- .7 CSA-O151-17 - Canadian Softwood Plywood.
- .8 CSA-O153-19 - Poplar Plywood.
- .9 CSA-W48-18 - Filler Metals and Allied Materials for Metal Arc Welding.
- .10 CSA-W55.3-08 (R2018) - Certification of Companies for Resistance Welding of Steel and Aluminum.
- .11 SEFA 8: Laboratory Furniture - Casework, Shelving and Tables Guidelines.

1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Section 01 31 00: Project management and coordination procedures.
- .2 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate casework installation with size, location and installation of service utilities.
- .3 Sequencing: Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.5 ACTION SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Product Data: Provide component dimensions, configurations, construction details, joint details, and attachments, utility and service requirements and locations.

- .1 Drawings shall include data and details for construction of the casework as well as information regarding name, quantity type and construction of materials (such as hardware, gauges etc.) that will be used to complete the project.
- .3 Shop Drawings: Indicate casework locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, and clearances required.
 - .1 Indicate profiles, sizes, connection attachments, reinforcing, and accessories. Include erection drawings, elevations, type and location of all service fittings and associated supply connections, and details where applicable.
 - .2 Indicate welded connections using standard welding symbols. Indicate net weld lengths.
 - .3 Preparation instructions and recommendations, storage and handling requirements and recommendations and installation methods shall also be included.
- .4 Samples:
 - .1 Submit two (2) samples, minimum size 75 x 150 mm of each colour of base metal, or other finish.

1.6 INFORMATIONAL SUBMITTALS

- .1 Section 01 33 00: Submission procedures.
- .2 Installation Data: Manufacturer's special installation requirements.

1.7 CLOSEOUT SUBMITTALS

- .1 Section 01 78 00: Submission procedures.

1.8 QUALITY ASSURANCE

- .1 Products of This Section: Manufactured to ISO 9000 and ISO 14000 certification requirements.
- .2 Design Data / Test Reports: Manufacturer shall submit test data and design criteria which as in compliance with the project specifications.
- .3 Certificates: All certificates required in the specifications shall be submitted with the original submittal package under separate cover. Certificates must be provided with the signature of a qualified individual of the supplier.
- .4 Manufacturers' Instructions: Provide manufacturer's instructions for installation and maintenance of all products provided and installed within this section. Instructions will be in bound form, tabbed and organized by section number.
- .5 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .6 Welders' Certificates: Submit to Section 01 33 00 requirements, certifying welders employed on the Work, verifying qualification within the previous twelve (12) months to CSA-W55.3.
- .7 Welded Stainless Steel Construction: AWS D1.6/D1.6M.

1.9 DELIVERY, STORAGE, AND HANDLING

- .1 Section 01 61 00: Transport, handle, store, and protect products.
- .2 Accept casework on site. Inspect on arrival for damage.
- .3 Coordinate size of access and route to place of installation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- .1 Selmar Lab.; 3513 199A Street Langley BC, Canada. Tel: (604) 533-8432, www.selmar.ca.
- .2 Substitutions: Refer to Section 01 25 00.

2.2 PERFORMANCE / DESIGN CRITERIA

- .1 Reinforce and support frames and counters in entire area, to safely support a load of 90 kg concentrated on 0.093 sq m in any area with no indentation showing on surface and with permanent set not exceeding 0.127 mm.

2.3 MATERIALS

- .1 Sheet Steel: Commercial quality galvanized sheet steel to ASTM A653/A653M, Z275 coating designation, stretcher leveled.
- .2 Stainless Steel Sheet: ASTM A240/A240M, Type 316, 1.6mm thickness.
- .3 Plywood: CSA-O121, Garde marine; unsanded.
- .4 Glass: Clear Float, 6mm and 3mm thick, conforming to CAN2 12.3-M76, Glazing Quality. Laminated Glass: CAN/CGSB-12.1-M90, Type 1 with clear PVB interlayer. Total nominal thickness of laminated glass: 6mm.
- .5 Welding Materials: Type required for materials being welded.
- .6 Welding Filler Material: CSA-W48.
- .7 Steel Legs / Support: As specified in Section 05 50 00 and herein.
- .8 Sound Deadening Material: Inorganic, for sandwich panel fabrication.
- .9 Sealant: Sanitary type, specified in Section 07 92 00.

2.4 HARDWARE

- .1 Hardware:
 - .1 Manufacturer's standard hardware.
- .2 Shelf Standards and Rests: Vertical steel standards with rubber button fitted steel rests, chrome finish.
- .3 Shelf Brackets: Vertical steel standards with steel arms; satin chrome finish.
- .4 Drawer and Door Pulls: Stainless steel handles on 100 mm centres.
- .5 Cabinet Locks: Lock with four (4) pin cylinder and two (2) keys per lock.
- .6 Drawer Slides: Full extension arms, steel and ball bearing construction; 45 kg capacity.
- .7 Hinges: Provide five knuckle-type barrel door hinges of 1.9mm (14 Ga) steel screwed into door and fastened to cabinet side stile with two counter sunk #8-32 zinc plated machine screws and captive serrated tooth washer nuts. Hinge finish shall be stainless steel.

2.5 FABRICATION - GENERAL

- .1 Fit and shop assemble items in largest practical sections, for delivery to site.
- .2 Fabricate casework, assembled and welded.
- .3 Fabricate corners and joints without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.
- .4 Fabricate components, counters, doors, drawers, and shelves of die formed stainless steel. Form each unit rigid, not dependent on building structure or adjacent units for rigidity.
- .5 Form edges and seams smooth. Form material for shelves, facings, and counter tops from continuous sheets.
- .6 Turn down edges of shelves 25 mm on each side and return 16 mm front and back.
- .7 Electric spot weld casework; grind joints smooth and flush.
- .8 Fabricate drawer and door fronts of sandwiched sheets of stainless steel welded together and reinforced for hardware. Fill with sound deadening core.

- .9 Fabricate countertop surfaces pressure glued to 25mm thick marine grade plywood core backing; without visible joints.
 - .1 Provide front and end overhang as indicated over base construction.
 - .2 Edges: No-drip marine edge or standard, as indicated on drawings, eased to small uniform radius as indicated; 38mm exposed face.
 - .3 Backsplash: Fabricate back splash, height as indicated, bonded to 19mm marine grade plywood, integrally coved to horizontal surface,
- .10 Component Sizes:
 - .1 3mm (11 Ga) levelling bolt gusset plates.
 - .2 1.9mm (14 Ga) drawer slides and side suspension channels.
 - .3 1.5mm (16 GA) for tubular rails, legs for tables, gusset plates, cabinet top and intermediate horizontal rails.
 - .4 1.2mm (18 Ga) for door and drawer fronts, cabinet floor, cabinet sides, vertical front members, cabinet toe kick, service cover panels, table and kneehole frames, front rails, gable legs and dust caps, false panels, furring and filler panels.
 - .5 0.9mm (20 Ga) for drawer backs, door backs, vertical closure channel, removable back panels, shelves, drawer bodies, drawer dividers, bin bodies, and pull-out shelves.
- .11 Cabinet Frame:
 - .1 Provide one-piece die-formed cabinet bottom construction with return side flanges turned down. Spot weld flanges to cabinet sides.
 - .2 Cabinet bottoms shall be turned down at front to form 32mm "U" channel to accept toe kick and turn down 133mm at back with 16mm return to form the back lower member of cabinet base. Provide punched 19mm dia. corner holes for access to levelers and to accept PVC press plugs. It shall be possible to access levelers from above cabinet without removing drawers or drawer supports.
 - .3 Provide additional vertical 75mm "HAT" shaped channels, spot-welded to or formed with the rear vertical corner. Channel shall be provided with pre-punched holes to receive shelf clips, and slotted holes to receive drawer suspension tracks. Cabinets 762mm wide and larger shall be provided with intermediate 117mm "HAT" channels to brace cabinet and accept shelf clips and drawer tracks.
 - .4 Where applicable, the front corner posts shall be pre-punched and slotted to accept drawer suspension systems and suspension pull-out shelves. Front vertical posts shall form inboard flush front construction for doors and drawers acting as the cabinet main member side gable tying the cabinet bottom and horizontal member together to form a rigid case. Front post rear closer channels shall be "J" shaped 9mm x 33mm x 49mm
 - .5 Provide channel with pre-punched holes to receive shelf clips.
 - .6 Doors and drawers shall overlay top intermediates and floor horizontal members.
 - .7 Top horizontal front framing member shall form a "J" shaped section 75mm wide, 10mm return by 25mm deep with 16mm return.
 - .8 Intermediate horizontal framing members shall form a "U" 32mm high with a 25mm return on top and 16mm return on bottom.
 - .9 Top rear horizontal framing member shall be 50mm x 32mm angle section welded to back corner lapped post and side gables with welded corner gusset plates acting as cabinet bracing and counter top material fixing member.
 - .10 Enclosed cabinetry toe space shall be 75mm deep x 150mm high and shall act as a total enclosure to bottom of cabinet. Toe space section shall key up into "U" shaped front floor member and act as reinforcement. Toe space, front floor pf cabinet and corner post sections shall be spot welded together forming one structural member.

- .11 The toe space members, side gable returns, and back lower member shall form all welded structural corner to accept leveler gussets and 10mm levelling bolts.
- .12 Cabinet construction shall be electro spot-welded to form a strong well-fitted, one-piece unit.
- .13 Exposed horizontal structural cabinet members between doors and drawers shall be unacceptable.
- .12 Base Cabinet Components:
 - .1 Provide removable back panels for cupboard base cabinets. Provide partial back panels 229mm in height to accommodate plumbing at sink units. When requested, provide back panels and security panels on cabinets requiring locks.
 - .2 Shelving edges; turned down on all four sides 25mm, and returned under on front and back 25mm. Shelves 914mm and longer shall be provided with "HAT" channel reinforcement at front edge.
- .13 Doors:
 - .1 Fabricate doors of 2 telescoping metal panels, 19mm thick with a sound deadening material extending continuously full-width, and top to bottom. Reinforce hinged side of door adequately with hinge machine screws to prevent sagging. Secure recessed hinges to cabinet posts with machine screws and concealed self-locking nuts. Provide nylon roller friction catches, mounted on horizontal top or intermediate members pull side of doors. Provide each door with 2 rubber bumpers.
 - .2 Doors, drawers, tracks and back panels shall be replaceable in the field without requiring special tools.
 - .3 All standard double door cabinets shall be designed without center stiles to maximize access to the cabinet.
- .14 Drawers:
 - .1 Fabricate drawer fronts of 2 telescoping metal panels and totally filled with sound deadening material to eliminate possible drumming effect. Form removable outside panel with lip to fit over inside panel on top edge, and to lock into position at bottom with rivets to form a rigid, one-piece 19mm thick drawer front.
 - .2 Provide drawer operation full extension drawer slides, 508mm extension, load capacity 45kg: Equal to: Knappe and Vogt #8400B.
 - .3 Drawer body shall consist of one piece stainless steel construction including the bottom, two sides, back and inner front flanged end which shall be welded to the interior drawer front head. The exterior drawer front shall have a channel formation on the top edge with ground smooth and fully finished return edges telescoping together to form fully sounded-deadened drawer front. Drawer bodies shall have a reinforcing bend on top edges.
 - .4 Provide built-in stops to prevent inadvertent removal of drawers, with allowance for drawer to be removed by lifting front of drawers and pulling out.
 - .5 Provide drawer pulls in central location of drawer face. Two handles shall be provided on units 762mm and larger,
- .15 Service Fittings and Fixtures:
 - .1 Refer to Mechanical and Electrical Drawings and Specifications.
- .16 Cut and drill countertops, backs, and other components for service outlets and fixtures.
- .17 Install fixtures and fittings built into or part of casework. Provide access panels for maintenance of utility service and mechanical and electrical components.

2.6 FINISHES

- .1 Stainless Steel: ASI No. 4 brushed finish.

- .2 Shop finish all components.
- .3 Grind and polish to uniform finish, with no visible welds and free of cross scratches.
- .4 When polishing is complete, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces clean.
- .5 Coat metal surfaces in contact with cementitious materials with bituminous paint.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify existing conditions before starting work.
- .2 Verify that field measurements are as indicated on shop drawings instructed by the manufacturer.
- .3 Verify adequacy of support framing and anchors.
- .4 Verify mechanical, electrical, and building items affecting work of their section are placed and ready to receive this work.

3.2 INSTALLATION

- .1 Install casework, components and accessories to manufacturer instructions.
- .2 Casework shall be set with components plumb, straight and square, securely anchored to building structure with no distortion. Concealed shims shall be used as required.
- .3 Wall casework shall be secured to solid material, not lath, plastic or gypsum board.
- .4 Use anchoring devices to suit conditions and substrate materials encountered.
- .5 Cabinets in continuous runs shall be fastened together with joints flush, uniform and tight with misalignment of adjacent units not to exceed 1/16 of an inch.
- .6 Set casework items plumb and square, securely anchored to building structure.
- .7 Top edge surfaces shall be abutted in one true plane. Joints are to be flush and gap shall not exceed 1/8 of an inch between top units.
- .8 Casework and hardware shall be adjusted and aligned to allow for accurate connection of contact points and efficient operation of doors and drawers without any warping or binding.
- .9 Countertop Installation:
 - .1 Countertops are to have been fabricated in lengths according to drawings, with ends abutting tightly and sealed with corrosion resistant sealant.
 - .2 Tops will be anchored to base casework in a single true plane with ends abutting at hairline joints with no raised edges at joints.
 - .3 Joints shall be factory prepared having no need for in-field processing of top and edge surfaces.
 - .4 Joints shall be dressed smoothly, surface scratches removed and entire surface cleaned thoroughly.
- .10 Insulate to prevent electrolysis between dissimilar metals.
- .11 Scribe to abutting surfaces and align adjoining components. Apply matching filler pieces where casework abuts dissimilar construction.
- .12 Field weld joints in stainless steelwork, without open seams. Grind smooth and polish to match adjacent surfaces.
- .13 Close ends of units, splash aprons, shelves and bases by welding and grinding smooth.
- .14 Field touch-up blemishes to original finish.

3.3 ADJUSTING

- .1 Adjust doors, drawers, hardware, fixtures, and other moving or operating parts to function smoothly.

3.4 CLEANING

- .1 Section 01 74 10: Cleaning installed work.
- .2 Clean casework, counters, shelves, legs, hardware, fittings and fixtures.

3.5 PROTECTION

- .1 Section 01 78 23: Protecting installed work.
- .2 Do not permit finished casework to be exposed to continued construction activity.
- .3 Cover finished surfaces with heavy kraft paper. Protect installed surfaces by approved means. Do not remove until immediately before final inspection.

End of Section

PART 1 GENERAL

1.1 MECHANICAL GENERAL REQUIREMENTS

- .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 Substantial Performance.
- .2 Provide operation and maintenance data as required under Section 01 77 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 Commissioning Authority – if applicable)
 - .1 Provide title page with clear plastic cover.
 - .2 The front title page shall include the cover information in addition to:
 - .1 The Owner
 - .2 The Architect
 - .3 The Engineer
 - .4 The General Contractor
 - .5 The Mechanical Contractor
 - .6 The Agency preparing the Manuals
 - .3 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 Commissioning Authority – if applicable)
- .6 Tab 1.2 Description of Systems: (Prepared by the Commissioning Authority – 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 safe guards to check if equipment goes off line.
 - .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 Commissioning Authority).
- .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.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

End of Section

PART 1 GENERAL

1.1 ELECTRICAL GENERAL REQUIREMENTS

- .1 Refer to 01 77 00 – Closeout Procedures.
- .2 Arrange and pay for *Maintenance Manual* to be prepared by an independent professional Commissioning Agent.
- .3 Cooperate with the Agency; provide all data, after making all necessary corrections. Provide final shop drawings, wiring diagrams, equipment brochures, etc., required for inclusion with the Manuals. Include all costs in the tender price associated with assisting the Agency and in providing all data, drawings, diagrams, brochures, etc.
- .4 Final Maintenance Manuals shall include:
 - .1 Sturdy hard cover expandable post binder(s) – (Prepared by the Commissioning Agent – if applicable)
 - .2 Introduction Page (Prepared by the Commissioning Agent – if applicable)
 - .1 Name of Project
 - .2 Type of Manual (i.e., Maintenance Manual for Electrical Systems)
 - .3 Listing (Company names, addresses, and telephone numbers) of Consultant, Electrical Consulting Engineer, General Contractor, Electrical Contractor, including his Subcontractors (i.e., Communication Systems Contractor, Testing Agency, etc.), and name of Agency that prepared the Manual.
 - .3 Instruction Page (Prepared by the Commissioning Agent – if applicable)
 - .1 Step-by-step instructions on how to use the Manual.
 - .4 Index Page (Prepared by the Commissioning Agent – if applicable)
 - .1 List all equipment, systems and special references such as conduit colour coding schedule, applicable Test Reports, Certificates, etc. The Index shall be arranged in the same order as the Specifications.
 - .2 List all “Project Record” drawings including drawings issued during the tender period and the construction stage.
 - .5 Equipment/System Pages (Prepared by the Commissioning Agent – if applicable)
 - .1 Provide, between each piece of equipment/system, divider pages complete with plastic tabs with large numbers corresponding to the Index listing.
 - .2 After each divider page, include a “local” Index sheet as per the following example. (Provide “local” divider pages complete with smaller plastic tabs corresponding to the “local” Index sheet.)

NAME		OF		PROJECT	
INDEX					
LIGHTING		AND	POWER	PANELS	
		Bulletin/ Drawings	Pages		
A	Description	-	A1		
B	Maintenance	Instruction	-	B1	
C	Renewal	Parts	-	C1	
D	Shop			Drawings/Brochures	
E	Identification/Colour			Coding	
F	Supplier/Manufacturer/Distributor				

The above Index sheet shall be used for all equipment/systems.

Under *Description* include a brief description and sequence of operation of equipment/systems and manufacturers' published technical literature. For major pieces of equipment such as switchgear, etc., include complete parts/component lists. Include revised and updated typewritten copy of all Schedules (motor, panel-board, feeder, lighting fixtures, receptacles, switchboard, equipment, etc.) in applicable section of the Maintenance Manual. Under *Maintenance Instruction* describe manufacturer's recommended maintenance program. (Describe on Index sheet if space permits.)

List *Renewal Parts* if applicable. (List on Index sheet if space permits.)

Under *Shop Drawings/Brochures* include a copy of reviewed and corrected shop drawings (reduced scale) and brochures. Also include final and detailed wiring diagrams (reduced scale) when applicable. If space permits, show listing of drawing numbers and brochures in the Index sheet; otherwise, include the list in the front part of the drawings and brochures. Shop drawings shall be so arranged that they can be removed directly from the Manual without undoing the pin-bars.

Under *Identification/Colour Coding* outline method used for identifying equipment [i.e., LP "E2A" stands for "Lighting Panel" (LP), connected to emergency load (E), operating on 208/120 V (2), last space (A) denotes sequential order of panel]. Colour coding used for identification of outlet boxes, raceways, etc., shall be shown with a coloured label glued to the page. All identification and colour coding information may be shown on the Index sheet if space permits.

Under *Supplier/Manufacturer/Distributor* list source of supply for replacement parts, including name, address, and telephone number. This information may be shown on the Index sheet if space permits.

- .6 Guarantees and Warranties
 - .1 Include all applicable guarantee and warranty information.
- .7 Test Reports and System Demonstration
 - .1 Include copies of all applicable Test Reports and manufacturers' letters verifying test completion.
 - .2 Include signed statement from Owner regarding systems' demonstrations.
- .8 Certificates
 - .1 Include a copy of Final Certificates from Electrical Inspection Department, Fire Chief, and other authorities having jurisdiction over the work.
- .9 Schedules
 - .1 All schedules included in the Specifications (Motor Schedules, Lighting Fixture Schedules, Panel Schedules, Equipment Schedules, etc.) shall be updated to reflect all changes made during tender and construction periods.
- .5 A holdback will be effected until all required copies of approved Maintenance Manuals have been delivered to the Consultant.
- .6 In addition to the hard copies of Maintenance Manuals provide electronic versions of Manuals on USBs as described in Section 01 77 00 – Closeout Procedures.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

End of Section

PART 1 GENERAL

1.1 SECTION INCLUDES

- .1 OSCI (Owner Supply Contractor Installed) Biological Safety Cabinet cut sheets.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

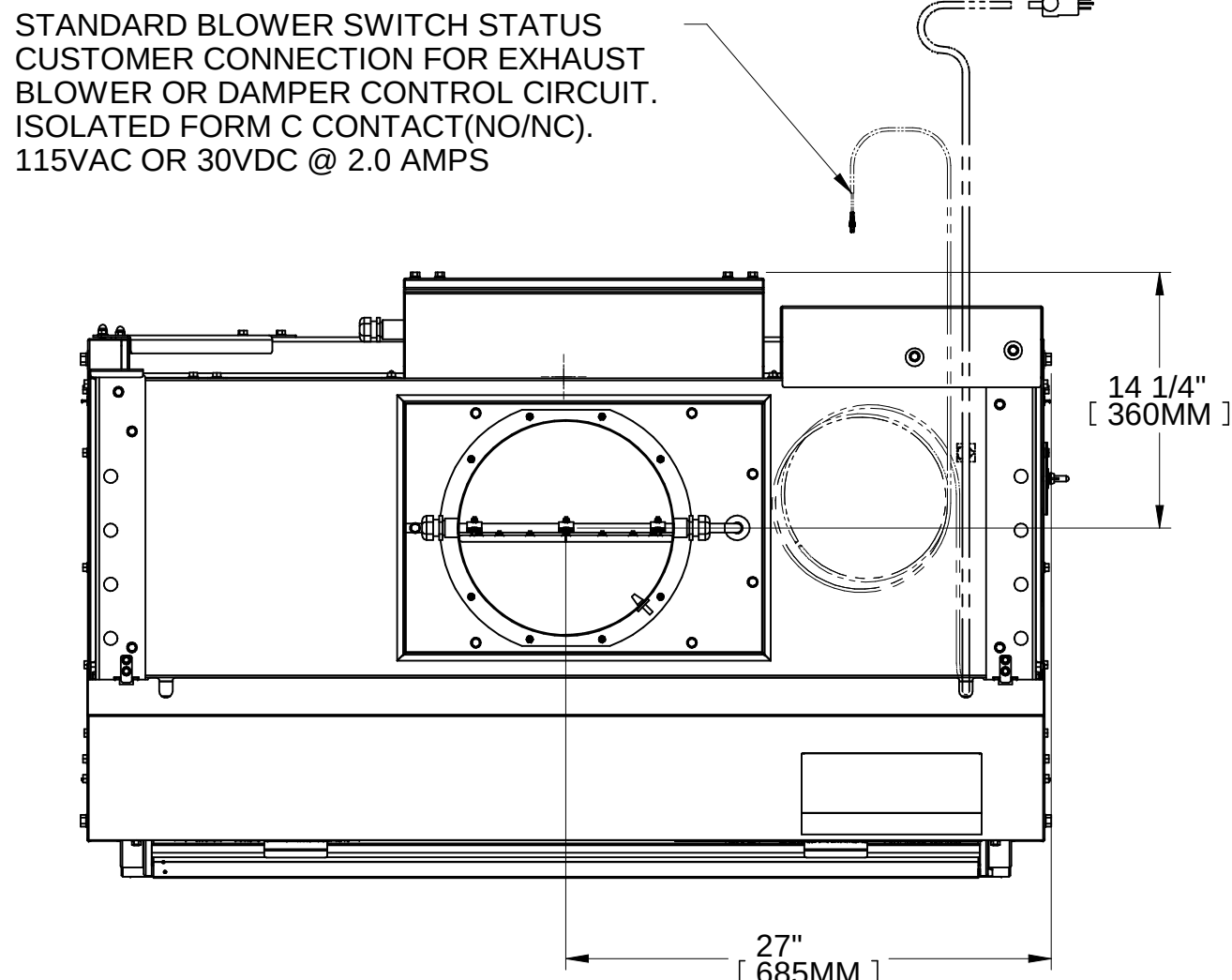
End of Section

D

C

B

A



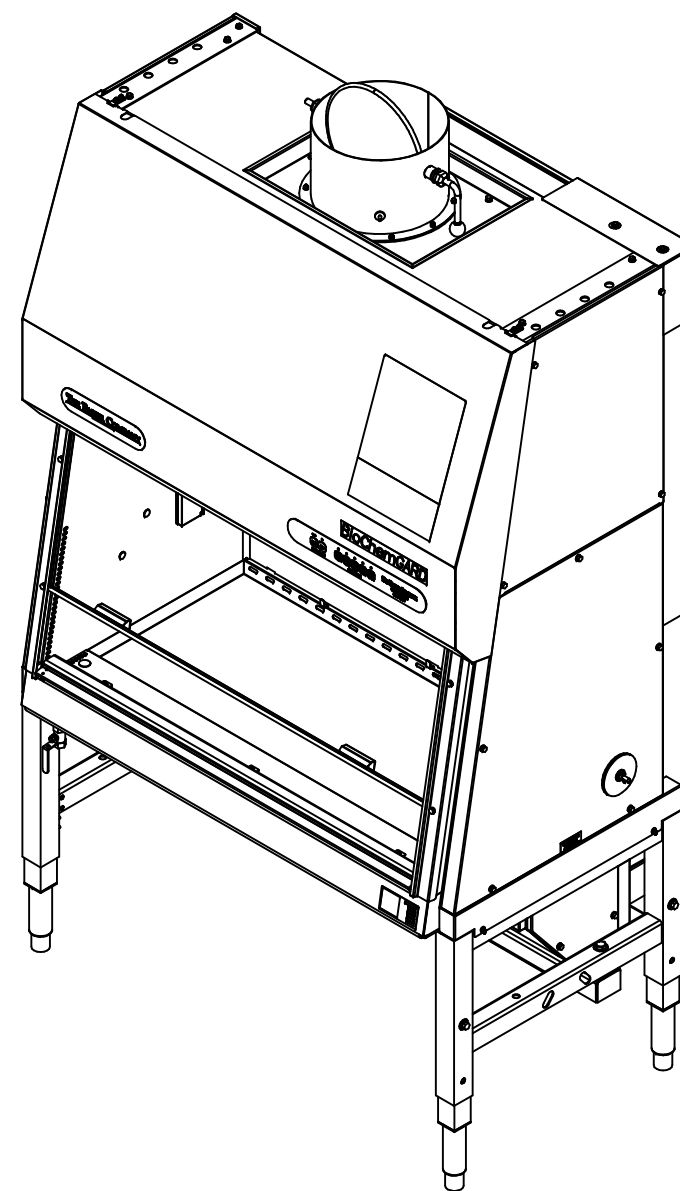
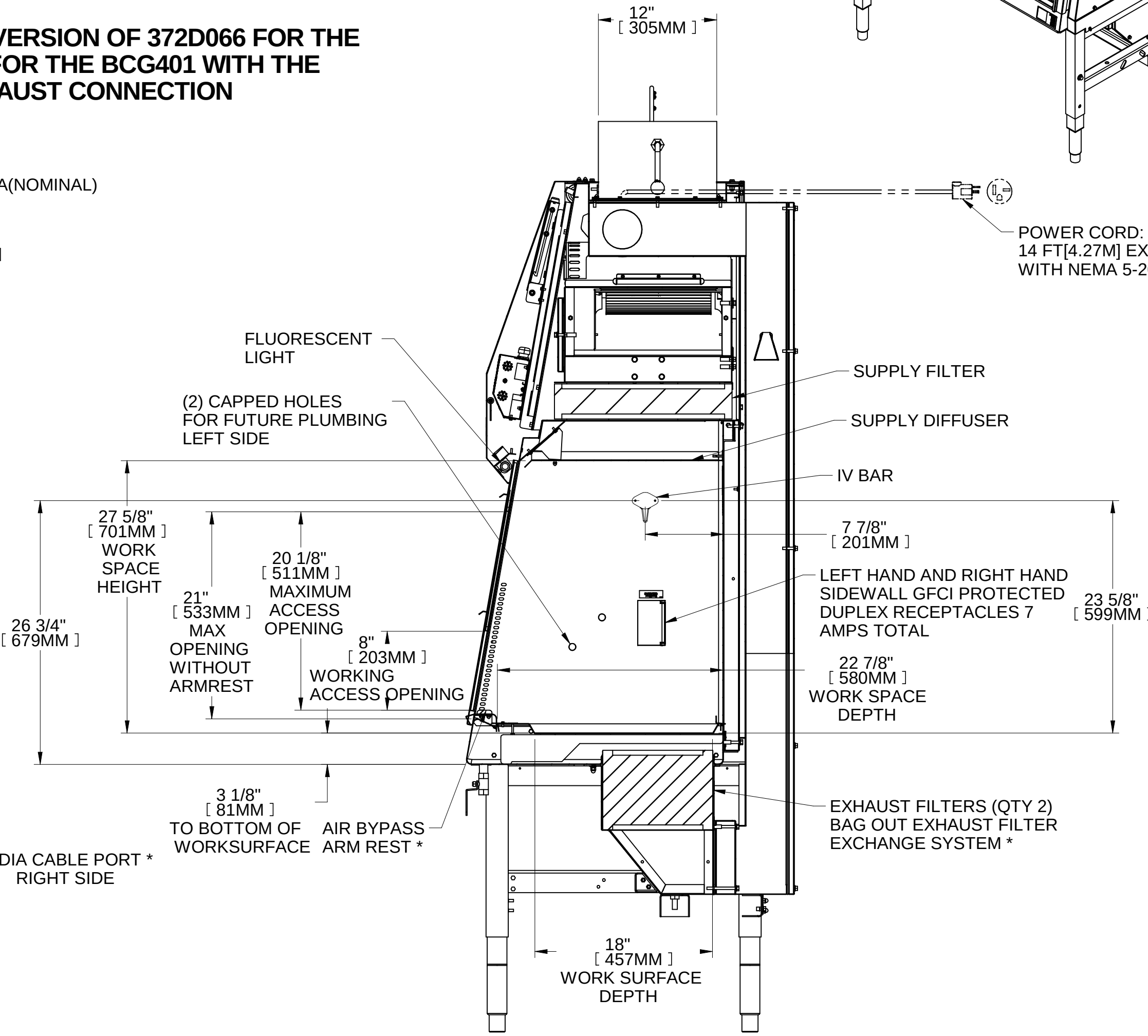
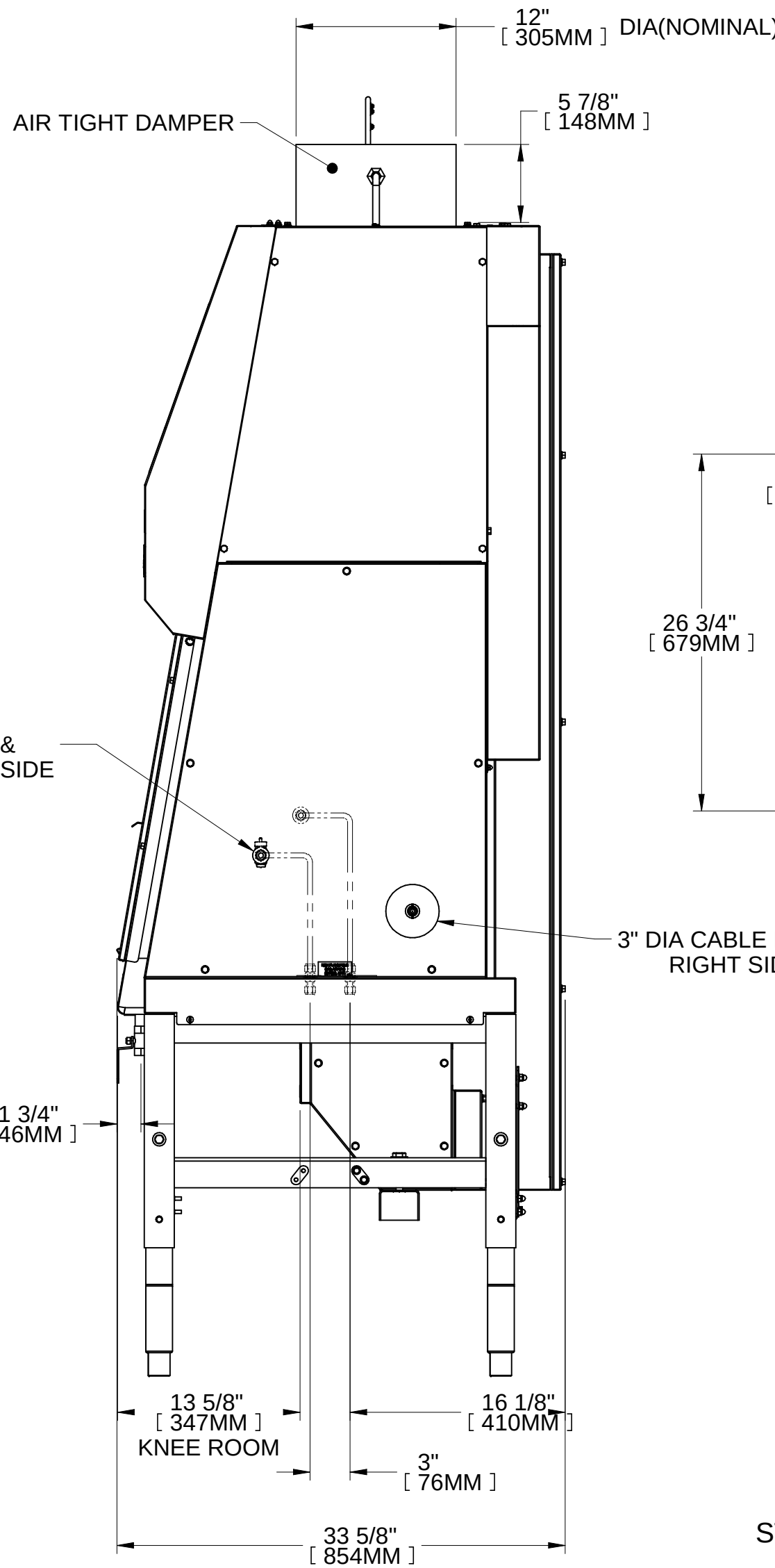
NOTES:

1. ELECTRICAL REQUIREMENTS: 115 VAC, 20 AMP, 60 HZ, SINGLE PHASE
2. CONSTRUCTION:
WORKSURFACE/WORK AREA - 16 GA[1.5 MM] 304 SS, #4 FINISH
ACCESS PANELS - 16 GA.[1.5 MM] & 18 GA.[1.2 MM] C.R.S. WITH A BAKER
PERMA WHITE POLYESTER HYBRID POWDER COAT FINISH
3. SUPPLY FILTER, MOTOR, BLOWER AND ALL ELECTRICAL COMPONENTS
ARE FRONT ACCESSIBLE.
4. PETCOCKS RECOMMENDED FOR USE WITH NONFLAMMABLE GAS,
AIR OR VACUUM
5. PLUMBING CONFIGURATION IS FACTORY ASSEMBLED AND TESTED
AT 100 P.S.I.. MAXIMUM WORKING PRESSURE IS 30 P.S.I..

PLEASE ADVISE OF ANY SPECIAL PLUMBING REQUIRED BY
LOCAL PLUMBING CODES

6. CABINET PLUMBING CONNECTORS ARE 3/8[9.5 MM] SWAGELOCK FITTINGS.
A 3/8 [9.5 MM]NPT ADAPTER IS SHIPPED WITH THE CABINET
7. EXHAUST FILTERS ARE ACCESSIBLE THROUGH THE CABINET
WORK AREA OPENING LOCATED DIRECTLY UNDER THE WORK SURFACE

NOTE: REFER TO THE LATEST VERSION OF 372D066 FOR THE
EXHAUST REQUIREMENTS FOR THE BCG401 WITH THE
12"[305MM] DIA EXHAUST CONNECTION



POWER CORD:
14 FT[4.27M] EXTERNAL LENGTH
WITH NEMA 5-20 PLUG

SECTION A-A

OPTION #	OPTION DESCRIPTION	QTY
111R	CABLE PORT - RIGHT SIDE	1
25A	AIR TIGHT DAMPER - 12 INCH DIAMETER	1
11	IV BAR	1
1	CHANNEL STAND	1

UNLESS OTHERWISE SPECIFIED: DO NOT SCALE DRAWING: REMOVE ALL BURRS AND SHARP EDGES U.S. CUSTOMARY TOLERANCES: (INCHES) DECIMALS MACHINED SHEET METAL ANGULAR X .002 .006 .002 .002 (°) XX .001 .005 .001 .001 (°) XXX .0005 .0025 .0005 .0005 (°) FUNCTIONS H/D H/D H/D H/D FINISH 16 16 16 16		THIS DRAWING AND ITS CONTENTS ARE THE PROPERTY OF THE BAKER COMPANY. THE INFORMATION CONTAINED HEREIN IS TO BE USED ONLY FOR THE PROJECT AND WITHOUT THE WRITTEN PERMISSION OF BAKER.	
ALL ITEMS MUST BE ROHS COMPLIANT		TITLE BioChemGARD e3 BCG401 CLASS II TYPE B2	
DRAWN HChabot	DATE 4/1/15	SIZE D	REV A
CHECKED CSmith	DATE 04/01/2015	DWG NO BGA-BCG401-B2-1-11-25A-111R	SHEET 1 OF 1

STANDARD UNIT WEIGHT = 720 LBS[327 KG]



TO UL 1805
(U.S. ONLY)



TO UL 61010-1
2ND EDITION



D03348

* = PATENT PENDING



PURCHASE SPECIFICATIONS : FOR NUAIRE LABGARD® ES ENERGY SAVER NU-560 (Series 1) BIOSAFETY CABINET

The intent herein is to provide a concise statement of requirements for a quality Class II, Type B2 Laminar Airflow Biosafety Cabinet which may be used to augment your purchase request/order.

The LABGARD® ES NU-560 meets the performance requirements of the NSF/ANSI 49. Your confidence is well placed in a Biosafety Cabinet that meets NSF Standard.

NuAire sales representatives will be pleased to explain the importance of the performance and control affected by each of the following requirements. The NuAire LABGARD® ES NU-560 meets all of the requirements in the following SPECIFICATION.

1. Dimensions Inches (mm)

Overall Dimensions	NU-560-400	NU-560-600
Width (W)	53 5/8 (1362)	77 5/8 (1972)
Depth (D) Armrest removed (Incl. Control Center)	32 3/8 (823)	32 3/8 (823)
Height (H) (Incl. Exh Filter Fastener)	62 (1575)	62 (1575)
Basestand, 30" W.S. (Incl. Exh Filter Fastener)	88 1/2 (2248)	88 1/2 (2248)
Basestand, 36" W.S. (Incl. Exh Filter Fastener)	94 1/2 (2400)	94 1/2 (2400)
Interior Dimensions		
Width (W)	46 3/8 (1178)	70 3/8 (1788)
Depth (D)+	26 (660)	26 (660)
Height (H)	25 3/16 (640)	25 3/16 (640)
+Measured at 8 inch (102mm) window height		

2. Cabinet shall provide airflows & biological safety performance as specified.

- **a. Cabinet shall provide biological containment protection for both operator and product proven by an actual test, (e.g. test conducted by NSF) and routinely validated by NuAire.
- b. Cabinet shall be single pass flow through design in which all HEPA filtered work zone and work access inflow air, is drawn through the cabinet's internal exhaust HEPA filter and exhaust duct work to a remotely located roof exhaust blower.
- *c. Cabinet shall be constructed from 16/18GA, Type 304 stainless steel forming an all welded, monolith, sealed structure.
- d. Cabinet shall be easily fumigated employing an established procedure such as that recommended by NIH or NSF.
- e. Supply HEPA filter shall be of full cabinet work zone width and depth.
- *f. Supply HEPA filter shall be protected by a perforated metal diffuser covering the entire top of the work zone.
- *g. Air velocity from the supply filter shall average 55 to 65 FPM (.28 to .33 m/s) with no single point outside the 20% of average range measured in a horizontal plane defined by 4 inches (102mm) above the bottom edge of window.
- *h. Work access opening shall be 8 inches (203mm) high. Average inflow velocity shall nominally be 105 LFPM (.53 m/s).

3. The cabinet shall be ergonomically designed for maximum user comfort and adjustability to meet the requirements of the American Disabilities Act (ADA.)

- Standard non-metallic armrest/airfoil incorporating a large 2 inch (51mm) forearm support area with 1/2 inch (12mm) recessed front grill, designed for arm rest comfort while maintaining containment performance.
- Maximum visibility into cabinet workzone shall be at least 20-1/2 inches (521mm) from front access airfoil to exterior light housing.

- Cabinet shall have a centrally located instrument panel within the control center that is easily serviced with quick disconnects.
 - Cabinet shall have the capability of incorporating a user-adjustable basestand or base storage cabinet as an option.
 - The cabinet shall have a smooth operating sliding window from 1.125 inches (29mm) closed to full opening at 18-1/2 inches (470mm).
 - Cabinet shall have a large worktray (20 3/4 inch (527mm) depth) removable with coved corners for easy cleaning.
 - Cabinet shall have a 10 degree slope.
- *4. The cabinet shall have all positive pressure plenums surrounded by a vacuum relative to the room (the LABGARD® ES employs the HEPEX™ Zero Leak Airflow System).
5. Electrical power shall be supplied with a 12 foot (2.5m), 3-wire cord. Electrical supply should be 115 VAC, 60 Hz (current rating varies per cabinet size, reference Electrical Requirements Page 5) protected with thermal circuit breaker from distribution panel.
- *6. The cabinet shall use a DC ECM Motor with optimally determined forward-curved fan for each model size/width to maximize both energy efficiency and filter loading capacity.
7. The cabinet shall have three (115VAC) internal electrical circuits; one each for blower and lights and one for the duplex outlets (115VAC). Each circuit shall be protected with a fuse located in the control center on the electronic module.
8. The cabinet shall be listed by Underwriters Laboratories to meet the requirements of both the U.S. and Canada for electrical/mechanical integrity.
- *9. Cabinet shall contain a control system which is a self-contained electronic module that will perform the following functions:
- Easy use interface via **TOUCHLINK** color LCD.
 - Control blower DC ECM Motor via solid-state DC Motor Controller that provides automatic compensation (constant volume control) for both filter loading and line voltage variances.
 - Intelliflow™ - Fast, accurate, reliable dual thermistor, airflow sensors and digital differential velocity pressure flow grid powered by TSI to control and monitor cabinet airflows to setpoints.
 - Control lights via solid state switch.
 - Control outlets via solid state switch.
 - Display date/time w/battery backup.
 - Display blower and optional UV light run timers.
 - Display alarm setpoints high/low for error conditions (downflow/inflow).
 - Display complete calibration, option menu and diagnostic functions.
- *10. The cabinet shall contain an exhaust interlock system that prevents operation of the internal supply blower unless the exhaust flow is sufficient to provide the correct air barrier inflow velocity at start up.
11. Cabinet shall contain a control system that provides the following optional functional features (included with cabinet, but must be configured during certification):
- Security password protection of cabinet use.
 - Night setback mode. Used to reduce exhaust volume during non-use times. Allows Building Automation System (BAS) contact closure input for cabinet indication of night setback mode.
 - Auto run timer allows the cabinet to automatically turn on and off on a daily basis.
 - Timer/Interlock functions for fluorescent light, outlet and ultraviolet light.
12. The cabinet shall be easily transportable through a standard 36 inch (914mm) wide door without disassembly.
13. Sound level shall be no more than 63 dbA measured 15 inches (381mm) above the work tray and 12 inches (305mm) in front of viewing window.
14. LED lighting shall be externally mounted and provide 80 to 150 foot-candles (860 to 1600 LUX) on work surface.
- *15. Cabinet shall come standard with one duplex outlet with drip proof covers on left front faring. One gas valve / one service coupling on right side wall.

16. Exhaust cabinet duct connections shall be 12 inches (305mm) in diameter.
17. Cabinet shall be easily converted to a free-standing console model with the addition of the optional base support stand.
- *18. Cabinet work zone shall be all 16/18 GA. stainless steel and reinforced with stainless steel U channels to minimize vibration.
19. A 3/8 inch (10mm) ball valve shall be provided in the drain trough beneath the work tray.
20. Cabinet shall have a permanent positive pressure plenum with quick release supply filter removal.
- *21. Motor/blower shall be positioned so as to create an even filter loading, thereby prolonging the life of the supply HEPA filter, automatically handling a 250% minimum increase in filter loading without reducing total air delivery by more than 10%.
- *22. Cabinet shall be capable of front filter removal without disassembly of the control panel and sliding window tracks/hardware.
23. The following optional equipment shall be available to support installation and user requirements:

Bag In/Bag Out of Exhaust HEPA Filter with Single Point External Filter Release

Ultraviolet Light

Additional Service Valves for Gas, Air, Vacuum

Remote Service Valves

Additional Duplex Outlet

Ground Fault Interrupter for Electrical System

IV Bar with 6 Stainless Steel Hooks

Gas Tight Butterfly Valves (Manual or Automatic)

Base Support Stand Telescoping - (standard working surface heights of 30 or 36 inches
(762 or 914mm) with or without storage shelves)

Adjustable Control for Support Stand or Storage Cabinet

Sink with Hot/Cold or DI Water Faucets

Storage Pull-Out Trays

Decorative Side Panels (hides plumbing fixture connections)

Prefilter for Supply Air

HEPA Filters 99.999% @ 0.3 Micron

Arm Rest (Stainless Steel)

Elbow Rests

*Having all of these features is unique ONLY to NuAire cabinets.

LabGard® ES Energy Saver Class II, Type B2 Laminar Flow Biosafety Cabinet
Models NU-560-400/600

Catalog Number	Catalog	Number
	NU-560-400 Nominal 4 foot (1.2m)	NU-560-600 Nominal 6 foot (1.8m)
Performance Specifications 1. Personal Protection 2. Product Protection	NSF/ANSI 49	NSF/ANSI 49
NSF Std. No. 49 Class	Class II, Type B2	Class II, Type B2
Style of Cabinet	Bench Top/Console w/Base Stand/ Storage Cabinet	Bench Top/Console w/Base Stand/ Storage Cabinet
Cabinet Construction	All Welded Stainless Steel 16GA, Type 304 Pressure Tight Design	All Welded Stainless Steel 16GA, Type 304 Pressure Tight Design
Diffuser for Air Supply (Metal)	Non-Flammable	Non-Flammable
HEPA Filter Seal Type: Supply Filter-99.99% Eff. on 0.3 Microns Exhaust Filter-99.99% Eff. on 0.3 Microns	HEPEX Seal Neoprene, Spring loaded	HEPEX Seal Neoprene, Spring loaded
Fumigation per NIH/NSF Procedure	Yes	Yes
Standard Services: Service Coupling (3/8 inch NPT) Gas Valve/Service Coupling (3/8 inch NPT) Duplex Outlet	Three: Left middle, Left bottom, Right middle Sidewalls One, Right bottom Sidewall One, Left Front Faring	Three: Left middle, Left bottom, Right middle Sidewalls One, Right bottom Sidewall One, Left Front Faring
Optional Services: Gas Cocks 3/8" NPT **Remote Controlled Valves Ultraviolet Light	Up to 3 ea. Sidewall Up to 3 ea. Sidewall One, Backwall	Up to 3 ea. Sidewall Up to 3 ea. Sidewall One, Backwall
Cabinet Size Inches (mm): Height (Fully Assembled) (Incl. Exh Filter Fastener) Height (Minimum for Transport) Width Depth (with Armrest removed)	62 (1575) 62 (1575) 53 5/8 (1362) 32 3/8 (823)	62 (1575) 62 (1575) 77 5/8 (1972) 32 3/8 (823)
Work Access Opening Inches (mm): Standard Opening Height Standard Inflow Velocity	8 (203) 105 FPM (.53 m/s)	8 (203) 105 FPM (.53 m/s)
Work Zone Inches (mm): Height Width Depth measured at 8 inches (203mm)	25 3/16 (640) 46 3/8 (1178) 26 (660)	25 3/16 (640) 70 3/8 (1788) 26 (660)
Viewing Window Inches (mm): Standard is Tempered Sliding Glass Hinged Tempered Glass (optional)	1.0 (25mm) Closed 18 1/2 (470) Open 8 (203) Access Opening	1.0 (25mm) Closed 18 1/2 (470) Open 8 (203) Access Opening
Certification Exhaust Value CFM/CMH Concurrent Balance Value CFM/CMH +	740/1257 815/1385	1122/1906 1275/2166
Plant Duct Static Pressure Eng./Metric	1.7 w.g./43mm w.g.	1.8 w.g./46mm w.g.
Heat Rejected, BTU, Per Hour	824	1020
Electrical: 115V Volts, AC (Hz) ++Amps: Blower/Lights Amps: Outlet Rated Amps: 12 ft. Power Cord (one)	U.L./UL-C, US Listed 115, 60 2.1 3 8 14 GA - 3 Wire, 15A	U.L./UL-C, US Listed 115, 60 2.6 3 10 14 GA-3 Wire, 15A
Crated Shipping Weight: Net Weight	540 lbs. /245 kg. 490 lbs. /222 kg.	730 lbs. /331 kg. 680 lbs. /308 kg.

**Remote controlled valve handles project through front fairing. Decorative side panels are available to cover plumbing.

+Concurrent Balance Value shall be used for design and balance exhaust/supply HVAC requirements. Values provided are nominal. Design tolerances should be added for measurement and system differences.

++ Based on cabinet with new filters running at 115 VAC.

AtkinsRéalis



Haida Gwaii Hospital NARPA Pharmacy Upgrades Electrical Specifications IF Tender

Project #: 701021

IF Tender

March 03, 2025

Prepared For Kirsten Reite Architecture (KRA)



26 05 01	General Requirements.....	1-20
26 05 10	Existing Site Conditions	1-1
26 05 15	Basic Electrical Materials & Methods	1-3
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26 05 34	Conduits, Conduit Fastenings and Conduit Fittings	1-3
26 27 26	Wiring Devices	1-4
26 28 20	Ground Fault Circuit.....	1-2
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APPENDICES

Appendix A	Lighting Fixtures Schedule.....	
Appendix B	Mechanical Equipment Schedule	
Appendix C	Panelboard Schedules	



1 GENERAL

1.1 Documents

- .1 This Division 26, 27 and 28 Specification, together with all the individual sections forms part of the Contract Documents and is to be read, interpreted, and co-ordinated with all other parts and Divisions.
- .2 The word 'provide' shall be taken to mean supply, install, test, and *commission*.

1.2 Summary of Work

- .1 The Work of this Contract is generally summarized but is not limited to the following:
 - .1 Demo all existing electrical systems with conduits and wiring back to source.
 - .2 New Lighting and lighting control
 - .3 Disconnect and remove all lighting including conduits and wiring to source as shown on the drawing.
 - .4 New Branch circuit wiring
 - .5 New power distribution
 - .6 New data
 - .7 New Fire Alarm
 - .8 Fire Stopping
 - .9 Coring
 - .10 Infection Control Procedures as per CSA Z317.13.22
 - .11 Provide Temporary Power for construction phase and coordinate with Facilities Services.
 - .12 Remove all obsolete materials and equipment, including cabling, conduits, etc.
 - .13 Provide all required as-builts drawings in CAD format and manuals. As-built drawings services to be paid by contractor.



1.3 Management of the Work

- .1 The Contractor shall provide a project manager dedicated to coordinating, planning and scheduling of the work. The project manager shall be at least certified electrical technologist. Project managers without electrical certification will not be accepted. The Contractors project manager shall develop the work plan for approval by the engineer and owner and be responsible for supervising the work during the critical work periods.

1.4 This Section Includes

- .1 Codes, Standards, and Regulatory Requirements
- .2 Permits, Fees, and Inspection
- .3 Quality of Work
- .4 Qualification of Tradesmen
- .5 Responsibility and Co-ordination
- .6 Protection
- .7 Power Supply
- .8 Temporary Work and Services
- .9 Drawings and Measurements
- .10 Cutting, Coring and Patching
- .11 Identification
- .12 Electrical Diagrams
- .13 Mounting Heights and Locations
- .14 Approvals
- .15 Equipment List
- .16 Delivery and Storage
- .17 Equipment Locks
- .18 Testing and Adjusting
- .19 Demonstration
- .20 Cleaning and Repair
- .21 Guarantee
- .22 Project Documentation: Shop Drawings, Maintenance Manuals, "As-Built" Drawings
- .23 Loose Equipment, Spare Parts, and Maintenance Materials
- .24 Substantial Performance Inspection
- .25 Measurement and Payment

- .26 Evaluation of changes to the Contract
- .27 Progress Draw Sample

2 CODES, STANDARDS, AND REGULATORY REQUIREMENTS

- 2.1 Any reference to Codes, Standards and Regulations in this Specification shall be taken as the latest or the most current in effect at time of tender.
- 2.2 Comply with all requirements of the British Columbia Building Code. Electrical local by-laws or rules regulating the installation of electrical equipment and their seismic restraint. In no instance, however, shall the standards established by the Contract Documents be reduced by any of these Codes or Regulations:
 - NHA Standards.
 - The National Association of Pharmacy Regulatory Authorities (NAPRA)
 - PHSA Latest Specifications.
 - Canadian Electrical Code, Part 1-C22.1, as adopted for use in British Columbia.
 - ULC Standard S524-latest edition – Standard for the Installation of Fire Alarm Systems.
 - CAN/ULC-S537-latest edition. -Standard for Fire Alarm Verification.
 - CSA Standard C282-019-Emergency Electrical Power Supply for Buildings.
 - Canadian Health Care Facilities Z8000-18
 - Fundamentals of Infection Control CSA Z317.13.22
 - IESNA Illumination Engineering Society of North America, latest edition.
 - EIA/TIA 568B Commercial Building Telecommunications Standards.
 - BICSI Communications Standards.
- 2.3 All materials shall bear the approval of the Canadian Standards Association and where applicable, the Underwriters' Laboratories of Canada or alternately shall bear local approval from the Electrical Inspection Department having jurisdiction. Include in the Tender all costs associated with obtaining local approvals.

3 PERMITS, FEES, AND INSPECTION

- 3.1 Before starting work submit the appropriate quantity of Drawings and Specifications to the Electrical Inspection Department and to other authorities having jurisdiction and obtain all necessary approvals and permits. Include all costs of approvals and all permit fees in the tender.
- 3.2 Consultant will provide Drawings and Specifications required by the Contractor for submission to the Electrical Inspection Department, the Supply Authority, and other authorities having jurisdiction, at no cost.
- 3.3 Arrange for inspection of the work as the installation progresses and as further required (as well as attendance during verification) by all applicable authorities having jurisdiction.
- 3.4 Notify Consultant of changes required by Electrical Inspection Department prior to making changes.
- 3.5 Upon completion, and before final payment will be made, present to the Consultant a certificate of unconditional approval for all electrical work from the Electrical Inspection Department and other authorities having jurisdiction.



- 3.6 Consultant will carry out site visits from time to time and prepare deficiency list for corrective action by Contractor, during construction, upon completion, and during the Warranty period.
- 4 QUALITY OF WORK
- 4.1 Unless otherwise indicated, all materials supplied shall be new and of the quality indicated in these Specifications. Otherwise, they shall be of the best commercial quality obtainable for the purpose.
- 4.2 Manufacturers' directions shall be followed in all cases where the manufacturers of equipment or materials used in this work furnish directions covering points not shown on the Drawings or Specifications.
- 4.3 Unless otherwise directed, all installed materials or equipment exposed to view shall be plumb, true, square, and/or level as the case directs and, where applicable, located symmetrically to the features of the building.
- 5 QUALIFICATION OF TRADESMEN
- 5.1 The work shall be performed by qualified and certified tradesmen as set out in the Electrical Safety Regulation within the Electrical Safety Act.
- 5.2 Electrical contractors bidding on the project must have more than 15 years' experience in Health Care projects.
- 5.3 Electrical contractors qualified for bidding must have extensive experience in Acute care hospitals and must have successfully completed more than 10 healthcare projects with NHA in the past 5 years in the Lower Mainland.
- 5.4 Electrical contractors must submit a list of 10 Health Care Projects completed in the last 5 years.
- 5.5 The Health Authority reserves the right to determine, at its sole discretion, if the bidder has the qualifications required to manage this project based on the responses provided.
- 5.6 Submit list showing names and qualifications of key supervisory personnel.
- 6 RESPONSIBILITY AND COORDINATION
- 6.1 Supply all labour, materials, equipment, tools, and incidentals necessary to provide a complete electrical installation as indicated on the Drawings and as set out in these Specifications.
- 6.2 The Contractor shall advise the Consultant during the tender period of any specified material or equipment which is either no longer available from manufacturers or whose delivery is likely to exceed the requirements of the anticipated Construction Schedule. Failure of the Contractor to perform the above shall cause the Contractor to supply, at his own expense, alternate material or equipment as selected by the Consultant at a later date. Alternatively, the Contractor shall procure the specified material or equipment at his own additional expense by means of air freight or other special means of transportation.
- 6.3 The Drawings and Specifications complement each other and what is called for by one is binding as if called for by both. If there is any doubt as to the meaning or true intent due to a discrepancy between the Drawings and Specifications, obtain a ruling from the Consultant prior to tender closing. Failing this, the most expensive alternative is to be allowed for.
- 6.4 Advise the Consultant of any specified equipment, material, or installation of same which appears inadequate or unsuitable or which is in violation of laws, ordinances, rules, or regulations of authorities having jurisdiction. Provide all labor and materials which are obviously necessary or reasonably implied to be necessary to complete the work as if the work was shown on the Drawings and/or described in the Specifications.



- 6.5 Check Drawings of all trades and coordinate the installation of all material and equipment to ensure adequate space and free access and to maintain headroom limitations for all new and indicated future work. Work out jointly, with all Subcontractors on the site, solutions to interference problems. Coordinate all work before fabricating or installing any material or equipment. It is incumbent on all Subcontractors on the site to ensure that all materials and equipment fit into the allocated spaces and that all equipment can be properly inspected, serviced, and replaced if and when required. Advise the Consultant of space problems before fabricating or installing any material or equipment. Demonstrate to the Consultant on completion of his work that all equipment and material installed by him can be properly and safely serviced and replaced. Make no deviations from the intent of the design, or any involving additional cost, without the Consultant's written direction.
- All limitation on equipment sizes as indicated on the drawings shall be respected.
- 6.6 Where electrical work and materials are noted as being provided by the Owner or under other Divisions of these Specifications, the responsibility for integrating, to the extent required, such work and materials into the complete installation, shall remain within Division 26.
- 6.7 Ensure that any building structure loaded during the installation is adequate to carry such load.
- 7 **PROTECTION**
- 7.1 Protect exposed live equipment during construction for personnel safety.
- 7.2 Shield and mark live parts "LIVE 120 VOLTS", or with appropriate voltage.
- 8 **POWER SUPPLY**
- 8.1 Power will be available approximately where shown, and of characteristics as indicated on the Drawings.
- 9 **TEMPORARY WORK AND SERVICES**
- 9.1 **Temporary Services**
- .1 The existing and/or new electrical system to be installed within the Scope of the Work shall not be used for construction power unless otherwise approved by the Owner. Approval for using the permanent electrical system(s) for construction power during the finishing stages of the project will be permitted in accordance with the following:
- .1 Only 15 A duplex receptacles are to be used.
- .2 Receptacles being used for this purpose shall be clearly identified for use as construction power and shall be replaced at completion of the project. (An acceptable method of identification for this purpose would be the use of different face colour receptacles than that being provided on the project.)
- 10 **DRAWINGS AND MEASUREMENTS**
- 10.1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work. Do not scale the Drawings.
- 10.2 Consult the Vendor for exact locations of outlets, fixtures, devices and equipment prior to installation. Obtain this information from the Consultant where definite locations are not indicated.
- 10.3 The Drawings show approximate locations of outlets, equipment and apparatus but the right is reserved to make such changes in location before installation of the work as may be necessary to center the lights or meet the exigencies of construction in any way. No extra will be allowed and conversely, no credit shall be expected for such changes unless for each item of work the distance moved exceeds 3 m prior to final installation of same.

- 10.4 Take field measurements where equipment and material dimensions are dependent upon building dimensions.

11 CUTTING, CORING, AND PATCHING

- 11.1 All cutting and core drilling required in structure to install electrical equipment shall be carried out under Division 26. **X-ray all walls and suspended floor slabs and adjust cutting location to clear hidden services.**
- 11.2 Prior to cutting of walls or floors, review the proposed location, size, and method with the Structural Engineering Consultant.
- 11.3 Arrange and pay for all patching to be done in such a manner as to return finishes to the same standard as surrounding finishes or to the original condition.

12 IDENTIFICATION

- 12.1 Identify all pieces of electrical equipment other than conduits, conductors and motors with engraved laminated plastic nameplates, having 3 mm height characters showing:
Lamacoid colors shall be as per the following:

Power Source		Label Colour	Label Text Colour
Vital	→	RED	White
Delayed Vital	→	BLUE	White
Conditional (or Standby)	→	YELLOW	Black
Normal	→	BLACK	White
Uninterruptible Power	→	GREY	Black

Attach, unless otherwise directed, with silicone cement. For identification of major pieces of equipment, (for example, Motor Control Centers [MCC #1], Distribution Panels [DP-AA], etc.), use size nameplates having 12 mm minimum height characters.

- 12.2 All labels for Equipment to identify from where the equipment is fed as well as the equipment tag itself. voltage and amperage and the location of the panel feeding it: e.g.
Panel "K3R02V"
225A, 3P, 4W 120/208 V
Fed from DP-4GH2V , Located on N3
- 12.3 **Use of "Dymo" tape will not be permitted.**
- 12.4 Identify (lamicoid nameplate) all receptacle outlet plates other than for single or duplex 20 A receptacles to indicate the voltage, current rating, and circuit number. In addition, identify the circuit number for all single and duplex 20 A receptacles using lamicoid nameplate with 6 mm letters fastened to the front of the cover plate. All receptacles in plug-in surface raceways, including single and duplex 20 A outlets shall have circuit identification nameplates (lamicoid nameplate at front of cover).
- 12.5 Identify (lamicoid nameplate) all Housekeeping receptacle outlet plate by having lamicoids labeled "House Keeping" as well as branch circuit number.
- 12.6 Identify (lamicoid nameplate) all GFI protected receptacles indicating on the lamicoid "GFI Protected" as well as branch circuit number.

- 12.7 Identify (lamicoid nameplate) all lighting switches indicating branch circuit & corresponding room controlling.
- 12.8 Identify (lamicoid nameplate) all fire stopping indicating method of installation.
- 12.9 Identify (lamicoid nameplate) all mechanical equipment, indicating tag, from where it is fed, voltage & current
- 12.10 Provide identification (lamicoid nameplates), inclusive of and additional to the above, for:
- .1 All circuit breakers, feeder overcurrent protection devices, and other similar items of distribution equipment.
 - .2 Each motor control centre, motor starter, motor disconnect switch, contactor, and controller. Indicate the corresponding remote control. Lamicoid plates shall also have Division 25 motor designation (refer to Motor Schedule), circuit number and source panel designation.
 - .3 Each disconnect switch, panelboard, distribution centre, relay or terminal cabinet, indicating the system and voltage characteristics & panel fed from.
 - .4 Each communication system cabinet or console and each time switch not included in a control cabinet.
 - .5 Transformers: indicate capacity, primary and secondary voltages.
 - .6 All LV and Line Switches indicating the circuit and corresponding room they are controlling.
 - .7 All other items where so detailed or noted on the Contract Documents.
- 12.11 Nameplate wording shall be such as to indicate clearly the function of each piece of equipment so identified. Prior to manufacture of nameplates, obtain approval from the Consultant for wording intended as well submit sample for lamicoid & letter sizes. Failure to do so, the contractor shall replace all the lamicoids at his own expense if they were not to the satisfaction of the Consultant & NHA Plant Services.
- 12.12 Identify all Fire Alarm Devices with corresponding addresses.
- 12.13 Nameplates shall be installed after all painting has been completed.
- 12.14 All junction and pull boxes for conduits, ducts, and other raceways in concealed ceiling spaces shall be permanently marked using a black felt pen on the inside and outside of cover plate as follows:
- .1 For power show the complete circuit numbers of all enclosed circuits.
 - .2 For communication systems, use letter identification as specified below.
- 12.15 Clearly and conspicuously identify all conduits, ducts and other raceways with sprayed-on major and minor color bands as set out below. Major bands to be not less than 100 mm wide; minor bands not less than 50 mm wide.
- .1 All conduit and raceways are to be color coded as per Hospital standards. Identification is to be within 2' of every J-Box or device and every 2 m thereafter, except where it passes through a well, where it shall be identified on both sides of the wall.
 - .2 All cable (telephone, video, computer, etc.) must be installed in a raceway to protect the cable. The approved method is conduit/tray to furthest practical point and flex conduit from there to termination. Minimum flex size ½". The cable shall terminate in a junction box – not just be passed through a wall.



- .3 No aluminum conductors are to be used under any circumstances.
 - .4 All conductors are to be identified with markers at supply and termination points and any point between where the cable is spliced.
 - .5 All Junction-boxes are to be identified as to source, voltage, and circuit numbers.
 - .6 All devices (ie. Receptacles, switches, male and female cord caps) are to be Hospital Grade.
 - .7 All devices (ie. Switches and receptacles) are to be identified as to panel and circuit number with appropriately colored lamicaid. Red for essential power. Black for non-essential power.
 - .8 All panels, disconnects, etc. are to be identified with appropriately colored lamicaid labels identifying the panel or switch.
 - .9 All conduits carrying power are to contain a minimum #10 green grounding conductor.
 - .10 All conductors' minimum #10 R90 or better (except for control lines).
 - .11 All conduit to be minimum 3/4" for power and one inch for Communication, Security & Nurse Call & control
 - .12 All fuses to be non-renewable type only. High rupturing capacity fuses shall be used if available in voltage and amperage range.
 - .13 Obtain from NHA FMO their color standards for labelling before commencing with work
-
- 12.16 Where conduits, ducts, and other raceways are surface-mounted and/or exposed, use masking tape to provide a sharp colored edge.
 - 12.17 Color identification for conduits, ducts and other raceways shall be provided at all junction and pull boxes, all locations where a conduit enters or leaves a partition wall, all locations where a conduit terminates at a cable tray, at both sides of fire walls penetrating ceiling spaces, and where conduits enter or leave floor slabs. Additionally, each service shall be identified at intervals along its transit through the space such that each identification is visible from the next and not more than 2 meters apart.
 - 12.18 Identification of junction boxes, pull boxes, conduits, ducts and other raceways shall be done on a continuous basis as the rough-in work progresses. Leaving the marking of conduits, raceways and boxes to the end of the rough-in stage will not be permitted.
".Identify the phasing ("A" Red, "B" Blue, "C" Black) at each and every set of 600 V and 208 V conductors at each termination (both Line and Load ends) with adhesive cable markers, Burndy or equal, and coloured PVC electrician's tape. Maintain phase sequence and colour coding throughout.
 - 12.19 All control and alarm conductors shall be identified at each terminal cabinet piece of equipment at both ends of the conductor, with Electrovert "Z" type markers having suitable identification markings, to match wiring diagram conductor identification.
 - 12.20 All conductors at motor control centers, motor starters and other devices shall be identified at the terminal blocks and terminations with Beta interlocking ferrules.
 - 12.21 All identification shall be in accordance with standards set by the owner.
 - 12.22 Refer to other sections in this Specification regarding identification of communication systems.
- 13 **MOUNTING HEIGHTS AND LOCATIONS**
- 13.1 If mounting height of equipment is not specified or indicated, verify before proceeding with installation. Failing to do so, the electrical contractor will re-do the work at his own expense.

- 13.2 Where electrical outlets are installed above or below counters, or in or near millwork and casework, refer to the latest Architectural drawings to ensure proper coordination. Ensure that outlets in these areas are mounted horizontally and are either entirely within or above splash backs. Ensure that outlets are not mounted behind or within 450 mm of final location of sinks. All cutting in millwork and casework shall be done by trades specializing in this work and be paid for by the Contractor for Division 25, 26 and 27.
- 13.3 Coordinate carefully with other trades and adjust mounting heights if required in order to stay clear of bumper rails and hand rails.
- 13.4 All power outlets such as receptacles, lighting switches, junction boxes, pull boxes, splitters shall be installed such minimum separation of closest points between such outlets and any communication outlet (data, telephone, fire alarm, etc.) shall be no less than 150 mm.
- 13.5 In areas where there is no conflict with other trades, mounting heights specified herein shall be used. Mounting heights are from finished floor level to centre line of device outlet, unless noted otherwise.
- 13.6 Wall Receptacles
- .1 Generally: 450 mm
 - .2 Above top of continuous baseboard heater: 200 mm
 - .3 Above top of counters or counter splashbacks: 180 mm
 - .4 In mechanical rooms: 1400 mm
 - .5 Convenience outlets, Specification Hospital Grade, will be installed in all corridors at 450 mm.
- 13.7 Motor Starters and Disconnect Switches: 1820 mm above floor to top of units where wall-mounted and 915 mm above floor to top of units where mounted on free-standing channel iron supports.
- 13.8 Lighting and Power Panels: 1830 mm from floor to top of panel.
- 13.9 Where two or more outlets are shown in the same proximity, they shall be either centered on a vertical line or centered on a common horizontal line, whichever is the more appropriate?
- 14 **APPROVALS**
- 14.1 Requests for approval of the substitution of materials pertaining to electrical work prior to awarding of any contract must be submitted to the Consultant electronically in so that they are received by the Consultant at least 10 working days prior to the close of tender or of bid depository, whichever is the earlier. *Note that facsimile submittals will NOT be accepted.*
- 14.2 All submissions shall include the following information:
- .1 Name and identification of specified item.
 - .2 Manufacturer, brand name, and catalogue number of the alternative item proposed.
 - .3 Detailed technical data and characteristics of alternative item such as dimensions, voltage, power requirements, performance characteristics, etc.
 - .4 Request for lighting fixture substitutions must be followed by photometric data and proper shop drawings.
- 14.3 Materials, equipment, apparatus, light fixtures, or other products specified by manufacturers' brand name, type, or catalogue number are so specified in one of two ways:
- .1 Specified item followed by the words or equal or o approved equal or preceded by the words equivalent to or equal to.

When the Specification is so worded, it is intended to establish a specific standard of quality and style but the item may be substituted for, provided written approval is stated in the form of an Addendum. *It is the responsibility of the Contractor to assure that all features of the specified items are supplied as part of the substitute item.* If written approval of a substitute item is not issued in the form of an Addendum, the item shall be supplied precisely as specified.

- .2 Specified item not followed or proceeded by any such qualifying phrases:

When the specification is so worded, the item shall be supplied as specified and *NO approved equals or equivalents* will be allowed.

- 14.4 Review by the Consultant of alternate materials as permitted above is only a general approval in principal and shall not relieve the Contractor of his responsibility to ensure that any approved alternate materials perform in the same manner and with the same intent as the originally specified material would have otherwise performed.
- 14.5 Where such substitutions alter the design or space requirements indicated on the Drawings, include all material, labour, design, and engineering costs for the revised design and construction including costs of all other trades affected and those incurred by the Architect and/or Consultant.
- 14.6 It is the Contractor's responsibility to ensure substituted products are approved and that suppliers have written approval indicating conditions of any such approval. Alternate manufacturers who do not have such approval shall not be used in the work.

15 EQUIPMENT LIST

- 15.1 Within 30 calendar days of contract award and prior to placing orders, submit to the Consultant a list of standard and special equipment to be supplied within Division 26. List to include item identification, manufacturer, catalogue numbers where applicable, custom features where applicable and the names of the installers if other than the prime sub-trade.
- 15.2 Include all power supply and distribution apparatus, wiring devices, motor control, lighting fixtures, fire alarm, communication systems, and other similar apparatus.

16 DELIVERY AND STORAGE

- 16.1 Store all electrical equipment and devices other than conduits, fittings, boxes, and ducts in a heated and ventilated space, and protect from construction damage. Include in the tender price all costs related to such storage.
- 16.2 Conduits, fittings, boxes, and ducts may be stored outside if properly protected against the weather.
- 16.3 Ship and store floor mounted equipment in upright position.
- 16.4 Ship equipment in adequate containers to assure it arrives undamaged at the site.
- 16.5 Keep equipment doors locked. Protect equipment from damage and dust.
- 16.6 Block moving parts when necessary to prevent damage during movement and shipment of equipment.
- 16.7 Remove from the site, and replace with new, all materials showing evidence of damage or rust.

17 EQUIPMENT LOCKS

- 17.1 Fit locks on the cabinet doors, where these are hinged, of all electrical equipment including panelboards, automatic lighting control cabinets, low tension and communication cabinets. All locks shall be identical. Turn over to the Owners a total of six (6) keys and obtain a receipt for same.

18 TESTING AND ADJUSTING

- 18.1 General



- .1 Coordinate and pay for all tests specified herein including further tests as required by authorities having jurisdiction.
 - .2 All testing shall be performed after each system installation has been completed and prior to the system being put into continuous operation unless otherwise noted.
 - .3 Perform the testing, adjusting, and balancing only when conditions are commensurate with actual operating conditions for the given system.
 - .4 Advise the Consultant 48 hours in advance of each test. Carry out tests in the presence of Consultant. Submit detailed typewritten test reports in duplicate to the Consultant within 7 days after the completion of each test. Include all test reports in the Maintenance Manuals. Each test shall clearly indicated, in a line-by-line format, that the components (not as a group) have been tested, test results, and whether test results are within acceptable limits. Each test report shall be accompanied by a front cover sheet briefly outlining what the test report is for and clearly summarizing all items that have failed the tests. The cover sheet shall indicate names of individuals who conducted the tests and their signatures.
- 18.2 Testing by Independent Testing Agency
- .1 Arrange and pay for the following tests to be performed by an independent Testing Agency such as Pro-Con Electrical Services Ltd., Cutler Hammer, Schneider. - Pacific Service Division, Power Serv Pacific Inc., or approved equal. All required testing shall be fully completed and any deficiencies corrected prior to energizing equipment.
 - .2 The following tests require that the Contractor provide materials, tools, and labour (qualified personnel) to prepare equipment and devices for testing and to perform work during the tests in order to assist the testing agency representatives and to make adjustments and re-calibrations for re-testing as necessary and to reconnect systems after the testing is completed. Include in the tender all costs associated with the provision of labour; to remove and re-install panel plates, to disconnect/reconnect cables, and perform any labour other than testing, and to provide any materials and tools other than testing instruments.
 - .1 Megger test all 600 V and 208 V circuits, feeders, and equipment.
 - .2 Check resistance to ground before energizing any equipment.
- 18.3 Testing by the Contractor
- .1 The Electrical Contractor shall use his own forces and the forces of his suppliers and Subcontractors for the following tests:
 - .1 Fire alarm system testing and certification by the manufacturer as specified elsewhere.
 - .2 Test phase relationships and polarity at all equipment and outlets and devices.
 - .3 Test all lighting and heating circuits and all circuits originating from branch distribution panels.
 - .4 Phase balance - When load conditions are commensurate with actual operating conditions, measure the load and the voltage on each phase at each switchboard, splitter, motor control centre, motor distribution centre, distribution panelboard, and lighting and power panelboard and report the results, including neutral currents, in writing to the Consultant. Rearrange circuit connections as necessary to balance the load on each phase as instructed by the Consultant. After making any such changes, make available to the Consultant marked prints showing the modified connections.
 - .5 Motor loading - measure the line current of each phase of each motor with the motor operating under load and report the results along with the motor nameplate current in

- writing to the Consultant. Upon indication of any unbalance or overload, thoroughly examine the electrical connections and rectify any defective parts or wiring. If electrical connections are correct, overloads due to defects in the driven machines shall be reported in writing to the Consultant.
- .6 Include in the written reports to the Consultant the hour and date on which each load was measured and the voltage at time of test.
- .7 Control and switching - all circuits shall be tested for the correct operation of devices, switches, and controls, including sequenced operation of systems where applicable.
- .2 Submit original copies of letters from the manufacturers of all communication systems indicating that their technical representatives have inspected and tested the respective systems and are satisfied with the methods of installation, connections, and operation. Where existing systems are extended, such letter shall cover both new and existing equipment and connections.
- .3 Refer to other sections in this specification regarding testing of communication systems.

19 DEMONSTRATION

- 19.1 Demonstrate to and instruct the Owner's representative on operating and maintenance procedures for all electrical systems using the assistance of specialist sub-trades and manufacturer's representatives for instruction and include all costs in the tender. Systems to be demonstrated shall include, but not be limited to, the following:
- .1 Operation of circuit breakers, interlocking schemes, capacitors, etc.
- .2 Routing and installation of major feeders, duct banks and manholes, grounding and cable trays.
- .3 Fire alarm system Interface.
- .4 Labelling and identification schemes.
- .5 Use of Maintenance Manuals.
- 19.2 Arrange an acceptable time with the Owner and the Consultant and submit a program of instruction and demonstration for the Consultant's approval. Assume that the Owner's representative is not familiar with any of the special equipment and/or systems installed.
- 19.3 Submit to the Consultant, at the time of Substantial Performance inspection, a complete list of systems stating for each system:
- .1 Date instructions were given to the Owner's staff.
- .2 Duration of instruction.
- .3 Name of persons instructed.
- .4 Other parties present (manufacturer's representative, Consultant, etc.).
- .5 Signature of the Owner's staff stating that they properly understood the system installation, operation, and maintenance requirements and identifying any systems or equipment which were not demonstrated to their satisfaction, and which must be re-demonstrated.



20 CLEANING AND REPAIR

- 20.1 At the conclusion of the job and before the building will be accepted by the Owner, all lighting fixtures, lenses, panelboards, and other electrical equipment shall be clean and free of dust, plaster, paint, and other foreign materials.
- 20.2 If, in the opinion of the Consultant, lighting fixtures require cleaning, this cleaning shall be done by a firm regularly engaged in this type of work. Plastic diffusers shall NOT be wiped. They shall be dipped in an approved anti-static hot detergent solution and drip-dried before installation. Reflectors shall be properly cleaned to remove dust, finger marks, etc.
- 20.3 Repair, at no cost to the Owner, any equipment or structures damaged by the execution of Contract to its original condition.
- 20.4 Replace, at no cost to the Owner, any equipment or structures damaged by the execution of Contract which is irreparable.
- 20.5 Openings and cutouts shall not be burned into panels. Oversized openings shall not be patched up with loose plates or oversized washers. Oversized openings shall be considered damage to the equipment and shall be treated as specified.

21 GUARANTEE

- 21.1 Use of installed equipment during construction, when permitted by the Consultant, shall not shorten or alter the guarantee period as specified within the General Conditions or Supplements thereto.
- 21.2 Unless otherwise noted, the warranty period for all equipment shall commence on the date of Substantial Performance for the entire Construction Contract.
- 21.3 Refer to other sections of these Specifications for extended warranty requirements (fire alarm, communication systems, etc.).
- 21.4 Within a period of one year from the date of substantial completion, replace or repair at own expense any defect in workmanship or material.

22 PROJECT DOCUMENTATION22.1 Shop Drawings

- .1 Refer to Section Submittals.
- .2 Notwithstanding the above, submit one (1) electronic copy, PDF form of all shop and setting drawings or diagrams to the Consultant sufficiently in advance of requirements to allow time for review and comment
- .3 Shop drawings shall be neatly drafted and shall be complete and detailed and shall be provided as stipulated elsewhere in these Specifications. This requirement is mandatory for such items as switchboards; custom-fabricated equipment panels, consoles, or racks; and custom-fabricated lighting fixtures and communication systems.
- .4 All shop drawings shall use metric dimensions. Scaled drawings shall use metric scale.
- .5 Shop drawings shall bear specific names for each and every unit assembly defined thereon, the name of the project where installation is to take place, the name of the manufacturer, and the date of the drawing including notation of latest revision, if any.



- .6 Except as may be necessary to indicate operation of switchgear and similar apparatus and to show field interconnections, detailed wiring diagrams of component assemblies need not be included with shop drawings unless requested by the Consultant. However, such wiring diagrams shall be included as part of the Maintenance Manual as required by these Specifications.
 - .7 Indicate details of construction, dimensions, locations of cable pits and trenches, capacities, weights and electrical performance characteristics of equipment and materials.
 - .8 Shop drawings may be prepared by the Contractor, or manufacturer's drawings will be accepted. All drawings required for one and the same system shall be submitted as a complete package. Incomplete system packages will not be reviewed and will be returned unmarked.
 - .9 Shop drawings shall be reviewed by the Contractor prior to submission to the Consultant. Shop drawings not bearing Contractor's approval stamp, approval date, signature, and project name will be returned without comment.
 - .10 Facsimile produced shop drawings will not be accepted.
 - .11 Review of shop drawings by the Consultant is for the sole purpose of ascertaining conformance with the general design intent. The review shall not mean approval of the detail design inherent in the shop drawings, responsibility for which shall remain with the Contractor submitting same, and such review shall not relieve the Contractor of his responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation and for coordination of the work of all sub-trades.
 - .12 Ensure that copies of all shop drawings are available at the job site.
- 22.2 Maintenance Manuals
- .1 Provide four (4) final and one (1) partial copy of a *Maintenance Manual* to be prepared specifically for this project
 - .2 Submit electronic copies of the above on CD.
 - .3 Provide all data, after making all necessary corrections. Provide final shop drawings, wiring diagrams, equipment brochures, etc., required for inclusion with the Manuals. Include all costs in the tender price associated with assisting the Agency and in providing all data, drawings, diagrams, brochures, etc.
 - .4 The partial copy referred to above shall include only descriptions of the systems, together with operating and maintenance instructions, and shall be delivered to the Consultant for review and comment no later than one (1) month prior to the date of substantial completion. This copy may be in a loose-leaf ring binder.
 - .5 Final Maintenance Manuals shall include:
 - .1 Sturdy black hard cover expandable post binder(s) with stamped white letters on the binding of the cover showing the following:
 - .1 Name of Project
 - .2 Type of Manual (i.e., Maintenance Manual for Electrical Systems)
 - .3 Listing (Company names only) of Consultant, Electrical Consulting Engineer, Electrical Contractor, and name of Agency that prepared the Manual
 - .2 Introduction Page



- .1 Name of Project
- .2 Type of Manual (i.e., Maintenance Manual for Electrical Systems)
- .3 Listing (Company names, addresses, and telephone numbers) of Consultant, Electrical Consulting Engineer, General Contractor, Electrical Contractor, including his Subcontractors (i.e., Communication Systems Contractor, Testing Agency, etc.), and name of Agency that prepared the Manual
- .3 Instruction Page
 - .1 Step-by-step instructions on how to use the Manual
- .4 Index Page
 - .1 List all equipment, systems and special references such as conduit colour coding schedule, applicable Test Reports, Certificates, etc. The Index shall be arranged in the same order as the Specifications.
 - .2 List all "As-Built" drawings including drawings issued during the tender period and the construction stage.
- .5 Equipment/System Pages
 - .1 Provide, between each piece of equipment/system, divider pages complete with plastic tabs with large numbers corresponding to the Index listing
 - .2 After each divider page, include a "local" Index sheet as per the following example. (Provide "local" divider pages complete with smaller plastic tabs corresponding to the "local" Index sheet.)
 - .3

NAME OF PROJECTINDEXLIGHTING AND POWER PANELS

	<u>Drawings</u>	Bulletin/	<u>Pages</u>
A	Description	-	A1
B	Maintenance Instruction	-	B1
C	Renewal Parts	-	C1
D	Shop Drawings/Brochures		
E	Identification/Colour Coding		
F	Supplier/Manufacturer/Distributor		



The above Index sheet shall be used for all equipment/systems.

Under *Description* include a brief description and sequence of operation of equipment/systems and manufacturers' published technical literature. For major pieces of equipment such as generator, switchgear, communication systems, etc., include complete parts/component lists. Include revised and updated typewritten copy of all Schedules (motor, panel board, feeder, lighting fixtures, receptacles, switchboard, equipment, etc.) in the applicable section of the Maintenance Manual.

Under *Maintenance Instruction* describe manufacturer's recommended maintenance program. (Describe on Index sheet if space permits.)

List *Renewal Parts* if applicable. (List on Index sheet if space permits.)

Under *Shop Drawings/Brochures* include a copy of reviewed and corrected shop drawings (reduced scale) and brochures. Also include final and detailed wiring diagrams (reduced scale) when applicable. If space permits, show listing of drawing numbers and brochures in the Index sheet; otherwise, include the list in the front part of the drawings and brochures. Shop drawings shall be so arranged that they can be removed directly from the Manual without undoing the pin-bars.

Under *Identification/Colour Coding* outline method used for identifying equipment [i.e., LP "E2A" stands for "Lighting Panel" (LP), connected to emergency load (E), operating on 208/120 V (2), last space (A) denotes sequential order of panel]. Colour coding used for identification of outlet boxes, raceways, etc., shall be shown with a coloured label glued to the page. All identification and colour coding information may be shown on the Index sheet if space permits.

Under *Supplier/Manufacturer/Distributor* list source of supply for replacement parts, including name, address, and telephone number. This information may be shown on the Index sheet if space permits.

- .6 Guarantees and Warranties
 - .1 Include all applicable guarantee and warranty information.
 - .7 Test Reports and System Demonstration
 - .1 Include copies of all applicable Test Reports (refer to Section 25 05 01 Testing and Adjusting) and manufacturers' letters verifying test completion.
 - .2 Include signed statement from Owner regarding systems' demonstrations (refer to Section 26 05 01 Demonstration).
 - .8 Certificates
 - .1 Include a copy of Final Certificates from Electrical Inspection Department, Fire Chief, and other authorities having jurisdiction over the work.
 - .9 Schedules
 - .1 All schedules included in the Specifications (Motor Schedules, Lighting Fixture Schedules, Panel Schedules, CCTV Schedules, Equipment Schedules, etc.) shall be updated to reflect all changes made during tender and construction periods.
 - .10 Drawings
 - .1 Include all small-format drawings issued during Tender and Construction periods.
- .6 A holdback will be effected until all required copies of approved Maintenance Manuals have been delivered to the Consultant.



- .7 A sample copy of a typical Maintenance Manual is available for inspection at the Consultant's office.

22.3 "As-Built" Drawings

- .1 Notwithstanding the above, maintain in the job site office in up-to-date condition, one (1) complete set of whiteprints of each of the Electrical Contract Drawings and one (1) set of Specifications, including Revision Drawings, marked clearly and indelibly in red, indicating "As-Built" conditions where such conditions deviate from the original directions of the Contract Documents, and indicating final installation of feeders and branch circuits.
- .2 "As-Built" drawing markings shall include but shall not be limited to the following:
- .1 All changes in circuiting.
 - .2 Size and routing of all conduits for all branch circuits including power, lighting, and systems. Note that branch circuit wiring is generally not shown on Drawings. Accurately record on "As-Built" drawings the size and routing of all installed raceways and cables.
 - .3 Number and size of conductors (#10 AWG and larger) in raceways and cables
 - .4 Location of all junction and pull boxes
 - .5 Location of all access panels
 - .6 Location of all conduit or duct stubs, installed equipment, devices, and fixtures
 - .7 All changes to electrical installation resulting from Addenda, Change Orders, and Field Instructions (Architectural Instructions)
 - .8 Exact location of all services left for future work
 - .9 Location by accurate horizontal and vertical dimensions of the routes and terminations of all raceways and cables installed underground beyond the building.
- .3 At completion of construction and prior to substantial performance of the work, the Contractor shall arrange and pay for a computer drafting service to update drawing disks containing AutoCAD version 2008 format drawing files for "As-Built" drawings. Tender set Cad files may be purchased from the Consultant and the cost of the same shall be included in the Tender price. Allow a single per project cost of \$150.00 plus \$15.00 per drawing. Note the contractor will be required to sign a standard consultant's agreement entitled "Authorization to use CAD drawing files". The agreement restricts the use of the CAD files for the purpose of "As-Built preparation only. The "As-Built" drawings must conform to the electronic file structure already established by the consultant (for example, layering schemes, fonts, dimensioning, etc.) and any deviation must be approved by the consultant.
- .4 Each "As-Built" drawing mylars as defined above shall bear the Contractor's identification and signature, the date of record, and the notation: *"We hereby certify that these Record Drawings represent the building as built."*
- .5 All Addenda and Revision Drawings not having their details transferred onto the submitted "Record" drawings shall be included in the submission using the same drawing format as previously described.
- .6 Deliver one (1) set of "As-Built" vellum drawings, final "As-Built" CAD discs and updated Specification Schedules to the Consultant at 'Substantial Completion' of the Contract for review and comment and, if necessary, revision, before ultimate transmittal to the Owner. The Consultant will effect a holdback until "Record" drawings are delivered in good order as required herein. Refer also to Division 1 of these Specifications.



- .7 Deliver final "As-Built" CAD discs two (2) copies, one (1) set of reproducible full drawing size "As-Built" vellum drawings, and (1) set of full drawing size "As-Built" digital prints to the consultant.

23 LOOSE EQUIPMENT, SPARE PARTS, AND MAINTENANCE MATERIALS

23.1 Loose Equipment

- .1 All loose and portable components and equipment that are to be provided under Division 16 shall be handed over to the Owner at Substantial Performance of the Contract and receipts obtained. Copies of such receipts shall be given to the Consultant.

24 SUBSTANTIAL PERFORMANCE INSPECTION

- 24.1 Before the Consultant is requested to make a Substantial Performance inspection, submit written confirmation that:
- .1 All wiring devices, cover plates, motor controls, lighting fixtures, and other equipment are operational, plumb, clean, and correctly labelled.
 - .2 All distribution equipment (distribution transformers, etc.) has been cleaned and vacuumed.
 - .3 All Test Reports have been submitted.
 - .4 All auxiliary systems (fire alarm, communication systems, etc.) have been tested as required and are in good and proper working order.
 - .5 All certificates of final acceptance from the authorities having jurisdiction have been received and submitted to the Consultant.
 - .6 Factory finished equipment has been cleaned, touched up, or refinished as necessary to present a new appearance.
 - .7 All sealing of conduits, cables, cable trays, wire ways, etc. at all wall, ceiling, and floor penetrations have been completed.
 - .8 All loose equipment including spare parts and replacement parts have been turned over to the Owner and receipts obtained for same.
 - .9 The Maintenance Manual has been submitted.
 - .10 All demonstrations and instructions to the Owner have been completed.
 - .11 The "As-Built" drawings and CADD disks have been submitted to the Consultant.
 - .12 Verification letter from Seismic Engineer has been submitted (refer to Section 26 05 30 Seismic Restraints."
- 24.2 Provision of the above shall not be construed as compliance with all administrative documentation required within Division 010010.
- 24.3 Notwithstanding any other provisions of the Contract, failure to complete all of the above shall give cause to deny the issuance of a Substantial Performance Certificate.



25 MEASUREMENT AND PAYMENT

- 25.1 Notwithstanding any other provisions of this Contract, supply the following general information and any additional information as may be requested by the Consultant, as part of each Monthly Progress Claim. Indicate the labour cost and the material cost separately for each *Item of Work* within Division 26, 27 & 28.
- 25.2 *Items of Work* shall include but shall not necessarily be limited to the following:
- .1 Main Distribution (distribution feeder conduits and wiring, distribution panel-boards, distribution transformers, etc.).
 - .2 Secondary Distribution (lighting and appliance panel boards and associated feeders, relay cabinets, etc.).
 - .3 Cable Tray.
 - .4 Branch Circuit Conduit and Boxes (rough-in) for power, lighting, motors, and auxiliary systems.
 - .5 Branch Circuit Wiring for power and lighting.
 - .6 Wiring Devices and Owner's Equipment Connections.
 - .7 Testing and adjusting (final test reports).
 - .8 Maintenance Manuals.
 - .9 Final "As-Built" drawings.
 - .10 Demonstrations.
 - .11 Set-Up Costs (not to exceed 2% of the Contract value).
- 25.3 The Consultant reserves the right to make changes to the allocation of costs. In case of a dispute, the cost allocations shall be as directed by the Quantity Surveyor who completed the pre-tender cost estimate. All cost figures shall be adjusted on a percentage basis to correlate with the actual tender price.
- 25.4 Progress claims will not be certified nor payment made beyond 95% with subsequent builders' lien holdback applied for each item of work as previously defined or on the overall contract until commissioning and verification of the systems have been completed. This procedure is to allow for any necessary deficiency holdbacks on items which do not become apparent until the systems have been fully commissioned and are operational.
- 25.5 Format for Monthly Progress Draws shall be similar to the sample shown at the end of this section.
- 25.6 For each Monthly Progress Draw, change orders shall be listed separately.

26 EVALUATION OF CHANGES TO THE CONTRACT

- 26.1 Notwithstanding other provisions of the Contract, this Contractor shall supply detailed information for the valuation of all changes to the Contract. Such information shall include, but not necessarily be limited to, the following:
- .1 Labour hours per unit of material or equipment to be added, deleted, or altered.
 - .2 Units of material or equipment to be added or deleted.

.3	Cost to the Contractor per unit of material, equipment and labour broken down by category of labour and type of material or equipment.
.4	Extensions of the above to arrive at total costs.
.5	Other miscellaneous and identifiable charges such as conveyancing, re-stocking, overhead, profit, etc.
26.2	Include in the valuation of any change to the Contract the cost, if any, of recording such change on the "As-Built" drawings as previously specified.

27 PROGRESS DRAW SAMPLE

Draw No.

For the Month of:

19

Project:

Prepared by

Item	Contract		To Date		Previous Claim		This Claim		Notes
	Labour \$	Material \$	Labour \$	Material \$	Labour \$	Material \$	Labour \$	Material \$	
These items are to be as generally listed in the Specification and as specifically agreed with the Consultant.									
Total									
Total Labour/Material									
Less 10% Lien Holdback									
Total Claim This Month									

Provide the following information with each progress draw:

A. Material on hand (not installed) previous claim	\$
B. Material from "A" installed this claim	\$
C. Material from "A" not installed this claim (A-B)	\$
D. Material on hand (not installed) added since last claim	\$
E. Total material on hand (not installed) this claim (C+D)	\$

END OF SECTION



1 GENERAL

1.1 Section Includes

- .1 General requirements related to existing building.

1.2 Related Sections

- .1 Section 26 05 01: Electrical General Requirements

2 EXISTING CONDITIONS

- 2.1 Examine the site and existing conditions prior to tendering on this work and make due allowance for these conditions in the tender. Confirm all locations and routings of any existing services, above and below grade, which might be affected by this installation and allow in the tender for such additional work.
- 2.2 Indication on the drawings of existing conduit, outlets and other electrical apparatus is based on casual field observations and records of past contracts. As such, this information represents the best data available but is not guaranteed to be full or accurate. Verify that field measurements and circuiting diagrams are as indicated on Drawings and that abandoned wiring and equipment serve only abandoned facilities. Report discrepancies to **Consultant** before disturbing existing installation.
- 2.3 Submission of a tender for this work shall indicate that the Contractor has made a thorough examination of the site and has accepted the existing conditions.
- 2.4 Permit no interruptions to the existing electric power, fire alarm, telephone, or other similar systems in the existing site during normal working hours where such systems service other sites.
- 2.5 Assume full responsibility for any disruption to existing services and systems. Should any temporary connections be required to maintain services during work in the existing buildings, supply and install all necessary material and equipment and provide all labour at no extra cost. Include the removal of such temporary connections at completion of the work in the tender price.

3 INSTALLATION

- 3.1 Examine drawings of all other trades and allow for all work such as the removal, temporary relocation, and re-installation of electrical equipment, wiring, raceways, etc., where such work is required due to alterations in or about existing site.
- 3.2 Remove abandoned wiring to source. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- 3.3 Disconnect abandoned outlets and remove devices with their corresponding wiring conduits to source. Remove abandoned outlets when servicing conduit is abandoned and removed. Blank off all unused outlet boxes.
- 3.4 Disconnect and remove abandoned panel boards and distribution equipment.
- 3.5 Remove all redundant wiring and conduits to source.
- 3.6 Clean and repair existing materials and equipment which remain or are to be reused, as described elsewhere in these Specifications.

END OF SECTION



1 GENERAL

1.1 Section Includes

- .1 Sleeves, openings, and curbs
- .2 Wall, ceiling, and floor penetrations
- .3 Waterproofing and vapor barriers
- .4 Access panels and doors
- .5 Equipment finishes
- .6 Vibration and noise control
- .7 Building Management System

2 SLEEVES, OPENINGS, AND CURBS

2.1 Sleeves

- .1 Through all exterior walls above grade, use standard weight galvanized steel pipe sleeves, machine cut, flush with finished structure inside and to suit flashing details on exterior.
- .2 Through all exterior walls below grade and all other waterproof walls use machine cut heavy weight cast iron pipe sleeves.
- .3 Through all floors, use extra heavy weight cast iron sleeves, machine cut. Extend sleeves 100 mm above finished floor and cut flush with underside of floor. Provide watertight concrete curbs, 100 mm high by required width with 20 mm chamfered edges around all sleeves and conduits passing through the floors.

2.2 Openings and Slots

- .1 For rectangular openings through concrete walls and floors use removable wood block-outs of the required size.
- .2 Provide all additional openings as necessary and as specified elsewhere to permit the installation of all raceways and cables and recessed equipment and devices.
- .3 Grind and file smooth the interiors and edges of all sleeves and slots prior to pulling any cables.

2.3 Curbs

- .1 Through floors where raceways are not furred in or enclosed in a shaft, provide watertight concrete curbs, 100 mm high, wide as required, with 20 mm chamfered edges all around. Extend sleeves where used, flush to top of curb. Through floors where duct is enclosed in a shaft or furred in, provide the curbs at the extreme top and bottom end of the shaft only.

3 WALL, CEILING, AND FLOOR PENETRATIONS

- 3.1 Any and all penetrations through walls, ceilings and floors (fire, smoke, sound as well as all other penetrations) must be sealed after the installation of all conduits, cables, bus ducts, cable trays, wire-ways, etc., to maintain the integrity of the separations in a manner approved by the Consultant and the authorities having jurisdiction. Use sealing materials as specified, conforming to NBC, CEC and CAN4-S101.



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BASIC ELECTRICAL

- 3.2 Sealing materials for wall, ceiling, and floor penetrations: Dow Corning #3.6548 RTV expanding foam, "Elasta Seal" as manufactured by Fire Stop Systems, 3M Fire Barrier System, or approved equal.
- 3.3 Provide cable trays, wire-ways, etc., with fire barriers at each floor and at each fire separation and smoke separation, and further seal against the migration of smoke.
- 3.4 Seal all slots, core holes, etc., not being used.
- 3.5 Provide fire-rated gypsum board of required thickness around all surfaces of recessed panelboards and cabinets within rated separations so as to maintain the separation rating as approved by the authorities having jurisdiction.
- 3.6 Provide fire-rated gypsum board enclosures for lighting fixtures recessed in fire rated ceiling assemblies, all as required by the authorities having jurisdiction.

4 WATERPROOFING/VAPOUR BARRIERS

- 4.1 Generally penetrations through waterproofing members and vapour barriers will not be permitted. However, where any work must pierce vapour barriers and waterproofing membranes including waterproofed concrete, the method of installation, colour of caulking material and location of penetration shall be as approved by the Consultant. Supply and install all necessary sleeves, caulking and flashing and make the penetrations watertight. For penetrations of vapor barrier, maintain integrity of the system. Restore penetrations through existing surfaces to match the surroundings.
- 4.2 Provide specified caulking around all exterior recessed lighting fixtures in concrete steps, walls, etc.
- 4.3 Provide clear silicon bead on top and down both sides of all exterior wall mounted devices (e.g. light fixtures and gongs) where devices are exposed to the weather.

5 ACCESS PANELS AND DOORS

- 5.1 Provide all access panels such that concealed electrical equipment requiring adjustment or maintenance in all locations is easily accessible. **Submit shop drawing indicating location of access panels before commencing with work for the Engineers and Architect's approval.**
- 5.2 Generally, access panels required for electrical equipment are not shown on Drawings.
- 5.3 Provide the appropriate trades with access panels and frames of appropriate fire rating complete with all pertinent information for installation. Ensure that panels are correctly placed. Arrange with and pay the Contractor in whose work they occur to install them.
- 5.4 Size all access panels to provide adequate access and commensurate with the type of structure and architectural finish. Should it be necessary for persons to enter, provide minimum 600 mm by 450 mm size doors.
- 5.5 Access panels in plastered walls and ceilings shall be flush type made of 14-gauge steel with perforated anchor flange, gasketed, adjustable anchor straps, concealed hinges, and screwdriver cam locks.
- 5.6 Access panels to have primer finish except for ceramic tiled areas where finish shall be stainless steel.
- 5.7 Access panels shall be manufactured by Milcor, Maxam Metal Products or approved equal.

6 EQUIPMENT FINISHES

- 6.1 Thoroughly degrease all metalwork and apply one overall coat of zinc chromate primer to all electrical equipment enclosures, supports, switchgear cubicles, bus ducts, gutters, panelboards, low tension and other



BASIC ELECTRICAL

- cabinets. Unless otherwise directed, apply one overall coat of grey enamel and a second coat of gloss enamel. Paint all exposed surfaces Grey ASA #61.
- 6.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint. Ensure that equipment finishes are not defaced during installation. Scratched or otherwise marred surfaces shall be refinished before the job will be accepted. Other surfaces shall be completely repaired to match original paint. Patching of damaged area will not be accepted.
- 6.3 Clean and prime exposed non-galvanized hangers, racks, and fastenings to prevent rusting.
- 6.4 Generally, equipment finishes shall be as outlined under applicable sections of the specifications.

7 VIBRATION AND NOISE CONTROL

- 7.1 Electrical equipment such as transformers shall be mounted using vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution of equipment so as to produce the manufacturers' recommended uniform deflection. Such equipment shall be restrained at each isolator pad using bolts into the floor slab with neoprene washers and clearance holes to prevent short circuiting.
- 7.2 Connections to rotating, vibrating, or other noise-producing equipment such as motors, generators and transformers shall be by means of flexible conduit and flexible stranded conductors so as to minimize transmitted noise and vibration. Where equipment is mounted by means of resilient supports and is subject to physical displacement under such conditions as energizing a motor, the flexible conduit connections shall be formed into a loop of sufficient length to permit freedom of travel.

END OF SECTION



1 GENERAL

1.1 Related Documents

- .1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

1.2 Definitions

- .1 Fire stopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, and hot gases through penetrations in fire rated wall and floor assemblies.

1.3 General Description Of The Work Of This Section

- .1 Only tested fire stop systems shall be used in specific locations as follows: Penetrations for the passage of cables, conduit, and other electrical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

1.4 References

- .1 Test Requirements: Test Requirements: CAN/ULC-S115-11, "Standard Method of Fire Tests of Through Penetration Fire Stops".
- .2 Test Requirements: CAN/ULC-S102-M, "Standard Test Method for Surface Burning Characteristics of Building Materials".
- .3 Underwriters Laboratories of Canada (ULC) of Scarborough runs CAN/ULC-S115-11 under their designation of ULC-S115-11 and publishes the results in their "FIRE RESISTANCE RATINGS DIRECTORY" that is updated annually. Underwriters Laboratories (UL) of Northbrook, IL runs ASTM E-814 under their designation of UL 1479 and publishes the results in their "FIRE RESISTANCE DIRECTORY" that is updated annually. UL tests that meet the requirements of ULC-S115-11 are given a cUL listing and are published by UL in their "Products Certified for Canada (cUL) Directory".
 - .1 UL Fire Resistance Directory:
 - .1 Firestop Devices (XHJ17)
 - .2 Fire Resistance Ratings (BXRH7)
 - .3 Through-Penetration Firestop Systems (XHEZ7)
 - .4 Fill, Voids, or Cavity Material (XHHW7)
 - .5 Forming Materials (XHKU7)
- .4 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments (referred to as Firestop Custom Details in BC).
- .5 Inspection Requirements: ASTM E 2174, "Standard Practice for On-site Inspection of Installed Fire Stops."
- .6 Test Requirements: ASTM E 90, "Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements"



- .7 Test Requirements: ASTM E 2178, "Standard Test Method for Air Permeance of Building Materials"
- .8 Test Requirements: ASTM E 84, "Standard Test Method for Surface Burning Characteristics of Building Materials."
- .9 Test Requirements: ASTM E 2178, "Standard Test Method for Air Permeance of Building Materials"
- .10 ASTM G-21, "Standard Test for Determining Resistance of Synthetic Polymeric Materials to Fungi".
- .11 All major building codes: NBC, BCBC,.
- .12 NFPA 101 - Life Safety Code
- .13 Canadian Electrical Code

1.5 Quality Assurance

- .1 A manufacturer's direct representative (account manager, fire protection specialist, 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.
 - .1 Firestop System installation must meet requirements of ASTM E 814 or UL 1479 tested assemblies that provide a fire rating equal to that of construction being penetrated
 - .2 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
 - .3 Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
 - .4 For those firestop applications that exist for which no UL tested system is available through a manufacturer, a manufacturer's engineering judgment derived from similar UL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineering judgment drawings must follow requirements set forth by the International Firestop Council.
 - .5 Manufacturer's fire protection specialist to work with consultant to determine frequency of site walk-throughs to be submitted to construction manager and consultant.
 - .6 Engage the services of a Supporting Registered Professional in the area of fire protection engineering to submit a Model Schedule S-B: Assurance of Professional Design and Commitment for Field Review and Model Schedule S-C: Assurance of Professional Field Review and Compliance.



1.6 Submittals

- .1 Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of UL firestop systems to be used and manufacturer's installation instructions to comply with Section 01 30 00 general requirements.
- .2 Submit qualified tested firestop system detail for each firestop application on the project.
- .3 Manufacturer's engineering judgment identification number and drawing details when no UL system is available for an application. Engineering judgment must include both project name and contractor's name who will install firestop system as described in drawing.
- .4 Submit material safety data sheets provided with product delivered to job-site.

1.7 Installer Qualifications

- .1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the fire stopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its fire stopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.
- .2 The work is to be installed by a contractor with at least one of the following qualifications:
 - .1 FM 4991 Approved Contractor
 - .2 UL Approved Contractor
 - .3 Hilti Accredited Fire Stop Specialty Contractor
- .3 Installer shall have not less than 3 years' experience with fire stop installation

1.8 Delivery, Storage, And Handling

- .1 Deliver materials undamaged in manufacturer's clearly labeled, unopened containers, identified with brand, type, and UL label where applicable.
- .2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- .3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements, including temperature limitations.
- .4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- .5 Do not use damaged or expired materials.

1.9 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 fire stopping 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 fire stopping materials from contaminating any adjacent surfaces.

2 PRODUCTS

2.1 Fire stopping, General

- .1 Provide fire stopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the fire stopping under conditions of service and application, as demonstrated by the fire stopping manufacturer based on testing and field experience.
- .2 Provide components for each fire stopping system that are needed to install fill material. Use only components specified by the fire stopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- .3 Provide a round enclosed fire rated cable management device whenever cable bundles penetrate fire rated walls. The cable management device shall contain integrated intumescent firestop wrap strip materials sufficient to maintain the hourly rating of the barrier being penetrated. The cable management device shall contain a smoke seal fabric membrane or intumescent firestop plugs sufficient to achieve the L-Rating requirements of the barrier type.
- .4 Provide non-curing, re-penetrable, intumescent firestop materials around communications cable trays or ladder racks penetrating through a fire rated wall. The firestop system assembly shall be able accessible and re-installed from one side of the wall. The firestop material shall allow up to 12" of unreinforced annular space.
- .5 Penetrations in Fire Resistance Rated Walls: Provide fire stopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - .1 F-Rating: Not less than the fire-resistance rating of the wall construction being penetrated.
- .6 Penetrations in Horizontal Assemblies: Provide fire stopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - .1 F-Rating: Minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.



- .2 T-Rating: when penetrant is located outside of a wall cavity, minimum of 1-hour rating, but not less than the fire-resistance rating of the floor construction being penetrated.
- .3 W-Rating: Class 1 rating in accordance with water leakage test per UL 1479.
- .7 Penetrations in Smoke Barriers: Provide fire stopping with ratings determined in accordance with UL 1479 or ASTM E 814.
 - .1 L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at both ambient and elevated temperatures.
- .8 Mold Resistance: Provide penetration fire stopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

2.2 Acceptable Manufacturers

- .1 Subject to compliance with through penetration firestop systems (XHEZ) listed in Volume II of the UL Fire Resistance Directory, provide products of the following manufacturers as identified below:
 - .1 Hilti (Canada) Corporation, Mississauga, Ontario
1-800-363-4458
www.ca.hilti.com
 - .2 Provide products from the above acceptable manufacturer; *no substitutions will be accepted.*

2.3 Materials

- .1 Use only firestop products that have been UL 1479 or ASTM E 814 tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- .2 Re-penetrable, round cable management devices for use with new or existing cable bundles penetrating gypsum or masonry walls, the following products are acceptable:
 - .1 Hilti Speed Sleeve (CP 653) with integrated smoke seal fabric membrane.
 - .2 Hilti Firestop Sleeve (CFS-SL SK)
 - .3 Hilti Retrofit Sleeve (CFS-SL RK) for use with existing cable bundles.
 - .4 Hilti Cable Collar (CFS-CC) surface mounted retrofit solution.
 - .5 Hilti Gangplate (CFS-SL GP) for use with multiple cable management devices.
 - .6 Hilti Gangplate Cap (CFS-SL GP CAP) for use at blank openings in gangplate for future penetrations.
- .3 Pre-installed firestop devices for use with noncombustible and combustible pipes (closed and open systems), conduit, and/or cable bundles penetrating concrete floors and/or gypsum walls, the following products are acceptable:
 - .1 Hilti Cast-In Place Firestop Device (CP 680-P) for use with combustible penetrants.
 - .2 Hilti Cast-In Place Firestop Device (CP 680-M) for use with noncombustible penetrants.
 - .3 Hilti Speed Sleeve (CP 653) for use with cable penetrations.
 - .4 Hilti Firestop Drop-In Device (CFS-DID) for use with noncombustible and combustible penetrants.



- .4 . Sealants, foams or caulking materials for use with non-combustible items including rigid steel conduit and electrical metallic tubing (EMT), the following products are acceptable:
 - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX)
 - .2 Hilti Fire Foam (CP 620)
 - .3 Hilti Flexible Firestop Sealant (CP 606)
 - .4 Hilti Elastomeric Firestop Sealant (CFS-S SIL GG)
- .5 Intumescent sealants, caulking materials for use with combustible items (penetrants consumed by high heat and flame) including PVC jacketed, flexible cable or cable bundles, and plastic pipe, the following products are acceptable:
 - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX)
- .6 Foams, intumescent sealants, or caulking materials for use with flexible cable or cable bundles, the following products are acceptable:
 - .1 Hilti Intumescent Firestop Sealant (FS-ONE MAX)
 - .2 Hilti Fire Foam (CP 620)
 - .3 Hilti Flexible Firestop Sealant (CP 606)
 - .4 Hilti Elastomeric Firestop Sealant (CFS-S SIL GG)
- .7 None curing, re-penetrable intumescent putty or foam materials for use with flexible cable or cable bundles, the following products are acceptable:
 - .1 Hilti Firestop Putty Stick (CP 618)
 - .2 Hilti Firestop Plug (CFS-PL)
- .8 Wall opening protective materials for use with U.L. listed metallic and specified nonmetallic outlet boxes, the following products are acceptable:
 - .1 Hilti Firestop Putty Pad (CFS-P PA)
 - .2 Hilti Firestop Box Insert
- .9 Materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - .1 Hilti Firestop Mortar (CP 637)
 - .2 Hilti Firestop Block (CFS-BL)
 - .3 Hilti Fire Foam (CP 620)
 - .4 Hilti Firestop Board (CP 675T)
- .10 Non curing, re-penetrable materials used for large openings and complex penetrations made to accommodate cable trays and bundles, multiple steel and copper pipes, electrical busways in raceways, the following products are acceptable:
 - .1 Hilti Firestop Block (CFS-BL)
 - .2 Hilti Firestop Board (CP 675T)
- .11 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected, the following products are acceptable:
 - .1 Hilti Firestop Block (CFS-BL)
 - .2 Hilti Firestop Plug (CFS-PL)



- .12 Provide a firestop system with a "F" Rating as determined by UL 1479 or ASTM E 814 which is equal to the time rating of construction being penetrated.

3 EXECUTION

3.1 Preparation

- .1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- .1 Verify penetrations are properly sized and in suitable condition for application of materials.
 - .2 Surfaces to which fire stop 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 fire stopping materials.
 - .4 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of fire stopping.
 - .5 Do not proceed until unsatisfactory conditions have been corrected.

3.2 Coordination

- .1 Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.
- .2 At pre-construction fire stop meeting with all stakeholders, including sub trades, code consultants, specifiers, manufacturers fire protection specialist and/or field engineer, to determine responsibility for handling such issues as FT rated partitions, fire stop custom details, compatibility, complete submittals, mixed penetrations, ect.

3.3 Installation

- .1 Regulatory Requirements: Install firestop materials in accordance with UL Fire Resistance Directory.
- .2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration materials.
 - .1 Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
 - .2 Protect materials from damage on surfaces subjected to traffic.

3.4 Field Quality Control

- .1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- .2 Keep areas of work accessible until inspection by applicable code authorities.
- .3 Inspection of through-penetration fire stopping shall be performed in accordance with ASTM E 2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.



- .4 Perform under this section patching and repairing of fire stopping caused by cutting or penetrating of existing firestop systems already installed by other trades.
 - .5 Any inspecting consultant or authority reserves the right to use destructive testing in which the installing contractor is responsible to repair.
 - .6 Install a warning card (Lamicoid) that is clearly visible adjacent to any openings that have been fire-stopped, may be re-penetrated, have multiple penetrants, penetrate a FT rated partition, or any other critical area as deemed by the electrical consultant. This card should contain the following information:
 - .1 Warning that the opening has being fire stop protected
 - .2 Indicate the fire stop system used (ULC or cUL) or the firestop custom detail number
 - .3 F rating or FT rating
 - .4 Fire stop product(s) used
 - .5 Person to contact and phone number in case of modification or new penetration of fire stop system
- 3.5 Adjusting and Cleaning
- .1 Remove equipment, materials and debris, leaving area in undamaged, clean condition.
 - .2 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

END OF SECTION



1 GENERAL

1.1 Section Includes

.1 Branch wiring

1.2 Related Sections

.1 Section 26 05 01: Electrical General Requirements

2 BRANCH WIRING

- 2.1 Minimum conductor size shall be #10 AWG for receptacle circuits. Increase size if required under Section 8-102 and Table D3 of the CEC.
- 2.2 Minimum conductor size shall be #12 AWG stranded for lighting branch circuits.
- 2.3 Each branch circuit shall have dedicated full size neutral. Sharing neutral is not permitted.
- 2.4 Adhere to the circuit numbers indicated on the drawings. Provide all branch circuit wiring using materials and methods described herein and in consultation with the Consultant.
- 2.5 Phase all panelboard buses throughout the building such that the left, centre, and right hand buses represent phase A, B, and C respectively. Identify all indicating meters to this sequence.
- 2.6 Provide all conduits and wiring including flexible connections, outlet boxes complete with wiring devices and surface raceways for all casework and millwork as shown on the drawings, unless otherwise noted. Arrange conduit so that it will be completely concealed along the entire run to the outlet.
- 2.7 No splicing will be allowed.

END OF SECTION



1 GENERAL

1.1 Section Includes

- .1 Building wire, MI cable
- .2 Wire connectors
- .3 Box connectors for cable

1.2 Related Work

- .1 Section 26 05 01: Electrical General Requirements
- .2 Section 26 05 29: Fastenings and Supports

1.3 References

- .1 CSA C22.2 No.0.3, Test Methods for Electrical Wires and Cables.
- .2 CSA C22.2 No.65, Wire Connectors.

2 PRODUCTS

2.1 Building Wire and Cable - General

- .1 Unless otherwise directed, building wire and cable shall be *copper* conductors, sized as indicated.
- .2 Except where otherwise directed or required by Code or other applicable regulations, building wire and cable insulation shall be Type R90, cross-linked polyethylene insulated for 600 volts for #10 AWG and smaller and insulated for 1000 volts for #8 and larger, and rated not less than 90°C except for Fire Alarm where it shall be MIC
- .3 Each branch circuit shall have dedicated neutral. Neutral shall not be shared.
- .4 All conductors #12 AWG and larger shall be stranded.
- .5 All conductors within cable trays shall have "plenum" rated (FT6 type) outer jacket to comply with all applicable regulations and bylaws.
- .6 **No BX Cable shall be allowed. All wires shall be in conduit.**
- .7 **No Teck cable is allowed for indoor or outdoor installations.**
- .8 **No splicing by any means of main feeders, branch wiring, LV cables etc.**

3 EXECUTION

3.1 Installation of Building Wires and Cables - General

- .1 Unless specifically indicated otherwise, *all wiring shall be installed in conduit*. Use flexible conduits for final connections to suspend light fixtures and vibrating equipment.
- .2 Use no wire smaller than ##10 AWG for receptacles unless otherwise directed.
- .3 No splicing shall be allowed in any circuit.



- .4 Conductors for lighting, receptacle, appliance and equipment branch circuits shall have ampacity not less than the rating of the over-current device protecting the branch circuit and shall be sized for a maximum voltage drop of 2% from panelboard to the last outlet of a circuit. The length of the branch circuit to be used in the determination of the required wire size shall be the combined vertical and horizontal distances from the panelboard to the last device in the circuit. In no case shall the wire sizes as determined above, be less than that indicated in the following table:

120 Volts, 1 Phase

15 Ampere Circuits

0-25 m - min. #10 AWG

Over 25 m - min. #8 AWG

20 Ampere Circuits

0-20 m - min. #10 AWG

0 m-30 m - min. #8 AWG

Over 30 m - min. #6 AWG

347 Volts, 1 Phase

15 Ampere Circuits

0-75 m - min. #10 AWG

Over 75 m - min. #10 AWG

20 Ampere Circuits

0-55 m - min. #10 AWG

Over 55 m - min. #10 AWG

The distance requirements and wire sizes shall be respected.

- .5 Make final connections to recessed incandescent or gas-discharge lamp fixtures, and other heat-producing equipment with thermoplastic insulated, lacquered glass-braid-jacketed "equipment wire," except that where higher temperature rating of insulation or larger conductor size than #10 AWG is required, use wire specifically approved for the purpose.

3.2 Installation of Feeders

- .1 Feeders terminating in switchboards, distribution centres, motor control centres, unit substations, etc. shall not be installed until the terminating equipment has been placed in its final location above pull pits, on housekeeping pads, on floors, or against walls.
- .2 Where feeders are terminated on top of equipment which has been provided with sprinkler shields or hoods, this shall be done using watertight connectors.

END OF SECTION



1 GENERAL

1.1 References

- .1 ANSI/IEEE 837 (current edition), Qualifying Permanent Connections Used in Substation Grounding.

2 PRODUCTS

2.1 Equipment

- .1 Master Ground Bus: Suitable length of 6 mm x 75 mm solid copper on 25 mm stand-off insulators, complete with fastenings and connections.
- .2 Grounding conductors: bare stranded copper, tinned, soft annealed, size [as indicated].
- .3 Insulated grounding conductors: green, Type R90.
- .4 Non-corroding accessories necessary for grounding system, of type, size, and material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Therm welded type conductor connectors.
 - .4 Bonding jumpers, straps.
 - .5 Pressure wire connectors.
 - .6 Connectors for conductor to ground rod: Cadweld
 - .7 Connectors for cable to reinforcing steel: Cadweld
 - .8 Clamp for conductor to electrically conductive underground water pipe: size as required.
 - .9 Clamps for damp and corrosive locations: brass.
 - .10 All others: Bur'ndy compression type or Cadweld.

3 EXECUTION

3.1 Installation - General

- .1 Install complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories. Where EMT is used for protection, run ground wire in conduit.
- .2 Provide all grounding to conform with CEC and the latest grounding instructions of the Inspection Authority, with any further requirements as noted herein or on the drawings.
- .3 Grounding conductors shall be as specified elsewhere and shall have green insulation or identification at all ends.
- .4 Install connectors in accordance with manufacturer's instructions.
- .5 Protect exposed grounding conductors from mechanical injury.



- .6 Wherever mechanical protection is required for individual grounding conductors, install in non-ferrous conduit unless associated phase conductors are also contained therein. Use PVC conduit in concrete or below grade slab and aluminum conduit in other dry locations.
- .7 Make buried connections, and connections to conductive water main, and to electrodes, using approved copper welding by thermit process.
- .8 Use cable lugs for grounding connections to switchboards, ground buses, and other equipment.
- .9 Soldered joints are not permitted.
- .10 Install separate and properly sized bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp, or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.
- .12 Bond the armour of single-conductor, metallic-armoured cables to cabinet at supply end, and provide non-metallic entry plate at load end
- .13 Ground secondary service pedestals.

3.2 Electrodes

- .1 Make ground connections to continuously conductive underground water pipe on street side of water meter.
- .2 Install water meter shunt.
- .3 Bond separate, multiple electrodes together.
- .4 Use size #4/0 AWG copper conductors for connections to electrodes unless otherwise noted on drawings.
- .5 Make special provision for installing electrodes that will give acceptable value of resistance to ground where rock or sand terrain prevails. Ground as indicated.
- .6 When grounding equipment enclosures, arrange conductors so that removal of the grounded item will not interrupt the ground conductor to other equipment.
- .7 Each receptacle shall have a grounding conductor installed between its grounded outlet box and the grounding terminal on the receptacle.
- .8 Refer to Section 26 27 19 Plug-In Surface Raceways for grounding of receptacles in plug-in surface raceways.
- .9 For isolated ground receptacles, provide an insulated separate ground conductor between the receptacle isolated ground terminal and the case of the panelboard serving the receptacle.
- .10 Where PVC conduit is used, install correctly sized ground conductor from outlet to outlet except for isolation transformer systems where grounding conductor shall run as detailed on the drawings.



3.3 System and Circuit Grounding

- .1 Install system and circuit grounding connections to neutral of Secondary 600V system.
- .2 Solidly ground the neutral of all 600 V/208-120V distribution transformers. Ground wire shall be continuous with no splices and run back to the master ground bus.
- .3 Refer to the drawings for grounding of main switchgear and transformers. Interconnect ground and neutral in accordance with details shown on the drawings in order to achieve a single-point grounding system.

3.4 Equipment Grounding

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to the following list:
 - Transformers
 - Switchgear
 - Frames of motors
 - Motor control centres
 - Starters
 - Control panels
 - Building steel work
 - Distribution panels
- .2 Bond all conduit, exposed metal parts, non-current-carrying conductive equipment, equipment cases, frames, bases, etc.

3.5 Master Ground Bus

- .1 Provide a Master Ground Bus rigidly supported on the wall of the Main Electrical Room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size #4/0 AWG minimum unless otherwise noted on drawings.
- .3 Make connections to the ground bus with cable lugs bolted to the copper with lock washers and nuts. Identify each grounding conductor at the bus.

3.6 Field Quality Control

- .1 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Consultant and local authority having jurisdiction over installation.
- .2 Perform tests before energizing electrical system.
- .3 Submit the results to the Engineer.

END OF SECTION



1 GENERAL

1.1 Section Includes

- .1 Supports, Hangers, and Fastenings
- .2 Backboards and Wood Items

1.2 Related Sections

- .1 Section 26 05 01: Electrical General Requirements

2 PRODUCTS

2.1 Materials

- .1 Long standard masonry expansion shields for use on concrete-filled masonry walls: Star "Stazin" or equal.
- .2 Clamps for use on structural steel members: Appleton or Unistrut devices manufactured specifically for the purpose.
- .3 Conduit and cable clamps for individual or pair runs:
 - .1 Appleton series 'CL,' one-hole steel or galvanized malleable iron for sizes 50 mm and smaller.
 - .2 Two-hole steel for sizes larger than 50 mm.
- .4 Wire and cable ties: nylon 'Ty-rap' or approved equal.
- .5 Threaded hanger rods: galvanized steel, minimum 6 mm diameter; larger sizes as specified herein or as shown on the drawings.
- .6 Backboards: New 20 mm GIS paint grade fir plywood, unless otherwise noted on drawings.
- .7 Wood: Kiln-dried to 12% maximum moisture content.

3 EXECUTION

3.1 Installation of Supports, Hangers, and Fastenings - General

- .1 Provide all supports required for secure fastening and erection of the electrical work.
- .2 Support equipment using clips, spring-loaded nuts, bolts, and clamps designed as accessories to basic channel members.
- .3 Install fastenings and supports as required for each type of equipment, cable, and conduit, and in accordance with manufacturer's installation recommendations.
- .4 All equipment enclosures, panelboards, boxes, cabinets and similar materials shall generally be fastened near each corner to the building; directly, by means of fasteners or, indirectly, by means of hanger assemblies; or fastened to backboards as the case directs. Install and size fasteners to the specific load in accordance with first class practice and the specific instructions, where such exist, of the manufacturer of the fasteners used. Wherever practicable, fastenings shall be made to the basic structure. Do not install fasteners supporting more than 9 kg in finish materials.



- .5 Unless specifically directed to the contrary, do not use bolts or rods smaller than 6 mm diameter, wood screws smaller than #8, fibre fastenings, fasteners driven by hammer or explosive charge, or perforated strap iron pipe hangers.
 - .6 Unless detailed to the contrary, use wood screws only for fastening equipment weighing less than 27 kg. per support.
 - .7 Make attachments to the following materials with fasteners complying with the above requirements of this Section and unless otherwise directed, of the following types:
 - .1 To concrete with metal inserts manufactured specifically for the purpose and complete with proper nuts, bolts or hanger devices as required, and installed at the time of concrete pour.
 - .2 To concrete-filled masonry walls with long standard masonry expansion shields.
 - .3 To hollow-core masonry walls with toggle bolts.
 - .4 To wood with wood screws or lag screws. Pilot-drill holes for lag screws and wood screws larger than #10.
 - .5 To wood panels or composition (drywall) panels with wood screws or toggle bolts as the case directs. Do not fasten to such panels less than 12 mm [1/2"] thick without special permission. Provide additional and substantial non-combustible backing behind wood or composition panels in order to provide a secure support for fastening of wall or ceiling mounted equipment such as, television support brackets, wall mounted magnetic door holders, etc.
 - .6 To structural steel members with welded-on studs or clamping devices manufactured specifically for the purpose. Alternatively, and where specifically permitted by the Consultant or Structural Engineer, bolt with nuts and lock-washers may be used in holes drilled through the structure.
 - .7 To sheet-metal with toggle bolts. Unless specifically directed, do not fasten to mechanical equipment enclosures or ductwork.
 - .8 Provide substantial vertical channel iron support with welded 6 mm steel baseplate bolted to floor or housekeeping pad for the support of motor starters and disconnect switches at free-standing motors away from walls. Paint support channels and baseplate with one coat of zinc chromate primer and two finish coats of enamel paint to match surrounding finishes.
- 3.2 Securing of Raceways, Wires, Cable, and Conduit
- .1 Provide metal brackets, frames, hangers, clamps and related types of support structures as required to support conduit and cable runs. Provide "trapeze" type conduit and cable racks consisting of minimum 10mm threaded rods, spring nuts, strut channel, and P-type clamps for all major feeder and branch wiring routes.
 - .2 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Consultant.

- .3 When part of a group of 3 or more runs, secure conduits and cables with pipe clamps to steel channels, heavy duty single or double trapeze hangers, or approved equal. Attach trapeze hangers to the structure with one-piece, threaded-end steel hanger rods, sized to suit the specific load but not less than 10 mm diameter. Prepare and submit loading calculations for all trapeze rack runs carrying cable trays, cables and conduits. Design shall allow for a minimum of 25% future loading and shall be based upon a safety factor of four (4) for hanger rod size and spacing. Use concrete inserts or other specified attachments to fasten hanger rods. Submit proposed anchorages/attachments to the Project Structural Engineer and Seismic Engineer for review. The attachment of conduits and cables to the ceiling suspension system will not be permitted.

3.3 Backboards and Wood Items

- .1 When these specifications or the drawings direct that electrical equipment be mounted on backboards, or when the Contractor elects to mount equipment on such items, cut the board and/or wood square, and neatly and securely attach it to building members. Back-, front- and edge-prime all backboards and apply a second coat of neutral grey enamel to all visible surfaces prior to mounting equipment.
- .2 Where backboards and other wood or timber items are to be installed in or around "non-combustible" construction, plywood and/or wood shall be treated with wood preservers and, as a result, shall bear a ULC label indicating a fire hazard classification rating of 25 for flame spread.

END OF SECTION



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1 GENERAL

1.1 Related Sections

- .1 Section 26 05 01: Electrical General Requirements

1.2 Shop Drawings and Product Data

- .1 Provide certified professionally sealed shop and placement drawings for all electrical equipment and equipment assemblies including runs of cable trays and conduit/cable racks showing the methods of attachment to the particular structure for each piece of equipment and assembly *and provide anchorage/attachment details approved and sealed by a B.C. Professional Engineer for review by the Project Structural Engineer.*
- .2 If requested by the Consultant, calculations *sealed by a Professional Engineer registered in B.C.* shall be provided for the seismic restraint design shown on the shop drawings. Shop drawings shall show the equipment type, manufacturer's name, model number, and weight of the equipment to be restrained.

1.3 Submittals

- .1 Submit samples of materials required to complete the seismic restraint work for review if and when required.

2 PRODUCTS

2.1 Materials

- .1 Earthquake snubbers for resiliently mounted major equipment: Mason Industries Series Z-1011 or equal.
- .2 Security bridles: Minimum #16 ASWG stranded stainless steel aircraft cable.
- .3 All equipment shall be tested in an independent testing laboratory or shall be certified by a *Registered Professional Engineer* to demonstrate that the equipment meets the requirements of all Codes and Bylaws in terms of "withstanding" the lateral forces in any direction to be expected in the project seismic zone. *Withstanding* shall generally mean remaining in one piece and not breaking away from moorings.
- .4 *Approved Professional Engineers* include:
- Mr. Mickey Wang, P.Eng.*
M. Wang Engineering Ltd.
Phone: 738-9089
- Mr. Nelson Lang, P.Eng.*
Lang Engineering
Phone: 872-8776



3 EXECUTION

3.1 Installation

- .1 Provide seismic restraint and anchorage for all equipment and services in accordance with the B.C. Building Code and all applicable Building Bylaws.
- .2 Arrange and pay for the *Professional Engineer* who designed all anchorage/attachments to inspect same on site (note that multiple inspections will be required as the work progresses) and to provide typewritten Inspection Reports to the Consultant throughout construction and to provide as required by the authorities having jurisdiction all required Letters of Assurance and Conformance with the specified Codes, Standards, and Bylaws... All seismic work shall be performed by Division 26, 27 & 28.
- .3 Free-standing equipment shall be fastened to the basic structure using anchorage/attachments to overcome seismic overturning forces as *designed by a Professional Engineer* as noted in this Section.
- .4 Resiliently-mounted major equipment such as core and coil of large power and distribution transformers shall be restrained by earthquake snubbers (Mason Z1011), selected for the weight of each piece of equipment to be protected. Securely bolt snubbers through floor or concrete base/housekeeping pad to basic structure and to the frame of equipment using anchorage/attachments, all as *designed by a Professional Engineer* as noted in this Section.
- .5 All transformer core and coils shall be seismically restrained without short circuiting the sound isolation resilient mounting. All transformer enclosures shall be separately restrained against seismic forces.
- .6 Provide seismic restraint for all cables, raceways, cable trays and bus ducts exceeding 50 mm in any cross-sectional dimension and which are supported more than 300 mm vertically from the basic structure.
- .7 Provide slack cable restraint systems as designed by a *Professional Engineer* as described previously, but generally as follows:
 - .1 Connect slack cable restraints to suspended equipment in such a way that the axial projection of the wires passes through the centre of gravity of the equipment.
 - .2 Orient restraint wires on suspended equipment at approximately 90° to each other (in plan), and tie back to the structure at an angle not exceeding 45° to the horizontal.
 - .3 Select each anchor in the structure for a load equal to twice the weight of the equipment with a safety factor of 4.
 - .4 Install cable using appropriate grommets, shackles, thimbles, U-bolts and other hardware to ensure alignment of the restraints and to avoid bending the cables at connection points.
 - .5 Restraints shall be installed at least 50 mm clear of all other equipment and services.
 - .6 Adjust restraint cables such that they are not visibly slack, but such that the flexibility is approximately 35 mm under thumb pressure for a 1500 mm cable length (equivalent ratio for other cable lengths).



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- .8 Provide transverse and axial restraints within 4 m of a vertical bend.
- .9 Trapeze hangers for cables, cable trays, raceways and bus ducts shall be restrained utilizing minimum 10 mm diameter slack cable restraints which shall be provided at a maximum transverse spacing of 12.5 m and longitudinal restraints at 25 m maximum spacing, or as otherwise limited by anchor/slack cable performance. Adjacent spacing of restraints on a run shall vary by 10% to 30% to avoid coincident resonances.
- .10 Transverse bracing for one raceway section may also act as longitudinal bracing for the raceway connected perpendicular to it, provided the bracing is installed within 610 mm of the elbow or junction box. Branch runs shall not be used to restrain main runs.
- .11 Install a 300 mm length of flexible conduit and a braided bonding jumper in each surface mounted conduit where it crosses a building expansion or seismic joint.
- .12 Install expansion-deflection fittings in each conduit embedded in concrete where it crosses a building expansion or seismic joint. The fitting shall include an integral bonding strap where the conduit is metallic.
- .13 Provide custom fabricated flexible sections allowing horizontal and vertical movement of cable trays at building expansion or seismic joint.
- .14 Rigid support systems 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.) Provide loops in cables and flexible connections in raceways where such services leave a suspended trapeze rack or other support and extend down to floor braced equipment or wall mounted equipment. Freedom of movement shall be up to 300 mm in all directions.
- .15 All recessed lighting fixtures in mechanical grid ceilings (e.g., T-bar) shall be restrained using at least two (2) security bridles per fixture tied to the basic building structure. Attach security bridles at ends of each fixture using a further attachment to each corner of the fixture and in such a manner that the fixture cannot fall lower than 300 mm beneath ceiling.
- .16 Surface-mounted lighting fixtures mounted on mechanical grid ceilings shall be attached to the ceiling system with positive clamping devices that completely surround the supporting members. Security bridles shall be attached between the clamping devices and the adjacent ceiling hanger or to the structure above in the same manner as described for recessed fixture supports.
- .17 Pendant-hung lighting fixtures supported from their outlet boxes shall be provided with a security bridle from the outlet box to an adjacent ceiling hanger or to the structure above in the same manner as described for recessed fixture supports.
- .18 Electrical outlet boxes flush mounted in mechanical grid ceilings shall be anchored to the ceiling grid.
- .19 Ceiling speakers flush mounted in mechanical grid ceilings shall be anchored to the ceiling grid.

END OF SECTION



1 GENERAL

1.1 Related Sections

- .1 Section 26 05 01: Electrical General Requirements

2 PRODUCTS

2.1 Junction Boxes and Pull Boxes

- .1 For conduits 25 mm or smaller, junction boxes and pull boxes shall be galvanized steel type 52171 or 72171 complete with cover plate unless otherwise indicated or required by Canadian Electrical Code.
- .2 For conduits larger than 25 mm, junction boxes and pullboxes shall be manufactured from code gauge steel welded and painted with ASA 61 grey enamel paint. Pull boxes and junction boxes shall be sized in accordance with Canadian Electrical Code for the given conduit sizes and arrangement and number of conductors and splices in the boxes.
- .3 For surface-mounted conduits in wet or damp locations and in all instances where surface-mounted conduits are exposed and are located less than 3 metres above the floor (other than in mechanical and electrical service rooms), junction and pull boxes shall be cast, type FS or FD single- or two-gang, with threaded hubs and gasketed cover plate.

3 EXECUTION

3.1 Junction Box and Pull Box Installation

- .1 Provide junction and pull boxes in all conduit runs on the basis of not more than two right angle bends (or equivalent) or a distance not exceeding 30 m between boxes.
- .2 Do not install junction or pull boxes in finished areas, on finished surfaces, in conspicuous locations, or in public areas. Locate them above accessible ceilings or in mechanical rooms and other similar accessible locations and service areas.
- .3 Coordinate the work carefully with other trades to provide easy and satisfactory access to all junction and pull boxes. Boxes located more than 1200 mm above cosmetic ceilings are deemed inaccessible and shall be lowered and properly supported.
- .4 Relocate pull boxes as directed when proper access has not been provided.
- .5 Where raceways are exposed, and unless directed otherwise, use surface-mounted boxes.
- .6 Where standard make boxes are not suitable for a particular device or conduit connection, provide boxes of special design to fit space and other applicable requirements.
- .7 Provide pull boxes for source and distribution feeders as required and to the local Inspector's approval.

END OF SECTION



1 GENERAL

1.1 Related Sections

- .1 Section 26 05 01: Electrical General Requirements

2 PRODUCTS

2.1 Materials

- .1 Unless otherwise directed, outlet boxes shall be one-piece formed, galvanized, code gauge steel as specified below. Plastic or PVC type boxes are not acceptable.
- .2 Galvanized Steel Boxes:
- .1 100 mm square box - 52151 or 52171 with appropriate device mounting cover (ring) or blank cover.
 - .2 120 mm square box - 72151 or 72171 with appropriate device mounting cover (ring) or blank cover.
 - .3 100 mm octagon box - 54151 or 54171 with appropriate cover plate.
 - .4 100 mm utility box - 1110 or 1110-HV (347 volt).
 - .5 100 mm masonry box - MBD series with number of gangs as needed (MBS series in shallow walls).
 - .6 4-gang wall mounted boxes as indicated on drawings, 125mm by 70mm deep as manufactured by Spider. Provide barrier between each gang.
 - .7 100 mm gang boxes - GSB series with appropriate device mounting cover and number of gangs.
 - .8 One-piece electrogalvanized steel construction (sectional boxes shall not be used).
 - .9 Knock-out arrangement to suit site conditions.
 - .10 Mounting brackets welded to the back as required.
 - .11 Extension rings of same general construction as the box, with depth to suit construction.
 - .12 Ground screw.
- .3 Cast Aluminum Boxes:
- .1 Weatherproof surface-mounted boxes.
 - .2 FS (shallow) or FD (deep) single- and two-gang boxes with appropriate gasketed device cover approved for use with such boxes.
 - .3 Threaded hubs to accept threaded conduits.

3 EXECUTION

3.1 Installation

- .1 Outlet boxes installed flush in metal stud walls shall be fastened to the wall in a minimum of two places which are located on the opposite sides of the box. Provide additional mounting channel and/or brackets if required to support each box in such a manner. Box shall be firmly attached to the wall, independent of subsequent device cover plate installation.
- .2 Unless otherwise noted or specified herein, install all outlets flush with the final finished surface.



- .3 Where standard make boxes are not suitable for a particular device or conduit connection, provide boxes of special custom design to fit space and other applicable requirements. Provide special multi-gang Spider boxes as indicated on drawings. Coordinate exact location on site prior to rough-in.
- .4 Unless otherwise directed, do not install outlets back-to-back. Allow a minimum of 150 mm horizontal clearance between outlet boxes. Where it is required that outlets be installed back-to-back or where recessed outlets are installed in close proximity to one another on both sides of a common stud construction "party-wall," install within the wall between the outlets extending from stud to stud (minimum height to be 600 mm centered on the box) a non-combustible, rated fire barrier and sound septum (20 mm drywall or other approved equal) for reduction of noise transmission from outlet to outlet and to act as a fire barrier, to the satisfaction of the authorities having jurisdiction.
- .5 Caulk all cracks and openings between outlet boxes and finished exterior walls with an expansive non-shrinking grout. Provide duct seal in conduits at the outlet boxes after all conductors installed so as to prevent air flow.
- .6 Recessed outlet boxes in metal grid ceilings (e.g. T-bar) shall be fastened to metal support channels spanning the ceiling grid. Two channels shall be fastened to the ceiling grid.
- .7 Unless otherwise directed, use boxes not smaller than No. 54151 or No. 52151 or deeper, for surface mounted or concealed general use junction boxes and outlets.
- .8 Fit flush mounted lighting fixture outlet for fixtures whose mounting surfaces or stem canopies will not cover the outlet box opening with plaster ring of correct size and depth.
- .9 All outlet boxes installed in concrete and masonry shall be protected from the concrete pour and the weather by filling the boxes with paper, sponges or foam, or similar approved material during construction. Immediately after concrete pour, outlet boxes shall have their conduits positively plugged to avoid the entrance of water and debris. After closing in of the work, all outlet boxes showing evidence of rusting or intrusion of concrete shall be cleaned out and protected with a rust inhibiting paint. Remove all temporary filling and protecting material upon completion of work.
- .10 When boxes of sizes and arrangements other than standard single- or multi-gang types are required, use factory manufactured boxes without knock-outs of Code gauge steel with screw-fastened painted covers. At locations exposed to weather or frequent wetting, boxes shall have continuous welded seams and shall be hot-dipped galvanized after fabrication. At such locations, fit special hot-dipped galvanized covers with neoprene gasketting.
- .11 Generally for surface mounted single- or multi-gang switch, receptacle or telephone outlets, use Type FS or FD boxes of corrosion-resistant cast metal as required with covers as directed elsewhere.
- .12 Generally for surface mounted single-gang switch, receptacle or telephone outlets, use "two-piece" surface boxes of the proper configuration. For surface mounted multi-gang switch, receptacle or telephone outlets, use solid boxes with the correct number of gangs and special covers with rolled back edges as directed elsewhere. Do not use boxes with device covers.

- .13 For single- or multi-gang surface mounted outlets at locations exposed to the weather or frequent wetting, and at other locations where directed, use Type FS or FD boxes as required. Outlet box and cover to be of a material that is compatible with the conduit used in order to avoid galvanic corrosion. Covers to be of the type to suit the devices to be installed.
- .14 Provide all outlet boxes required for heavy duty and high ampacity receptacles. Where required, boxes shall be specially made to fit within walls specified.
- .15 Outlet boxes installed in concrete or masonry shall be Masonry Boxes, 100 mm octagonal Concrete Rings, or 100 mm square or multi-gang MBD boxes approved for use in concrete with device covers as the use dictates. Boxes intended to be mounted at the same height in block walls, shall be mounted so that the bottom of the boxes are set on the same block joint. Patch all voids between boxes and masonry with low conductivity, high tensile strength, expansive, non-shrinking concrete grout.

END OF SECTION



1 GENERAL

1.1 Section Includes

- .1 Conduits, conduit fastenings, and conduit fittings

1.2 Location of Conduit

- .1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

2 PRODUCTS

2.1 Conduits

- .1 Electrical metallic tubing (EMT): galvanized steel.
- .2 Unless otherwise indicated, rigid conduit shall be galvanized steel, threaded type.
- .3 Flexible conduit and liquid tight flexible conduit shall be aluminium.

2.2 Conduit Fittings

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.
- .3 EMT couplings and connectors shall be malleable steel, set screw type. Connectors shall have insulated throats. Cast fittings are not acceptable.
- .4 Couplings and connectors for rigid conduit: threaded type, galvanized steel.
- .5 Connectors for flexible conduit: of the type clamping the outside surface of the conduit, and with insulated throats.
- .6 Liquid-tight fittings for liquid-tight flexible conduit: equivalent to T&B 'Super-Tite' 5000 Series. All connectors shall have insulated throats.
- .7 Nylon-Insulated Conduit Bushings: T&B or equal.

2.3 Pull cord

- .1 For 25 mm or larger trade size conduit: 6 mm diameter nylon or polypropylene cord or other approved product.

3 EXECUTION

3.1 Installation - General

- .1 Wire all power, lighting, and communication systems and security in the building in conduit except where specified otherwise or detailed on the drawings. No free air installations are allowed. Generally and where permitted by the Canadian Electrical Code, use galvanized EMT unless otherwise noted.
- .2 Do not install EMT where it may be subject to mechanical injury.
- .3 Do not run conduits through corners



- .4 For any one conduit section, use the maximum possible conduit length. Installations which use partial lengths and/or excessive number of couplings shall not be acceptable and shall be replaced at contractor's expense.
- .5 Minimum size of conduit shall be $\frac{3}{4}$ inch for power and lighting branch circuits and minimum one inch for data, security and LV.
- .6 Conceal all conduits except in service spaces and in unfinished areas unless otherwise indicated.
- .7 Horizontal conduit runs shall, wherever possible, be tight to the underside of concrete slab. Exposed conduit runs for service and distribution feeders may be installed in more than one layer when required. Submit sketches to the Consultant prior to installation showing intended conduit runs.
- .8 Use rigid steel conduit for the following:
 - .1 At all locations where the conduit is subject to mechanical injury.
 - .2 At all exterior locations where conduit is exposed to the weather.
 - .3 In masonry at all locations where EMT cannot or will not be effectively protected from damage during construction.
 - .4 At all points where conduits emerge from concrete floors, columns, walls, etc.
- .9 Unless specifically directed to the contrary, use flexible conduit only for final connections to recessed lighting fixtures or equipment mounted on vibrating or moving installations. Such connections shall comply with the Code but otherwise shall be kept as short as possible without impeding free travel or removal for inspection when required, and without permitting undue strain on the raceway or its connections during normal operation.
- .10 Flexible conduit in accessible ceiling spaces shall not be draped on ceiling tiles but shall be fastened to the underside of the structure using manufacturer's approved fastening devices. Flexible conduits shall not run draped below pipes and ducts but shall be fished over such obstructions.
- .11 Use liquid-tight flexible conduit for the following:
 - .1 Where flexible conduit is required at locations exposed to the weather or frequent wetting.
 - .2 At all motor and equipment connections.
- .12 Install exposed conduits in close parallel groups wherever two or more conduits running in the same direction would otherwise be within 1800 mm of each other.
- .13 Install all conduits parallel or at right angles to building lines, as the case directs.
- .14 Do not install conduit through structural members unless specific contrary instructions are given.
- .15 Do not attach conduits to any portion of the ceiling suspension system or to mechanical ductwork or piping or its suspension system.

- .16 Adjust the locations of conduits, outlets and other raceway components as required to provide proper access and operating clearance for convector dampers, air mixing boxes, access hatches, inspection and/or service parts and other similar items installed throughout the building.
- .17 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- .18 Conduit stub-outs for the extension of open communication wiring shall be fitted with nylon insulated bushings.
- .19 Ream and de-burr the ends of each conduit length prior to installation.
- .20 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .21 Install a pull cord in all empty conduits.

END OF SECTION



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1 GENERAL

1.1 Section Includes

- .1 Motor Starters
- .2 Motor control and power wiring.

1.2 Related Work

- .1 Section 26 05 01: General Electrical Provisions

2 PRODUCTS

2.1 Motor Starters

- .1 All motor starters supplied under Division 26 shall be of the same manufacturer.
- .2 Motor starters are indicated in the Motor Schedule by letter types in conjunction with numerical suffixes. The letters indicate the type of starter and the numerals indicate special features which must be incorporated into or placed adjacent to the starters as specified.
- .3 The following letter types shall apply:
 - .1 **Type A** - Magnetic in general purpose enclosure
 - .2 **Type B** - Magnetic in Motor Control Centre
 - .3 **Type C** - Manual starter in general purpose enclosure
 - .4 **Type D** - Manual open type flush mounted in switchbox and fitted with plate to match other switch plates in the area
 - .5 **Type E** - Manual with special features - see Specification
 - .6 **Type F** - Combination breaker/magnetic starter in an EEMAC I enclosure. Overcurrent device rating shall be as noted in the Motor Schedule. Overcurrent devices to be capable of being locked OFF" and ON
 - .7 **Type G** - Combination unfused switch/magnetic starter in an EEMAC I enclosure
 - .8 **Type H** - Fusible switch in Motor Control Centre
 - .9 **Type R-2(2SP)** - two-speed relay type starter w/o overload heaters. Locate in EEMAC I enclosure. Refer to drawings for wiring diagrams.
- .4 The following suffixes shall apply:
 - .1 Reset only in cover.
 - .2 Reset and HAND-OFF-AUTOMATIC or LOCAL-OFF-REMOTE switch in cover.
 - .3 Reset and START-STOP pushbuttons in cover.
 - .4 Run (red) and Stop (green) PUSH-TO-TEST pilot lights in cover.
 - .5 Fitted with special features - see Motor Schedule.
 - .6 Reset and ON-OFF selector switch in cover.
- .5 All individual starters shall have RUN and STOP pilot lights, with PUSH-TO-TEST feature, and START/STOP pushbuttons or selector switches as required or indicated.
- .6 Starters located in finished areas (other than service spaces) shall be of a flush-mounted type with stainless steel cover.



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- .7 Fit all motor starters supplied under Division 26 with adjustable electronic overload trips in all normally ungrounded lines.
- .8 All magnetic starters, including combination starters provided under Division 26 shall be complete with 4 sets of spare auxiliary contacts (2 sets N/C, 2 sets N/O, all sets reversible). Each and every starter shall have a separate control transformer complete with fused secondary protection at 120 volt, 60 Hz AC. Transformer volt-ampere rating will be confirmed with Division 23 prior to ordering. Where line overcurrent protection exceeds 15 amperes, provide primary fuses for the control transformers.
- .9 Minimum magnetic starter size shall be CEMA Size 1.
- .10 Coordinate with the BMS Controls contractors. Interposing relays required to interface BMS system to the wiring in motor starters shall be provided by BMS Controls Contractor.
- .11 Starters shall be as manufactured by Allen Bradley, Klockner Moeller, Cutler Hammer or Square D.

2.2 Miscellaneous Control Devices

- .1 Pushbuttons: Heavy Duty Oil-Tight
- .2 Selector Switches: Heavy Duty Oil-Tight
- .3 Indicating (Pilot) Lights: Transformer Base PUSH-TO-TEST Type Employing General Electric #23, 6 volt indicator lamps or approved equal. Coordinate the pilot light transformer and circuit voltages such that not more than 6 volts are available at the lamp terminals.
- .4 Control Circuit Transformers: Confirm the volt-ampere rating of the control transformer with Division 23 prior to ordering.

3 EXECUTION

3.1 Motor Starters

- .1 Install, and wire adjacent to the starters, all devices, equipment, and enclosures described in the Mechanical Equipment Schedule with applicable special letter types and suffixes.
- .2 Furnish and install for every motor in the building, unless otherwise noted, either a manual or magnetic motor starter as indicated in the Motor Schedule.
- .3 Check the actual nameplate current rating of all motors installed before ordering the electronic overloads for motor starters. Adjust the electronic overloads to suit the motors installed. The Contractor shall be liable for any damage to motors attributing to improper selection or set-up of electronic overloads.
- .4 Provide power connections from the Motor Control Centre to the VSC and from the VSC to the motor.



3.2 Motor Control Wiring

- .1 All motor control wiring (120 V line voltage and 24 V low voltage) including conduit as well as supply and installation of control devices will, except where specifically noted on the electrical drawings, in the Motor Schedule, or outlined below, be provided as described in Division 23 of the Specification. Except where specifically directed to the contrary, motor control wiring, associated conduits, and control devices do not form a part of Division 26 work.
- .2 The motor control work which shall be provided under Division 26 shall include the following:
 - .1 All conduit and control wiring specifically noted on the drawings and outlined in the different parts of the Specification.
 - .2 All control wiring as specified in the Mechanical Equipment Schedule.
 - .3 Control wiring related to air handling shutdown during fire alarm.

3.3 Motor Power Wiring

- .1 Connect all motors shown on the drawings or mentioned in this Specification. The locations of motors are approximate only. Check to determine correct locations and install wiring to these points.
- .2 Responsibility of supplier and installer is indicated in the Mechanical Equipment Schedule Appendix 'B' in Electrical Specifications. Related mechanical responsibility is indicated on the Mechanical Equipment Schedule on mechanical drawings.
- .3 Check motor rotation before mechanically coupling to load.
- .4 Except where otherwise directed, connect all motors with flexible conduits. Ground the conduit system with a separate grounding conductor installed in the flexible conduit.

END OF SECTION



1 GENERAL

1.1 Section Includes

- .1 General purpose switches.
- .2 HP-rated switches.
- .3 Receptacles.
- .4 Dimmers
- .5 Occupancy Sensors
- .6 Cover plates.
- .7 Pilot lights.

1.2 Related Sections

- .1 Section 26 05 01: Electrical General Requirements
- .2 Section 26 28 20: Ground Fault Circuit Interrupters - Class A.

2 PRODUCTS

2.1 Switches

- .1 All line voltage switches shall be 20A, white colored flush toggle type, single-pole, three-way, four-way, 3-position, etc., as indicated on the drawings.
- .2 Line voltage switches, shall be premium Specification grade, complete with grounding terminal for installation of a ground wire jumper to the ground stud on the outlet box.
- .3 Manually operated general purpose AC switches with following features:
 - .1 Terminal holes approved for #10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine molding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
- .4 For switch and pilot light assembly, use two-gang boxes. Pilot light assembly shall consist of LED lamp (50,000 hour),
- .5 Where key-operated switches are required, they shall be of the same series.
- .6 Toggle switches used as disconnects for fractional horse-power motors shall be HP-rated.
- .7 Switches shall be of one manufacturer throughout project.



2.2 Receptacles

- .1 All receptacles shall be of Specification Hospital Grade with white color for non-essential and red for essential power and orange for isolated ground throughout the project.
- .2 Duplex receptacles, CSA type 5-20 RA, 125 V, 20 A, with following features:
 - .1 Urea molded housing.
 - .2 Suitable for #10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side-wiring screws.
 - .5 Triple-wipe contacts and rivetted grounding contacts.
 - .6 Equivalent to Pass & Seymour or Hubbell Heavy Duty Hospital Grade receptacle.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles are to be of one manufacturer throughout project.
- .5 Receptacles shall have minimum ground pin tension of 2.7 N and minimum twin-pin tension of 13.3 N.
- .6 Receptacles shall be as manufactured by Pass & Seymour, Arrow-Hart, Legrand, or Hubbell.

2.3 Cover plates

- .1 All cover plates for flush switches, receptacles shall be stainless steel
- .2 Telephone outlets, communication outlets, etc., shall be Nylon. Color to PHSA Standards.
- .3 Where two or more switches, dimmers, receptacles, jacks are in tandem, use multiple gang outlet box for each type and common cover-plates.
- .4 Weatherproof cover plates shall be spring-loaded cast aluminum complete with gaskets for single or duplex receptacles or switches.
- .5 Colour of plates shall be in accordance to Hospital Standards and CSA colour coded.

2.4 Dimmers and Occupancy sensors

- .1 Wall mounted occupancy sensors shall be combination of dimmers /vacant sensors, turned on manually and turns off the lights automatically once the room is vacant after 5 minutes..
- .2 Ceiling mounted occupancy sensors shall be dual technology and shall only turn the lights off once the space is vacant after 5 minutes. .Lighting on shall only be controlled by the wall mounted dimmers or lighting switches.
- .3 Dimmers shall be specification grade compatible with the Lighting fixtures LED
- .4 All dimmers shall be grouped under one cover plate.
- .5 Cover plate shall be white.



- .6 Electrical contractor shall allow for lighting controllers, and any accessories required to make the system functioning.
- .7 Approved manufacturers: Lutron, Steinel

3 EXECUTION

3.1 Lighting Switches

- .1 Line voltage lighting switches shall be ganged wherever shown close together on the drawings.
- .2 Install ground wire jumper between the ground terminal of lighting switches and the ground stud of the outlet box.

3.2 Receptacles

- .1 Install receptacles in gang-type outlet box when more than one receptacle is indicated in close proximity.
- .2 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3 Cover plates shall be properly aligned and fit tightly to walls on which they are mounted. Any dimpling or buckling caused by fixing of screws shall be cause for correcting position of the outlet box if necessary and replacement with a new cover plate at no additional cost.
- .4 Where isolated ground receptacles are used, extend separate insulated ground wire in branch circuit conduit from the isolated ground receptacles back to panel board, and bond to case of panel board.

END OF SECTION



1 GENERAL

1.1 Section Includes

- .1 Breaker type ground fault interrupter

1.2 Related Sections

- .1 Section 26 05 01: Electrical General Requirements

2 PRODUCTS

2.1 Ground Fault Circuit Interrupter Receptacle

- .1 Self-contained with 15 A, 120 V circuit interrupter and duplex receptacle complete with:

- .1 Solid state ground-sensing device.
- .2 Facility for testing and reset.
 - .1 Cover plate as specified in Section 26 27 26 - Wiring Devices.
 - .2 CSA Class A certified.
 - .3 Equal to Hubbell No. GF-5252I.

2.2 Circuit Breaker-Type Ground Fault Interrupter

- .1 Single-pole ground fault circuit interrupter for 15/20/30/40/A, 120/208 V, 1-phase operation as indicated on drawings and/or panelboard schedules and complete with test and reset facilities.
- .2 Sensitivity 5mA (standard). Use 30mA for heat tracing cables.
- .3 2-pole units to have indication and provision for remote indication.
- .4 Circuit breakers to have thermal and magnetic trip units and to be integral to the panelboard.
- .5 Circuit breakers to be of similar construction and of same manufacturer as the non-ground fault units in the same panelboard.

3 EXECUTION

3.1 Installation

- .1 Do not ground neutral on load side of ground fault relay.
- .2 Connect supply and load wiring to equipment in accordance with manufacturer's recommendations.
- .3 All exterior-mounted receptacles, pool pumps, and pool lighting circuits shall be protected by ground fault circuit interrupters.
- .4 Provide self-contained GFCI type receptacles where indicated.
- .5 If the manufacturer of the panelboard being used throughout this project has available a Type A GFCI, designed to replace normal circuit breakers in the panel boards, such a device may be used. Alternately, a separate approved GFCI shall be used.



3.2 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 01 Electrical - General Requirements.
- .2 Arrange and pay for field testing of ground fault equipment by Contractor before commissioning service.

END OF SECTION



1 GENERAL

This section of the Specifications forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.

1.1 Section Includes

- .1 Molded-case circuit breakers.

1.2 Related Sections

- .1 Section 26 05 01: General Electrical Provisions

1.3 Product Data

- .1 Submit product data.
- .2 Include time-current characteristic curves for all new breakers.

2 PRODUCTS

2.1 Molded Case Circuit Breakers

- .1 **All circuit breakers shall be fully rated.**
- .2 **Series rated circuit breakers shall not be permitted.**
- .3 All circuit breakers shall be electronic circuit breakers with adjustable settings.
- .4 Three--pole circuit breakers shall have a common tripping mechanism and single handle. Handle ties are not acceptable.
- .5 Provide one loose spare breaker for each rating size in addition to those noted on the Drawings.

2.2 Circuit Breaker Locks

- .1 Supply and install circuit breaker handle guards fabricated specifically for the circuit breakers supplied in panelboards to prevent accidental manual operation. The above requirement shall be mandatory for circuit breakers feeding mechanical control devices, Exit lights, Fire Alarm System, Security System, Communications Relay Rack, Nurse Call System.
- .2 Provide padlock devices were indicated to permit locking of breakers in the OFF position.

3 EXECUTION

3.1 Installation

- .1 Install circuit breakers and breaker locks as indicated on the Drawings and as required.
- .2 Set the magnetic trip element of all adjustable breakers to the approved setting.

END OF SECTION



1 PRODUCTS

1.1 Loose Disconnect Switches

- .1 Provide all fused disconnect or safety switches as shown on the drawings and/or as required by Code, complete with fuses where applicable.
- .2 Heavy duty rated 250 and 600 volt as applicable.
- .3 Solderless neutral bar where required.
- .4 CSA Enclosure NEMA 3R
- .5 Provision for padlocking in ON and OFF switch position.
- .6 Mechanically interlocked door to prevent opening when handle in ON position. Interlock to be voidable.
- .7 Fuse holders: suitable without adapters, for type and size of fuse indicated.
- .8 Quick-make, quick-break action.
- .9 ON-OFF switch position indication on switch enclosure cover.
- .10 Disconnect switches shall be manufactured by Schneider Group, Cutler-Hammer, Square D, Commander,.

2 EXECUTION

2.1 Installation

- .1 Install disconnect switches complete with fuses.
- .2 Provide approved disconnecting means for each and every motor as required by Code.
- .3 Fractional HP motors equipped with integral overload protection may use HP-rated toggle switches as a disconnecting means.

END OF SECTION



-
- 1 GENERAL
- 1.1 General Requirements
- .1 This section of the specification's forms part of the Contract Documents and is to be read, interpreted, and coordinated with all other parts.
- 1.2 Related Sections
- .1 Section 26 05 01: General Electrical Provisions
- .2 Section 26 05 21: Wiring
- .3 Section 26 05 34: Conduits, Conduit Fastenings, and Conduit Fittings
- 1.3 References
- .1 CAN/ULC-S524, latest edition, Installation of Fire Alarm Systems
- .2 ULC-S525, latest edition, Audible Signal Appliances, Fire Alarm
- .3 CAN/ULC-S527, latest edition, Control Units, Fire Alarm
- .4 ULC-S528, latest edition, Manually Actuated Signaling Boxes, Fire Alarm
- .5 CAN/ULC-S529, latest edition, Smoke Detectors, Fire Alarm
- .6 ULC-S530, latest edition, Head Actuated Fire Detectors, Fire Alarm
- .7 CAN/ULC-S536, latest edition, Inspection and Testing of Fire Alarm Systems
- .8 CAN/ULC-S537, latest edition, Verification of Fire Alarm Systems
- 1.4 Requirements of Regulatory Agencies
- .1 The Fire Alarm System shall be Simplex 4100ES
- .2 The Fire Alarm System shall be fully addressable, Class A wired.
- .3 System components: listed by ULC and comply with applicable provisions of B.C. Building Code, and meet requirements of local authority having jurisdiction.
- 1.5 Shop Drawings-
- .1 Submit shop drawings in accordance with Section 26 05 01 Electrical General Requirements.
- .2 A riser wiring diagram identifying new control equipment, initiating zones, and signaling circuits; identifying terminations, terminal numbers, conductors, and raceways.
- .3 Details and performance specifications for control, annunciation and peripherals with item by item cross reference to specification for compliance.



- 1.6 Operation and Maintenance Data
- .1 Provide operation and maintenance data for any new fire alarm components for incorporation into manual specified in Section 26 05 01.
- 2 PRODUCTS
- 2.1 Materials
- .1 Equipment and devices: ULC listed and labeled and supplied by single manufacturer. Manufacturer to be Microm. All devices to match.
- .2 Audible signal devices: to ULC-S524.
- .3 Control unit: to CAN/ULC-S527.
- .4 Manual fire alarm stations: to ULC-S528.with protective covers
- .5 Thermal detectors: to ULC-S530.
- .6 Smoke detectors: to CAN/ULC-S529.
- 2.2 Initiating/Input Circuits
- .1 Receiving circuits for alarm-initiating and supervisory devices such as manual pull stations, smoke detectors, heat detectors and water flow switches, wired in Class A configuration.
- .2 Alarm-receiving circuits (active and spare): compatible addressable devices.
- .3 All devices to match existing.**
- .4 All manual pull stations to have protective covers with local sounders.**
- .1 Alarm output circuit: connected to audible and visual signaling devices, wired in Class A configuration.
- 2.3 Auxiliary Circuits
- .1 Auxiliary contacts for control functions.
- .2 Actual status indication (positive feedback) from controlled device.
- .3 Alarm and/or supervisory trouble on system to cause operation of programmed auxiliary output circuits.
- .4 Upon resetting system, auxiliary contacts to return to normal or to operate as pre-programmed.
- .5 Auxiliary circuits: rated at 2 A, 24 V DC or 120 V AC, fuse-protected.
- .6 All devices to match existing.



- 2.4 Wiring
- .1 As required by the Fire Alarm manufacture.
- 3 EXECUTION
- 3.1 Installation
- .1 Install systems in accordance with CAN/ULC-S524.
- .2 The Fireworks at HOSPITAL shall be modified to incorporate the new project.
- .3 Main tie-in to the fire alarm system and fire alarm verification are to be completed by the landlord's contractor. Electrical contractor for the project is to hire and carry landlord' contractor for this scope of work
- .4 Supply install a separate isolator for the new FA zone at all new zones as per 4.2.8 of CAN/ULC-S524-01
- .5 Addressable modules, end of line resistors as shown on the drawings with new wiring and conduits.
- .6 The Fire alarm graphic interface shall be modified to add all new devices and floor plans.
- .7 Existing and new sprinkler flow switches and supervisory switches to remain and be connected to the fire alarm system with annunciation as per existing scheme. The Fire Alarm zones and sprinkler system zones must coincide.
- .8 Control of selected mechanical air handling systems and dampers during a fire alarm will be provided by Division 25
- .9 Devices such as magnetically locked doors (card access) will be wired to release upon second stage Fire Alarm and magnetic hold open devices to release door on first stage FA.
- .10 Modify Fire Alarm Annunciators as required in the hospital.
- .11 Electrical contractor shall be responsible for obtaining Fire Alarm Single diagram from Simplex as well as location of all graphic and LCD Annunciators in the hospital in order to carry in his bid the required annunciators to be modified.
- 3.2 Wiring
- .1 The Contractor shall obtain from the manufacturer a detailed composite wiring diagram custom made for this project complete with wire sizes, quantity and colour coding.
- .2 Wiring colour coding for fire alarm system shall be to Fraser Health Hospital Standards (colour must be impregnated in conductor insulation and not bonded during construction).
- .3 Conductors shall 2 hour fire rated MIC for risers from floor to floor or from one FA Zone to another zone. Minimum conductor size shall be as per manufacturer recommendations.
- .1 All conductors entering and leaving the control panel shall be terminated on individual terminals which are identified.
- .2 Provide necessary raceways, cable and wiring to make interconnections to all equipment as required by equipment manufacturer and the Contract Documents.



- .3 Ensure that wiring is free of opens, shorts or grounds, before system testing and handing over.
- .4 All devices on supervised circuits shall be connected such that each incoming and outgoing conductor is broken, stripped and terminated on separate connection points.
- .5 Splices in wiring conductors are not permitted anywhere in the system.
- .6 Identify circuits and other related wiring at central control unit and annunciator.

3.3 Field Quality Control

- .1 Perform tests in accordance with Section 26 05 01 and CAN/ULC-S537.
- .2 Upon completion of the installation, arrange and pay for the system manufacturer's representative to test and verify the system and to certify in writing to the Consultant that:
 - .1 Each and every device has been checked individually for operation and zoning.
 - .2 Each and every device has been checked individually for supervision by unplugging or conductor removal.
 - .3 All features as specified have been tested.
- .3 **Electrical contractor shall allow for multiple verifications due to the phasing of the project. Refer to architectural drawings.**
- .4 **It shall be the responsibility of the contractor to verify Fire Alarm zones beyond the project zone if required at no extra cost.**
- .5 **The contractor shall coordinate with Simplex during the tender period. No claim shall be allowed for lack of coordination.**
- .6 After a complete and 100% successful verification procedure, Verification Company shall provide a ULC-S537 APPENDIX A verification report.
- .7 Include for qualified field electricians to be available for the manufacturer's verification, and the Owner's acceptance testing and demonstration.
- .8 Provide final programming incorporating program changes made during construction.

END OF SECTION



General Notes:

- ❖ All lighting fixtures shall be Specifications Grade 120 Volt unless specifically noted otherwise.
- ❖ Due to constant changes in catalogue numbers, all numbers indicated must be verified with the luminaire description and confirmed with the vendor prior to ordering. Catalogue numbers are not necessarily complete and may not indicate all options that are specified. Options specified must be provided.
- ❖ Manufacturers Listed below are approved if they meet the indicated specifications.
- ❖ It is the responsibility of the Electrical contractor to review the reflected ceiling plan provided under the architectural drawings and provide the proper installation kits for Grid ceiling and Dry ceiling at no extra cost.
- ❖ Lighting suppliers & distributors shall confirm that the delivery of lighting fixtures will not exceed 6 weeks before signing the PO. If for any reason the delivery got delayed, the contractor/dealer shall use the expedited delivery method at their own cost or the contractor shall cancel the PO and contract another dealer/supplier to meet the delivery schedule.
- ❖ All LED Drives and back up batteries shall have 5-year warranty including labour.
- ❖ All lighting fixtures shall be manufactured in Canada, USA or Europe and shall be CSA Certified. Other countries are not acceptable.
- ❖ All lamps in the project shall be low mercury content such that a minimum of 90% of the lamps must meet a target for the overall average of mercury content in lamps of 70 picograms per lumen-hour or less. Electrical contractor to submit cut sheets confirming this.

	Image	Description
Z14D		• Recessed 1x4 LED Lighting fixture with unique floating diffuser. Lens element features an optical microstructure. • Lens element features an optical microstructure with glare control and high levels of efficiency. • 4000K with CRI>90, • 120V • LED modules and drivers are replaceable from below. • 3000 Lumen output (high output) • Dimmable <u>Manufacturer</u> Focal Point—FZR-14-FL-3000L-940K-1C-UNV-LD1-G-WH

J14D	 1' x 4'	• Recessed 1 X 4 Clean room LED Lighting fixture • One-piece sealed housing, smooth exterior doorframe and lens for infection prevention and simplified cleaning protocols • Symmetrical distribution • OPTICS: High-efficiency diffused, tempered glass-internal reflection optics to work in conjunction with diffused lens providing symmetry while maintaining uniform appearance. • 4000K with CRI>90 • 5000 lumens-120V. 95 Watt, IP 65 • Anti-microbial finish including housing and doorframe • Dimmable • Installed in dry ceiling <u>Manufacturer:</u> vHealth- SUR-1x4—D1MV-4000K, 90 CRI Amico
J22D	 LIGHTING	• Similar to J14D but 2x2 ft.
Q18 (18 inch)	 ide	• Valence light under cabinet • Matte white acrylic resin lens with antimicrobial paint • 4000K, LED, 120V • 1600 Lumens • White colour <u>Approved Manufacturers</u> • vHealth –TUCL series

EXIT SIGN		• Running Man Exit sign • Stainless steel body • 120 minutes back up battery • AC-120V • Refer to drawings for directions and double face. <u>Manufacturers</u> • STANPRO • Lumacell • Thomas & Bett, Begalli

DATE: 27-Feb-25
Revision 0

[illegible]

PANEL PP-E1A-Vital Power
Existing

	WATTAGE			BRKR	CCT	PH	PH	PH	CCT.	BRKR	WATTAGE			
DESIGNATION	PH.A	PH.B	PH.C	AMPS	NO.	A	B	C	NO.	AMPS	PH.A	PH.B	PH.C	DESIGNATION
EXISTING				EX	1				2					SPACE
LIGHTING - PHARMACY		200		15A	3				4					SPACE
SPACE					5				6	EX				EXISTING
EXISTING				EX	7				8	EX				EXISTING
EXISTING				EX	9				10					SPACE
EXISTING				EX	11				12	EX				EXISTING
SPARE				EX	13				14	EX				EXISTING
EXISTING				EX	15				16					SPACE
SPACE					17				18	EX				EXISTING
SPARE					19				20					SPACE
EXISTING				EX	21				22					SPACE
EXISTING				EX	23				24					SPACE
EXISTING				EX	25				26	EX				EXISTING
EXISTING				EX	27				28	EX				EXISTING
EXISTING				EX	29				30					SPACE
EXISTING				EX	31				32	EX				EXISTING
EXISTING				EX	33				34					SPACE
EXISTING				EX	35				36	EX				EXISTING
EXISTING				EX	37				38					SPACE
EXISTING				EX	39				40	EX				EXISTING
EXISTING				EX	41				42	EX				EXISTING
EXISTING				EX	43				44					
RECEPTACLE - ANTEROOM		300		15A	45				46	EX				EXISTING
EXISTING				EX	47				48	EX				EXISTING
EXISTING				EX	49				50	EX				EXISTING
EXISTING				EX	51				52	EX				EXISTING
EXISTING				EX	53				54	EX				EXISTING
EXISTING				EX	55				56	EX				EXISTING
EXISTING				EX	57				58	EX				EXISTING
EXISTING				EX	59				60	EX				EXISTING
EXISTING				EX	61				62					SPACE
EXISTING				EX	63				64					SPACE
EXISTING				EX					66	EX				EXISTING
EXISTING				EX	67				68					SPACE
EXISTING				EX	69				70					SPACE
EXISTING				EX	71				72					SPACE
EXISTING				EX	73				74					SPACE
EXISTING				EX	75				76					SPACE
EXISTING - PHARMACY					77				78					SPACE
					79				80	EX				EXISTING
RECEPTACLE - COMPOUNDING RM		300		15A	81				82	EX				EXISTING
EXISTING				EX	83				84	EX				EXISTING

0	800	0

LOCATION - Corridor
VOLTS - 120/ 208
PHASE - 3
WIRE - 4
PANEL TYPE - 84-circuit
MOUNTING - Recessed
MAIN BUS AMPS - 100 Amp
INTERRUPTING CAPACITY -
FEEDER AWG -
Main Circuit breaker -

TOTAL LOAD
AMPS/PH

0	0	0
0	800	0
0.0	6.7	0.0

TOT. LOAD 0.8 KVA

Notes:
15GFI = 15A Ground Fault Breaker 30mA RCD, IEC60364 Compliant
15 = 15A Standard 1 pole breaker
15-2p = 15A Standard 2 pole breaker
15-3p = 15A Standard 3 pole breaker
15* = 15A Standard 1 pole breaker c/w Lock On Device

PANEL PP-E1A-Vital Power
Existing

	WATTAGE			BRKR	CCT	PH	PH	PH	CCT.	BRKR	WATTAGE			
DESIGNATION	PH.A	PH.B	PH.C	AMPS	NO.	A	B	C	NO.	AMPS	PH.A	PH.B	PH.C	DESIGNATION
EXISTING				EX	1				2					SPACE
EXISTING				EX	3				4	EX				EXISTING
EXISTING				EX	5				6	EX				EXISTING
EXISTING				EX	7				8	EX				EXISTING
EXISTING				EX	9				10	EX				EXISTING
EXISTING				EX	11				12	EX				EXISTING
EXISTING				EX	13				14					SPACE
EXISTING				EX	15				16	EX				EXISTING
EXISTING				EX	17				18	EX				EXISTING
EXISTING				EX	19				20	EX				EXISTING
EXISTING				EX	21				22	EX				EXISTING
EXISTING				EX	23				24	EX				EXISTING
EXISTING - PHARMACY					25				26	EX				EXISTING
EXISTING - PHARMACY				EX	27				28	EX				EXISTING
EXISTING				EX	29				30	EX				EXISTING
EXISTING				EX	31				32	EX				EXISTING
EXISTING				EX	33				34	EX				EXISTING
EXISTING				EX	35				36	EX				EXISTING
EXISTING				EX	37				38	EX				EXISTING
EXISTING				EX	39				40	EX				EXISTING
EQUIPMENT - COMPOUNDING ROOM			500	20A	41				42					SPACE
EXISTING				EX	43				44					SPACE
EXISTING				EX	45				46					SPACE
RECEPTACLE - COMPOUNDING RM			300	15A	47				48					SPACE
RECEPTACLE - COMPOUNDING RM	300			15A	49				50					SPACE
DOORS JB		150		15A	51				52					SPACE
SINKS			300	15A	53				54					SPACE
EXISTING				EX	55				56					SPACE
RECEPTACLE - STAGING AREA		300		15A	57				58					SPACE
RECEPTACLE - STAGING AREA			300	15A	59				60					SPACE
FRIDGE - HD STORAGE	300			15A	61				62					SPACE
RECEPTACLE - STORE RM		300		15A	63				64					SPACE
EQUIPMENT - HD STORAGE			500	20A	65				66					SPACE
MECHANICAL CONTROLS	300			15A	67				68					SPACE
LIGHTING		300		15A	69				70					SPACE
RECEPTACLE - HD STORAGE			300	15A	71				72					SPACE
RECEPTACLE - STORE RM	300			15A	73				74					SPACE
DOORS JB		300		15A	75				76					SPACE
CLOCK			150	15A	77				78					SPACE
SPACE					79				80					SPACE
SPACE					81				82					SPACE
SPACE					83				84					SPACE

120013502350

LOCATION - Corridor
VOLTS - 120/ 208
PHASE - 3
WIRE - 4
PANEL TYPE - 84-circuit
MOUNTING - Recessed
MAIN BUS AMPS - 60 Amp
INTERRUPTING CAPACITY - -
FEEDER AWG - -
Main Circuit breaker -

TOTAL LOAD
AMPS/PH

TOT. LOAD KVA

Notes:
15GFI = 15A Ground Fault Breaker 30mA RCD, IEC60364 Compliant
15 = 15A Standard 1 pole breaker
15-2p = 15A Standard 2 pole breaker
15-3p = 15A Standard 3 pole breaker
15* = 15A Standard 1 pole breaker c/w Lock On Device

AtkinsRéalis



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The background of the entire page is a faded, high-contrast image of mechanical components, likely from a pharmaceutical machine, showing various pipes, valves, and bolts.

HAIDA GWAI PHARMACY RENOVATION

Mechanical Specifications
Issued for Tender

Prepared by:

Rocky Point Engineering
#502-211 E. Georgia St.
Vancouver, BC
V6A 1Z6

Project No. #24348-V

SPECIFICATION DIVISION		SECTION
Division 20	20 05 05	Mechanical Work General Instructions
Mechanical	20 05 10	Basic Mechanical Materials and Methods
	20 05 15	Seismic Control and Restraint
	20 05 20	Mechanical Vibration Control
	20 05 25	Mechanical Insulation
	20 05 30	Variable Frequency Drives
	20 05 35	Motor Starters, Control Centres, & Wiring
	20 05 40	Demolition and Revision Work
	20 05 45	Mechanical Work Commissioning
	20 05 55	Testing, Adjusting and Balancing
	20 05 60	Firestopping and Smoke Seal Systems
Division 21	21 12 00	Fire Protection System
Fire Protection		
Division 22	22 11 16	Domestic Water Piping and Valves
Plumbing	22 11 19	Domestic Water Piping Specialties
	22 13 16	Drainage Waste and Vent Piping and Valves
	22 13 19	Drainage and Vent Piping Specialties
	22 42 00	Plumbing Fixtures and Fittings
Division 23	23 21 13	Hydronic Piping and Valves
Heating, Ventilating, and	23 21 16	Hydronic Piping Specialties
Air Conditioning (HVAC)	23 25 00	HVAC Water Treatment
	23 31 05	Standard Ductwork
	23 31 06	Special Systems Ductwork
	23 33 00	Duct System Dampers and Accessories
	23 33 15	Utility Fans
	23 33 20	Centrifugal Inline Fans
	23 36 00	Air Terminal Units
	23 37 13	Grilles and Diffusers
	23 41 00	Air Filters and Accessories
Division 25	25 05 05	Automatic Control Systems
Integrated Automation	25 90 10	Sequences of Operation

1 GENERAL

1.1 References

- .1 The General Conditions of the Contract, the Supplementary Conditions, and all Sections of Division 01 apply to and are a part of this Section of the Specification.

1.2 Application

- .1 This Section specifies requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and shall be read accordingly.

1.3 Note Re: Bold Lettering

- .1 "**Bold**" type lettering is used throughout this Specification in an attempt to enhance the readability of the text. The use of "**bold**" lettering does not indicate a greater level of importance.

1.4 Submittals

- .1 As specified in this Section, submit the following to the Consultant:
 - .1 **Notice for field reviews:** written notice for attendance at the site for field reviews.
 - .2 **Project close-out documentation:** O & M Manuals, record as-built drawings, and all associated data.
 - .3 **Progress payment breakdown:** a detailed breakdown of the mechanical work cost.
 - .4 **Contractor's P.Eng. Documentation:** the name, qualifications, and evidence of current liability insurance for all professional engineers to be retained by the Contractor to perform work associated with the Contract.
 - .5 **Extended Warranties:** copies of all extended warranties specified, and in the name of the Owner.
 - .6 **O & M Training Schedules & Modules:** a proposed schedule of demonstration and training dates and times.

1.5 Definitions

- .1 The following are definitions of words found in mechanical work Sections of the Specification and on associated drawings:
 - .1 "Concealed" – means work hidden from normal sight in furred spaces, shafts, tunnels, ceiling spaces, walls, and partitions.
 - .2 "Exposed" – means work normally visible, including work in equipment rooms and similar spaces.
 - .3 "Provide" (and tenses of provide) – means supply and install complete.
 - .4 "Install" (and tenses of install) – means install and connect complete.
 - .5 "Supply" – means supply only.
 - .6 "Finished area" - means any area or part of an area which receives a finish such as paint, or is factory finished.
 - .7 "Governing authority" and/or "regulatory authority" and/or "Municipal authority" – means all government departments, agencies, standards, rules and regulations that apply to and govern the mechanical work and to which the work must adhere.
 - .8 "Consultant" – means the Architect or Consulting Engineer who has prepared the Contract Documents on behalf of the Owner.
- .2 Wherever the words "indicated", "shown", "noted", "listed", or similar words or phrases are used in the specification they are understood, unless otherwise defined, to mean that the product referred to is "indicated", "shown", "listed", or "noted" on the drawings.
- .3 Wherever the words "approved", "satisfactory", "as directed", "submit", "permitted", "inspected" or similar words or phrases are used in the specification or on the drawings they are understood, unless otherwise defined, to mean that work or product referred to is "approved by", "inspected by", etc., the Consultant. In the mechanical specification, singular may be read as plural, and vice-versa.

1.6 Quality Assurance

- .1 All mechanical work shall be done by journeyman tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on-site supervision of an experienced journeyman tradesman. The use of apprentice tradesmen shall be limited and the journeyman/apprentice ratio is 1 journeyman for every 2 apprentices.
- .2 All journeyman tradesmen are to have valid trade certificates available at the site for review by the Consultant at any time.
- .3 An experienced and qualified superintendent shall be on-site at all times when mechanical work is being performed.
- .4 Submit to the Consultant for review, a Quality Assurance Programme within 21 days of Contract award. Upon review and acceptance, the programme shall be implemented for the duration of the Contract.

1.7 Codes, Regulations, and Standards

- .1 All Codes, Regulations, and Standards referred to in this Section and in Sections to which this Section applies are the latest edition of the Codes, Regulations, and Standards in effect at the time of issue of a building permit or bidding on this Project, whichever comes first.
- .2 All work shall be in accordance with requirements with Codes, Regulations, and Standards applied by governing authorities, including:
 - .1 The British Columbia Building Code.
 - .2 The British Columbia Plumbing Code
 - .3 Inspection branches of Technical Safety BC.
 - .4 Technical Safety BC.
 - .5 WorkSafe BC
 - .6 Canadian Standards Association
Municipal and City ByLaws
 - .7 British Columbia Electrical Code
 - .8 Canadian Standards Association (CSA Z317.1, Z317.2, Z7396.1 & Z8000)
- .3 All mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA Standard B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products must bear a CRN number.
- .4 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted. Pay all associated costs associated with these submittals.
- .5 All electrical items associated with mechanical equipment are to be certified and bear the stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.
- .6 Requirements of the Contract Documents are to take precedence when they are more stringent than codes, ordinances, standards, and statutes.
- .7 Ventilation systems and equipment are to be installed and conform to ASHRAE and SMACNA standards.

1.8 Imperial and Metric Measurements

- .1 Conform to requirements of CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- .2 If both Metric and Imperial units of measurement are indicated in the Mechanical Specification, Metric measurements are "soft" and have been rounded off.

1.9 Examination of Site and Documents

- .1 When estimating the cost of the work and prior to submitting a bid for the work carefully examine all of the bid documents and visit the site to determine and review all existing site

conditions that will or may affect the work, and include for all such conditions in the bid price.

- .2 Report to the Consultant, prior to bid submittal, any existing site condition that will or may affect performance of the work as per the drawings and specifications. Failure to do so will not be grounds for additional costs.

1.10 Drawings and Specification

- .1 Read the mechanical work drawings in conjunction with all other structural, architectural, sprinkler, electrical, etc., drawings and, where applicable, the Code Consultant's report.
- .2 The mechanical drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of the building are to be taken at the site. Do not scale the drawings, and do not use the drawings for prefabrication work.
- .3 The drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, all offsets, fittings, transformations, and similar products required as a result of obstructions and other architectural and structural details not shown on the drawings.
- .4 The locations of equipment and materials shown may be altered, when reviewed by the Consultant, to meet requirements of the equipment and/or materials, other equipment or systems being installed, and of the building, all at your cost.
- .5 Sections of the mechanical specification are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and the Sections are to be read as a whole.
- .6 The mechanical specification does not generally indicate the specific number of items or extent of material required. The specification is intended to provide product data and installation requirements. It is necessary to refer to drawing schedules, layouts, schematic diagrams, riser diagrams, and details to determine correct quantities.
- .7 The mechanical drawings and specification are intended to be cooperative. Perform all work that is shown, specified, or reasonably implied on the drawings but not mentioned in the specification, or vice-versa, as though fully covered by both.
- .8 The mechanical drawings and specifications have been prepared solely for the use by the party with whom the Consultant has entered into a contract and there are no representations of any kind made by the Consultant to any other party.
- .9 In the case of discrepancies between the drawings and specifications, the documents will govern in the order specified in the General Conditions, however, when the scale and date of the drawings are the same, or where the discrepancy exists within the specification, the costliest arrangement will take precedence.

1.11 Planning and Layout of The Work, and Associated Drawings

- .1 Properly plan, coordinate, and establish the locations and routing of services with general contractor and all subcontractors affected prior to installation such that the services will clear each other as well as any obstructions, including structural components of the building. Unless otherwise specified, the order of right-of-way for services shall be as follows:
 - .1 Piping requiring uniform pitch.
 - .2 Piping 100 mm (4") diameter and larger.
 - .3 Large ducts (main runs).
 - .4 Electrical cable tray and bus duct.
 - .5 Conduit 100 mm (4") diameter and larger.
 - .6 Piping less than 100 mm (4") diameter.
 - .7 Smaller branch ductwork.
 - .8 Conduit less than 100 mm (4") diameter.

- .2 Unless otherwise shown or specified, conceal all work in finished areas, and conceal work in partially finished or unfinished areas to the extent made possible by the area construction. Install piping, ductwork, and similar services as high as possible to conserve headroom and/or ceiling space. Notify the Consultant where headroom or ceiling space appears to be inadequate prior to installation of the work and where location of valves and equipment requiring maintenance access appears to be too high for ease of access.
- .3 Revise or alter the arrangement of work that has been installed without proper coordination, study and review, even if it was completed in accordance with the Contract Documents, in order to conceal the work behind finishes, or to allow the installation of other work, at no additional cost. In addition, pay for the cost of alterations in other work required by the alterations to your work.
- .4 All shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.
- .5 Relocate improperly located holes and sleeves.
- .6 Drill for expansion bolts, hanger rods, brackets and supports. Obtain written approval from Consultant prior to altering structural members.
- .7 **Layout Drawings:** Do not use the Contract Drawing measurements for prefabrication and layout of piping and sheet metal work. Locations and routing are to generally be in accordance with the Contract Drawings, however, layout drawings are to be prepared for all such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for the work of other trades, accurately layout the work, and be entirely responsible for all work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with the Contract Drawings, notify the Consultant prior to proceeding with the work.

1.12 Alteration Works

- .1 Where existing utilities are removed, relocated, or abandoned, cap, valve, plug, or by-pass to make a complete and working installation.
- .2 A "complete and working installation" includes providing new surfaces identical to the ones removed or disturbed and matching adjacent surfaces with no visible difference between new and existing.
- .3 Where repainting of a surface is required, paint the entire surface between the nearest adjacent corners, i.e. the entire plane of the surface containing the disturbed area.
- .4 Where concealed conditions differ from those indicated on the drawings, immediately notify the Consultant.

1.13 Coordination of the Work

- .1 Review all the Contract Documents and coordinate the work with the work of all subcontractors. Coordination requirements are to include, but not be limited to, the following:
 - .1 Preparation of electronic coordination drawings as required, submitted as for shop drawings, with drawing scale as required to indicate the necessary details.
 - .2 Written notification of all concrete work such as housekeeping pads, sumps, bases, etc., required for mechanical work, and including required dimensions, operating weight of equipment, location, etc.
 - .3 Depth and routing of excavation required for mechanical work, and requirements for bedding and backfill.
 - .4 Schematic wiring for all wiring work required for mechanical equipment and systems but not specified to be done as part of the mechanical work, including termination points, wiring type and size, and any other requirements.

1.14 General Re: Installation of Equipment

- .1 Unless otherwise specified all equipment shall be installed in accordance with the equipment manufacturer's recommendations and instructions, Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.
- .2 Ensure that proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Remove and replace any equipment which does not meet this requirement.

1.15 Energy Efficiency Standards

- .1 All applicable mechanical equipment has been selected to meet energy efficiency requirements of the Model National Energy Code of Canada for Buildings or ANSI/ASHRAE/IESNA 90.1, Energy Standards for Buildings, and shop drawings/product data submittals for such equipment must indicate compliance with this Standard or they will be returned for correction and re-submittal.

1.16 Permits, Fees, and Certificates

- .1 Apply for, obtain and pay for all permits required to complete the mechanical work.
- .2 Submit to the Consultant, all approval/inspection certificates issued by governing authorities to confirm that the work as installed is in accordance with the rules and regulations of the governing authorities. Pay any costs associated with issue of the certificates.
- .3 Include a copy of all approval/inspection certificates in each operating and maintenance manual.

1.17 Workplace Safety

- .1 Comply with requirements of the Workplace Hazardous Materials Information System (WHMIS) regarding the use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for all products where required, and maintain one copy at the site in a visible and accessible location available to all personnel.
- .2 Comply with all requirements of WorkSafe BC Occupational Health and Safety Regulations and all other regulations pertaining to health and safety, including worker's compensation/ insurance board and fall protection regulations.

1.18 Fall Restraint for Roof Mounted Equipment

- .1 Wherever possible, locate roof mounted mechanical equipment or access hatch a minimum of 2 m from the edge of any roof 3 m or higher above the surrounding grade.
- .2 Where mechanical equipment or hatches are located within 2 m from the edge of any roof 3 m or higher above the surrounding grade, supply roof anchors (a minimum of 2 per piece of equipment or roof hatch) capable of withstanding a minimum live load of 800 lb. in any direction and to which personal fall restraint equipment can be secured, and coordinate installation with the roofing trade. Refer also to Part 11 of the WorkSafe BC Occupational Health and Safety Regulations.
- .3 Retain the services of a Professional Engineer registered in the Province of British Columbia to ensure that the fall restraint anchors provided are of adequate capacity and correctly installed, and to certify in writing (with signed professional stamp) that the anchor installations have been inspected on-site and are correctly installed and of adequate capacity. Submit the certification to the Consultant.

1.19 Shop Drawings and Product Data Sheets

- .1 Prior to supplying any products to the site, submit for review, shop drawings and/or product data sheets indicating in detail the design, construction, and performance of products as requested in Sections of this Specification. The number of copies of shop drawings and/or product data sheets will be as later directed.

- .2 Shop drawings are those prepared specifically for the Project. Product data sheets are copies of manufacturer's standard catalogue, etc., literature.
- .3 Unless otherwise specified or required, submit shop drawings/product data sheets via email in AutoCAD or PDF format only.
- .4 Wherever possible, shop drawings and/or product data sheets are to be 216 mm x 280 mm (8½" x 11"), 216 mm x 356 mm (8½" x 14"), or 356 mm x 432 mm (11" x 17"), with sufficient clear space for review stamps, comments, and identification as specified below.
- .5 Shop drawings and product data sheets must confirm that the product proposed meets all requirements of the Contract Documents.
- .6 Each shop drawing or product data sheet shall be properly identified with the project name and the product drawing or specification reference, i.e. "Exhaust Fan EF-1", and all shop drawing or product data sheet dimensions are to be either SI or Imperial to match dimensions on the drawings.
- .7 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure that this requirement is clearly indicated on the submission.
- .8 Carefully review each shop drawing and product data sheet prior to submittal to ensure that the proposed product is correct and meets with all requirements of the Project. Endorse each copy of each shop drawing or product data sheet "Correct for Review By Consultant", or "Certified to Be In Accordance with All Requirements" and include your company name, the submittal date, and the signature of an officer of your company to indicate your review and approval as above.
- .9 The Consultant will review shop drawings and product data sheets and will indicate the review status by stamping the shop drawings and product data sheets as follows:
 - .1 **"Reviewed" or "Reviewed as Modified"** to indicate that his review is final and no re-submittal is required.
 - .2 **"Revise and Resubmit"** to indicate that the submission is rejected and shall be revised in accordance with comments marked on the shop drawings and product data sheets by the Consultant and re-submitted.
 - .3 **"Not Reviewed"** to indicate that the submission has not been reviewed.
- .10 The following shall be read in conjunction with the wording on the Consultant's review stamp applied to each and every mechanical work shop drawing or product data sheet submitted:

"This review is for the sole purpose of ascertaining conformance with the general design concept. This review does not approve the detail design inherent in the shop drawings, responsibility for which remains with the Contractor, and such review does not relieve the Contractor of the responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents. Be responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all sub-trades."

1.20 Changes or Revisions to the Work

- .1 Whenever the Consultant proposes in writing to make a change or revision to the design, arrangement, quantity or type of any work from that required by the Contract Documents, prepare and submit to the Consultant for approval, a quotation being your proposed cost for executing the change or revision.
- .2 Your quotation shall be a detailed and itemized estimate of all products, material, labour, and equipment costs associated with the change or revision, plus overhead and profit percentages and all applicable taxes and duties.
- .3 Unless otherwise stated in the Contract Documents, the following requirements apply to all quotations submitted:

- .1 When the change or revision involves deleted work as well as additional work, the cost of the deleted work (less overhead and profit percentages but including taxes and duties) shall be subtracted from the cost of the additional work before overhead and profit percentages are applied to the additional work.
 - .2 Costs for journeyman and apprentice labour must not exceed prevailing rates at the time of execution of the Contract and must reflect the actual personnel performing the work.
 - .3 Cost for the site superintendent must not exceed 10% of the total hours of labour estimated for the change or revision, and the change or revision must be such that the site superintendent's involvement is necessary.
 - .4 Costs for rental tools and/or equipment are not to exceed local rental costs.
 - .5 If overhead and profit percentages are not specified in the General Conditions of the Contract, Supplementary Conditions, or elsewhere in preceding Sections of the Specification, but allowable under the Contract, then allowable percentages for overhead and profit are to be 10% and 10% respectively.
 - .6 The overhead percentage will be deemed to cover all quotation costs other than actual site labour, product and materials, and rentals.
 - .7 All quotations, including those for deleted work, must include a figure for any required change to the Contract time.
- .4 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable the Consultant to expeditiously process the quotation and issue a Change Order will not be grounds for any additional change to Contract time.
 - .5 If, in your opinion, changes or revisions to the work should be made, inform the Consultant in writing and, if the Consultant agrees a Notice of Change will be issued.
 - .6 Do not execute any change or revision until written authorization for the change or revision has been obtained

1.21 Notice for Required Field Reviews

- .1 Whenever there is a requirement for the Consultant to perform a field review and/or inspection prior to concealment of any work (including piping/duct system leakage testing, to inspect/re-inspect the work for deficiencies prior to Substantial Performance, for commissioning demonstrations, and any other such field review, give the Consultant a minimum of 72 hours written notice.
- .2 If the Consultant is unable to attend a field review when requested, arrange an alternative date and time.
- .3 Do not conceal work until the Consultant advises that it may be concealed.
- .4 When the Consultant is requested to perform a field review and the work is not ready to be reviewed, reimburse the Consultant for all time and travel expenses.

1.22 Scaffolding, Rigging, and Hoisting

- .1 Unless otherwise specified or directed, supply, erect and operate all scaffolding, rigging, hoisting equipment and associated hardware required for your work. Immediately remove from the site all scaffolding, rigging, and hoisting equipment when no longer required.
- .2 Do not place major erection loads on any portion of the structure without approval from the Consultant.

1.23 Trial Usage

- .1 When directed by the Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with the Specification and governing Codes and Regulations, prior to Substantial Performance of the work.

- .2 When, in the opinion of the Consultant, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.
- .3 All tests are not to be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the equipment or system due to the test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.
- .4 When, in the Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from the site and replace them with acceptable equipment and/or products, at no additional cost.

1.24 General Re: Project Closeout Submittals

- .1 Prior to application for Substantial Performance, submit all required items and documentation specified, including the following. Items in **bold** are minimum requirements for Occupancy:
 - .1 Operating and Maintenance Manuals.
 - .2 As-built record drawings and associated data.
 - .3 Extended warranties for equipment as specified.
 - .4 Mechanical equipment start-up reports
 - .5 Chemical cleaning & treatment report
 - .6 Duct cleaning report
 - .7 **Pressure test reports for piping systems**
 - .8 **Fire-stop certificate**
 - .9 **Fire damper test report**
 - .10 Valve tag schedule
 - .11 Megger test report for heat tracing
 - .12 **Refrigeration final certificate**
 - .13 **AHJ Certificates of completion: Gas Inspector, Boiler inspector, Plumbing Inspector**
 - .14 **Letters of Assurance (schedules S-B and S-C) from contractor retained engineers (ie Seismic, etc.)**
 - .15 **Fire damper test reports**
 - .16 **Backflow prevention assembly device test reports**
 - .17 Final commissioning report from commissioning agent
 - .18 Final TAB report from TAB contractor
 - .19 Identified keys for mechanical equipment and/or panels for which keys are required, and all other items required to be submitted.
 - .20 Letter signed by Owner and Contractor stating that all spare items as identified below or otherwise in the specification have been handed over and received by the Owner. Items include but are not limited to:
 - .1 Spare HVAC filters
 - .2 Spare keys to any lockable doors, cabinets, etc.
 - .21 Owner controls system demonstration
 - .22 Written verification that all systems complete and fully operational or a complete list of items that are not finished or are deficient.

1.25 Operating and Maintenance Manuals

- .1 Submit 1 hard copy of operating and maintenance manuals consolidated in hardcover 3 "D" ring binders, each binder sized to include approximately 25% spare space for future data, and identified permanently with the Project name, "MECHANICAL OPERATING AND MAINTENANCE MANUAL" wording, and the date. Manuals are to include the following:
 - .1 An Introduction sheet listing the Consultant's, Contractor's, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses.
 - .2 A Table of Contents sheet, and corresponding index tab sheets.
 - .3 A copy of each "Reviewed" status shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, and the email address for local source of parts and service.

- .4 Pressure leakage test reports for all piping systems.
- .5 Certificates issued by governing authorities.
- .6 **Operating Data:** Operating data shall include:
 - .1 A description of each system and its controls.
 - .2 Control schematics for equipment/systems including building environmental controls.
 - .3 If applicable, the building automation system (bas) "as-built" architecture and all required operating data.
 - .4 Description of operation of each system at various loads together with reset schedules and seasonal variances.
 - .5 Operation instruction for each system and each component.
 - .6 Description of actions to be taken in event of emergencies and/or equipment failure.
 - .7 Valve tag schedule, and flow diagrams to indicate valve locations.
- .7 **Maintenance Data:** Maintenance data shall include:
 - .1 Servicing maintenance, operation and trouble-shooting instructions for each item of equipment and each system.
 - .2 Schedules of tasks, frequency, tools required, and estimated task time.
 - .3 Complete parts lists with numbers.
- .8 **Performance Data:** Performance data shall include:
 - .1 Equipment and system start-up data sheets.
 - .2 Copies of all signed and dated piping system leakage test data.
 - .3 Equipment performance verification test results, and final commissioning report.
 - .4 Final testing adjusting and balancing reports.
- .9 **Review Submittal:** Assemble one copy of the O & M Manual and submit to the Consultant for review prior to Owner training and instructions, and assembling the remaining copies. Incorporate all comments into the final submission.
- .10 **Digital O & M Manuals:** Submit digital version of the hard copy manual using the latest version of Adobe Acrobat Portable Document format and enhanced with bookmarks, internet links, and internal document links. The digital copies are to be copied to a USB Flash Drive with custom label indicating the project name, date, the Consultant's name, and "Operating & Maintenance Manual for Mechanical Systems".

1.26 Record "As-Built" Drawings and Data

- .1 As work progresses at the site, clearly mark in red "as -built" conditions in a neat and legible manner on a set of white print drawings printed from a PDF of the mechanical drawings supplied by the Consultant. Drawings will be kept on site at all times and available for reference.
- .2 "As-Built" conditions include all significant changes and deviations from the routing of services and locations of equipment shown on the Contract Drawings and resulting from the issue of Addenda, Site Instructions, Change Orders, and job conditions.
- .3 Use notes marked in red as required. Maintain the white print red line as-built set at the site for the exclusive use of recording as-built conditions, keep the set up-to-date at all times, and ensure that the set is always available for periodic review. The as-built set is also to include the following:
 - .1 The size, location, route, and extent of ductwork, piping, control devices and wiring conduit, cleanouts, valves, and similar items.
 - .2 The dimensioned location of all inaccessible concealed work the locations of control devices with identification for each.
 - .3 The location of all piping system air vents and water hammer arrestors.
 - .4 The location and tag identification for all tagged valves.
 - .5 For underground piping, including service entrance/exit piping, record dimensions, invert elevations, all offsets, fittings, cathodic protection and accessories if applicable, including invert elevations for underground drainage piping at each cleanout, manhole, and change in direction both inside and outside the building, and locate dimensions from benchmarks that will be preserved after construction is complete.

- .6 For fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings.
- .7 The location of all concealed services terminated for future extension.
- .4 **Review and Submittal:** Prior to Substantial Performance of the work, and after the red line site as-built white prints have been transferred to PDF electronic files, plot a set of bond prints the electronic file as-built drawings, neatly add the notation 'CERTIFIED RECORD DRAWINGS', date and sign the bond prints, and submit the prints and the electronic files to the Consultant for review. The Consultant will review the drawings and, if necessary, return the electronic files and the marked-up prints for corrections or further revisions, in which case complete the corrective and/or revision work and resubmit the electronic files and vellum prints until they are determined to be acceptable, all prior to Substantial Performance.

1.27 Progress Payment Breakdown

- .1 Submit, prior to submittal of the first progress payment draw, a breakdown of the cost of the mechanical work to assist the Consultant in reviewing and approving monthly progress payment claims.
- .2 The payment breakdown is subject to the Consultant's approval and progress payments will not be processed until an approved breakdown is in place. The breakdown shall include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, and project closeout submittals.
- .3 Equipment, material and labour costs are to be indicated for site services (if applicable), plumbing and drainage, fire protection, HVAC piping, HVAC sheet metal, controls, and insulation work, etc., in the same manner as they will be indicated on the monthly progress draw.

1.28 Requirements for Contractor Retained Engineers

- .1 All professional engineers retained by you to perform consulting services with regard to your work, i.e. seismic engineer, fire protection engineer, structural engineer, are to be members in good standing with the local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of the governing authorities in the locale of the work.
- .2 Your engineer's professional liability insurance is to protect your Consultants and Sub-Consultants, and their respective servants, agents, and employees against any loss or damage resulting from the professional services rendered by your Consultants, Sub-Consultants, and their respective servants, agents, and employees in regards to the work of this Contract.
- .3 Liability insurance requirements are as follows:
 - .1 Coverage shall be a minimum of \$1,000,000.00 inclusive of any one occurrence.
 - .2 The insurance policy is not to be cancelled or changed in any way without the insurer giving the Owner a minimum of thirty days written notice.
 - .3 Liability insurance shall be obtained from an insurer registered and licensed to underwrite such insurance in the location of the work.
 - .4 Evidence of the required liability insurance in such form as may be required shall be issued to the Owner, the Owner's Consultant, and Municipal Authorities as required prior to commencement of your Consultant's services.

1.29 Guarantee-Warranty

- .1 The Contractor shall furnish a written warranty stating that all work executed will be free from defects of material and workmanship for a period of one year from the date of total performance. 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.

- .2 The 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 guarantee-warranty

1.30 Extended Warranties

- .1 All extended warranties specified in mechanical work Sections of the Specification are to be full parts and labour warranties, at the site, and in accordance with requirements of the Contract warranty, but direct and in writing from the equipment manufacturer/supplier to the Owner. Submit signed and dated copies of extended warranties which clearly state requirements specified above.

1.31 Healthcare Facility Infection Control and Standards

- .1 The following CAN/CSA Standards apply to the work of this Project and are to be adhered to:
 - .1 CAN/CSA-Z317.2, Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Healthcare Facilities.
 - .2 CAN/CSA-Z317.1, Special Requirements for Plumbing Installations in Healthcare Facilities.

1.32 Equipment and System Manufacturer's Certification

- .1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for the equipment/system manufacturer's authorized representative to visit the site to examine the installation, and when any required corrective measures have been made, to certify in writing to the Consultant that the equipment/system installation is complete and in accordance with the equipment/system manufacturer's instructions.

1.33 Equipment and System Start-Up

- .1 When installation of equipment/systems is complete, but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with the following requirements:
 - .1 Submit a copy of each equipment/system manufacturer's blank start-up report sheet to the Consultant for review and incorporate any comments.
 - .2 Under direct on-site supervision and involvement of the equipment/system manufacturer's representative, start-up the equipment/systems, make any required adjustments, document the procedures, leave the equipment/systems in proper operating condition, and submit a complete set of start-up documentation sheets signed by the manufacturer/supplier and the Contractor.

1.34 Equipment and System Commissioning

- .1 After successful start-up and prior to Substantial Performance, commission the mechanical work in accordance with requirements of CSA Z320, Building Commissioning. Use commissioning sheets included with the CSA Standard, and any supplemental commissioning sheets required. Submit final commissioning data sheets, TAB reports, project closeout documents, and other required submittals.
- .2 Commission mechanical equipment and systems in accordance with the Section entitled Mechanical Work Commissioning.

1.35 Equipment and System O & M Demonstration & Training

- .1 Train the Owner's designated personnel in all aspects of operation and maintenance of equipment and systems as specified in mechanical work Sections of the Specification. All demonstrations and training shall be performed by qualified technicians employed by the equipment/system manufacturer/supplier. The number of hours of training and the number of Owner's personnel to be involved will be specified in the mechanical work Sections to which this Section applies.

- .2 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Operating and Maintenance Manuals are to be used during the training sessions, and training modules are to include:
 - .1 **Operational Requirements and Criteria:** Requirements and criteria are to include but not be limited to equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations.
 - .2 **Troubleshooting:** Troubleshooting shall include but not be limited to diagnostic instructions, test and inspection procedures.
 - .3 **Documentation:** Documentation shall include but not be limited to equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like.
 - .4 **Maintenance:** Maintenance requirements are to include but not be limited to inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools.
 - .5 **Repairs:** Repair requirements are to include but not be limited to diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .3 Schedule demonstrations and training at mutually agreed to times with a minimum of 7 working days notice.
- .4 The following sub-contractors are required to participate and assist with the demonstration and training session:
 - .1 Controls
 - .2 Balancing
 - .3 Manufacturer's representative for the following equipment:
 - .1 Custom Air Handling Units
 - .2 Variable Frequency Drives
- .5 **Demonstration and Training Confirmation:** Obtain a list of personnel to receive demonstration and training from the Consultant, and have each participant sign the list to confirm that he/she understood the demonstration and training session.

2 PRODUCTS

2.1 NOT APPLICABLE

3 EXECUTION

3.1 NOT APPLICABLE

END OF SECTION

1 GENERAL

1.1 Application

- .1 This Section specifies products, common criteria and characteristics, and methods and execution that are common to one or more mechanical work Sections of the Specification, and it is intended as a supplement to each Section and shall be read accordingly.

1.2 Submittals

- .1 Submit the following for review:
 - .1 **Product data sheets:** submit for:
 - .1 Pressure gauges and thermometers.
 - .2 Electric motors (submit with equipment they are associated with).
 - .2 **Access door locations:** submit white prints of architectural reflected ceiling plan drawings and elevation drawings to indicate proposed access door locations in walls and ceilings in finished areas.
 - .3 **List of equipment nameplates:** submit a list of equipment identification nameplates indicating proposed wording and sizes.
 - .4 **Pipe & duct identification:** submit a list of pipe and duct identification colour coding and wording.
 - .5 **Valve tag chart:** submit a proposed valve tag chart and a list of proposed valve tag numbering and identification wording.
 - .6 **Drive belts:** as specified in Part 2 of this Section, submit a spare belt set, tagged and identified, for each belt driven piece of equipment.
 - .7 **Piping pressure and temperature access fitting test kit:** submit a hinged case with pressure gauge and a thermometer, each with an adapter for a piping access fitting.
- .2 **Additional submittals:** submit any other submittals specified in this Section or other mechanical work Sections of the Specification.

1.3 Equipment and Material Manufacturer Requirements

- .1 Equipment and materials scheduled or specified on the drawings or in the Specification have been selected to establish a performance and quality standard.
- .2 Unless otherwise stated the bid price may be based on products supplied by any of the manufacturers named as acceptable for the particular product. If acceptable manufacturers are not listed for a particular product, base the bid price on the products supplied by the specified manufacturers.
- .3 If products supplied by a manufacturer named as acceptable are used in lieu of the products specified by manufacturer's name and model number, ensure that the product is equivalent in performance and operating characteristics (including energy efficiency if applicable) to the specified product. Pay for any additional costs and changes to associated or adjacent work resulting from the use of products supplied by a manufacturer other than the specified manufacturer. In addition, in equipment spaces where products named as acceptable are used in lieu of the specified products and the dimensions of such products differ from the specified products prepare and submit for review, if requested, accurately dimensioned layouts of the rooms affected to prove that all the equipment in the room will fit properly.

1.4 Substituted or Alternative Products

- .1 Products supplied by a manufacturer/supplier other than a manufacturer specified as acceptable may be considered for acceptance by the Consultant if requested in writing a minimum of five full working days prior to the bid closing date. Requests may be made by letter, by fax, or by email. Telephone requests will not be considered.
- .2 Each request for acceptance of a proposed substitution or alternative product must be accompanied by detailed catalogue and engineering data, fabrication information, and performance characteristics to permit the Consultant to make an informed decision.

- .3 Pay for any additional costs and changes to associated or adjacent work resulting from the use of products supplied by a substituted or alternative manufacturer. In addition, in equipment spaces where substituted or alternative products are used in lieu of the specified or acceptable products and the dimensions of such products differ from the specified or acceptable products, prepare and submit for review, if requested, accurately dimensioned layouts of the rooms affected to prove that all the equipment in the room will fit properly.
- .4 The Consultant's decision regarding any proposed substitution or alternative product is final.

1.5 Products – Base Bid and Acceptable Manufacturers

PRODUCT	APPROVED MANUFACTURER
Access Doors	Acudor, E.H. Price, Maxam, Milcor, Mifab, Enpoco
Commissioning Agencies	Western, MDT Systems Ltd., KD Engineering, Kane Consulting, Raincity
Control Dampers – Low Leakage	American Warming, Tamco, Ruskin
Controls – DDC	Delta Controls (Ainsworth)
Dampers – Fire and Smoke	Canadian Advanced Air, Maxam, Ruskin, Controlled Air, Nailor Industries, Pottoroff
Duct Cleaning	Enviro-Vac, Ace Mobile, Power Suction Services
Duct Silencers	Vibro Acoustics, VAW Systems
Ductwork – Flexible	Thermaflex, Wiremold, Flexmaster, Canaflex
Expansion Compensation - Piping	Mason Industries inc., The Metraflex Co., Hyspan Precision Products Inc., Flexicraft Industries, Senior Flexonics
Fans – Centrifugal Utility Blowers	Loren Cook Co., Greenheck, Twin City Fan & Blower
Fans – In-Line Centrifugal	Greenheck Fan Corp., Twin-City Fan and Blower, Loren Cook Co.,
Filters	Farr, Continental, Cambridge, AAF
Firestopping and Smoke Seals	3M Canada "Fire Barrier", Tremco Inc. Fire Protection Systems Group "TREMstop", Hilti (Canada) Ltd. Firestop Systems
Flow and Pressure Switches	Potter, System Sensor
Grilles, Registers and Diffusers	Titus, Tuttle & Bailey, Price Industries Inc., Nailor Industries, Krueger Division of Air System Components Inc.
Identification – Pipe and Duct	3M, SMS, Duramark, Bradley
Insulation – Piping and Duct	3M, Dow, Fibrex, Knauf, Johns-Manville, Owens Corning, Pittsburgh Corning, Manson, Roxul, Fibreglass Canada, Certainteed
Insulation Jacketing	Childers, Fiberglass, Johns-Manville
Pipe Couplings – Grooved	Victaulic, Grinnell, Shur Joint (confirm approved manufacturer based on each PM)
Pipe Couplings – Di-Electric	Watts, AG Specialties

PRODUCT	APPROVED MANUFACTURER
Pipe Couplings – Flexible	Mason, Flexonics, Hyspan, Goodall, Victaulic, Proco
Pipe Fittings and Flanges	Crane, Grinnell, Jenkins
Pipe Supports and Hangers	Crane, Unistrut, Myatt, Grinnell, Sarco, Hunt, Taylor
Plumbing Fixtures	Refer to Section 22 42 00
Pressure Gauges	Weiss, Ashcroft, Terice, Marsh, Winter, Miljoco
Pressure Reducing Valves	Watts, Singer
Pressure Relief Valves	ITT Bell & Gossett 3301/4100 or 790/1170, Spirax Sarco Ltd. SVI Series, McDonnell & Miller Models 250 & 260, Watts Industries (Canada) inc. 174A or 740, Conbraco 10-600 Series
Seismic Control and Restraint	Mason Industries Inc., Vibro-Acoustics Ltd.,
Strainers	Red & White, Sarco, Armstrong, Mueller, Watts, Conbraco
Testing, Adjusting and Balancing Agencies	Western Mechanical, KD Engineering, Airmec, Kane, Precision-Air, Raincity Technical Services, Tempest
Thermometers	Weiss, Ashcroft, Terice, Marsh, Winter, Miljoco
Valves (Ball, Gate, Globe, Check)	Red & White/Toyo, Grinnell, Watts, Kitz, Crane, Milwaukee, Conbraco
Valves (Butterfly)	Red & White/Toyo, Grinnell, Kitz, Crane, Milwaukee, Keystone, DeZurik, Lukenheimer
Valves (Balancing)	Armstrong, DeZurik, Grinnell
Valves (Circuit Balancing)	Tour & Anderson, Bell & Gossett, Armstrong, Griswald, RWV
Variable Air Terminal Units	Titus, EH Price
Variable Frequency Drives	Yaskawa, Danfoss, Baldor, Hitachi, ABB, Siemens
Venturi Air Valves	Phoenix Controls, Antec
Vibration Isolation	Refer to section 20 05 20 for specific applications

2 PRODUCTS

2.1 Pipe Sleeves

- .1 **Galvanized Sheet Steel:** Minimum #16 gauge galvanized steel with an integral flange at one end to secure the sleeve to formwork construction.
- .2 **Polyethylene:** Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.
- .3 **Waterproof Sleeves:** Schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate at the sleeve midpoint, or PSI-Thunderline "Century-Line" Model CS HDPE sleeves.

- .4 **Galvanized Steel or Cast Iron Pipe:** Schedule 40 mild galvanized steel, or Class 4000 cast iron.

2.2 Firestopping and Smoke Seal Materials

- .1 Firestopping and smoke seal system materials for mechanical penetrations through fire rated construction are specified in Division 07 and the work will be done as part of the work of Division 07.
- .2 Firestopping and smoke seal system materials for mechanical penetrations through fire rated construction are specified in the mechanical work Section entitled Firestopping and Smoke Seal Systems and the work shall be done as part of the mechanical work.

2.3 Waterproofing Seal Materials

- .1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and the pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so that when the bolts are tightened the links expand to seal the opening watertight. The seal assemblies are to be selected to suit the pipe size and the sleeve size or wall opening size.

2.4 Pipe Escutcheon Plates

- .1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with matching screws for attachment to the building surface, each plate sized to completely cover the pipe sleeve or building surface opening, and to fit tightly around the pipe or pipe insulation.

2.5 Piping Hangers and Supports

- .1 **General:** Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with the Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to the following requirements:
 - .1 Unless otherwise specified, all ferrous hanger and support products are to be electro-galvanized.
 - .2 Hangers and supports for insulated piping are to be sized to fit around the insulation and the insulation jacket.
- .2 **Horizontal Suspended Piping:** Hangers and supports are to be:
 - .1 Adjustable steel clevis hanger – Anvil Fig. 260 – MSS Type 1.
 - .2 Adjustable swivel ring band type hanger – Anvil Fig. 69 – MSS Type 10.
 - .3 Adjustable roller hanger – Anvil Fig's. 171, 177 & 181 – MSS Types 41, 43, and/or 45, with Anvil Fig. 160 to 166a – MSS Type 39 steel protection saddle.
- .3 **Horizontal Pipe on Vertical Surfaces:** Epoxy coated steel pipe stays are not permitted. Supports are to be:
 - .1 Steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170.
 - .2 Heavy-duty steel pipe bracket – Anvil Fig. 262 or Myatt Fig. 161 – MSS Type 26.
 - .3 Single steel pipe hook - Myatt Fig. 156.
- .4 **Floor Supports for Vertical Risers:** Supports are to be:
 - .1 Copper tubing riser clamp – Anvil Fig. CT-121, Anvil Fig. CT-121C (plastic coated), or Myatt Fig. 150CT – MSS Type 8.
 - .2 Heavy-duty steel riser clamp – Anvil Fig. 261, or Myatt Fig's. 182, 183, 190 and 191 – MSS Type 8.
- .5 **Vertical Piping on Vertical Surfaces:** Epoxy coated steel pipe stays are not permitted. Supports are to be:
 - .1 Steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170.
 - .2 Heavy-duty steel pipe bracket or soil pipe bracket – Anvil Fig. 262 or Myatt Fig. 161 – MSS Type 26.
 - .3 Extension split pipe clamp – Anvil Fig's. 138R or Myatt Fig. 129 – MSS Type 12.

- .6 **Base of Vertical Risers:** Support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment shall consist of a base elbow support with flange equal to Empire tool & Mfg. Co. Fig. 830.
- .7 **Horizontal Pipe on Racks:** Unistrut or equal galvanized steel pipe racks with pipe securing hardware as follows:
 - .1 Standard galvanized steel U-bolts/clamps supplied by the rack manufacturer.
 - .2 Adjustable roller chair - Anvil Fig. 175 with Fig. 160-165 steel protection saddle.
- .8 **Special Hangers and Supports:** Special hangers and supports for various applications are as follows:
 - .1 **Vibration isolated riser supports** – black steel riser clamps as specified above, complete with neoprene–steel–neoprene sandwich type vibration isolation pads between the clamp and the floor.
 - .2 **For groups of pipes having the same slope** – Anvil Fig. 195 welded steel brackets, Anvil Fig. 46 universal trapeze assemblies, or Unistrut or equal support assemblies, all with U-bolts, clamps, etc., to secure pipes in place.
 - .3 **For sections of piping connected to vibration isolated equipment** – hangers and supports as specified above but complete with MSS Type 48 spring cushions.
 - .4 **For piping on an existing roof** – Portable Pipe Hangers (Canada) Inc. "PP" Series prefabricated portable pipe support system components to suit the pipe, complete with all required accessories including bases, galvanized structural steel frames, and galvanized steel pipe hangers and/or supports conforming to MSS SP-58.
 - .5 **For plastic piping above ground** – generally as specified above but in accordance with the pipe manufacturer's printed recommendations.
 - .6 **For bare horizontal copper piping** – generally as above but factory vinyl coated to prevent direct copper/steel contact.
 - .7 **For bare copper vertical piping** – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate the pipe from the clamp.
 - .8 **For embedded (in concrete) PVC piping:** special site fabricated galvanized steel pipe clamp support assembly with vertical rods, a Unistrut or equal base secured to base reinforcing steel, and guy wire, designed to be adjustable for proper piping slope and to secure the piping in position during the concrete pour.
 - .9 **Insulation protection shields to & including 40 mm (1½") diameter** – equal to Anvil "Rib-Lok" Fig. 168 galvanized steel shields with ribs to keep the shield centred on the hanger.
- .9 **Hanger Rods:** Electro-galvanized carbon steel (unless otherwise specified), round, threaded, complete with captive machine nuts with washers at hangers, sized to suit the loading in accordance with Table 3 in MSS SP-58, but, in any case, minimum 9.5 mm (3/8") diameter and in accordance with ASTM A307, Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000PSI Tensile Strength, and ASME B18.31.3, Threaded Rods (Inch Series).

2.6 Equipment Bases and Supports

- .1 **Concrete Housekeeping Pads:** Unless otherwise specified, shown or required, minimum 100 mm (4") high reinforced concrete housekeeping pads 200 mm (8") clear of the equipment on each side and end, or a minimum of 200 mm (8") from the centreline of equipment anchor bolts to the edge of the base, whichever is larger. Conform to the following requirements:
 - .1 Supply dimensioned drawings and equipment base templates, and provide anchor bolts for proper setting and securing of equipment on pads.
 - .2 Place anchor bolts during the concrete pour and be responsible for all required levelling, alignment, and grouting of the equipment.
 - .3 As a minimum, use wire mesh reinforcement, however, for pads for large heavy equipment, use reinforcement as per structural drawing details.
- .2 **Roof or Grade Metal Frame Supports:** Equal to Eco Support Products "EcoFoot-EcoFrame metal framework support assemblies, each sized to suit the equipment to be

mounted and consisting of UV stabilized rubber base mats, support legs adjustable from 300 mm to 450 mm (12" to 18"), galvanized steel fixings for the tubing framework, 15 mm (½") diameter bolts, 50 mm (2") square hot dipped galvanized mild steel tubing.

- .3 **Structural Steel Stands/Supports:** for equipment not designed for base mounting, where required, provide welded or bolted, cleaned and galvanized, prime coat painted structural steel stands or supports conforming to the following requirements:

- .1 All stands and supports, except those for small equipment, are to be designed by a structural engineer registered in the jurisdiction of the work, and stamped and signed design drawings with calculations are to be submitted as shop drawings for review.
- .2 All steel stands are to be flange bolted to concrete housekeeping pads.

- .4 **Access Platforms and Miscellaneous Steel Work:** Provide welded or bolted, cleaned, galvanized and prime coat painted structural steel platforms where shown for service access to equipment. Access platforms are to be designed by a structural engineer registered in the jurisdiction of the work, and stamped and signed shop drawings with calculations are to be submitted as shop drawings for review. Service access platforms are to conform to the following requirements:

- .1 Platforms are to be in accordance with OSHA requirements and are to be adequately sized, braced, anchored, and, as required, seismically restrained.
- .2 Flooring shall be Fisher & Ludlow "Tru-Weld" Type 19-4, Borden type W/B (19-W-4), or equal, welded steel bar type grating.
- .3 Support legs are to be welded Schedule 40 black steel pipe with welded steel cross-bracing, securely anchored and sway braced.
- .4 Safety guard rails, constructed from minimum 32 mm (1¼") diameter Schedule 40 black steel pipe are to be provided for all platforms and are to be complete with vertical stanchions at maximum 1.2 m (48") centres, top and intermediate horizontal railing, and toe plates at the floor.
- .5 Vertical ladders are to be constructed of Schedule 40 black steel pipe, 25 mm (1") diameter for equal height rungs, 40 mm (1½") for stringers, anchored to floors and walls and sway braced as required.
- .6 Ships ladders, which are to be used wherever space conditions permit, are to be of welded steel construction, are to climb at an approximate 60° angle, and are to be complete with channel iron stringers, open grate equal height risers approximately 165 mm (6½") wide and factory made by the grating manufacturer, handrails, and suitable anchoring and support.

2.7 Piping Strainers – "Y" Shaped

- .1 Wye shaped strainers, bronze with sweat type or flanged connections in copper piping, cast iron with screwed, flanged, or grooved end connections in steel piping, minimum 1725 kPa (250 psi) rated and complete with a removable perforated type 304 stainless steel 20 mesh screen, and, for strainers 40 mm (1½") diameter and larger, a blow down pipe connection tapping.

2.8 Piping Drain Valves

- .1 Minimum 2070 kPa (300 psi) water rated, 20 mm (¾") diameter, straight pattern full port bronze ball valves, each complete with a lever handle, threaded outlet suitable for coupling connection of 20 mm (¾") diameter garden hose, and a cap and chain.

2.9 Access Doors

- .1 Prime coat painted steel (unless otherwise specified) flush access doors, each complete with a minimum #16 gauge frame, minimum #18 gauge door panel, heavy-duty rust-resistant concealed hinges, a positive locking screwdriver lock, and mounting and finishing features to suit the particular construction in which it shall be installed.
- .2 Access door sizes are to suit the concealed work for which they are supplied, and wherever possible they are to be of a standard size for all applications, but, in any case, they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.

- .3 Access doors in fire rated construction are to be ULC listed and labelled and of a rating to maintain the fire separation integrity.
- .4 Where access doors are located in surfaces where special finishes are required, they are to be of a recessed door type capable of accepting the finish in which they are to be installed so as to maintain the final building surface appearance throughout, and constructed of stainless steel with a #4 finish.

2.10 Pressure Gauge and Thermometer Access Fittings

- .1 Peterson Equipment Co. Inc. "Pete's Plug II" threaded, piping mounting temperature and pressure test plug with two self-closing valves, each 3450 kPa (500 psi) rated and 135° C (275° F) rated, each equipped with a cap and restraining strap and a gasket, and, for insulated piping, "XL" extra length to accommodate the insulation.
- .2 Supply a #1500 pressure and temperature test kit and submit as specified in Part 1 of this Section.

2.11 Pressure Gauges and Thermometers

- .1 **Pressure Gauges:** Adjustable, glycerine filled, 100 mm or 115 mm (4" or 4½") diameter, each accurate to within 1% of scale range and complete with a type 304 stainless steel case with relief valve and polished stainless steel bayonet, stainless steel rotary movement with stainless steel bushings and socket, a clear acrylic window, a dual scale white dial with a scale range such that the working pressure of the system is at the approximate mid-point of the scale, and black pointer.
- .2 **Pressure Gauge Accessories & Additional Requirements:** Accessories and additional requirements are as follows:
 - .1 A bronze ball type shut-off valve shall be provided in the piping to each pressure gauge.
 - .2 Each pressure gauge for piping and equipment with normal everyday flow shall be equipped with a brass pressure snubber.
 - .3 Each pressure gauge for steam piping or steam equipment shall be equipped with a steel coil syphon.
 - .4 Pressure gauges in fire protection piping must be ULC listed and labelled.
 - .5 Pressure gauges in medical gas piping systems are to conform to CSA Z7396.1 and are to be identified with the name of the service it is provided for as well as "USE NO OIL".
 - .6 Wetted parts of pressure gauges in domestic water piping are to be ANSI/NSF 61 certified lead free.
- .3 **Thermometers:** Round, 125 mm (5") diameter, adjustable (90°) angle bimetal dial type thermometers, each accurate to within 1% of full scale and complete with a hermetically sealed stainless steel case with stainless steel ring, dampened bimetal coil, calibration adjustment screw, white aluminum dual scale dial with black and blue markings and a range such that the working temperature of the system is the approximate mid-point of the scale, black aluminum pointer, double strength glass window, 12 mm (½") NPT connection with 6.4 mm (¼") diameter stainless steel stem, a suitable thermowell, and, for thermometers in domestic water piping, ANSI/NSF 61 lead free certification.

2.12 Equipment Belt Drives

- .1 ANSI/RMA Standard V-belt type rated at minimum 1.5 times the motor nameplate rating, and in accordance with the following requirements:
 - .1 Belts are to be reinforced cord and rubber, and multiple belts are to be matched sets.
 - .2 Sheaves are to be cast iron or steel, secured to shafts with removable keys unless otherwise specified, standard adjustable pitch (± 10% range) for motors under 10 HP, fixed pitch type with split tapered bushing and keyway for motors 10 HP and larger, and, if required, replaced as part of the mechanical work to suit system air/water quantity testing and balancing work.
 - .3 Motor slide rail adjustment plates are to allow for centre line adjustment.

- .2 Supply a spare belt set (tagged and identified) for each belt drive and hand to the Owner upon Substantial Performance of the work.

2.13 Equipment Drive Guards and Accessories

- .1 **For V-belt drives** - removable, four sided, fully enclosed, galvanized sheet steel guards to OSHA standards, cleaned, factory primed and painted with yellow equipment enamel, complete with a 2-piece full length hinged front panel to permit belt maintenance or replacement without removing the guard, and 40 mm (1½") diameter tachometer openings at each shaft location.
- .2 **For flexible couplings** - removable "U" shaped galvanized steel guards to OSHA Standards with a 2.3 mm (3/32") thick frame and expanded mesh face.
- .3 **For unprotected fan inlets & outlets** - unless otherwise specified, removable 20 mm (¾") galvanized steel wire mesh with galvanized steel frames, all to OSHA Standards.

2.14 Electric Motors

- .1 Unless otherwise specified, motors are to conform to EEMAC Standard MG1, applicable IEEE Standards, and applicable CSA C22.2 Standards, and are to meet NEMA standards for maximum sound level ratings under full load. Confirm motor voltages prior to ordering.
- .2 Vertically mounted and submersible motors are to be purposely designed for mounting in this attitude.
- .3 **AC Motor Efficiency:** The efficiency of single phase AC motors to 1 HP shall be in accordance with CAN/CSA C747. The efficiency of all three phase motors 1 HP and larger shall be in accordance with CAN/CSA C390 or IEEE 112B.
- .4 **Single Phase AC Motors:** Unless otherwise specified, AC motors smaller than ½ HP are to be 115 volt, continuous duty capacitor start type with an EEMAC 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, Class "B" insulation, and a 1.15 service factor at 40°C (105°F) ambient temperature.
- .5 **Brushless DC Motors:** Energy efficient electronically commutated motors (ECM) are to be brushless DC motors with an integral inverter, a permanent magnet on the rotor, and a programmable microprocessor based motor controller which will accept a remote adjustment signal for integration into a DDC building automation system
- .6 **Three Phase AC Motors:** Unless otherwise specified, motors ½ HP and larger are to be totally enclosed, fan cooled, 3 phase, T-frame, squirrel cage continuous duty induction motors suitable for voltages indicated on the Drawings, EEMAC Design "B" for normal starting torque or Design "C" for high starting torque as required by the application, each complete with Class "B" insulation, a 1.5 service factor at 40°C ambient temperature, grease lubricated open ball bearings with grease fittings to permit re-lubrication without dismantling the motor, a cast iron frame with cast iron feet where required, cast iron end bracket and precision machined bearing fit, and balanced carbon steel shaft assembly with die-cast aluminum rotor windings.
- .7 **Motors for VFD's:** Motors for equipment with variable frequency drives are to be generally as specified above but inverter duty type to NEMA Standard MG-1, Section IV, Part 31, quantified by CSA for operation from a variable frequency drive of the type specified, and complete with Class "H" insulation and a shaft grounding bearing protection ring.
- .8 **Corrosion Protection:** Motors for equipment which is scheduled or specified with a corrosion resistant coating or constructed from corrosion resistant materials are to be factory coated with a primer and epoxy paint finish.

2.15 Motor Starters and Accessories

- .1 Loose motor starters and accessories, disconnect switches, and motor control centres for mechanical equipment will be provided as part of the electrical work.

2.16 Mechanical Work Identification Materials

- .1 **Equipment Nameplates:** Minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Additional requirements are as follows:

- .1 Unless otherwise specified or required, each nameplate shall be white, complete with bevelled edges and black engraved capital letter wording to completely identify the equipment and its use with no abbreviations.
- .2 Wording is generally to be as per the drawings, i.e. Fan ef-1, and shall include equipment service and building area/zone served, but must be reviewed prior to engraving.
- .3 Supply stainless steel screws for securing nameplates in place.
- .4 Nameplates for equipment suspended above floor level or generally not within easy viewing from floor level are to be increased in size so as to be easily readable from floor level.

- .2 **Valve Tags:** Coloured, 40 mm (1½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match the piping identification colour, each complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording, i.e.:

VALVE V2

100 mm (4")

CHILL. WATER

NORMALLY OPEN

- .3 **Standard Pipe Identification:** Standard pipe identification shall be equal to Smillie McAdams Summerlin Ltd. or Brady vinyl plastic with indoor/outdoor type vinyl ink lettering and directional arrows, as follows:

- .1 For pipe to and including 150 mm (6") diameter, coiled type snap-on markers of a length to wrap completely around the pipe or pipe insulation.
- .2 For pipe larger than 150 mm (6") diameter, saddle type strap-on markers with 2 opposite identification locations and complete with nylon cable ties.

- .4 **Standard Pipe Identification Wording and Colours:** Identification wording and colours for pipe identification materials are to be as follows:

PIPE SERVICE	IDENTIFICATION COLOUR	LEGEND
Domestic cold water	Green	DOM. COLD WATER
Domestic hot water supply	Green	DOM. HW SUPPLY
Domestic hot water recirculation	Green	DOM. HW RECIRC.
Tempered domestic water	Green	TEMP. DOM. WATER
Storm drainage	Green	STORM
Sanitary drainage	Green	SAN.
Plumbing vent	Green	SAN. VENT

- .5 **Colours for Legends & Arrows:** Colours for pipe identification legends and directional arrows are to be as follows:

IDENTIFICATION COLOUR	LEGEND & ARROW COLOUR
Yellow	Black

IDENTIFICATION COLOUR	LEGEND & ARROW COLOUR
Green	White
Red	White

- .6 **Duct Identification:** Custom made Mylar stencils with 50 mm (2") high lettering to accurately describe the duct service, i.e. "AHU-1 SUPPLY", complete with a directional arrow, and coloured ink with ink pads and roller applicators. Ink colour is generally to be black but must contrast with the lettering background.

2.17 Flexible Connectors

- .1 Double wall stainless steel flexible connectors for piping connections to vibration isolated equipment, each selected by the manufacturer to suit the application. Shop drawings or product data sheets must indicate construction and performance requirements that suit the application.

3 EXECUTION

3.1 General Piping and Ductwork Installation Requirements

- .1 Unless otherwise specified, locate and arrange horizontal pipes and ducts above or at the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained. If required to maintain ceiling heights, reroute and/or resize ductwork, with Consultant's approval.
- .2 Unless otherwise specified, install all work concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer to and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Note that walls which are painted are considered finished.
- .3 Install all pipes and ducts parallel to building lines and to each other.
- .4 Neatly group and arrange all exposed work.
- .5 **Service and Maintenance Access:** Locate all work to permit easy access for service or maintenance as required and/or applicable. Locate all valves, dampers and any other equipment which will or may need maintenance or repairs and which are installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical services in shafts, pipe spaces or partitions, locate the accessories at the floor level.
- .6 **Dissimilar Metal Pipe Connections:** Make all connections between pipes of different materials using proper approved adapters. Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe.
- .7 **Cleaning:** Carefully clean all ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.
- .8 **Insulation Clearance:** Install piping and ductwork which are to be insulated so that they have sufficient clearance to permit insulation and finish to be applied continuously and unbroken around the pipe or duct, except for ductwork at fire barriers, in which case the insulation will be terminated at each side of the duct fire damper.
- .9 **Surfaces to Receive Your Work:** Inspect surfaces and structure prepared by other trades before performing your work. Verify that surfaces or the structure to receive your work have no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing. Installation of your work will constitute acceptance of such surfaces as being satisfactory.
- .10 **Piping Rust and Dirt:** Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both shall be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is

complete or prior to being concealed from view. Where dirt is evident, clean the piping prior to being concealed.

- .11 **Drain Pans:** Provide continuous galvanized sheet metal drip pan under all drain, water and water solution piping extending through all rooms with electrical equipment such as electrical, elevator equipment and transformer rooms, and all other spaces provided primarily for the installation of electrical equipment. Drip pans are to be complete with a drain pipe connection and drain piping shall be extended to the closest drain.
- .12 **Repair of Finished Surfaces:** for factory applied finishes, repaint or refinish all surfaces damaged during shipment and installation. The quality of the repair work shall match the original finish. This requirement also applies to galvanized finishes.
- .13 **Unions and Flanges:** Whether shown or specified on the drawings or not, provide screwed unions or flanges in all piping connections to equipment, and in regular intervals in new piping runs in excess of 12 m (40') to permit removal of sections of piping.
- .14 **Elbows and Eccentric Reducers:** Unless otherwise specified and except where space limitations do not permit, all piping elbows are to be long radius. Eccentric reducers are to be installed with the straight side at the top of the piping.

3.2 Pipe Joint Requirements

- .1 Do not make pipe joints in walls or slabs.
- .2 Ream all piping ends prior to making joints.
- .3 **Screwed Steel Piping:** Properly cut threads in screwed steel piping and coat male threads only with Teflon tape or paste, or an equivalent thread lubricant. After the pipe has been screwed into the fitting, valve, union, or piping accessory, not more than 2 pipe threads are to remain exposed.
- .4 **Welded Steel Piping:** Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove all scale and oxide from the bevels and leave smooth and clean. Use factory made welding tees or welding outlet fittings for piping branches off mains. Do not use shop or site fabricated fittings unless written approval has been obtained.
- .5 **Welding Requirements:** Welded joints are to be made by CWB certified, currently licensed journeyman welders qualified in accordance with CSA B51, Boiler Pressure Vessel and Pressure Piping Code, and who are in possession of a proper certificate of qualification for each procedure to be performed.
 - .1 Each weld shall be identified with the welder's identification symbol, and welds are not to be concealed until they have been inspected and approved.
 - .2 Electrodes are to be in accordance with CSA W48 Series, Electrodes, and requirements of CAN/CSA W117.2, Safety in Welding, Cutting and Allied Processes are to be followed.
- .6 **Flanged Joints:** Unless otherwise specified, make all flanged joints with EDPM gasket materials to suit the application, and bolts and nuts. Bolts are not to be longer than the length necessary to screw the nut up flush to the end of the bolt. Bolts used for flanged connections in all piping with a working pressure of 690 kPa (100 psi) and greater are to be ASTM A-193, Grade B-7, with heavy hexagon nuts to ASTM A-194, CL-2H. Provide suitable washers between each bolt head and the flange and between each nut and the flange.
- .7 **Examination of Flanged Joints:** A random check of bolted flanged connections will be made to verify that flanged connections are properly mated with no shear force acting on bolts. Supply all labour to disconnect and reconnect the selected flanged joints. If improperly mated joints are found, remove and reinstall the affected piping so that the flanges mate properly. If improperly mated joints are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.
- .8 **Soldered Joints:** Unless otherwise specified make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside

of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering. Comply with requirements of ASTM B828, Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings.

- .9 **Mechanical Joints:** Install mechanical joint fittings and couplings in accordance with the manufacturer's instructions.
- .10 **Grooved Pipe & Coupling Joints:** Make arrangements with the coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to the manufacturer's instructions with respect to pipe grooving, support, type of gasket required, anchoring and guiding the grooved piping system.
- .11 **Pressure Crimped Piping Joints:** If pressure crimped couplings and fittings are used, ensure that gaskets are fully compatible with the piping fluid, and that all valves and piping accessories are suitable. Use only fitting manufacturer supplied crimping equipment. Comply with the manufacturer's latest published specification, instructions, and recommendations with respect to pipe, coupling, and fitting preparation and installation, and support, anchoring and guiding of the piping system.
- .12 **PVC Piping Solvent Weld Joints:** Solvent weld PVC piping in 2 parts, primer stage and cementing stage, in accordance with the manufacturer's recommendations, ASTM D2855, and CSA requirements.
- .13 **PVC Piping Gasketed Joints:** Install PVC piping with gasketed joints in accordance with the manufacturer's current published specifications, instructions and recommendations, and CSA requirements.

3.3 Installation of Pipe Sleeves

- .1 Where pipes pass through new concrete and/or masonry surfaces provide pipe sleeves as follows:
 - .1 **In poured concrete slabs:** unless otherwise specified - minimum #16 gauge flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves.
 - .2 **In concrete or masonry walls:** Schedule 40 galvanized steel pipe or Class 4000 cast iron pipe.
- .2 **Waterproof Sleeves:** Sleeves in waterproofed slabs or walls are to be lengths of Schedule 40 mild galvanized steel pipe with a water stop plate in accordance with the drawing detail. Provide waterproof sleeves in the following locations:
 - .1 In mechanical room floor slabs, except where on grade.
 - .2 In slabs over mechanical, fan, electrical and telephone equipment rooms or closets.
 - .3 In all floors equipped with waterproof membranes.
 - .4 In the roof slab.
 - .5 In waterproof walls.
- .3 Size sleeves, unless otherwise specified, to leave 12 mm ($\frac{1}{2}$ ") clearance around the pipes, or where the pipe is insulated, a 12 mm ($\frac{1}{2}$ ") clearance around the pipe insulation.
- .4 Pack and seal the void between the pipe sleeves and the pipe or pipe insulation in non-fire rated construction for the length of the sleeves as follows:
 - .1 **Interior construction:** pack sleeves in interior construction with mineral wool and seal both ends of the sleeves with non-hardening silicone base caulking compound.
 - .2 **Exterior walls above grade:** pack sleeves in exterior walls above grade with mineral wool and seal both ends of the sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified.
 - .3 **Exterior walls below grade:** seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified below.
- .5 Where sleeves are required in masonry work, accurately locate and mark the sleeve location, and hand the sleeves to the mason for installation.

- .6 Terminate piping for sleeves that will be exposed so that the sleeve is flush at both ends with the building surface concerned so that the sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to terminate 100 mm (4") above the finished floor.
- .7 "Gang" type sleeving will not be permitted.
- .8 Where sleeves are provided in non-fire rated construction for future piping, or where piping has been removed from existing sleeves, cap and seal both ends of the sleeved opening.

3.4 Installation of Waterproof Mechanical Seals

- .1 Provide watertight link type mechanical seals in exterior wall openings where shown or specified.
- .2 Assemble and install each mechanical seal in accordance with the manufacturer's instructions.
- .3 After installation, periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until the seal is completely watertight.

3.5 Duct Openings

- .1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in new poured concrete work, masonry, drywall and other building surfaces by the trade responsible for the particular construction in which the opening is required.
- .2 Ensure that openings for fire dampers to 600 mm (24") high are sized to suit the damper arrangement with the folding blade out of the air stream.
- .3 For all duct openings except where fire dampers are required, pack and seal the space between the duct or duct insulation and the duct opening as specified above for pipe openings in non-fire rated construction.

3.6 Sleeve and formed Opening Location Drawings

- .1 Prepare and submit for review, white print drawings indicating the size and location of all required sleeves, recesses and formed openings in new poured or precast concrete work.
- .2 Such drawings are to be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum, and are to take into account structural items such as grade beams, column caps, and column drop slabs.
- .3 Begin to prepare such drawings immediately upon notification of acceptance of bid and award of Contract.

3.7 Installation of Pipe Escutcheon Plates

- .1 Provide escutcheon plates suitable secured over all new exposed piping passing through finished building surfaces. A finished building surface is any surface with a factory finish or that receives a site applied finish.
- .2 Install the plates so that they are tight against the building surface concerned, and ensure that the plates completely cover pipe sleeves and/or openings, except where waterproof sleeves extend above floors, in which case the plate shall fit tightly around the sleeve.

3.8 Installation of Fastening and Securing Hardware

- .1 Provide all fastening and securing hardware required for mechanical work to maintain installations attached to the structure or to finished floors, walls and ceilings in a secure and rigid manner capable of withstanding the dead loads, live loads, superimposed dead loads, and any vibration of the installed products.
- .2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.

- .3 Where the floor, wall or ceiling construction is not suitable to support the loads, provide additional framing or special fasteners to ensure proper securement to the structure that is to support the products. Provide reinforcing or connecting supports where required to distribute the loading to the structural components. Submit support details for review prior to installation.
- .4 Obtain written consent before using explosive actuated fastening devices. If consent is obtained, comply with requirements of CSA Standards CAN3-Z166.1 and CAN3-Z166.2.
- .5 Do not attach fasteners to steel deck without written consent from the Consultant.

3.9 Installation of Pipe Hangers and Supports

- .1 Provide all required pipe hangers and supports.
- .2 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting pipe. Unless otherwise shown or specified, hang or support pipes from the structure only.
- .3 **For Insulated Pipe:** Size the hanger or support to suit the diameter of the insulated pipe and install the hanger or support on the outside of the insulation and insulation finish.
- .4 **Horizontal Above Ground Piping:** Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for suspended pipe to and including 25 mm (1") diameter are to be clevis type or adjustable ring type, and hangers for suspended pipe 40 mm (1½") diameter and larger are to be adjustable clevis type. Space hangers and supports in accordance with the following:
 - .1 **Cast iron pipe:** hang or support at every joint with maximum 2.4 m (8') spacing.
 - .2 **Plastic pipe:** conform to pipe manufacturer's recommended support spacing.
 - .3 **Glass pipe:** conform to pipe manufacturer's recommended support spacing and support requirements.
 - .4 **Copper and steel pipe:** hang or support at spacing in accordance with the following schedule:

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
To 25 mm (1")	2.4 m (8')	1.8 m (6')
40 mm (1½")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2½")	3.6 m (12')	3.0 m (10')
75 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3½")	3.6 m (12')	3.6 m (12')
100 mm (4")	4.2 m (14')	3.6 m (12')
250 mm (10")	6.0 m (20')	
300 mm (12")	6.7 m (22')	

- .5 **Flexible grooved pipe/coupling joint piping:** as above but with not less than 1 hanger or support between joints.
- .6 **Changes in direction:** where pipes change direction, either horizontally or vertically, provide a hanger or support on the horizontal pipe not more than 300 mm (12") from the elbow, and where pipes drop from tee branches, support the tees in both directions not more than 50 mm (2") on each side of the tee.
- .7 **Grouped piping:** when pipes with the same slope are grouped and a common hanger or support is used, space the hanger or support to suit the spacing requirement of the smallest pipe in the group and secure pipes in place on the common hanger or support.

- .8 **Roller hangers & supports:** provide roller hangers or supports for all heat transfer piping 150 mm (6") diameter and larger and conveying a material 75°C (170°F) or greater to facilitate pipe movement due to expansion and contraction, and at each hanger or support tack weld a steel protection saddle to the pipe to protect the piping insulation.
- .5 **Vertical Piping:** Unless otherwise shown or specified, support vertical piping by means of supports specified in Part 2 of this Section, spaced in accordance with the following:
 - .1 Support vertical pipes at maximum 3 m (10') intervals or at every floor, whichever is lesser.
 - .2 For sections of vertical piping with a length less than 3 m (10'), support the pipe at least once.
 - .3 For all vertical cast iron plain end pipe (mechanical joint type), secure the riser or pipe clamp around the pipe under a flange integral with the pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support.
 - .4 For all vertical steel pipe risers in excess of 3 m (10'), weld shear lugs to the pipe to carry the load.
 - .5 For vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between the riser clamps and the floor.
 - .6 For piping subject to vertical movement exceeding 40 mm (1½") due to vertical pipe expansion, provide suitable engineered constant support hangers.
- .6 **Piping on The Roof:** Support piping on the roof in accordance with requirements of the drawing detail.
- .7 **Piping on The Roof:** Support piping on the roof as follows:
 - .1 **On existing roof** - provide support members as specified in Part 2 of this Section spaced as per the schedule above and of a type to suit the application, and, for each support, carefully scrape away the roofing gravel, bed the support in a heavy covering of roofing mastic, then scrape the gravel back up around the support - secure pipes to supports
- .8 **Isolation for Bare Copper Tubing:** Each hanger, support or securement for horizontal bare copper tubing shall be plastic coated to prevent direct contact between the pipe and the ferrous hanger. Each wall or floor clamp for vertical bare copper piping shall be isolated from the pipe by means of strips of flexible rubber inserts. The use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.
- .9 **Insulation Protection Shields:** for insulated horizontal piping to and including 40 mm (1½") diameter, provide galvanized steel insulation protection shields between the insulation and the hanger or support. Install shields immediately after the pipe is insulated.
- .10 **Pipe Support from Steel Deck:** Do not support piping from steel deck without written consent from the Consultant.

3.10 Installation of Pipeline Strainers

- .1 Provide strainers in piping systems where shown on the drawings.
- .2 Equip each strainer with a construction screen and remove after piping has been flushed and cleaned. Install permanent screens/mesh.
- .3 Provide isolating valves in piping a maximum of 3 m (10') from the strainer on each side of a strainer.
- .4 For "Y" shaped strainers 40 mm (1½") diameter and larger, provide blow-off piping complete with a shut-off valve with cap and chain, and terminate blow-off piping downward in a vertical position.
- .5 For duplex basket strainers, equip each chamber drain plug with valved drain piping.

3.11 Installation of Equipment Drains and Piping Drain Valves

- .1 Unless otherwise shown or specified, provide minimum 40 mm (1½") diameter type DWV copper drain piping from equipment overflows, condensate drain pans, pump bases, fresh air intake plenum drains, etc., to a floor drain location. Equip the drain piping with deep seal traps located in heated areas.
- .2 Provide a drain valve at the bottom of piping risers, at all other piping low points, and wherever else shown and/or specified.
- .3 Locate drain valves so that they are easily accessible.

3.12 Supply of Access Doors

- .1 Supply access doors to give access to all mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on the drawings.
- .2 Locate access doors as inconspicuously as possible in walls and partitions and arrange mechanical work such that it is clearly within view and accessible for inspection and servicing, and to suit access door locations shown on the reviewed and approved white prints of reflected ceiling plan and elevation drawings submitted as per Part 1 of this Section.
- .3 Group piping and ductwork to ensure the minimum number of access doors is required. Access doors will be installed by the trades responsible for the particular type of construction in which the doors are required.
- .4 Submit a sample of each proposed access door for review prior to ordering.
- .5 Identify access doors supplied for concealed medical gas system shut-off valves or equipment with a permanent label in accordance with requirements of CAN/CSA Standard Z7396.1.

3.13 General Re: Installation of Valves

- .1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification where the valves are specified, however, regardless of locations shown or specified, the following requirements apply:
 - .1 Provide shut-off valves to isolate all systems, at the base of all vertical risers, in branch take-offs at mains and risers on all floors, to isolate all equipment, to permit work phasing as required, and wherever else required for proper system operation and maintenance.
 - .2 Install shut-off valves with handles upright or horizontal, not inverted, and located for easy access.
 - .3 Unless otherwise specified, provide a check valve in the discharge piping of each pump.
 - .4 Valve sizes are to be the same as the connecting pipe size.
 - .5 Valves are to be permanently identified with the size, manufacturer's name and figure number, and wherever possible, valves are to be the product of the same manufacturer.
 - .6 The manufacturer's name, valve model or figure number, and the pressure rating are to be clearly marked on each valve.
 - .7 For valves in insulated piping, the design of the valve stem, handle and operating mechanism shall be such that the insulation does not have to be cut or altered in any manner to permit valve operation. Provide valve extensions to allow for insulation of piping and valves to maintain consistent thickness while maintaining proper operation. Do not cut into the insulation to provide access to the valves.

3.14 Installation of Pressure Gauge & Thermometer Access Fittings

- .1 Provide pressure gauge and thermometer access fittings in 6.4 mm (¼") threaded opening fittings for insertion/removal of piping mounted pressure gauges and thermometers. Where piping is insulated, provide extended length access fittings to accommodate the insulation.

- .2 Unless pressure gauges and/or thermometers are provided with equipment, provide access fittings in the following locations:
 - .1 In valved tubing across the suction, suction strainer (if applicable), and discharge piping of each circulating pump.
 - .2 In the supply and return piping connections to main mechanical plant equipment such as boilers, chillers, heat exchangers, main coils, etc.
 - .3 In expansion tank(s) or piping immediately at the expansion tank.
 - .4 In all water connections to hot water heaters.
 - .5 In the downstream side of mixing valves.
 - .6 In separate domestic hot water storage tank(s).
 - .7 At the top most outlet in each standpipe fire protection system riser.
 - .8 In piping at each side of a pressure reducing valve.
 - .9 In domestic water service piping downstream of the meter.
 - .10 Wherever else shown and/or specified on the drawings or in the Specification.
- .3 All metal surfaces that are in contact with domestic water are to be NSF/ANSI 61 certified.

3.15 Installation of Pressure Gauges and Thermometers

- .1 **Pressure Gauges:** Provide pressure gauges in the following locations:
 - .1 In valved tubing across the suction, suction strainer (if applicable), and discharge piping of each circulating pump.
 - .2 In the supply and return piping connections to main mechanical plant equipment such as boilers, chillers, heat exchangers, main coils, etc.
 - .3 In expansion tank(s) or piping immediately at the expansion tank.
 - .4 In separate domestic hot water storage tank(s).
 - .5 At the topmost outlet in each standpipe fire protection system riser.
 - .6 In piping at each side of a pressure reducing valve.
 - .7 In domestic water service piping downstream of the meter.
 - .8 Wherever else shown and/or specified on the drawings or in the Specification.
- .2 **Thermometers:** Provide thermometers in the following locations:
 - .1 In supply and return piping connections to main mechanical plant equipment such as boilers, chillers, cooling towers, liquid to liquid heat exchangers, main coils, etc., unless temperature indication is supplied with the equipment.
 - .2 In all water piping connections to hot water heaters.
 - .3 In the downstream side of mixing valves.
 - .4 Wherever else shown and/or specified herein or on the drawings.
- .3 **Installation Requirements:** Conform to the following installation requirements:
 - .1 For installation of thermometers in piping wells, provide a coat of metallic base heat transfer paste or grease in the piping well.
 - .2 For pressure gauges in piping at equipment locations, install the pressure gauge between the equipment and the first pipe fitting.
 - .3 Locate, mount, and adjust all instruments so they are easily readable.
 - .4 Where pressure gauges and/or thermometers are located at high level or in an area where they cannot be easily seen, provide remote reading instruments.
 - .5 All metal surfaces that are in contact with domestic water are to be NSF/ANSI 61 certified.

3.16 Installation of Equipment Drive Guards and Accessories

- .1 Provide OSHA guards for all exposed accessible rotating parts such as belt drives, couplings, fan wheels, and shaft ends on all mechanical equipment.
- .2 Install belt guards to allow movement of motors for adjusting belt tension.
- .3 Provide a means to permit lubrication and use of test instruments with guards in place.
- .4 Secure guards to the equipment or equipment base but do not bridge sound or vibration isolation.

- .5 Where equipment oil level gauges, oil reservoirs, grease cups, or grease gun fittings are integral with the equipment but are not easily accessible for service, extend to an accessible location using aluminium or copper tubing.

3.17 Mechanical Work Identification

- .1 Identify all new/relocated mechanical work in accordance with existing identification standards at the site.
- .2 **Exposed Piping & Ductwork:** Identify new exposed piping and ductwork as per Part 2 of this Section in locations such that it can be seen from the floor or service platforms, as follows:
 - .1 At every end of every piping or duct run.
 - .2 Adjacent to each valve, strainer, damper, and similar accessory.
 - .3 At each piece of connecting equipment.
 - .4 On both sides of every pipe and duct passing through a floor, wall, or partition.
 - .5 At 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length.
 - .6 At least once in each room, and at least once on pipe and duct runs less than 6 m (20') in length.
- .3 **Concealed Piping & Ductwork:** Unless otherwise specified identify new concealed piping and ductwork as per Part 2 of this Section in locations as follows:
 - .1 At points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas.
 - .2 At maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room.
 - .3 At each access door location.
 - .4 At each piece of connected equipment, automatic valve, etc.
- .4 **Equipment:** Provide an identification nameplate for each new piece of equipment, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate all nameplates in the most conspicuous and readable location. Unless otherwise specified, equipment identification terminology shall be as per drawing identification.
- .5 **Motor Starters and Disconnect Switches:** Provide an identification nameplate for each new motor starter or disconnect switch located in a motor control centre or on a motor starter panel, and on each individually mounted starter which you supply, and on each disconnect switch provided as part of the electrical work for motorized equipment which you provide.
- .6 **Electrical Tracing:** for all new electrically traced mechanical work, identification wording shall include "ELECTRICALLY TRACED".
- .7 **Valve Tagging & Chart:** Tag valves and prepare a valve tag chart in accordance with the following requirements:
 - .1 Attach a valve tag to each new valve, except for valves located immediately at the equipment they control.
 - .2 Prepare a computer printed valve tag chart to list all tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed).
 - .3 If an existing valve tag chart is available at the site, valve tag numbering shall be an extension of existing numbering and the new valve tag chart shall incorporate the existing chart.
 - .4 Frame and glaze one copy of the chart and, unless otherwise directed, affix to a wall in each main mechanical and/or equipment room.
 - .5 Include a copy of the valve tag chart in each copy of the operating and maintenance instruction manuals.

- .6 Hand an identified and packaged (jewel case) compact disc of the valve tag chart to the owner at the time the O & M Manuals are submitted.
- .8 **Ceiling Tacks or Stickers:** Where new shut-off valves, control dampers, sensors, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in the ceiling panel material, or stickers equal to Brady "Quick Dot" on the ceiling grid material to indicate locations of the items. Unless otherwise specified, ceiling tack or sticker colours are to be as follows:
 - .1 HVAC piping valves and equipment yellow
 - .2 Fire protection valves and equipment red
 - .3 Plumbing valves and equipment green
 - .4 HVAC ductwork dampers and equipment blue
 - .5 Control system hardware and equipment orange

3.18 Finish Painting of Mechanical Work

- .1 Finish paint exposed mechanical work as specified and/or scheduled in accordance with requirements of the painting Section in Division 09.
- .2 Touch-up paint all damaged factory applied finishes on mechanical work products.
- .3 Finish painting of exposed mechanical work is specified in Division 09 and is part of the work of Division 09.

3.19 Pipe Leakage Testing

- .1 Before new piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test all piping for leakage.
- .2 Tests are to be witnessed by the Consultant and/or Owner's representative, and, where required, representatives of governing authorities. Give ample notice of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.
- .3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.
- .4 **Gravity Drainage & Vent Piping:** Securely close all openings and pipe ends and fill piping with water up to the highest level, and ensure that the water stands at the same level for a minimum of 2 hours. After the fixtures and fittings are set and the pipes connected to the building drain or drains, turn on water into all pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Make a smoke test if required by the Municipality. at your option, drain and vent piping may be pressure tested with cold water at 345 kPa (50 psi) for 2 hours with zero leakage.
- .5 **Domestic Water Piping:** Test piping with cold water at a pressure of 1½ times normal working pressure and maintain the pressure for a minimum of 2 hours.
- .6 **Standpipe System Piping:** Test all system piping in accordance with requirements of NFPA No. 14, "STANDPIPE AND HOSE SYSTEMS", and in accordance with any additional requirements of governing authorities.
- .7 **Refrigerant Piping:** Test refrigerant piping for leakage and dehydrate in accordance with requirements of Chapter 18 of the ASHRAE HANDBOOK - FUNDAMENTALS.
- .8 **General Re: All Testing:** The following requirements apply to all testing:
 - .1 Ensure that all piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing.
 - .2 Temporarily remove or valve off all piping system specialties or equipment which may be damaged by test pressures prior to pressure testing the systems, and flush piping to remove foreign matter.

- .3 When testing is carried out below the highest level of the particular system, increase the test pressure by the hydrostatic head of 7 kPa (1 psi) for every 600 mm (24") below the high point.
- .4 Include for temporary piping connections required to properly complete the tests.
- .5 Piping under test pressure shall have zero pressure drop for the length of the test period.
- .6 Make tight leaks found during tests while the piping is under pressure, and if this is impossible, remove and refit the piping and reapply the test until satisfactory results are obtained.
- .7 Where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions.
- .8 Tests are to be done in reasonably sized sections so as to minimize the number of tests required.
- .9 In addition to the leakage tests specified above, demonstrate proper flow throughout the systems including mains, connections and equipment, as well as proper venting and drainage, and include for any necessary system adjustments to achieve the proper conditions.

3.20 Supply of Motor Starters and Accessories

- .1 Motor starters for mechanical equipment, except for starters integral with packaged equipment and starters factory installed in equipment power and control panels, will be provided as part of the electrical work.

3.21 Electrical Wiring Work for Mechanical Work

- .1 Unless otherwise specified or indicated, the following electrical wiring work for mechanical equipment will be done as part of the electrical work:
 - .1 "Line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from the starters or disconnects to the equipment.
 - .2 "Line" side power wiring to individual wall mounted starters, and "load" side wiring from the starters to the equipment.
 - .3 "Line" side power wiring to pre-wired power and control panels and variable frequency drives, and "load" side power wiring from the panels and VFD's to the equipment.
 - .4 Provision of receptacles for plug-in equipment.
 - .5 Provision of disconnect switches for all motors that are in excess of 10 m (30') from the starter location, or that cannot be seen from the starter location, and all associated power wiring.
 - .6 All motor starter interlocking in excess of 24 volts.
 - .7 Wiring from motor winding thermistors in motors 30 HP and larger to motor starter contacts.
 - .8 Provision of dedicated 120 volt, 15A-1P circuits terminated in junction boxes in mechanical equipment rooms for automatic control and building automation system wiring connections to be made as part of the automatic controls work.
 - .9 120 volt power connections to electrical receptacles integral with small ceiling exhaust fans, including wiring through light switches or speed controllers.
 - .10 120 volt wiring connections to lighting fixture/switch combinations integral with air handling units.
 - .11 120 volt wiring connections to duplex receptacles integral with air handling unit control panels.
 - .12 120 volt wiring connections to line voltage thermostats.
 - .13 120 volt wiring connections to DDC controls transformers.
 - .14 All disconnects to be provided by Div. 26 unless otherwise noted.
- .2 Mechanical wiring work not listed above or specified herein or on the drawings to be done as part of the electrical work shall be installed in conduit and shall be done as part of the mechanical work in accordance with wiring requirements specified for the electrical work.

3.22 Interruption to and Shut-Down of Mechanical Services and Systems

- .1 Co-ordinate all shut-down and interruption to existing mechanical systems with the Owner/Facilities Manager. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning.
- .2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform the Owner/Facilities Manager and Consultant in writing 72 hours in advance of the proposed shut-down or interruption and obtain written approval to proceed. Do not shut-down or interrupt any system or service without such written approval.
- .4 Perform work associated with shut-downs and interruptions as continuous operations to minimize the shut-down time and to reinstate the systems as soon as possible, and, prior to any shut-down, ensure that all materials and labour required to complete the work for which the shut-down is required are available at the site.
- .5 **Pipe Freezing:** Pipe freezing is to be used to connect new piping to existing piping without draining the existing piping. Pipe freeze equipment shall be equal to "NORDIC FREEZE" CO2 equipment supplied by Mag tool Inc.

3.23 Installation of Equipment Bases and Supports

- .1 **Concrete Housekeeping Pads:** Unless otherwise specified, shown, or required, set all floor or grade mounted equipment on reinforced concrete housekeeping pads.
- .2 **Steel Framework Supports:** Where indicated, support base mounting smaller HVAC equipment such as heat pumps, condensing units, and fan equipment on galvanized steel adjustable tubular steel framework support assemblies.
- .3 **Structural Steel Stands/Supports:** for equipment not designed for base mounting, where required, provide welded, cleaned, and prime coat painted structural steel stands or supports flange bolted to concrete housekeeping pads.
- .4 **Access Platforms and Miscellaneous Steel Work:** Provide access platforms where shown for service access to equipment.

3.24 Mechanical Service Requirements for Floating Floor Slabs

- .1 Where mechanical services are required to be installed in or through a vibration isolated floating slab, install such services so as not to transmit any vibration to the base slab on which the floating floor slab is placed.
- .2 Wherever possible arrange mechanical work to avoid penetrating a floating floor slab.

3.25 Concrete Work for Mechanical Equipment Bases/Pads

- .1 All concrete work required for mechanical equipment bases/pads will be provided as part of the concrete work of Division 03.
- .2 Exactly locate bases/pads at the site and be present during the concrete pour to ensure that anchor bolts, inserts, plates, and similar hardware are not damaged or dislodged.
- .3 Coordinate base/pad installations with the concrete trade and ensure that bases and pads are keyed into the structure to meet seismic restraint requirements.

3.26 Concrete Work for Mechanical Equipment Bases/Pads

- .1 Provide all poured concrete work, including reinforcing and formwork, required for mechanical equipment bases/pads. Perform concrete work in accordance with requirements specified in Division 03.
- .2 Concrete shall be minimum 20,700 kPa ready-mix concrete in accordance with CAN/CSA-A23.1 and the Building Code.

- .3 Submit for review, dimensioned shop drawings for all concrete pads or bases for support of large, heavy equipment. Indicate on the shop drawings the total weight of the pad or base as well as the equipment it is provided for, and concrete reinforcing. Shop drawings are to be prepared and stamped by a professional structural engineer registered in the place of the work.
- .4 Ensure that bases and pads are keyed into the structure to meet seismic restraint requirements.

3.27 Cutting and Patching for Mechanical Work

- .1 All cutting and patching of existing building surfaces required for mechanical work, including core drilling walls and slabs for piping, will be done as part of another Division of the work and is excluded from the mechanical work.
- .2 Accurately and carefully mark out the location and extent of cutting or drilling required and co-ordinate with the trade(s) performing the work. Note that the location and size of cut or drilled openings must be approved by the Consultant before the work commences, and all cut or drilled openings must not be larger than is absolutely necessary for installation of the pipe, duct, etc., and insulation where necessary.

3.28 Cutting, Drilling, and Patching for Mechanical Work

- .1 Do all cutting, drilling and patching of the existing building for the installation of your work. Perform all cutting and drilling with proper tools and equipment. Confirm the exact location of cutting and drilling with the Consultant prior to commencing the cutting and/or drilling work.
- .2 Patch surfaces, where required, to exactly match existing finishes using tradesmen skilled in the particular trade or application worked on.
- .3 Where new pipes pass through existing construction, core drill an opening. Size openings to leave 12 mm (½") clearance around the pipes or pipe insulation.
- .4 Prior to drilling or cutting an opening in poured concrete construction, determine the location, if any, of existing services concealed in the construction to be drilled or cut. X-ray or Ferro Scan Test the walls or slabs if required.
- .5 You will be responsible for the repair of any damage to existing services, exposed or concealed, caused as a result of your cutting or drilling work.
- .6 Where drilling is required in waterproof slabs, size the opening to permit snug and tight installation of a pipe sleeve which is sized to leave 12 mm (½") clearance around the pipe or pipe insulation. Provide a pipe sleeve in the opening. Pipe sleeves are to be Schedule 40 galvanized steel pipe with a flange at one end and a length to extend 100 mm (4") above the slab. Secure the flange to the underside of the slab and caulk the void between the sleeve and slab opening with proper non-hardening silicone base caulking compound to produce a water-tight installation.

3.29 Packing and Sealing Core Drilled Pipe Openings

- .1 Pack and seal the void between the pipe opening and the pipe or pipe insulation for the length of the opening as follows:
 - .1 **Non-fire rated interior construction:** pack openings in non-fire rated interior construction with mineral wool and seal both ends of the opening with non-hardening silicone base caulking compound to produce a water-tight seal.
 - .2 **Exterior walls above grade:** pack sleeves in exterior walls above grade with mineral wool and seal both ends of the sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified.
 - .3 **Exterior walls below grade:** seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified below.

3.30 Flashing for Mechanical Work Penetrating the Roof

- .1 Do all required flashing work, including counterflashing, for mechanical work penetrating and/or set in the roof.
- .2 Perform flashing work in accordance with requirements of drawing details, and requirements specified in Division 07.

3.31 Cleaning Mechanical Work

- .1 Refer to cleaning requirements specified in Division 01.
- .2 Clean all mechanical work prior to application for Substantial Performance of the work.
- .3 Include for vacuum cleaning the interior of air handling units and ductwork systems.

3.32 Use of Mechanical Systems for Temporary Heating

- .1 Permanent building mechanical systems are not to be used for temporary heating purposes during construction.
- .2 Permanent mechanical systems in the building may be used for temporary heating during construction subject to the following conditions:
 - .1 Each entire system is complete, pressure tested, cleaned, and flushed out.
 - .2 Specified water treatment system has been commissioned, and treatment is being continuously monitored.
 - .3 Building has been closed in and areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
 - .4 There is no possibility of damage from any cause.
 - .5 Supply ventilation systems are protected by minimum MERV 7 filters, which are to be inspected every other day, and changed every 2 weeks, or more frequently as required.
 - .6 Return air systems have approved construction filters over all openings, inlets, and outlets.
 - .7 All systems are operated as per the manufacturer's recommendations or instructions, and are monitored on a regular and frequent basis.
 - .8 Warranties are not affected in any way.
 - .9 Regular preventive and all other manufacturer's recommended maintenance routines are performed.
 - .10 Before Substantial Performance, each entire system shall be refurbished, cleaned internally and externally, restored to "as-new" condition, and filters in air systems replaced.
 - .11 Energy costs are to be paid by the Contractor.

3.33 Maintaining Equipment Prior to Acceptance

- .1 Maintain all equipment in accordance with the manufacturer's printed instructions prior to start-up, testing, and commissioning.
- .2 Employ a qualified millwright to check and align shafts, drives, and couplings on all base mounted split coupled motor driven equipment.
- .3 Where equipment lubrication fittings are not easily accessible, extend the fittings to accessible locations using copper or aluminium tubing.
- .4 All filters are to be new upon Substantial Performance of the work. This is in addition to any spare filters specified.

3.34 Connections to Other Equipment

- .1 Carefully examine the Contract Documents during the bidding period and include for mechanical work piping and/or ductwork connections to equipment requiring such connections.

3.35 Waste Management and Disposal

- .1 Separate and recycle waste materials in accordance with requirements specified in Division 01.
- .2 Separate and recycle waste materials in accordance with requirements of Canadian Construction Association Standard Document CCA 81, A Best Practices Guide to Solid Waste Reduction.
- .3 Prepare a waste management and reduction plan and submit a copy for review prior to work commencing at the site.
- .4 Place materials defined as hazardous or toxic waste in designated containers.
- .5 Ensure emptied containers are sealed and stored safely for disposal.

3.36 Seismic Restraint Anchor Points for Equipment

- .1 All mechanical equipment requiring seismic restraint (see the mechanical work Section entitled Seismic Control and Restraint) shall be complete with manufacturer designed and rated seismic restraint anchor points and attachments, certified by the equipment manufacturers, so that the equipment may be bolted down or restrained in the field.
- .2 The equipment to be restrained must be designed such that the strength and anchorage of the internal components of the equipment exceeds the force level used to restrain and anchor the equipment itself to the supporting structure.

3.37 Installation of Flexible Connectors

- .1 Provide flexible connectors in piping connections to all seismically restrained equipment, and wherever else shown.
- .2 Provide flexible connectors in all piping connections to vibration isolated equipment.

END OF SECTION

1 GENERAL

1.1 Application

- .1 This Section specifies seismic control and restraint requirements that are common to mechanical work Sections of the Specification, it is a supplement to each Section and shall be read accordingly.

1.2 Seismic Consultant

- .1 Retain and pay for the services of an experienced Seismic Consultant who is a registered professional engineer licensed in the jurisdiction of the work and a member in good standing of a Professional Engineers Association in the jurisdiction of the work.
- .2 The Seismic Consultant shall:
 - .1 Determine the proper seismic hazard level, design, recommend, and review all proposed mechanical work seismic restraint shop, placement and securing drawings, and sign and stamp all drawings prior to submittal for review as specified below.
 - .2 Supervise installation of all mechanical work seismic restraint and, when work is complete, certify in writing that the seismic restraint work has been installed in accordance with signed, stamped, and reviewed drawings.
 - .3 Prepare and submit to the Municipality and authorities having jurisdiction, on a form approved by the Municipality and authorities having jurisdiction, at the beginning of seismic restraint work and when the work is complete, original signed and sealed Letters of Assurance for the design, installation and field review of all seismic restraint work.

1.3 Submittals

- .1 **Shop Drawings/Product Data Sheets:** Obtain all required equipment information and submit manufacturer's shop drawings/product data sheets for all restraining devices and steel bases. Include placement data, and details of attachment to both the equipment and the structure meeting requirements of the forces involved. All product data sheets and drawings are to be signed and stamped by the Seismic Consultant referred to above.
- .2 **Seismic Consultant's/Seismic Control Product Manufacturer's Certification Letters:** Submit copies of the Seismic Consultant's Letters of Assurance as specified above. Submit copies of the Seismic Consultant and seismic control manufacturer's certification letters as specified in Part 3 of this Section.
- .3 **Samples:** If requested, submit samples of seismic restraint materials for review.

1.4 Quality Assurance

- .1 Seismic restraints are to be designed by a Seismic Consultant as specified above, and are to be installed by qualified tradesmen under the supervision of and to the approval of the Seismic Consultant.
- .2 Unless otherwise specified seismic control and restraints are to be designed in accordance with:
 - .1 BC Building Code.
 - .2 ANSI/SMACNA Seismic Restraint Manual Guidelines for Mechanical Systems.
 - .3 CAN/CSA-S832, Seismic Risk Reduction of Operational and Functional Components (OFC's) of Buildings.
 - .4 ANSI/SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems.
- .3 Seismic control and restraints for fire protection piping and equipment are to be in accordance with NFPA requirements. When specified and/or required, design is also to include Factory Mutual requirements.

2 PRODUCTS

2.1 General

- .1 All restraint products must be tested in an independent testing laboratory, or certified by the Vibration Isolation and Seismic Control Manufacturer's Association and Seismic Consultant, to confirm that the restraint products meet all requirements of this Section.

3 EXECUTION

3.1 Installation of Seismic Restraint Materials

- .1 Provide seismic restraint for all mechanical system equipment, piping, and ductwork, etc., as per the requirements of specified Codes and Standards.

3.2 Seismic Restraint of Piping Systems

- .1 Provide seismic restraint for all new piping systems with the following exceptions:
 - .1 Natural gas piping less than 25 mm (1") diameter.
 - .2 Domestic water piping 32 mm (1¼") diameter and smaller in mechanical equipment rooms.
 - .3 All other piping 65 mm (1½") diameter and smaller.
 - .4 All piping suspended by individual hangers 300 mm (12") or less in length from the top of the pipe to the bottom of the hanger.

3.3 Seismic Restraint of Duct Systems

- .1 Provide seismic restraint for all new ductwork systems with the following exceptions:
 - .1 All rectangular ducts less than 0.56 sq. m (6 sq. ft.) in cross-sectional area.
 - .2 All round ducts less than 710 mm (28") in diameter.
 - .3 All ductwork suspended by individual hangers 300 mm (12") or less in length from the top of the duct to the bottom of the hanger.

3.4 Seismic Restraint for Motor Driven Equipment

- .1 Connect slack cable restraints to ceiling hung or in-line pumps in such a way that the axial projection of the wires passes through the centre of gravity of the equipment. Orient the restraint wires at approximately 90° to each other (in plan), and tie back to the ceiling or structure above at an angle not exceeding 90°.
- .2 Connect slack cable restraints to ceiling hung fans in such a way that the axial projection of the wires passes through the centre of gravity of the equipment. Orient the restraint wires at approximately 90° to each other (in plan), and tie back to the ceiling or structure above at an angle not exceeding 90°.
- .3 Provide seismically rated spring mount isolators for fans installed on floor structures or inside air handling unit casings. Refer to the mechanical Section entitled Mechanical Vibration Control.
- .4 For roof mounted fans supplied with seismically rated roof curbs, the Seismic Consultant shall determine the appropriate methods of attachment of the roof curbs to the roof structure.

3.5 Site Inspection and Letters of Certification

- .1 When all seismic control products have been installed, arrange for the Seismic Consultant to examine the installation of all seismic control products and to certify in writing that the products have been properly installed in accordance with governing Codes and Regulations, reviewed shop drawings and product data, and recommendations and instructions. The Seismic Consultant shall apply his signed and dated professional stamp to the letter.

3.6 Seismic Restraint Anchor Points for Equipment

- .1 All mechanical equipment requiring seismic restraint (see the mechanical work Section entitled Seismic Control and Restraint) shall be complete with manufacturer designed and

rated seismic restraint anchor points and attachments, certified by the equipment manufacturers, so that the equipment may be bolted down or restrained in the field.

- .2 The equipment to be restrained must be designed such that the strength and anchorage of the internal components of the equipment exceeds the force level used to restrain and anchor the equipment itself to the supporting structure.

3.7 Installation of Flexible Connectors

- .1 Provide flexible connectors in piping connections to all seismically restrained equipment, and wherever else shown.
- .2 Provide flexible connectors in all piping connections to vibration isolated equipment.

END OF SECTION

1 GENERAL

1.1 Application

- .1 This Section specifies vibration isolation product requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and shall be read accordingly.
- .2 All mechanical equipment, piping and ductwork as noted on the equipment schedule or in the specification shall be mounted on or suspended from vibration isolators to reduce the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
- .3 The work in this section includes, by is not limited to:
 - .1 Vibration isolation for piping, ductwork and equipment
 - .2 Equipment isolation bases
 - .3 Flexible piping connections
 - .4 Resilient Pipe Anchors and Guides

1.2 Submittals

- .1 Submittals shall be based on actual equipment to be supplied to site and not necessarily the scheduled equipment when approved alternatives have been carried by the Contractor. Vibration isolation submittal shall be coordinated appropriately with other submittals as well as proposed means of installation.
- .2 **Product Data:** Submit copies of manufacturer's product data sheets for all products specified in this Section. Product data sheets shall include:
 - .1 Descriptive Data:
 - .1 Schedules of flexibly mounted equipment, referencing drawings by number
 - .2 Catalog cuts or data sheets on vibration isolators
 - .2 Drawings:
 - .1 Submit details of equipment bases including dimensions, structural member sizes, and support point locations
 - .2 Submit details of isolation hangers for ceiling hung equipment, piping and ductwork
 - .3 Submit details of mountings for floor supported equipment, piping and ductwork
 - .4 All hanger, mounting or pad drawings shall indicate deflections and model numbers as well as any other requirements in the specifications.
 - .5 Spring diameters, rated loads, and deflections, heights at rated load and closed height shall be provided for all springs shown in the submittals in tabular form.

1.3 Quality Assurance

- .1 Mechanical vibration isolation product manufacturers are to be current members of the Vibration Isolation & Seismic Restraint Manufacturers Association.
- .2 All isolation materials shall be supplied by the same manufacturer.
- .3 Any variance or non-compliance with these specification requirements shall be corrected by the contractor in an approved manner.

1.4 Base Bid and Acceptable Manufacturers

- .1 Refer to the article entitled Equipment and Material Manufacturer Requirements in the Section entitled Mechanical Work General Instructions.
- .2 The following is a list of base bid and acceptable manufacturers for products specified in this Section:
 - .1 Mason Industries Inc.
 - .2 VMC Group.
 - .3 Vibro-Acoustics by Swegon.

.4 Kinetics Noise Control.

1.5 Seismic Restraint Requirements

- .1 Refer to the mechanical work Section entitled Seismic Control and Restraint for requirements for use of a Seismic Consultant, and seismic restraint requirements applicable to vibration isolated materials and equipment.
- .2 Hangers used in seismic applications shall be provided with a neoprene and steel rebound washer installed 6mm (1/4") clear of bottom of hanger housing in operation to prevent spring from excessive upward travel.

2 PRODUCTS

2.1 General

- .1 Vibration isolation products are to be in accordance with the drawing schedule and details, and as specified below.
- .2 **Finishes:** All steel components of isolation products not exposed to the weather or moisture are to be zinc plated or finished in powder coated enamel. All steel components of isolation products exposed to the weather or in a damp, moist environment are to be hot dipped galvanized or factory finished with rust inhibiting primer and 2 coats of neoprene.
- .3 Where the weight of isolated equipment may change significantly due to draining or filling with a liquid, vibration isolators are to be equipped with limit stops to limit spring extensions.
- .4 **Seismic Rated Vibration Isolation:** All seismic restraints supplied with vibration isolation are to meet requirements specified in the mechanical work Section entitled Seismic Control and Restraint.
- .5 **Flexible Piping Connections:** Flexible piping connections to vibration isolated equipment are specified in the appropriate piping sections of the Specification. Neoprene mountings shall have a minimum static deflection of 0.35"(9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang. Mountings shall be type ND or rails type RND as manufactured by Mason Industries, Inc.

2.2 Neoprene Mountings shall have a minimum static deflection of 0.35"(9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang. Mountings shall be type ND or rails type RND as manufactured by Mason Industries, Inc.

2.3 Pads Neoprene or neoprene/steel/neoprene pad isolators. Select Type 1 pads for minimum 2.5 mm static deflection or greater. Use hold down bolts selected for seismic loads. Isolate bolts from base of unit using neoprene hemi-grommets. Avoid over-compressing grommets (e.g. use Hilti HVA adhesive set bolts, or equal, with steel washers and lock nuts, adjusted finger tight to hemi-grommets). Size bolt and hemi-grommet for minimum lateral clearance. Use grommets only on light-weight equipment.

- .1 Acceptable Products: Mason WMW, Super W pads, Mason Industries Type HG Hemi-Grommets, EAR Grommets, Kinetics Noise Control Inc. Type RSP.

2.4 Rubber Floor Mounts: Rubber/neoprene-in-shear isolators designed to meet specified seismic requirements. Select for 4.0 mm minimum static deflection and bolt to structure. Rubber isolators, provide protection in design of isolator to avoid contact of rubber element to oil in mechanical room.

- .1 Acceptable Products: Mason BR, maximum 50 durometer, Kinetics Noise Control Inc. Type RD, RQ.

- 2.5 Spring Isolators** shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4" (6mm) neoprene acoustical friction pad between the baseplate and the support. All mountings shall have leveling bolts that must be rigidly bolted to the equipment. Installed and operating heights shall be equal. The ratio of the spring diameter divided by the compressed spring height shall be no less than 0.8. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be type SLF, as manufactured by Mason Industries, Inc.
- 2.6 Spring Floor Mounts:** Spring mounts complete with levelling devices, selected to achieve 25 mm deflection under load. Spring to incorporate minimum 6.0 mm thick neoprene sound pad or cup having 1.3 mm minimum deflection under load. Design isolator to meet specified seismic requirements.
- .1 Acceptable Products: Mason SSLFH, Mason SSLR (for chillers and cooling towers only), Kinetics Noise Control Inc. FLS.
- 2.7 Hanger Mounts:** Spring hangers, complete with 6.0 mm thick neoprene cup/bushing sized for 1.3 mm minimum deflection, or neoprene hangers.
- .1 Acceptable Products: Mason HD, HS, Kinetics Noise Control Inc. SH.
- 2.8 Pipe Hangers (general)** shall consist of rigid steel frames containing minimum 1-1/4" (32mm) thick LDS Rubber elements at the top and a steel spring with general characteristics as in specification **2.5** seated in a steel washer reinforced LDS Rubber cup on the bottom. The LDS Rubber element and the cup shall have LDS Rubber bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the LDS Rubber element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30° arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30° capability. Hangers shall be type 30N as manufactured by Mason Industries, Inc.
- 2.9 Duct Hangers** shall be manufactured with minimum characteristics as in Specification **2.5 (Spring Isolators)**, but without the LDS Rubber element. Springs are seated in a steel washer reinforced LDS Rubber cup that has an LDS Rubber bushing projecting through the bottom hole to prevent rod to hanger contact. Spring diameters and the lower hole sizes, shall be large enough to allow the hanger rod to swing through a 30° arc from side to side before contacting the cup bushing. If ducts are suspended by flat strap iron, the hanger assembly shall be modified by the manufacturer with an eye on top of the box and on the bottom of the spring hanger rod to allow for bolting to the hanger straps. Submittals on either of the above hangers shall include a scale drawing of the hanger showing the 30° capability. Hangers for rods shall be Type 30 or for straps W30 as manufactured by Mason Industries, Inc.
- 2.10 Horizontal Thrust Restraints for Fans:** when total air thrust exceeds 10% of the isolated weight, floor mounted or suspended air handling equipment shall be protected against excessive displacement by the use of horizontal thrust restraints. The restraint shall consist of a modified Specification **2.5 (Spring Isolators)** spring mounting. Restraint springs shall have the same deflection as the isolator springs. The assembly shall be preset at the factory and fine tuned in the field to allow for a maximum of 1/4" (6mm) movement from stop to maximum thrust. The assemblies shall be furnished with rod and angle brackets for attachment to both the equipment and duct work or the equipment and the structure. Restraints shall be attached at the center line of thrust and symmetrically on both sides of the unit. Horizontal thrust restraints shall be WB as manufactured by Mason Industries, Inc.
- 2.11 Bases and Rails**
- .1 Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped. Pump bases for split case pumps shall be large enough to support suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14"

(356mm) provided that the deflection and misalignment is kept within acceptable limits as determined by the manufacturer. Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1"(25mm). Bases shall be type WF as manufactured by Mason Industries, Inc.

- .2 Vibration isolation manufacturer shall provide steel members welded to height saving brackets to cradle equipment having legs or bases that do not require a complete supplementary base. Members shall have sufficient rigidity to prevent distortion of equipment. Inverted saddles shall be type ICS, as manufactured by Mason Industries, Inc.
- .3 Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating concrete bases. Bases for split case pumps shall be large enough to provide support for suction and discharge elbows. Bases shall be a minimum of 1/12 of the longest dimension of the base but not less than 6" (152mm). The base depth need not exceed 12" (305mm) unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2" (13mm) bars welded in place on 6" (152mm) centers running both ways in a layer 1 1/2"(38mm) above the bottom. Forms shall be furnished with steel templates to hold the anchor bolt sleeves and anchor bolts while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1" (25mm) clearance below the base. Wooden formed bases leaving a concrete rather than a steel finish are not acceptable. Base shall be type BMK or K as manufactured by Mason Industries, Inc.

2.12 Rubber expansion joints shall be peroxide cured EPDM throughout with Kevlar tire cord reinforcement. Substitutions must have certifiable equal or superior characteristics. The raised face rubber flanges must encase solid steel rings to prevent pull out. Flexible cable wire is not acceptable. Sizes 1-1/2" through 14"(40mm through 350mm) shall have a ductile iron external ring between the two spheres. Sizes 16" through 24" (400mm to 600mm) may be single sphere. Sizes 3/4" through 2"(19mm through 50mm) may have one sphere, bolted threaded flange assemblies and cable retention.

- .1 Minimum ratings through 14"(350mm) shall be 250psi at 170°F and 215psi at 250°F. (1.72MPa at 77°C and 1.48MPa at 121°C), 16"(400mm) through 24"(600mm) 180psi at 170°F and 150psi at 250°F. (1.24MPa at 77°C and 1.03 MPa at 121°C). Higher published rated connectors may be used where required.
- .2 Safety factors shall be a minimum of 3/1. All expansion joints must be factory tested to 150% of maximum pressure for 12 minutes before shipment.
- .3 The piping gap shall be equal to the length of the expansion joint under pressure. Control rods passing through 1/2"(13mm) thick Neoprene washer bushings large enough to take the thrust at 1000psi (0.7 kg/mm²) of surface area may be used on unanchored piping where the manufacturer determines the condition exceeds the expansion joint rating without them. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer. All expansion joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.

2.13 Flexible stainless steel hoses with a safety factor of 4 shall be manufactured using type 304 stainless steel braided hose with one fixed and one floating raised face carbon steel plate flange. Sizes 2-1/2" (65mm) and smaller may have threaded nipples. Copper sweat ends, 4" (100mm) and smaller, may have SS (gas service) or Bronze (water service) bodies. Grooved ends may be used in sizes 2" (50mm) through 12" (300mm). Welding is not acceptable. Minimum lengths, minimum live lengths and minimum number of convolutions per foot to assure flexibility shall be as per Figure 1. Shorter lengths are not acceptable. Hoses shall be installed on the equipment side of the shut off valves horizontal and parallel to the equipment shafts wherever possible. Submittals shall include original test data showing force/displacement, fittings, material, live lengths, number of corrugations per foot and safety factor at pressure ratings. Hoses shall be type BSS or CPSB as manufactured by Mason Industries, Inc.

Pipe or Tubing Size (in) (mm)	FLANGED		THREADED		GROOVED ENDS		COPPER SWEAT BRONZE		Minimum Convol- utions per (foot) (m)
	Face to (in) (mm)	Live Length (in) (mm)	End to (in) (mm)	Live Length (in) (mm)	End to (in) (mm)	Live Length (in) (mm)	End to (in) (mm)	Live Length (in) (mm)	
1/2 15	—	—	24 600	193/4 501	—	—	18 457	141/4 362	92 302
3/4 20	—	—	24 600	193/4 501	—	—	18 457	133/4 349	80 262
1 25	—	—	24 600	193/4 501	—	—	18 457	133/8 340	72 236
1 1/4 30	—	—	24 600	183/4 469	—	—	18 457	131/4 337	67 220
1 1/2 40	24 600	217/8 469	24 600	183/4 469	—	—	18 457	13 330	63 207
2 50	24 600	211/8 450	24 600	18 450	24 600	18 450	18 457	121/2 318	58 190
2 1/2 65	24 600	211/8 450	24 600	17 425	24 600	18 450	18 457	103/4 273	48 157
3 75	36 900	331/8 841	36 900	29 737	36 900	30 750	18 457	101/2 267	46 151
4 100	36 900	331/8 841	36 900	29 737	36 900	28 700	18 457	151/2 394	32 105
5 125	36 900	327/8 822	—	—	36 900	28 700	—	—	29 95
6 150	36 900	327/8 822	—	—	36 900	28 700	—	—	25 82
8 200	36 900	325/8 816	—	—	36 900	28 700	—	—	23 75
10 250	36 900	325/8 816	—	—	36 900	26 650	—	—	21 69
12 300	36 900	325/8 816	—	—	36 900	26 650	—	—	20 66
14 350	36 900	325/8 816	—	—	—	—	—	—	18 59
16 400	36 900	325/8 816	—	—	—	—	—	—	16 52

Figure 1 - Flexible SS Hose Min. Convolutions per ft (m)

- 2.14 Pipe Wall Penetrations:** where pipes pass through structural openings, the space shall be sealed by a 2 piece clamp lined with 3/4" (19mm) thick Neoprene Sponge. Concrete or block shall be poured or built around the clamp or back packed with concrete. 10 Lb. density fibreglass with caulked ends will replace the sponge where temperatures exceed 225°F (107°C). Seals shall be type SWS as manufactured by Mason Industries, Inc.
- 2.15 All-directional acoustical pipe anchors,** consist of two sizes of steel tubing separated by a minimum 1/2" (13mm) thickness of 60 duro or softer LDS Rubber. Vertical restraint shall be provided by similar material arranged to prevent up or down vertical travel. Allowable loads on the isolation material shall not exceed 500 psi (3.45 N/mm²) and the design shall be balanced for equal resistance in any direction. All-directional anchors shall be type ADA as manufactured by Mason Industries, Inc.
- 2.16 Pipe guides** shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2" (13mm) thickness of 60 durometer or softer neoprene. The height of the guides shall be preset with a set screw to allow vertical motion due to pipe expansion or contraction. Guides shall be capable of ±15/8" (41mm) motion, or to meet location requirements. Pipe guides shall be type VSG as manufactured by Mason Industries, Inc.
- 2.17 Flexible Duct Connections** shall be constructed from EPDM or neoprene. Install 75mm (3") flexible duct connections with a minimum 40mm (1-1/2") metal to metal gap. Flexible duct connections shall be installed so that the duct size is not reduced by the deflection of the flexible connector. Flexible connections shall be rated for duct system pressures and shall meet SMACNA pressure and leakage classifications of connected ductwork. Provide flanged connections to ductwork.

3 EXECUTION

3.1 Installation of Vibration Isolation Materials

- .1 Provide vibration isolation products for mechanical work in accordance with the drawing schedule and details, and requirements specified herein and/or on the drawings.
- .2 Supply to the vibration isolation product manufacturer or supplier a copy of a "Reviewed" shop drawing or product data sheet for each piece of equipment to be isolated, and dimensioned pipe layouts of associated piping to be isolated.
- .3 Unless otherwise specified, all vibration isolation products are to be the product of one manufacturer.
- .4 Ensure that the vibration isolation manufacturer coordinates material selections with equipment provided in order to ensure adherence to performance criteria. Allow for expansion and contraction when material is selected and installed.
- .5 Maintain a minimum clearance of 50 mm (2") between vibration isolated equipment and adjacent structures, piping, ductwork, equipment, and similar items.
- .6 Installation of vibration isolators must not cause any change of position of equipment, piping or duct work resulting in stressed or misalignment.
- .7 No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.
- .8 The contractor shall not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.
- .9 Coordinate work with other trades to avoid rigid contact with the building.
- .10 Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the architects/engineer's attention prior to installation. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.

- .11 Bring to the architects/engineer's attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the responsible contractor's expense.
- .12 Correct, at no additional cost, all installations which are deemed defective in workmanship and materials at the contractor's expense
- .13 Where piping passes through walls, floors, or ceilings the vibration isolation manufacturer shall provide split acoustic wall seals consisting of 19mm (3/4") thick closed cell neoprene sponge as per section **2.14**, Mason SWS or approved equal.
- .14 Locate isolation hangers as near to the overhead support structure as possible.
- .15 Air handling equipment and centrifugal fans shall be protected against excessive displacement which results from high air thrust when thrust forces exceed 10% of the equipment weight. Horizontal thrust restraints shall be as per **2.10**.
- .16 Rooftop equipment isolators must be bolted to the equipment and structure. Mountings must be designed to resist 100m/h(160 km/h) wind loads.
- .17 Vibration Isolation of Horizontal Piping.**
 - .1 The first four pipe hangers in the main lines near the mechanical equipment shall be as described in specification.
 - .2 Hangers supporting piping 2"(50mm) and larger in all other locations throughout the building shall be isolated by hangers as described in specification **2.3**.
 - .3 Floor supported piping shall rest on isolators as described in specification.
 - .4 Heat exchangers and expansion tanks are considered part of the piping run.
 - .5 The first four isolators from the isolated equipment shall have the same static deflection as specified for the mountings under the connected equipment.
 - .6 If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first four hangers shall have
 - .1 0.75" (19mm) deflection for pipe sizes up to and including 3" (75mm),
 - .2 1-1/2" (38mm) deflection for pipe sizes over 3" (75mm) and up to and including 6" (150mm), and
 - .3 2-1/2" (64mm) deflection thereafter.
 - .7 Where piping connects to mechanical equipment install specification **2.12 Rubber Expansion Joints** or specification **2.13 Stainless Hoses** if **2.12** is not suitable for the service.
 - .8 All piping passing through the equipment walls, floors or ceilings shall be protected against sound leakage by means of an acoustical seal, as described in Specification **2.14**.
- .18 Vibration Isolation of Riser Piping.**
 - .1 All vertical risers shall be supported by spring isolators designed to support the riser filled with water, if it is a water line. Assigned loads must be within the building design limits at the support points. Neutral central resilient anchors close to the center of the run shall direct movement up and down. The anchors shall be capable of holding an upward force equal to the water weight when the system is drained. If one level cannot accommodate this force, anchors can be located on 2 or 3 adjacent floors.
 - .2 Resilient guides shall be spaced and sized properly depending on the pipe diameter.
 - .3 Submittals must include the initial load, initial deflection, change in deflection, final load and change in load at all spring and anchor support locations, as well as guide spacing. The initial spring deflection shall be a minimum of 0.75" (19mm) or four times the thermal movement at the isolator location, whichever is greater.
 - .4 Calculations shall include pipe stress at end conditions and branch off locations and the manufacturer must include installation instructions.
 - .5 Submittal must be stamped and signed by a licensed professional engineer in the employ of the vibration vendor for at least 5 years.
 - .6 Support spring mountings shall be per Specification **2.5**, anchors per Specification **2.15**, telescoping guides per Specification **2.16**.

- .19 **Vibration Isolation of Ductwork**
- .1 All air ducts with a cross section of 2 ft² (0.19m²) or larger shall be isolated from the building structure by specification **2.9 (Duct Hangers)** or **2.5 (Spring Isolators)** floor supports with a minimum deflection of 0.75"(19mm). Isolators shall continue for 50'(15m) from the equipment. If air velocity exceeds 1000 fpm(5.3mps), hangers or supports shall continue for an additional 50'(15m) or as shown on the drawings.
 - .2 Provide flexible duct connections on inlet and outlet of all centrifugal fans.
- .20 **Control Wiring Connections:** for all control wiring connections to vibration isolated equipment ensure that flexible metallic conduit with 90° bend is used for conduit 25 mm (1") dia. and smaller, and for conduit larger than 25 mm (1") dia., use Crouse Hinds EC couplings. Connections are to be long enough so that the conduit will remain intact if the equipment moves 300 mm (12") laterally from its installed position, and flexible enough to transmit less vibration to the structure than is transmitted through the vibration isolation. Coordinate these requirements with the mechanical trades involved. If electrical power connections are not made in a similar manner as part of the electrical work, report this fact to the Consultant.
- .21 **Seismic Restraint Isolation:** Refer to the mechanical work Section entitled Seismic Control and Restraint for requirements pertaining to seismically restrained vibration isolation.
- .22 **Adjusting, Commissioning and Testing:**
- .1 Adjust vibration isolators after piping systems are filled and equipment is at operating weight.
 - .2 Check for vibration and noise transmission through connections, piping, ductwork, foundations, and walls. Adjust, repair, or replace isolators as required to reduce vibration and noise transmissions to specified levels.
 - .3 For large rotating equipment that requires final alignment on-site, provide follow-up vibration isolation adjustment to suit final operating condition and any final equipment alignment requirements, ie for large base mounted pumps, fans, etc. Coordinate vibration isolation adjustment with start-up and commissioning personnel.

4 EQUIPMENT SCHEDULE

4.1

EQUIPMENT SCHEDULE			
EQUIPMENT TAG	Provided With Equipment	VIBRATION ISOLATION	
		Isolator, Base, Restraint, Flexible Connector Specification	Minimum Static Deflection
EF-2	Y	Floor Mounted Spring Isolator	25
EF-11	Y	Ceiling Mounted Spring Isolator	25

END OF SECTION

1 GENERAL

1.1 Application

- .1 This Section specifies thermal insulation requirements that are common to mechanical work Sections of the Specification. It is a supplement to each Section and shall be read accordingly.

1.2 Submittals

- .1 **Product Data Sheets & WHMIS Sheets:** Submit a product data sheet and a WHMIS sheet for each insulation system product. Product data sheets must confirm that the product conforms to requirements and insulation thickness of referenced Codes, Standards, and thermal conductivity and density values.
- .2 **Insulation Systems:** Submit shop drawing of each system at least 4 weeks prior to insulation work commencing. Submit a shop drawing of each type of insulation for approval and identify each product with the manufacturer's name and insulation type. Work shall not proceed prior to approved shop drawing review.
- .3 **Removable/Reusable Insulation Covers:** Submit a fabrication drawing for each custom made cover to indicate material and fabrication details, and a 300 mm (12") square sample of the proposed cover material.

1.3 Definitions

- .1 "Concealed" means insulated mechanical services and equipment located in suspended ceiling spaces, non-accessible chases, and furred-in spaces.
- .2 "Exposed" means not concealed as defined above and visible to building occupants.
- .3 "Insulation system" means insulation material, fasteners, jacket, vapour barrier and any other accessory.
- .4 "BCICA" means British Columbia Insulation Contractors Association.
- .5 "Mineral fibre" means glass fibre, rock wool fibre, and slag wool fibre.
- .6 "Domestic water" means all piping (cold, hot, tempered and re-circulation) extended from the building Municipal supply main.
- .7 "WHMIS sheets" means Workplace Hazardous Materials Information System sheets
- .8 "TIAC" means Thermal Insulation Association of Canada.

1.4 Quality Assurance

- .1 **Insulation System Materials, Application, and Finishes:** Insulation system materials, application, and finishes must, as a minimum, conform to the standards listed in the current version of the BCICA "Quality Standards for Mechanical Insulation."
- .2 **Insulation Values:** Minimum piping and duct insulation thickness / R values shall conform to the current version of National Energy Code for Canada for Buildings and ASHRAE 90.1 Section 6 - Heating, Ventilation and Air Conditioning & Section 7 – Service Water Heating.
- .3 **Qualification of Applicators:** Mechanical insulation shall be applied by tradespersons with a BCICA membership and a Red Seal or TQ designation in the Heat and Frost Insulation Trade. Registered apprentice tradespersons must be under direct, daily, on-site supervision of a journeyman.
- .4 Do not apply insulation unless leakage tests have been satisfactorily completed.
- .5 Ensure that all surfaces to be insulated are clean and dry.
- .6 Ensure that the ambient temperature is minimum 13°C (55°F) for at least one day prior to the application of insulation, and for the duration of insulation work, and that relative humidity is and will be at a level such that mildew will not form on insulation materials.

- .7 All insulation materials must be stored on site in a proper and dry storage area. Any wet or damaged insulation material shall be removed from the site and replaced.

2 PRODUCTS

2.1 Base Bid and Acceptable Manufacturers

- .1 Refer to the article entitled Base Bid and Acceptable Manufacturers in the Section 20 05 10 – Basic Mechanical Materials and Methods.

2.2 Fire Hazard Ratings

- .1 Unless otherwise specified, all insulation system materials inside the building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

2.3 Thermal Performance

- .1 Unless otherwise specified, thermal performance, i.e. conductivity, of insulation shall meet or exceed the values given in the current version of the National Energy Code of Canada for Buildings and ANSI/IES/ASHRAE Standard 90.1.
- .2 Insulation thickness around pipe fittings, including shoulders and hardware, to be the same installed thickness as the adjacent or adjoining pipe insulation. Pipe and fitting insulation to be equal thickness and thermal performance throughout the entire system.
- .3 Pipe insulation to be continuous through hanging supports, walls, ceilings and floors. Hangers, supports, anchors, etc. that are secured directly to cold surfaces (ie: piping) will be adequately insulated and vapor sealed to prevent condensation.

2.4 Pipe Insulation Materials

- .1 **Horizontal Pipe Insulation at Hangers & Supports:** Equal to Shur Fit Products "Pro-Pipe Support" or Belform Insulation Ltd. "Koolphen K-Block" insulated pipe support inserts consisting of minimum 150 mm (6") long, premoulded, rigid, sectional phenolic foam insulation (of same thickness as adjoining insulation) with a reinforced foil and Kraft paper vapour barrier jacket and a 180° captive galvanized steel saddle.
- .2 **Specialty insulation for Piping:** Factory fabricated foamed glass or closed cell foamed plastic insulation fittings specifically made for pipe mechanical joint fittings and couplings, and pipe risers at riser clamps. Equal to Armacell Canada Inc. or Owens Corning "FOAMGLASS".
- .3 **BCICA Standard 1501, Type A2, Preformed Mineral Fibre:** Rigid, sectional, sleeve type insulation to ASTM Standard C 547, Standard Specification for Mineral Fibre Pipe Insulation, supplied in 915 mm (3') lengths with a factory applied vapour barrier jacket and adhesive jacket closure to ASTM C1136, Standard Specification for Flexible, Low Permeance Vapor Retarders for Thermal Insulation, with a minimum thermal conductivity of 0.033 W @ 24°C.
- .1 Johns Manville Inc. "Micro-Lok AP-T Plus"
- .2 Knauf Fiber Glass "Pipe Insulation" with "ASJ-SSL" jacket
- .3 Manson Insulation Inc. "ALLEY K APT"
- .4 Owens Corning Fiberglas Pipe Insulation
- .4 **BCICA Standard 1501, Type A2, Preformed Non-Combustible Mineral Fibre:** Rigid, sectional, sleeve type insulation to ASTM Standard C 547, Standard Specification for Mineral Fibre Pipe Insulation, minimum thermal conductivity of 0.047 @ 93°C, supplied in 915 mm (3') lengths with a factory applied vapour barrier jacket and adhesive jacket closure, and non-combustible, in accordance with requirements of CAN/ULC-S114, Test for Non-Combustibility, and compatible with firestopping as per CAN/ULC-S101, Fire Endurance Tests of Building Construction and Materials.

- .1 Roxul "Techton 1200"
- .2 Paroc 1200
- .5 **BCICA Standard 1501, Type A5, Flexible Foam Elastomeric:** Closed cell, sleeve type, longitudinally split self-seal, foamed plastic pipe insulation in accordance with requirements of ASTM C534, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form, with all required installation accessories. Acceptable products are:
 - .1 Armacell AP/Armaflex SS
 - .2 Aeroflex "Aerocel SSPT"
 - .3 K-FLEX USA TITAN
- .6 **BCICA Standard 1501, Type A7, Closed Cell Foamed Glass:** Expanded, sectional, rigid sleeve type insulation manufactured in accordance with requirements of ASTM C552, Standard Specification for Cellular Glass Thermal Insulation, minimum thermal conductivity of 0.027 W @ 24°C, minimum density of 32 kg/m³, and equipped with a factory applied self-sealing jacket. Pittsburgh Corning "FOAMGLASS" with a factory applied "PITWRAP SSII" self-sealing jacket, or equivalent.

2.5 Barrier-Free Lavatory/Sink Piping Insulation Kits

- .1 Removable, flexible, reusable, white moulded PVC insulation kits with internal fasteners for barrier-free fixture drain piping and domestic water supplies exposed under the fixture.

2.6 Ductwork System Insulation Materials

- .1 **BCICA Standard 1502, Type A2, Rigid Mineral Fibre Board:** Preformed board type insulation to ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation, with a factory applied reinforced aluminum foil and kraft paper facing.
 - .1 Knauf Fiber Glass Insulation Board with FSK facing
 - .2 Manson Insulation Inc. "AK BOARD FSK"
 - .3 Johns Manville Inc. Type 814 "Spin-Glas"
 - .4 Owens Corning 703, 704
- .2 **BCICA Standard 1502, Type B2, Flexible Mineral Fibre:** Roll form insulation to ASTM C1393, Standard Specification for Perpendicularly Oriented Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks, with a factory applied vapour barrier facing consisting of consisting of cut strips of rigid mineral board insulation glued to an aluminium foil and kraft paper facing.
 - .1 Multi-Glass Insulation Ltd. "Multi-Flex MKF"
 - .2 Glass-Cell Fabricators Ltd. "R-FLEX"
 - .3 Owens Corning Pipe and Tank Insulation
- .3 **Blanket Mineral Fibre:** Blanket type roll form insulation to ASTM Standard C553, Standard Specification for Mineral Fibre Blanket Thermal Insulation, 24 kg/m³ (1½ lb./ft.³) density, 40 mm (1½") thick, with a factory applied vapour barrier facing. Acceptable products are:
 - .1 Knauf Fiber Glass Blanket Insulation with multi-purpose "FSK" facing
 - .2 Manson Insulation Inc. "ALLEY WRAP FSK"
 - .3 Johns Manville Inc. Duct Wrap Type 150 "Microlite"
 - .4 Isofab Faced Flexible FSK Insulation
- .4 **Premoulded Calcium Silicate:** Rigid block and sheet insulation in accordance with requirements of ASTM C533, Structural Insulating Board, Calcium Silicate. Acceptable products are:

- .1 Johns Manville Inc. "Thermo-12 Gold"
- .2 Industrial Insulation Group "Thermo-12 Gold"
- .5 **Flexible Foam Elastomeric Sheet:** Sheet form, CFC free, closed cell, self-adhering elastomeric EDPM rubber insulation in accordance with requirements ASTM C534, Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular form, with all required installation accessories.
 - .1 Armacell "AP/Armaflex SA"
 - .2 Aeroflex "Aerocel Sheet"

2.7 Equipment Insulation Materials

- .1 **BCICA Standard 1503, Type A1D, Semi-Rigid Mineral Fibre:** Blanket type roll form insulation to ASTM Standard C553, Standard Specification for Mineral Fibre Blanket Thermal Insulation, 24 kg/m³ (1½ lb./ft.³) density, with a factory applied vapour barrier facing.
 - .1 Knauf Fiber Glass Blanket Insulation with multi-purpose "FSK" facing
 - .2 Manson Insulation Inc. "ALLEY WRAP FSK"
 - .3 Johns Manville Inc. Type 150 "Microlite"
 - .4 Isofab Faced Flexible FSK Insulation
- .2 **BCICA Standard 1503, Type A1D, Semi-Rigid Mineral Fibre:** Roll form, moulded insulation to ASTM Standard C1393, Standard Specification for Perpendicularly Oriented Fiber Roll and Sheet Thermal Insulation for Pipes and Tanks, with a factory applied vapour barrier facing consisting of laminated aluminum foil and kraft paper.
 - .1 Knauf Fiber Glass Pipe and Tank Insulation
 - .2 Manson Insulation Inc. "AK FLEX"
 - .3 Johns Manville Inc. Pipe and Tank Insulation
 - .4 Multi-Glass Insulation Ltd. "MULTI-FLEX MF"
 - .5 Owens Corning Pipe and Tank Insulation
 - .6 Glass-Cell Fabricators Ltd. "R-Flex"
- .3 **Semi-Rigid Mineral Wool Blanket:** Equal to Roxul "Enerwrap80" flexible, black fibrous scrim faced mineral fibre blanket insulation to ASTM C 553, Standard Specification for Mineral Fibre Blanket Thermal Insulation.
- .4 **Closed Cell Foamed Glass:** Pittsburgh Corning "FOAMGLAS" expanded, rigid board and block type insulation in accordance with requirements of ASTM C552, Standard Specification for Cellular Glass Thermal Insulation, and equipped with a factory applied facing with a liquid or vapour permeability rating of 0.00 as per ASTM C240, Standard Test Method of Testing Cellular Glass Insulation Blocks.

2.8 Insulating Coatings

- .1 Equal to Robson Thermal Manufacturing Ltd. insulating coatings as follows:
 - .1 Anti-condensation coating, "No Sweat-FX".
 - .2 Thermal insulating coating, "thermalite".

2.9 Insulation Fastenings

- .1 **Wire:** Minimum #15 gauge galvanized annealed wire.
- .2 **Wire Mesh:** Minimum #15 gauge galvanized annealed wire factory woven into 25 mm (1") hexagonal mesh.

- .3 **Aluminium Banding:** Equal to Childers Products Co. "FABSTRAPS" minimum 12 mm (½") wide, 0.6 mm (1/16") thick aluminium strapping.
- .4 **Stainless Steel Banding:** Equal to Childers Products Co. "FABSTAPS" 0.6 mm (1/16") thick, minimum 12 mm (½") wide type 304 stainless steel strapping.
- .5 **Duct Insulation Fasteners:** Weld-on 2 mm (3/32") diameter zinc coated steel spindles of suitable length, complete with minimum 40 mm (1½") square zinc plated steel self-locking washers.
- .6 **Tape Sealant:** Equal to MACtac Canada Ltd. self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match the surface being sealed.
- .7 **Adhesive - Mineral Fibre Insulation:** Clear, pressure sensitive, brush consistency adhesive, suitable for a temperature range of -20°C to 82°C (-4°F to 180°F), compatible with the type of material to be secured, WHMIS classified as non-hazardous,
- .8 **Adhesive – Flexible Elastomeric Insulation:** Armacell "Armaflex" #520 air-drying contact adhesive.
- .9 **Adhesive – Closed Cell Foamed Glass Insulation:** Equal to Pittsburgh Corning PC88 multi-purpose two-component adhesive.
- .10 **Lagging Adhesive:** White, brush consistency, ULC listed and labelled, 25/50 fire/smoke rated lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.
- .11 **Sheet Metal Screws:** No. 10 stainless steel sheet metal screws.

2.10 Insulation Jackets and Finishes

- .1 **BCICA Type D1, PVC:** Roll form sheet and fitting covers in accordance with ASTM D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds, minimum 15 mil thick, white, PVC, 25/50 rated, complete with installation and sealing accessories. Do not use screws or tacks that will compromise vapor seal under covers.
 - .1 Proto Corp. "LoSMOKE"
 - .2 The Sure-Fit System "SMOKE-LESS 25/50"
 - .3 Johns Manville Inc. "Zeston" 300
- .2 **BCICA Type D2, Rigid Aluminium:** Equal to Childers Metals "Lock-on" 0.406 mm (5/32") thick embossed aluminum jacket material to ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate, factory cut to size and complete with moisture barrier and continuous modified Pittsburgh Z-Lock, and "Fabstraps" and butt straps to cover end to end joints. Fittings are to be 2-piece epoxy coated pressed aluminum with weather locking edges. Do not use screws or tacks that will compromise vapor seal under covers.
- .3 **Protective Coating - Foamed Glass Insulation:** Pittsburgh Corning "PITTCOTE 404" flexible acrylic latex weather barrier coating, white unless otherwise specified
- .4 **Protective Coating - Flexible Foam Elastomeric Insulation:** Equal to Armacell "WB Armaflex" weatherproof, water-based latex enamel finish.
- .5 **Insulation Cement:** Heat resistant, trowel consistency thermal insulating and finishing cement to CAN/CGSB 51.12, Thermal Insulating and Finishing Cement, and suitable in all respects for the application.

2.11 Removable/Reusable Insulation Covers

- .1 **Valve, Etc. Covers:** "No Sweat Valve Wrap Inc." "NO SWEAT" reusable insulation wraps with vapour barrier jacket and self-sealing ends and longitudinal seam, with a length to suit the application and an insulation thickness equal to the adjoining insulation.

- .2 Do not use screws or tacks that will compromise vapor seal under covers.
- .3 **Equipment Covers:** Custom manufactured covers conforming to the shape of the item to be insulated, designed to be easily removable and replaceable to suit the use and maintenance procedures of the particular item, and to provide adequate personnel protection. Covers are to be complete with minimum 95 kg/m³ (6 lb./ft.³) density ceramic fibre insulation sewn between minimum 542.5 g/m² (1.8 oz./ft.²) weight silicone impregnated fibreglass fabric in a quilted pattern using double stitches made with Kelvar or Teflon coated fibreglass thread. Overlap flaps are to be secured using laces, snaps, or Velcro double stitched in place.
 - .1 Cossby Dewar Inc.
 - .2 Insufab Systems Inc.
 - .3 ADL Insulflex Inc.
 - .4 Firwin Corp.
- .4 Do not use screws or tacks that will compromise vapor seal under covers.

2.12 Duct Lining

- .1 Minimum 25 mm (1") thick acoustic lining material meeting NFPA 90A requirements, and flame spread and smoke developed fire hazard ratings of CAN/ULC-S102, flexible, consisting of NBR/PVC based closed-cell, flexible elastomeric foam thermal and acoustic insulation. UL Greenguard gold-certified for low VOC emissions. K-Flex Duct Liner Gray or equivalent.
 - .1 Where shown on drawings.

2.13 Firestopping

- .1 Refer to Section 20 05 60 – Firestopping and Smoke Seal Systems

3 EXECUTION

3.1 General Insulation Application Requirements

- .1 Unless otherwise specified, do not insulate the following:
 - .1 Factory insulated equipment and piping.
 - .2 Branch domestic water piping located under counters to serve counter mounted plumbing fixtures and fittings, except barrier-free lavatories.
 - .3 Exposed chrome plated domestic water angle supplies from concealed piping to plumbing fixtures and fittings, except barrier-free lavatories.
 - .4 Domestic water and heating system expansion tanks.
 - .5 Manufactured expansion joints and flexible connections.
 - .6 Acoustically lined ductwork and/or equipment.
 - .7 Flexible branch ductwork from sheet metal ducts to grilles or diffusers.
 - .8 Domestic hot and tempered water and heating system piping unions, except for steam and condensate piping.
- .2 Do not apply insulation unless leakage tests have been satisfactorily completed.
- .3 Ensure that all surfaces to be insulated are clean and dry.
- .4 Ensure that the ambient temperature is minimum 13° C (55° F) for at least one day prior to the application of insulation, and for the duration of insulation work, and that relative humidity is and will be at a level such that mildew will not form on insulation materials.

- .5 All insulation materials must be stored on site in a proper and dry storage area. Any wet insulation material is to be removed from the site and replaced. Repair damaged insulation jackets.
- .6 Install insulation directly over pipes and ducts and not over hangers and supports.
- .7 Install piping insulation and jacket continuous through pipe openings and sleeves.
- .8 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.
- .9 When insulating "cold" piping and equipment, extend insulation up valve bodies, temperature gauges, shut-off valves and other such projections as far as possible, and protect the insulation jacketing from the action of condensation at its junction with the metal.
- .10 When insulating vertical piping risers 75 mm (3") diameter and larger, use insulation support rings welded directly above the lowest pipe fitting, and thereafter at 4.5 m (15') centres and at each valve and flange. Insulate as per Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.
- .11 Where mineral fibre rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover the exposed end of the insulation with a purpose made PVC cover on "cold" piping, and with canvas jacket material on "hot" piping, or with barrier mastic.
- .12 Insulation thickness must be maintained even where there is interference between weld bead, mechanical joints, etc. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.
- .13 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in the insulation and provide a suitable grommet in the opening.
- .14 Where piping and/or equipment is traced with electric heating cable, ensure that the cable has been successfully tested prior to the application of insulation, and ensure that the cable is not damaged or displaced during the application of insulation. Insulation for electric heat traced systems shall be sized to allow for the presence of heater cable.
- .15 Insulate, vapour seal, and finish all seismic restraints, braces, anchors, hanger rods, and similar hardware directly connected to "cold" piping and/or equipment, for a distance of 300 mm (12") clear of the adjacent pipe or equipment finish, to match the piping and/or equipment insulation.
- .16 Where existing insulation work is damaged as a result of a new mechanical work, repair the damaged insulation work to new work standards.

3.2 Insulation for Pipe Mechanical Joint Fittings & Couplings, etc.

- .1 Provide manufactured insulation fittings, the same thickness as the adjoining pipe insulation, for mechanical joint fittings and couplings, and for piping at riser clamps through the floor. Cover with purpose made full thickness PVC covers with joints sealed with tape.

3.3 Insulation for Horizontal Pipe at Hangers and Supports

- .1 At each hanger and support location for piping 50 mm (2") diameter and larger and scheduled to be insulated, except where roller hangers and/or supports are required, and unless otherwise specified, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield. Supply the insulation sections to the piping installers for installation as the pipe is erected.
- .2 For 100 mm (4") diameter and larger heating system piping where roller type hangers and supports are provided, a steel saddle will be tack welded to the pipe at each roller hanger or support location. Pack saddle voids with loose mineral fibre insulation.
- .3 Coordinate the pre-insulated pipe supports with the mechanical contractor.

3.4 Valve Stem Extensions

- .1 Valve stem extensions are required where valve operation will damage or come in contact with the vapor and mechanical insulation jacket.

3.5 Pipe Insulation Requirements – Above Ground Inside and Outside the Building

- .1 Insulate pipe inside the building and above ground, as scheduled below, in accordance with BCICA Quality Standard 1501, Piping, as follows:

- .1 **Material:** Type A2 mineral fibre.

- .2 **Insulation application:**

- .1 1501-H for hot piping.

- .2 1501-C for cold piping.

- .3 **Exposed Insulation finish:**

Exposed Mechanical Rooms - PF2 Premium 2

- .1 Over the pipe insulation apply a layer of sheathing paper adequately stapled in place, then apply treated fabric jacket with fabric adhesive.
 - .2 Alternately, a factory applied integral all-service type jacket on the pipe insulation may be used as the sheathing paper. The factory-applied jacket shall be neatly applied to receive the treated fabric jacket. Over insulated surface, apply treated canvas jacket as per manufacturer's recommendations.
 - .3 Over insulated fittings, apply PVC fitting covers. Over insulated valve bodies, valve bonnets, strainers and flanges apply treated fabric jacket as per manufacturer's recommendations. Alternatively, commercially available PVC covers may be used.
 - .4 Finish fabric with one (1) coat of fabric coating imbedded into fabric.

Exposed Inside the Building – PF5 PVC Jacket

- .5 Over the pipe insulation, apply PVC jacket using necessary fastenings on approximately 100mm centre. Alternatively, SSL (self-seal lap) or solvent weld seams are acceptable. Tacks will not be used where a continuous vapour barrier is required.
 - .6 Over insulated fittings, valve bodies, valve bonnets, strainers and flanges, apply PVC jacket or pre-formed PVC fitting covers to provide a complete jacket system. Secure with necessary fastening and jacket finishing tape.

Concealed Inside the Building – PF3 Economy

- .7 Apply pipe covering with integral vapour barrier jacket to piping and hold in place by securing the jacket flap. Seal all flaps and butt strips with vapour barrier adhesive. Pipe covering with integral self-sealing vapour barrier jacket will not require additional fastening.
 - .8 Over insulated fittings, apply PVC cover. Over insulated valve bodies, valve bonnets, strainers and flanges, apply all service jacketing (ASJ) using necessary fastenings and jacket finishing tape, or alternatively use PVC fitting covers.

Exposed Outside the Building – PF4 Metal Jacket

- .9 Over the pipe insulation, apply aluminum metal jacket using necessary fastenings at minimum 150mm centres including refrigerant piping.
 - .10 Over insulated fittings, valve bodies, valve bonnets, strainers and flanges, apply metal jacket or preformed metal fittings to provide a complete metal jacket system. Secure with necessary fastenings.

Note:

- The use of PVC jacketing or fitting covers is limited by the Building Code or by-law requirements for smoke/flame developed classification.
- Where continuous vapour barrier is required, the use of penetrating type fasteners will be avoided and if required, such fasteners shall be sealed to maintain the vapour barrier performance.

COLD PIPE INSULATION									
System	Class	Insulation Material	Operating Temperature	Insulation Thickness					
				Runouts (4m/13ft Max)	Less than 25mm (1")	25mm (1") to 32mm (1-1/4")	38mm (1-1/2") to 75mm (3")	100mm (4") to 200mm (8")	Greater than 200mm (8")
Condensate Drain (From Cooling Systems)	A2	Mineral Fibre c/w Vapour Seal	-	12mm (1/2")	25mm (1")	25mm (1")	25mm (1")	25mm (1")	25mm (1")
Domestic & Non-Potable Cold Water	A2	Mineral Fibre c/w Vapour Seal	<15.6C (<60F)	25mm (1")	25mm (1")	25mm (1")	25mm (1")	25mm (1")	25mm (1")
Drainage Vent (Min 3m/10ft From Roof Penetration)	A2	Mineral Fibre c/w Vapour Seal	-	-	-	-	25mm (1")	25mm (1")	25mm (1")
Storm Drains	A2	Mineral Fibre c/w Vapour Seal	-	-	-	25mm (1")	25mm (1")	25mm (1")	25mm (1")

HOT PIPE INSULATION									
System	Class	Insulation Material	Operating Temperature	Insulation Thickness					
				Runouts (4m/13ft Max)	Less than 25mm (1")	25mm (1") to 32mm (1-1/4")	38mm (1-1/2") to 75mm (3")	100mm (4") to 200mm (8")	Greater than 200mm (8")
Domestic Hot Water & Non-Potable Hot Water & Hot Water Recirculation	A2	Mineral Fibre	60.6C-93.3C (141F-200F)	25mm (1")	38mm (1-1/2")	38mm (1-1/2")	50mm (2")	50mm (2")	50mm (2")
Domestic Hot Water & Non-Potable Hot Water & Hot Water Recirculation	A2	Mineral Fibre	43.9C-60.6C (111F-140F)	25mm (1")	25mm (1")	25mm (1")	38mm (1-1/2")	38mm (1-1/2")	38mm (1-1/2")
Domestic Hot Water & Non-Potable Hot Water & Hot Water Recirculation & Tempered Water	A2	Mineral Fibre	<43.9C (<111F)	25mm (1")	25mm (1")	25mm (1")	38mm (1-1/2")	38mm (1-1/2")	38mm (1-1/2")
Sanitary Traps (Barrier Free Lavatories)	A2	Closed Cell Vinyl	-	-	-	12mm (1/2")	12mm (1/2")	-	-

Notes:

1. Insulate storm drainage piping from roof drains including drain bodies, from the roof drain to the lowest aboveground point where the piping connects to a below grade horizontal main.
2. BCICA Standard 1501 Type A6 insulation may be used in lieu of Type A2, with Type 1501-AA /CA application.
3. Use non-combustible rock slag mineral fiber insulation for insulated pipe penetrating through fire rated construction, and for high temperature piping insulation such as high pressure steam and condensate.
4. BCICA Standard 1501, Type A5 insulation with 1501-CA application may be used in lieu of mineral fibre insulation.

3.6 Ductwork System Insulation Requirements – Inside Building

- .1 Insulate duct systems inside the building and above ground, as scheduled below, in accordance with BCICA Quality Standard 1502, Ductwork and Plenums, as follows:
 - .1 **Material:**
 - .1 Type A2 rigid mineral fibre for exposed rectangular ducts, and all plenums.
 - .2 Type B2 flexible mineral fibre for concealed rectangular ducts, and concealed and exposed round or oval ducts.
 - .2 **Insulation application:**
 - .1 ER/1 for heating and ventilating system rigid insulation.
 - .2 ER/2 for heating and air conditioning system rigid insulation.
 - .3 EF/1 for heating and ventilation system flexible insulation.
 - .4 EF/2 for heating and air conditioning system flexible insulation.
 - .3 **Insulation finish:** RF/3 for exposed duct systems.

DUCT SYSTEM SERVICE	INSULATION THICKNESS	
	Rigid Insulation	Flexible Insulation
Fresh (outside) air ducts	38 mm (1-1/2")	50 mm (2")
Fresh (outside) air casings and plenums	38 mm (1-1/2")	N/A
Mixed air casings and plenums	25 mm (1")	N/A
Mixed air supply ducts (except where exposed in area served)	25 mm (1")	38 mm (1-1/2")
3 m of exhaust discharge ducts downstream (back) from exhaust openings to atmosphere	25 mm (1")	38 mm (1-1/2")
Exhaust air casings and plenums within 3 m of exhaust openings to atmosphere	25 mm (1")	N/A

Notes:

1. Provide commercial quality corner bead on rigid duct, plenum, and casing insulation in all equipment rooms where the insulation is subject to damage.

3.7 Duct System Insulation Requirements – Outside Building

- .1 Insulate all exposed exterior ductwork (i.e. exhaust air duct) and any associated casings and plenums (except fresh air intake systems) outside the building and above ground, with 50 mm (2") thick flexible foam elastomeric sheet insulation applied in 2 layers with staggered tightly butted joints and secured in place with adhesive in strict accordance with

the insulation manufacturer's instructions. Ensure that sheet metal joints are sealed water-tight prior to the insulation application.

3.8 Common Duct System Insulation Requirements: Insulation application requirements common to all types of rigid ductwork are as follows:

- .1 At duct connection flanges insulate the flanges with neatly cut strips of the rigid insulation material secured with adhesive to side surfaces of the flange with a top strip to cover the exposed edges of the side strips, then butt the flat surface duct insulation up tight to the flange insulation, or alternatively, increase the insulation thickness to the depth of the flange and cover the top of the flanges with tape sealant.
- .2 The installation of fastener pins and washers shall be concurrent with the duct insulation application.
- .3 Cut insulation fastener pins almost flush to the washer and cover with neatly cut pieces of tape sealant.
- .4 Accurately and neatly cut and fit insulation at duct accessories such as damper operators (with standoff mounting) and pitot tube access covers.
- .5 Prior to concealment of insulation by either construction finishes or canvas jacket material, patch all vapour barrier damage by means of tape sealant.

3.9 Equipment Insulation Requirements – Inside Building

- .1 Insulate equipment inside the building the building, as scheduled below, in accordance with BCICA Quality Standard 1503, Equipment, as follows:
 - .1 **Material:** Type A1D semi-rigid mineral fibre.
 - .2 **Insulation application:**
 - .1 1503-H for hot tanks and equipment.
 - .2 1503-C for cold tanks and equipment.
 - .3 **Insulation finish:**
 - .1 EF/2 for hot tanks and equipment.
 - .2 CF/2 for cold tanks and equipment.

3.10 Equipment Insulation Requirements – Removable/Reusable Type

- .1 Provide "wrap type" removable and reusable insulation covers for "cold" circuit balancing valves, backflow preventers, and similar items, and for steam traps and similar items requiring service in piping less than 150 mm (6") diameter.

3.11 Application of Insulating and Protective Coatings

- .1 Apply insulating and protective coatings in accordance with the manufacturer's instructions. Remove any splatter from adjacent surfaces. Apply insulating/protective coating to the following surfaces:
 - .1 Paint all bare metal surfaces clear of "cold" piping and/or equipment insulation for a distance of from 300 mm (12") to 600 mm (24") clear of the pipe or equipment insulation, with "No Sweat-FX" anti-condensation coating.
 - .2 Paint all bare metal surfaces associated with mechanical systems with an operating temperature 60°C (140°F) with "thermalite" insulating coating.
 - .3 Paint all seismic restraint hardware such as hanger rods, braces, anchors, etc., as specified on .1 and .2 above
 - .4 Coat elastomeric foamed insulation (pipe & duct) with 1 coat of the specified coating on all insulation inside the building and 2 coats (with 24 hours between coats) of the specified coating on all insulation outside the building.

3.12 Chilled & Cold Water Pipe Insulation Vapour Damage Protection

- .1 Ensure that all pipe insulation longitudinal and circumferential joints are properly sealed.
- .2 Ensure that there are no perforations to insulation vapour barriers.
- .3 Provide properly sealed vapour dams in locations as follows:
 - .1 On butt ends at all locations where the insulation terminates
 - .2 On butt ends and other exposed insulation surface on either side of fittings, tees, flanges, couplings, valves, strainers, and similar pipe accessories, with the exception of cluster piping (every 75mm)
 - .3 Butt ends at every 3rd section of insulation (maximum 6 m (20') intervals) on horizontal piping
 - .4 On butt ends at every 2nd section of insulation (maximum 2.4 m (8') intervals) in vertical piping

3.13 Valves

- .1 Provide valve stem extensions as required to enable insulation of valve stems. Insulate void space around valve fittings. Valves to be fully operational without compromising the insulation integrity.

3.14 Insulation Finish Requirements

- .1 **White PVC:** Install sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Linear overlaps to have a factory installed self-seal tape. Seal all joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by manufacturer's instructions. Do not use tacks or staples on piping systems requiring a vapor barrier.
- .2 **Rigid Aluminum:** Install aluminum jacket material tightly in place with overlapped circumferential joints positioned to shed water and covered with butt straps supplied with the jacket. Provide aluminum jacket for the following insulation:
 - .1 All outdoor insulated piping.
 - .2 All outdoor ductwork.
- .3 **Protective Coating - Foamed Glass Insulation:** Apply 2 heavy coats of "PITTCOTE 404" coating with 24 hours between coats to all foamed glass insulation exposed above grade.
- .4 **Protective Coating – Flexible Elastomeric Insulation:** Apply 1 coat of the specified coating to all insulation inside the building. Apply 2 coats (with 24 hours between coats) of the specified coating to all insulation outside the building.

3.15 Installation of Barrier Free Lavatory/ Sink Insulation Kits

- .1 Provide manufactured insulation kits to cover exposed drainage and water piping under new barrier free lavatories/sinks.

3.16 Installation of Duct Lining

- .1 Provide acoustic lining in ductwork in locations as follows:
 - .1 Wherever shown and/or specified on the drawings.
 - .2 Supply ductwork downstream of air terminal boxes for a distance of 2.4 m (8') measured along the duct and outward from the box in all directions.
- .2 Install lining in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, for all installations regardless of velocity, at leading and trailing edges of duct liner sections, provide galvanized steel nosing channel as per the detail entitled Flexible Duct Liner Installation found in the ANSI/SMACNA manual referred to above.

3.17 Insulation of Seismic Restraint Hardware:

- .1 Insulate all seismic restraint hardware such as hanger rods, braces, anchors, etc., directly connected to "cold" category piping and equipment for a distance of 300 mm (12") from the piping or equipment with insulation and finish to match the pipe or equipment insulation. Coat all seismic restraint hardware for a distance of 300 mm (12") from the termination of the insulation with Robson Thermal "NO-SWEAT-FX" water based anti-condensation coating.

End of Section

1 GENERAL

1.1 Application

- .1 This Section specifies variable frequency drive requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and shall be read accordingly.

1.2 Submittals

- .1 **Product Data:** Submit product data sheets for variable frequency drives. Include all construction and performance details with the submission, as well as wiring and control schematics, and dimensions.
- .2 **Certification Letter:** Submit a start-up and installation certification letter from the supplier of the variable frequency drives as specified in Part 3 of this Section.

1.3 Base Bid and Acceptable Manufacturers

- .1 Refer to the article entitled Base Bid and Acceptable Manufacturers in the Section 20 05 10 – Basic Mechanical Materials and Methods.

2 PRODUCTS

2.1 Variable Frequency Drives

- .1 Factory assembled and tested, CSA or ETL certified, fully digital, pulse width modulated type VFD's, each matched to the motor it is associated with and each suitable for operation in an ambient temperature range of between -10°C and 40°C (15°F and 105°F) with a maximum humidity of 95% non-condensing, and a maximum altitude of 100 m (3300') for rated output. No transformers are to be used in either the input or output of the VFD.
- .2 **Operation:** Each VFD shall operate as follows:
 - .1 If the "Manual" mode is selected the VFD/motor is to start when the run key is depressed and the speed shall be controlled by depressing the Accelerate or Decelerate keys on the keypad, or by the direct speed set mode.
 - .2 If the "Auto" mode is selected the VFD/motor is to start when a contact closure run command is received from the building control system, and the speed shall be controlled by a speed reference signal from the building control system.
 - .3 In the event of a power outage the VFD is to automatically restart when the power returns provided the run command is maintained.
 - .4 In the event of an inverter fault trip, the VFD is to attempt to restart automatically up to maximum of five attempts and, if after five attempts, restart does not occur, the VFD is to lock out.
- .3 **Performance:** Each VFD shall have performance characteristics as follows:
 - .1 Minimum efficiency of 97% at maximum load and speed.
 - .2 Minimum line side displacement power factor of 0.96 at all speeds and loads.
 - .3 Adjustable minimum and maximum motor frequency of 0 to 120 Hz.
 - .4 Separately adjustable acceleration and deceleration ramps from 0.1 to 3,600 seconds with damping and smoothing parameters for 0% to 100% speed.
 - .5 DC injection braking.
 - .6 Automatic restart after an inverter fault trip, and the VFD is to attempt to restart automatically five times with lock-out after the fifth attempt if a restart has not occurred.
 - .7 The VFD is to restart the motor at the speed at which it is rotating and then re-accelerate to the speed called for by the speed reference signal.
 - .8 Capable of running for setup and testing without a motor connected.
 - .9 Auto restart after power outage.
 - .10 Skip frequency reject point to prevent the motorized equipment from operating at a resonant speed, and adjustable centre frequency with a band width of 0-10 Hz.
 - .11 Automatic/manual signal follower for 4-20 ma, 0-20ma, 0-10 VDC or 2-10 VDC reference.

.12 Capable of accepting AC line voltage variations of +10% to -15%.

- .4 **Design and Construction Features:** Each VFD, as a minimum, shall be complete with:
- .1 External 5% DC Swing Choke input reactor capable of maintaining impedance thru entire speed range. to reduce the total harmonic distortion. 575 volt applications to include 3% output load reactors to limit the dv/dt to 1500 volts / 0.5 microseconds at motor terminals.
 - .2 Soft switching insulated gate bipolar transistors in the inverter section.
 - .3 NEMA12, sprinkler-proof metal enclosure with hinged door.
 - .4 A horsepower rated, door interlocked, pad-lockable fused main disconnect switch.
 - .5 Input line fuses coordinated with electronic protection circuits so as not to blow under normal output faults such as overcurrent, short circuit, and ground fault, and three spare fuses in a holder on the back of the enclosure door.
 - .6 Protective devices consisting of, as a minimum:
 - .1 Line over voltage and line under voltage protection.
 - .2 Phase loss and unbalance protection.
 - .3 Short circuit protection for line to line and line to ground faults.
 - .4 Electronic instantaneous overcurrent protection.
 - .5 Current limit, adjustable between 25% and 120%.
 - .6 A continuous duty service factor of 100% rated output current with 1st overload protection rating of 120% for 1 minute.
 - .7 Internal over temperature protection.
 - .8 Electronic motor stall protection to trip the VFD off should a motor overload or stall occur.
 - .7 Operate interface facilities consisting of a door mounted keypad with a 32 character Alpha-numeric high resolution display to allow personnel to set up and monitor the VFD parameters, observe output speed, load or other programmable values, and monitor status and fault information, complete with tactile keys and backlit display, and the following:
 - .1 Maintenance monitoring to display the time since starting, total elapsed run time, and total KWH, and maintenance target alarm to alert the operator with a displayed message.
 - .2 The following control functions on the door mounted keypad, as follows:
 - .1 Run (Hand and Auto Mode).
 - .2 Stop (Hand and Auto Mode).
 - .3 Parameterization button (to toggle between parameters).
 - .3 A selectable display to observe the following parameters:
 - .1 Frequency.
 - .2 Frequency set-point.
 - .3 Motor current.
 - .4 DC-link voltage.
 - .5 Motor torque (% nominal).
 - .6 Motor RPM.
 - .4 Fault diagnostics to simplify troubleshooting, and, in the event of a fault condition, the display it so indicate the nature of the fault, including:
 - .1 Overvoltage.
 - .2 Undervoltage.
 - .3 Overcurrent.
 - .4 Overload.
 - .5 Overheating of motor (monitoring with PTC).
 - .6 Inverter over temperature.
 - .7 Main phase missing (for 3 phase units).
 - .8 Control system interface facilities, consisting of:
 - .1 Dry contact closure from the control system for run command (Auto Mode).
 - .2 4-20 mA (0-20 mA, 0-10 VDC, 2-10 VDC) signal from the control system for speed control (Auto Mode).
 - .3 Dry contact (N.O.) output to the control system to indicate:
 - .1 Inverter fault.

- .2 Inverter running.
- .4 0-20 mA or 4-20 mA analog output to the control system, proportional to 0-100% speed or load.
- .5 6 programmable digital inputs, 3 programmable output, relays, 2 analog inputs, 2 programmable 4-20ma analog outputs, 2 PID loops, RS485 w- BACnet, N2 Metasys and Modbus RTU protocols.
- .9 Modular components and circuitry necessary to safely bypass the motor from the VFD to line, or from the line to the VFD at zero speed, and consisting of:
 - .1 Mechanically interlocked contactors on the output of the VFD and in the bypass circuit.
 - .2 An inverter/bypass selector switch with indicator lights for each mode of operation, located in the enclosure door when specified on schedule.

3 EXECUTION

3.1 Supply of Variable Frequency Drives

- .1 Supply variable frequency drives for motorized mechanical equipment in accordance with drawing requirements.
- .2 Ensure that all variable speed drives are the products of the same manufacturer.
- .3 Where VFD's are required for custom made air handling units the VFD's will be supplied, factory mounted on fan cabinets, and "load" side connected to fan motors by the air handling unit manufacturer. "Line" side power wiring to these VFD's will be done as part of the electrical work.
- .4 Where VFD's are required for commercial fans, mount each VFD generally where shown but with exact location to ensure that the VFD is accessible in accordance with Electrical Code requirements. "Line" and "load" side power wiring to these VFD's will be done as part of the electrical work.
- .5 Where VFD's are required for pumps, mount each VFD generally where shown but with exact location to ensure that the VFD is accessible in accordance with Electrical Code requirements. "Line" and "load" side power wiring to these VFD's will be done as part of the electrical work.
- .6 When installation of the VFD's is complete, arrange for the VFD manufacturer/supplier to:
 - .1 Supply a factory authorized technician at the site for a minimum of 4 hours per system to examine installation and connection of each VFD, and to perform start-up and set-up procedures in conjunction with equipment start-up and testing procedures.
 - .2 Supply a factory authorized technician at the site for a minimum of one 8 hour day to train the Owner's personnel on VFD operating and maintenance procedures.
 - .3 Prepare and submit a letter to certify that all VFD's have been properly installed, tested and adjusted, and are in proper operating condition.

END OF SECTION

1 GENERAL

1.1 Application

- .1 This Section specifies requirements for supply of motor starters, motor control centres, and mechanical wiring for mechanical work that are common to mechanical work Sections of the Specification and it is a supplement to each Section and shall be read accordingly.

1.2 Submittals

- .1 **Product Data:** Submit product data sheets for all products specified in this Section except conduit, wiring and accessories. Include all construction and performance details with the submission, as well as wiring and control schematics.
- .2 **Switch Keys:** Submit three identified keys for each key operated manual motor starting switch.

1.3 Quality Assurance

- .1 Motor starters shall be in accordance with the following standards:
 - .1 CSA-C22.2 NO. 14, Industrial Control Equipment.
 - .2 Tri-National Standard CAN/CSA-60947-4-1/UL 60947-1A/NMX-J-Z90-ANCE, Low Voltage Switchgear and Controlgear-Part 4-1: Contactors and Motor Starters-Electromechanical Contactors and Motor Starters.
- .2 Motor control centres are to be in accordance with requirements of CSA-C22.2-No. 254, Motor Control Centres.
- .3 Base Bid and Acceptable Manufacturers:
 - .1 Refer to the article entitled Base Bid and Acceptable Manufacturers in the Section 20 05 10 – Basic Mechanical Materials and Methods.

2 PRODUCTS

2.1 Motor Starters

- .1 **General:** General requirements for motor starters are as follows:
 - .1 All motor starters must be capable of starting the associated motors under the imposed loads.
 - .2 Confirm that starter voltage matches the motor prior to ordering.
 - .3 Unless otherwise specified, all motor starters (and disconnect switches) are to have a 50,000 symmetrical SCIA (short circuit interrupting capacity).
 - .4 Equip starters with accessories and modifications as per the drawing motor starter schedule.
 - .5 Equip every starter associated with a building fire alarm system fan shutdown with a double voltage relay with suitable coil voltage.
 - .6 Each starter that controls a motor with thermistor protection shall be equipped with a latching relay which controls a blue neon pilot light upon activation of the thermistor and an auxiliary contact installed in series with the overloads, and a reset button to reset the latching relay.
- .2 **Single Phase Motor Starters:** Unless otherwise specified or scheduled single phase motor starters are to be manual motor starting switches, each suitable in all respects for the motor it controls and complete with a neon "ON" pilot light, a snap action toggle operator designed to prevent the switch from being held closed under a sustained motor overload, an enclosure to suit the application, and properly sized thermal overload protection which can be reset by moving the toggle to the "OFF" position.
- .3 **Starters for Three Phase Motors Less Than 25 HP:** Unless otherwise specified, starters for three phase motors less than 25 HP are to be combination "quick-make" and "quick-break" fused disconnects and full voltage non-reversing across-the-line starters, each complete with a properly sized thermal overload relay per phase, a 120 volt holding coil, and an enclosure to suit the application.

- .4 **Motor Starter Enclosures:** Unless otherwise specified, motor starter enclosures are to be in accordance with the following NEMA/EEMAC ratings:
- .1 All enclosures located in sprinklered areas – Type 2.
 - .2 All enclosures exposed to the elements – Type 3R, constructed of stainless steel.
 - .3 All enclosures inside the building in wet areas – Type 3R, constructed of stainless steel.
 - .4 All enclosures in explosion rated area – Type 7 with exact requirements to suit the area and application.
 - .5 All enclosures except as noted above – Type 1.
 - .6 All enclosures located in finished areas – as above but recess type with #4 brushed finish stainless steel faceplate.

2.2 Motor Control Centres

- .1 Multi-unit, modular, 2.4 m (8') high overall, minimum 300 mm (12") high modules, EEMAC Class II, type "B", factory assembled, dead front, floor mounting, free-standing, front accessible motor control centre(s) as per drawing schedule and details, each capable of operating continuously in a 40° C (105° F) ambient temperature and complete with accessible horizontal and vertical tin plated copper bus including ground bus with grounding lugs, wiring gutter barriered from bus compartments, blank spaces with hinged covers and full bussing where indicated, and an EEMAC Type 1 or Type 2 enclosure as for loose starters specified above. Each motor control centre exterior shall be finished with ASA 61 grey enamel and each interior shall be finished with white enamel. Each motor control centre shall be equipped with starters as specified above, load and barriered control wiring terminal boards, and all required facilities for line and load side power wiring connections.
- .2 The external operating handle of each disconnecting device shall be identified with "ON" and "OFF" indication, and each handle shall be interlocked with the module door such that the handle must be in the "OFF" position before the door can be opened.

2.3 Disconnect Switches for Motor Control Centres

- .1 Heavy-duty, CSA certified, front operated switches as per the motor starter schedule, each complete with a handle suitable for padlocking in the "off" position and arranged so that the door cannot be opened with the handle in the "on" position and an EEMAC enclosure as specified for loose starters. Fusible units are to be complete with fuse clips to suit fuse types specified below.

2.4 Fuses

- .1 **Fuses:** Unless otherwise scheduled or specified, English Electric Ltd. HRC fuses, Form I Class "j" for constant running equipment and Form II Class "C" for equipment that cycles on and off.

2.5 Motor Starter Panels

- .1 Level #14 gauge G60 galvanized sheet steel panel with rolled edges, sized to suit the number of starters/disconnect switches to be mounted plus 20% blank space, secured to a galvanized steel angle framework suitable for wall mounting and equipped with a suitable length of splitter trough to feed the starters/disconnects.

2.6 Warning Signs

- .1 Appropriately sized white PVC warning signs with red lettering, screw holes, and stainless steel screws.

3 EXECUTION

3.1 Supply of Motor Starters and Accessories

- .1 Unless otherwise shown or specified, supply a starter for each item of motorized equipment you provide. Refer to the drawing Motor Starter Schedule.

- .2 **Three Phase Motor Starters in Motor Control Centres:** Where three phase starters are indicated in motor control centres, supply the motor control centres with starters and bolt, level and plumb, to a concrete housekeeping pad where shown.
- .3 **Disconnect Switches in Motor Control Centres:** Where package type equipment with integral starters, or equipment with starters integral in loose power and control panels supplied with the equipment is fed from a motor control centre, provide a disconnect switch in the motor control centre in lieu of a motor starter.
- .4 **Three Phase Motor Starters on Motor Starter Panels:** Where three phase starters are indicated and/or scheduled to be mounted on a motor starter panel, provide the panel(s). The starters will be mounted and connected, complete with the panels and splitter trough, as part of the electrical work. Hand the starters to the electrical trade at the site when they are required.
- .5 **Disconnect Switches on Motor Starter Panels:** Where package type equipment with integral starters, or equipment with starters integral in loose power and control panels supplied with the equipment is fed from a motor starter panel, a disconnect switch will be provided on the motor starter panel as part of the electrical work
- .6 **Single Phase Motor Starters:** Unless otherwise specified or shown on the drawings, single phase motor starters will be mounted adjacent to the equipment they serve and connected complete as part of the electrical work. Hand the starters to the electrical trade at the site at the proper time.
- .7 **Warning Signs:** Provide warning signs at starter locations where required, i.e. "Motor is Under Automatic Control and May Start at Any Time without Warning".

3.2 Electrical Wiring Work for Mechanical Work

- .1 Unless otherwise specified or indicated, the following electrical wiring work for mechanical equipment will be done as part of the electrical work:
 - .1 "Line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from the starters or disconnects to the equipment.
 - .2 "Line" side power wiring to individual wall mounted starters, and "load" side wiring from the starters to the equipment.
 - .3 "Line" side power wiring to pre-wired power and control panels and variable frequency drives, and "load" side power wiring from the panels and VFD's to the equipment.
 - .4 Provision of receptacles for plug-in equipment.
 - .5 Provision of disconnect switches for all motors that are in excess of 10 m (30') from the starter location, or that cannot be seen from the starter location, and all associated power wiring.
 - .6 All motor starter interlocking in excess of 24 volts.
 - .7 Wiring from motor winding thermistors in motors 30 HP and larger to motor starter contacts.
 - .8 Provision of dedicated 120 volt, 15A-1P circuits terminated in junction boxes in mechanical equipment rooms for automatic control and building automation system wiring connections to be made as part of the automatic controls work.
 - .9 120 volt power connections to electrical receptacles integral with small ceiling exhaust fans, including wiring through light switches or speed controllers.
 - .10 120 volt wiring connections to lighting fixture/switch combinations integral with air handling units.
 - .11 120 volt wiring connections to duplex receptacles integral with air handling unit control panels.
- .2 Mechanical wiring work not listed above or specified herein or on the drawings to be done as part of the electrical work shall be installed in conduit and shall be done as part of the mechanical work in accordance with wiring requirements specified for the electrical work.

3.3 Installation of Motor Control Centres

- .1 Provide motor control centres where shown.
- .2 Secure each MCC in place on a concrete housekeeping pad.
- .3 Ensure that the electrical trade connecting the MCC's tightens all accessible bus connections using a torque wrench in accordance with the MCC manufacturer's instructions, and does all "load" and "line" side wiring.
- .4 Ensure that all motor starter interlocking work is performed in accordance with Contract Document control diagrams and sequences.
- .5 Supply a complete set of spare identified fuses for each fuse protected device and store in an identified wall mounted steel cabinet within the Electrical Room.
- .6 If MMC and component identification is not factory installed, install at the site using stainless steel screws.
- .7 Coordinate building automation system connections to MCC hardware with the mechanical trade doing the building automation system work. Assist as required during testing and commissioning of the BAS.
- .8 **Equipment and System Manufacturer's Certification:** Refer to the article entitled Equipment and System Manufacturer's Certification in the Mechanical Work General Instructions Section.
- .9 **Start-Up:** Refer to the article entitled Equipment and System Start-up in the Mechanical Work General Instructions Section.
- .10 **Commissioning:** Commission equipment after successful start-up and submittal of reports.
- .11 **Demonstration and Training:** Refer to the article entitled Equipment and System O&M Demonstration & Training in the Mechanical Work General Instructions Section. Include for one 4 hour day of on-site operation demonstration and training for 2 groups of 6 people.

END OF SECTION

1 GENERAL

1.1 Application

- .1 This Section specifies requirements, criteria, methods, and execution for mechanical demolition work that are common to one or more mechanical work Sections, and it is intended as a supplement to each Section and shall be read accordingly.

1.2 Submittals

- .1 Submit documentation to confirm that reclaimed refrigerant has been properly removed and stored, recycled, or disposed of as applicable.

1.3 Reference Standard

- .1 Perform demolition work in accordance with requirements of CAN/CSA-S350, Code of Practice for Safety in Demolition of Structures.

2 PRODUCTS

2.1 NOT APPLICABLE

3 EXECUTION

3.1 Disconnection and Removal of Existing Mechanical Work

- .1 Where indicated on the drawings, disconnect and remove existing mechanical work, including hangers, supports, insulation, and similar items. Disconnect at the point of supply, remove obsolete connecting services, and make the system safe. Cut back obsolete piping behind finishes, identify, and cap water-tight unless otherwise specified.
- .2 The scope and extent of the demolition or revision work is only generally indicated on the drawings. Estimate the scope, extent, and cost of the work at the site during the bidding period scheduled site visit(s).
- .3 Where concealed conditions differ from those indicated on the drawings, immediately notify the Consultant.
- .4 Where utilities are removed, relocated, or abandoned, cap, valve, plug, or by-pass to produce a complete and working installation.
- .5 Where deemed necessary by the Owner and Consultant, existing shafts, walls, and inaccessible ceilings will be opened by the Owner to permit site visit inspection of services to be removed/revised as part of the work but usually concealed behind such construction.
- .6 Claims for extra costs for demolition work not shown or specified but clearly visible or ascertainable at the site during bidding period site visits will not be allowed.
- .7 If existing isolation valves are not available to isolate sections of piping to be removed, provide such valves as required. Determine this requirement at the site during the bidding period.
- .8 Where existing valves are removed, remove the valve tags, revise existing valve tag charts, and hand the obsolete tags to the Owner.
- .9 If any re-design is required due to discrepancies between the mechanical drawings and site conditions, notify the Consultant who will issue a Site Instruction. If, in the opinion of the Consultant, discrepancies between the mechanical drawings and actual site conditions are of a minor nature, the required modifications are to be done at no additional cost.
- .10 Where existing mechanical services extend through, or are in an area to serve items which are to remain, maintain the services in operation. Include for rerouting existing services concealed behind existing finishes and which become exposed during the renovation work, so as to be concealed behind new or existing finishes.

- .11 Unless otherwise specified, remove from the site and dispose of all existing materials which have been removed and are not to be relocated or reused.
- .12 When existing DDC controls devices are being removed such as valves or sensors, update the DDC graphics to accurately reflect the changes. Notify the controls contractor of any control devices removed during demolition.

3.2 Hazardous Materials and Waste

- .1 Be advised that items such as drainage sumps, catch basins, interceptors, and the like may contain unidentified hazardous waste and caution shall be taken when disconnecting and removing these items.
- .2 If hazardous waste not listed in the Specification is found, stop the associated work and notify the Owner and Consultant immediately and await directions.

3.3 Decommissioning or Alterations to Refrigeration Equipment

- .1 Remove and reclaim refrigerant from all applicable equipment to be decommissioned and/or altered. All refrigerant reclaim and recycling work shall be in accordance with Refrigerant Management Canada guidelines, and governing codes and regulations. Do not under any circumstances vent refrigerant from existing equipment to atmosphere.
- .2 Use refrigerant recovery equipment designed specifically to reclaim and recycle refrigerant, and use only skilled refrigeration mechanics to perform the reclaim and recycle work.
- .3 Provide approved, properly sized, and sealable refrigerant containers for reclaimed refrigerant.
- .4 Hand the containers of refrigerant to the Owner at the site.
- .5 Dispose of reclaimed refrigerant by engaging the services of a licensed firm specializing in recycling of reclaimed refrigerant. Submit documentation to confirm that the refrigerant has been properly removed from the site and recycled or disposed of.

3.4 Roofing Work

- .1 Where roof revisions and/or replacements are part of the project, include for disconnecting, lifting, or temporarily removing mechanical equipment on the roof as required to permit completion of the roofing work, and for re-installing the equipment when the roofing work is complete.

3.5 Making Good

- .1 Where existing building surfaces and finishes are cut or other wise disturbed to permit demolition work, you are responsible for "making good" the existing surfaces and finishes.
- .2 "Making good" means providing new surfaces and finishes identical to the surfaces and finishes cut or disturbed with no visible difference between new and existing.
- .3 Where painting is required, paint the entire surface between the nearest adjacent corners, i.e. the entire plane surface incorporating the cut or disturbed surface.

END OF SECTION

1 GENERAL

1.1 Application

- .1 This Section specifies commissioning requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and shall be read accordingly.

1.2 Reference

- .1 Refer to commissioning requirements specified in Division 01.

1.3 Commissioning Agent Involvement vs Warranty Obligations

- .1 The involvement of the Commissioning Agent performing duties as described in this Section does not in any way void or alter any Contractual warranty obligations.

1.4 Submittals

- .1 **Shop Drawings/Product Data Sheets:** Submit to the Commissioning Agent, at the same time as submittal to the Consultant, 1 copy of each shop drawing or product data sheet associated with equipment or systems to be commissioned.
- .2 **Commissioning Plan, Procedures, Schedule, and Data Sheets:** Submit for review, a Commissioning Plan with schedule, commissioning procedures for all commissioning events, and a copy of the Commissioning Agent's commissioning data sheets for all equipment/systems to be commissioned.
- .3 **List of Commissioning Instruments:** Submit a list of commissioning instruments and for each instrument, indicate the purpose of the instrument and include a recent calibration certificate.
- .4 **Start-Up and Test Report Sheets:** Submit equipment and system manufacturer's start-up and test report sheets for review a minimum of 1 month prior to equipment and system start-up procedures.
- .5 **Letters to Certify Readiness for Functional Performance Testing:** After start-up and successful pre-functional performance testing and submittal of completed forms, submit, for each system or subsystem, a letter to confirm that pre-functional performance testing has been successfully completed and the system or subsystem is ready for functional performance testing and the commissioning process to commence.

1.5 Definitions

- .1 The following are definitions of words used in this Section:
 - .1 **Commissioning:** the process of demonstrating to the Owner and Consultant, for the purpose of final acceptance, by means of successful and documented functional performance testing, that all systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of the Contract Documents, all as further described below.
 - .2 **Commissioning Agent:** the commissioning authority who will supervise the commissioning process, and who will recommend final acceptance of the commissioned mechanical work.
 - .3 **Start-Up and Adjusting:** the process of equipment manufacturer's/supplier's technical personnel, with the Contractor, starting and operating equipment and systems, making any required adjustments, documenting the process, and submitting manufacturer's/supplier's start-up reports to confirm that the equipment has been properly installed and is operational as intended, and a pre-requisite to operational performance testing.
 - .4 **Operational Performance Testing:** testing, adjusting and operating of components, equipment, systems and/or subsystems, by the Contractor, after start-up but before functional performance testing, to confirm that all components, equipment, systems and/or subsystems operate in accordance with requirements of the Contract

Documents, including all modes and sequences of control and monitoring, interlocks, and responses to emergency conditions, and including submittal of pre-functional performance testing documentation sheets.

- .5 **Functional Performance Testing:** a repeat of successful operational performance testing by the Contractor, in the presence of the Commissioning Agent and Consultant with completed Commissioning Agent's commissioning documentation sheets to document, validate and verify that the equipment, systems and subsystems are complete in all respects, function correctly, and are ready for acceptance.
- .6 **Commissioning Documentation Sheets:** prepared sheets for operational performance testing and for functional performance testing supplied by the Commissioning Agent for each piece of equipment/system to be commissioned, each sheet or set of sheets complete with the Project name and number, date of commissioning, equipment/system involved, equipment/system name and model number, equipment tag as per the drawings, and, for each commissioning procedure listed, a column giving the expected data as per the Contract Documents, a column to fill in the observed data during commissioning, and space for signatures of the Contractor and Commissioning Agent.
- .7 **BAS:** building automation system.
- .8 **Systems Operating Manual:** a manual prepared by the Commissioning Agent to present an overview of the building mechanical systems and equipment to be used by building maintenance personnel to assist them in daily operation of the systems.
- .9 **Validate:** to confirm by examination and witnessing tests the correctness of equipment and system operation.

1.6 Commissioning Agent

- .1 Retain the services of a qualified Commissioning Agent.

1.7 Quality Assurance

- .1 Commissioning work shall be in accordance with requirements of the following:
 - .1 CSA Z8001, Commissioning of Health Care Facilities.
 - .2 CSA Standard Z320, Building commissioning.
 - .3 ASHRAE Guideline 1.2, The Commissioning Process for Existing HVAC&R Systems.
 - .4 ASHRAE Guideline 1.5, Commissioning Smoke Control Systems.
- .2 The Commissioning Agent shall meet the following qualifications:
 - .1 Be a member of the Professional Engineers Association in the Province of the work.
 - .2 Be a member of the Building Commissioning Association, and a Certified Commissioning Professional (CCP) as designated by the Building Commissioning Association.
 - .3 Have a minimum of 5 years of successful documented commissioning experience on projects of similar size and complexity as this Project.
 - .4 Supply a qualified P. Eng. and a Building Commissioning Association Certified Commissioning Professional (CCP) or an ASHRAE Commissioning Project Management Professional (CPMP) on site to supervise the commissioning process.

1.8 Commissioning Objectives

- .1 Objectives of the commissioning process are as follows:
 - .1 To support quality management by means of monitoring and checking the installation.
 - .2 To verify equipment/system performance by means of commissioning of the completed installation.
 - .3 To move the completed equipment/systems from the "static completion" state to the "dynamic" operating state so as to transfer a complete and properly operating installation from the Contractor to the Owner.

1.9 Testing Equipment

- .1 The Contractor shall supply all instruments and test equipment required to conduct start-up and testing. The Commissioning Agent shall supply all instruments and test equipment required commissioning procedures.

2 PRODUCTS

2.1 NOT APPLICABLE

3 EXECUTION

3.1 Commissioning

- .1 Commission the mechanical work in accordance with requirements of this Section of the Specification.
- .2 **Prerequisites to Commissioning:** Prerequisites to successful completion of commissioning are as follows:
 - .1 Submittal of signed start-up and test reports.
 - .2 Completion by the Contractor of system testing, adjusting, and balancing, and acceptance of the TAB reports.
 - .3 Permanent electrical and control connections of all equipment.
 - .4 Successful completion and documentation of operational performance testing.
 - .5 Submittal of letters to the Consultant certifying that the systems and subsystems have been started, tested, adjusted, successfully operationally performance tested, are ready for functional performance testing, and are in accordance with requirements of the Contract Documents.

3.2 Phasing of Commissioning

- .1 The Project will be constructed in phases as described in the Specification. Commissioning must be phased to suit the progress and phases of the work.

3.3 Deficiencies Listed During Commissioning

- .1 Deficiencies listed by the Consultant and Commissioning Agent during the commissioning process are to be corrected by the Contractor within 10 calendar days unless agreed otherwise with the Consultant, and when deficiencies have been corrected, notify the Consultant and Commissioning Agent at once.

3.4 Systems to be Commissioned

- .1 Mechanical systems to be commissioned include, but are not to be limited to, the systems described below.
- .2 **Drainage Systems:** Commissioning of drainage systems shall include:
 - .1 Commissioning of all drainage pumps and controls by means of tests recommended by the manufacturer to confirm proper operation and performance.
 - .2 Commissioning of all equipment such as interceptors and backwater valves.
- .3 **Fire Protection Systems:** Commissioning of fire protection systems will be considered complete upon preparation and submittal by the Contractor of completion certificates required by applicable NFPA Standards, demonstration of proper system operation to the local Fire Chief and any other authorities, including the Owner's insurance underwriter as required, and coordination and cooperation with fire alarm system commissioning procedures, in particular smoke control systems and other such fan system control sequences.
- .4 **Water Systems:** Commissioning of water systems (all piping extended from the Municipal main) shall include:
 - .1 Commissioning of piping specialties such as backflow preventers, pressure reducing valves, mixing valves, and similar components.
 - .2 Commissioning of plumbing fixtures by successful operation of each fixture.
- .5 **Heating Systems:** Commissioning of heating systems shall include all piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during the heating season, a follow-up site visit during the heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

- .6 **Cooling Systems:** Commissioning of cooling systems shall include all piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during the cooling season, a follow-up site visit during the cooling season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
- .7 **Air Handling Systems:** Commissioning of air handling systems shall include all equipment, ductwork, ductwork specialties, controls, interlocks, and checking and validating air capacities and flows as per TAB reports.
- .8 **Controls:** Control work commissioning shall include confirmation of proper operation of all individual control components, and overall operation of the controls in conjunction with the operation of the connected building systems, including heating season/cooling season testing requirements specified above.
- .9 **Building Automation System:** Commissioning of the BAS shall include confirmation of proper operation of all components, all input/output points, all hardware and software, and demonstration of the system performing all required procedures.
- .10 **Special Usage Room Controls:** Commissioning of special usage room controls shall include confirmation of proper operation of all individual components, and proper operation of the overall control system, all in accordance with governing Codes and Standards.
- .11 **Noise and Vibration Control Systems:** Commissioning of noise and vibration control equipment shall include noise and vibration measurements to confirm proper operation of the equipment.
- .12 **Existing Systems:** The following existing systems, revised as part of the mechanical work, are to be commissioned as for new systems:

3.5 Commissioning Process

- .1 The commissioning process shall be performed in stages and shall include, but not be limited to, the following:
 - .1 **Stage 1:** Commissioning of mechanical equipment/systems as listed in this Section, which is a prerequisite to an application for Substantial Performance and includes supervising and validating results of functional performance testing, and submittal of the reviewed Systems Operating Manual.
 - .2 **Stage 2:** Commissioning work to be performed twelve months after issue of a Certificate of Substantial Performance and which includes supervision of the Contractor's "fine tuning" of equipment/systems through seasonal occupancy, and any other such work to achieve optimal comfort and performance conditions.
 - .3 **Stage 3:** Successful completion of satisfactory equipment/system operation during the first month after issue of a Certificate of total Performance of the Work.
 - .4 **Stage 4:** Successful completion of satisfactory equipment/system operation during the 3rd month after issue of a Certificate of total Performance of the Work.
 - .5 **Stage 5:** Successful seasonal commissioning of the building.

3.6 Responsibilities of the Commissioning Agent

- .1 **Construction Phase:** During the construction phase the Commissioning Agent shall:
 - .1 Review the Contractor's shop drawings for commissioning related issues, and report any such issues to the Consultant.
 - .2 As soon as possible after project start-up, prepare and issue a Commissioning Plan based on the Contractor's construction schedule.
 - .3 Prior to tests, supply and issue operational performance test commissioning data sheets for all equipment and systems to be commissioned.
 - .4 Monitor and inspect the installation on a regular basis throughout the construction stages, issue reports identifying any issues which may have an impact on the commissioning process, and work with the project team to expeditiously resolve any problems that may arise due to site conditions.

- .5 Arrange with the Contractor for on-site commissioning meetings on an as-required basis, to be attended by the Contractor and applicable subcontractors, the Owner, and the Consultant, chair the meetings, and prepare and distribute meeting minutes to all attendees.
 - .6 Witness and validate tests, identify deficiencies, and issue progress reports.
 - .7 Coordinate commissioning scheduling with the Contractor.
 - .8 Review the final TAB report on site with the Contractor, and check 100% of TAB results for fan equipment, 30% of TAB results for duct systems outward from fan equipment, and issue a report to the Consultant.
 - .9 For smaller multiple items of equipment such as air terminal boxes, fan coil units, backflow preventers, and similar equipment, review completed commissioning data sheets submitted by the Contractor and review data sheet information on-site with the Contractor for 30% of the quantity of each item of equipment.
 - .10 Review operational performance test commissioning data sheets submitted by the Contractor, then witness and supervise functional performance testing and supervise and direct the commissioning process, validate the commissioning procedures, witness completion of commissioning data sheets by the Contractor, and sign the completed data sheets.
 - .11 Perform a preliminary review of the Contractor's O & M Manuals, before they are issued to the Consultant, and issue any comments to the Consultant.
 - .12 Coordinate with the Contractor and Owner the training and instructions by the Contractor and his equipment and system manufacturers/suppliers to the Owner's operating and maintenance personnel, and comment on the quality of the training and instructions to the Consultant.
 - .13 Prepare and issue to the Owner prior to equipment and system training by the Contractor, the Systems Operation Manual.
- .2 **Post Construction Phase:** During the post construction phase the Commissioning Agent shall:
- .1 Prepare and issue the final report on commissioning, identifying any deficiencies that remain outstanding.
 - .2 Recommend any training and/or instructions to be given to the Owner's operating and maintenance personnel in addition to training and instructions already given.
 - .3 After Substantial Performance, witness system checks and validate documentation by the Contractor as follows:
 - .1 Once during the 1st month of building operation.
 - .2 Once during the 3rd month of building operation.
 - .3 Once between the 4th and 10th month of building operation but during a season opposite to the 1st or 3rd month visits.
 - .4 Ensure that any deficient work resulting from system checks described above are corrected.
 - .5 3 months after Substantial Performance, attend a question and answer session(s) with the Contractor to answer any questions and concerns related to commissioning work from the Owner's operating personnel.

3.7 Responsibilities of the Consultant

- .1 **Construction Phase:** Responsibilities of the Consultant are as follows:
 - .1 Review the Contractor's shop drawing/product data submissions for general conformance requirements of the Contract, and add any review comments made by the Commissioning Agent as applicable.
 - .2 Review the Contractor's delivery schedule and installation program to ensure that the installation sequences have been coordinated with the construction schedule.
 - .3 Monitor and inspect the mechanical work throughout the construction stages to ensure that the work is in accordance with requirements of the Contract, witness tests, note deficient work, and ensure that deficient work is corrected.
 - .4 Attend site commissioning meetings requested by the Commissioning Agent and arranged by the Contractor.

- .5 When informed by the Contractor that work is essentially complete, inspect the equipment and systems, issue deficiency reports, and ensure that deficiencies are corrected in a timely manner.
- .6 With the Commissioning Agent, review the Commissioning Plan to ensure that proposed tests and the sequencing and methods of tests conform to Contract requirements, and that the testing and commissioning sequences coincide with the construction schedule.
- .7 With the Commissioning Agent, certify completion of the commissioning.

3.8 Responsibilities of the Contractor

- .1 **Construction Phase:** Responsibilities of the Contractor during the construction phase are as follows:
 - .1 Prepare and submit an installation schedule which shall include the time schedule for each activity with lead and lag time allowed and indicated, shop drawing/product data and working detail drawing submissions, and major equipment factory testing and delivery dates.
 - .2 Prepare and submit a commissioning schedule which shall include a time schedule coordinated with the installation schedule referred to above, and allowances for additional time for re-tests as may be required, and update the schedule on a monthly basis as required.
 - .3 When requested by the Commissioning Agent, arrange site commissioning meetings with the Owner, Consultant, and applicable subcontractors present, to be chaired by the Commissioning Agent who will also prepare and distribute meeting minutes.
 - .4 Promptly correct all reported deficient work, and report when corrective work is complete.
 - .5 Where required by Codes and/or the Specification, retain equipment manufacturers/suppliers or independent third parties to certify correct installation of equipment/systems.
 - .6 Under the supervision of equipment manufacturers/suppliers, start-up and adjust all equipment to design requirements, and submit start-up sheets which include all equipment data such as manufacturer and model number, serial number where applicable, and performance parameters, all signed by the equipment manufacturer/supplier and the Contractor.
 - .7 Complete the Commissioning Agent's commissioning data sheets for all multiple items of smaller equipment such as air terminal boxes, fan coil units, backflow preventers, etc., submit the sheets to the Commissioning Agent, accompany the Commissioning Agent for an on-site check of 30% of the data sheet information for each type of equipment, and perform any corrective action required as a result of the site checks.
 - .8 Perform system testing, adjusting and balancing and, when complete, issue a copy of the final report to the Commissioning Agent for review and a site check of results, and perform any corrective work required as a result of site checks by the Commissioning Agent.
 - .9 In accordance with the updated commissioning schedule and actual progress at the site, certify in writing to the Consultant and the Commissioning Agent that equipment and/or systems are complete, have been checked, started and adjusted, successfully operationally performance tested and documented, and are ready for functional performance testing and the commissioning procedures, giving the Consultant and Commissioning Agent a minimum of 5 working days notice.
 - .10 Perform system and subsystem functional performance testing in the presence of the Commissioning Agent and under the supervision of the Commissioning Agent, and submit to the Consultant and Commissioning Agent, completed and signed functional performance testing and commissioning data sheets (issued by the Commissioning Agent) and also signed by the Commissioning Agent.
- .2 **Post Construction Phase:** Responsibilities of the Contractor during the post construction phase are as follows:

- .1 Optimize system operation in accordance with the building's occupant's needs and comments using the System Operation Manual prepared by the Commissioning Agent as reference.
- .2 Complete all commissioning procedures, activities, and performance verification procedures that were delayed or not concluded during the construction phase.
- .3 Accompanied by the Commissioning Agent, complete system checks and "fine tuning" with signed documentation as follows.
 - .1 Once during the 1st month of building operation.
 - .2 Once during the 3rd month of building operation.
 - .3 Once between the 4th and 10th months in a season opposite to the 1st and 3rd month visits.
- .4 Correct all deficiencies revealed by the system checks described above, and, where required, involve equipment manufacturers/suppliers during corrective actions, and report completion of corrective work.
- .5 Schedule for 3 months after Substantial Performance and conduct question and answer session(s) at the building with the Owner's operating and maintenance personnel, with the duration of the session(s) dictated by the number of questions and concerns that have to be addressed.

END OF SECTION

1 GENERAL

1.1 Application

- .1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each applicable Section and shall be read accordingly.

1.2 Contractual Relationship with a Testing and Balancing Agency

- .1 Retain and pay for the services of a qualified testing and balancing agency to perform testing, adjusting and balancing work specified in this Section.

1.3 Submittals

- .1 **Draft Report:** Submit a draft report, as specified in Part 3 of this Section.
- .2 **Final Report:** Submit a final report, as specified in Part 3 of this Section.
- .3 **Post Construction Site Visit Reports:** Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

1.4 Definitions

- .1 The following are definitions of words used in this Section:
 - .1 "TAB" – means testing, adjusting, and balancing to determine and confirm quantitative performance of equipment and systems and to regulate the specified fluid flow rate and air patterns at the terminal equipment, e.g., reduce fan speed, throttling, etc.
 - .2 "Hydronic systems" – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system.
 - .3 "Air systems" – includes all outside air, supply air, return air, exhaust air, and relief air systems.
 - .4 "Flow rate tolerance" – means the allowable percentage variation, minus to plus, of actual flow rate values in the Contract Documents.
 - .5 "Report forms" – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form the permanent record to be used as the basis for required future testing, adjusting and balancing.
 - .6 "Terminal" – means the point where the controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
 - .7 "Main" – means the duct or pipe containing the system's major or entire fluid flow.
 - .8 "Sub-main" – means the duct or pipe containing part of the systems' capacity and serving two or more branch mains.
 - .9 "Branch main" – means duct or pipe servicing two or more terminals.
 - .10 "Branch" – means duct or pipe serving a single terminal.

1.5 Quality Assurance.

- .1 **Standards:** Testing, adjusting, and balancing of the complete mechanical systems shall be performed over the entire operating range of each system in accordance with 1 of the following publications:
 - .1 National Standards for A total System Balance published by the Associated Air Balance Council.
 - .2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by the National Environmental Balancing Bureau.
 - .3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

2 PRODUCTS

2.1 NOT APPLICABLE

3 EXECUTION

3.1 Scope of Work

- .1 The TAB Agency shall perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of the fluid quantities of the mechanical systems as required to meet design specifications and comfort conditions, and recording and reporting the results.
- .2 Mechanical systems to be tested, adjusted, and balanced include:
 - .1 **Domestic Water Systems:** TAB of domestic water systems (all piping extended from the Municipal main) shall include:
 - .1 Domestic hot water recirculation piping.
 - .2 Tempered water piping flows.
 - .2 **Heating Systems:** TAB of heating systems shall include all piping and equipment fluid temperatures, flows and control, and if TAB is not done during the heating season, a follow-up site visit during the heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
 - .3 **Cooling Systems:** TAB of cooling systems is also to include all piping and equipment fluid temperatures, flows and control, and if TAB is not done during the cooling season, a follow-up site visit during the cooling season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
 - .4 **Air Handling Systems:** TAB of air handling systems shall include all equipment and ductwork air temperatures, capacities, and flows.
 - .5 **Existing Systems:** The following existing systems, revised as part of the mechanical work, are to be tested, adjusted, and balanced as for new systems:

3.2 Testing, Adjusting and Balancing

- .1 **General Requirements:** Conform to the following requirements:
 - .1 As soon as possible after award of Contract, the Agency shall carefully examine a white print set of mechanical drawings with respect to routing of services and location of balancing devices, and shall issue a report listing the results of the evaluation.
 - .2 The set of drawings examined by the Agency shall be returned with the evaluation report, with red line mark-ups to indicate locations for duct system test plugs, and required revision work such as relocation of balancing devices and locations for additional devices.
 - .3 Testing, adjusting, and balancing is not to begin until:
 - .1 Building construction work is substantially complete and doors have been installed.
 - .2 Mechanical systems are complete in all respects, and have been checked, started, and adjusted.
 - .4 All mechanical systems to be tested, adjusted, and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing.
 - .5 Obtain copies of reviewed shop drawings of all applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences.
 - .6 The Agency shall walk each system from the system "head end" equipment to terminal units to determine variations of installation from design, and the system installation trades will accompany the Agency.
 - .7 The Agency shall check all valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment.
 - .8 Wherever possible, the Agency shall lock all balancing devices in place at the proper setting, and permanently mark settings on all devices.

- .9 For belt-driven equipment, the Agency shall report any situation where fan drive sheaves have to be replaced to suit testing and balancing, and replacements are to be done by the Contractor at no cost.
- .10 **Noise:** the Agency shall balance all systems with due regard to objectionable noise which shall be a factor when adjusting fan speeds and performing terminal work such as adjusting air quantities, and should objectionable noise occur at the design conditions, the Agency shall immediately report the problem and submit data, including sound readings, to permit an accurate assessment of the noise problem to be made.
- .11 **Tolerances:** the Agency shall perform testing, adjusting and balancing to within $\pm 5\%$ of design values, and make and record measurements which are within $\pm 2\%$ of actual values.
- .12 **Filters** for all air handling systems equipped with air filters, test and balance the systems with simulated 50% loaded (dirty) filters by providing a false pressure drop.
- .13 **Seasonal requirements:** test, adjust and balance air conditioning systems during the summer season and heating systems during winter season, including at least a period of operation at outside conditions within 2.8°C (5°F) wet bulb temperature of maximum summer design condition, and within 5.5°C (10°C) dry bulb temperature of minimum winter design condition, and take final temperature readings during seasonal operation.
- .2 **Preparation of Reports:** Prepare reports as indicated below.
 - .1 **Draft Reports:** Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be handwritten, but must be complete, factual, accurate, and legible. Organize and format draft reports in the same manner specified for the final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
 - .2 **Final Report:** Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports. Use units of measurement (SI or Imperial) as used on the Project Documents. The final report is a prerequisite to Substantial Performance.
 - .3 **Report format:** Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, 3-ring binders. Provide binding edge labels with the project identification and a title descriptive of the contents. Divide the contents of the binder into the divisions listed below, separated by divider tabs:
 - .1 General Information and Summary.
 - .2 Plumbing Systems.
 - .3 Air Systems.
 - .4 Temperature Control Systems.
 - .5 Special Systems.
 - .4 **Report Contents:** The Agency shall provide the following minimum information, forms, and data:
 - .1 Inside cover sheet to identify the Agency, the Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of the instrumentation used for the procedures along with the proof of calibration.
 - .2 The remainder of the report shall contain the appropriate forms containing as a minimum, the information indicated on the standard AABC or NEBB report forms prepared for each respective item and system.
 - .3 The Agency shall include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying all equipment, terminals, and accessories.
 - .4 The Agency shall include report sheets indicating building comfort test readings for all rooms.

- .3 **Verification of Reports:** After the final testing and balancing report has been submitted, the Agency shall visit the site with the Contractor and Consultant to spot check results indicated on the balancing report. The Agency shall supply all labour, ladders, and instruments to complete spot checks. Note that if results of spot checks do not, on a consistent basis, agree with the final report, the spot check procedures will stop and the Agency shall then rebalance the systems involved, resubmit the final report, and again perform spot checks with the Contractor and Consultant.
- .4 **Post Balancing Site Visits:** Include for two 8-hour day site visits after Total Performance of the work. During each return visit and accompanied by the Owner's representative, the Agency shall spot rebalance terminal units as required to suit building occupants and eliminate complaints.

END OF SECTION

1 GENERAL

1.1 Application

- .1 This Section specifies fire stopping and smoke seal requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and shall be read accordingly.

1.2 Submittals

- .1 **Firestop & Smoke Seal System Samples:** at least four weeks prior to work commencing, submit a sample of each type of firestop and smoke seal system in applied form, for approval. Submittal shop drawing to include proposed asbestos free material, anchorage construction details and method of installation. Identify each system with the manufacturer's name and type, the ULC designation, and the proposed use. When the samples are approved, all work shall conform to the approved samples.
- .2 **Product Data & WHMIS Sheets:** Submit a product data sheet and a WHMIS sheet for each firestopping and smoke seal product.
- .3 **Name & Experience of Proposed Applicator:** Submit for approval the full company name and experience of the proposed firestopping and smoke seal system applicator.
- .4 **Letter of Certification:** Submit a letter of proper firestopping and smoke seal certification as specified in Part 3 of this Section.

1.3 Quality Assurance

- .1 **Applicator:** The applicator shall have a minimum of 3 years of successful experience on projects of similar size and complexity, and shall be approved by the Consultant.
- .2 **Environment Conditions:** Comply with the firestopping and smoke seal product manufacturer's recommendations regarding suitable environment conditions for product installation.

2 PRODUCTS

2.1 Firestopping and Smoke Seal System Materials

- .1 Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with CAN4-S115, Standard Method of Fire Tests of Firestop Systems and CAN/ULC-S101, Standard Method of Fire Endurance Tests of Building Construction and Materials for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal, and a fire-resistance rating (flame, hose stream and temperature) not less than the fire resistance rating of surrounding fire rated construction.
- .2 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with the firestopping manufacturer's recommendations and the ULC tested assembly.
- .3 Pipe insulation forming part of a fire and smoke seal assembly is specified in the Mechanical Insulation Section.
- .4 Fire resistance rating of the installed product shall not be less than the surrounding rating in walls and floors for which the fire stopping material is applied and be an effective barrier against flame, smoke and gases.

2.2 Base Bid and Acceptable Manufacturers

- .1 Refer to the article entitled Base Bid and Acceptable Manufacturers in the Section 20 05 10 – Basic Mechanical Materials and Methods.

3 EXECUTION

3.1 Installation of Firestopping and Smoke Seal Materials

- .1 Where mechanical work penetrates fire rated construction, provide ULC listed and labelled firestopping and smoke seal materials installed in accordance with requirements of CAN4-S115 (ratings F, FT, FH, and FTH as required), CAN/ULC-S101, and all other governing authorities to seal the penetrations.
- .2 **Preparation:** Abide by the following requirements:
 - .1 Examine substrates, openings, voids, adjoining construction, and conditions under which the firestop and smoke seal system shall be installed, and confirm compatibility of surfaces.
 - .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
 - .3 Ensure that substrates and surfaces are clean, dry and frost free.
 - .4 Maintain insulation around pipes and ducts penetrating a fire separation without interruption to the vapour barrier.
 - .5 Verify penetrating items are securely fixed and properly located with the proper space allowance between penetrations and surfaces of openings.
 - .6 Report any unsuitable or unsatisfactory conditions to the Contractor and Consultant in writing, prior to commencement of work, and note that commencement of work will mean acceptance of conditions and surfaces.
 - .7 Mask where necessary to avoid spillage and over coating onto adjoining surfaces, and remove stains on adjacent surfaces.
- .3 **Application:** Conform to the following application requirements:
 - .1 Use an experienced applicator approved by the manufacturer of the firestopping material manufacturer.
 - .2 Prime substrates in accordance with the product manufacturer's written instructions.
 - .3 Provide temporary forming as required and remove only after materials have gained sufficient strength and after initial curing.
 - .4 Tool or trowel exposed surfaces to a neat, smooth, consistent finish.
 - .5 Remove excess compound promptly as work progresses and upon completion.
 - .6 At all fusible link damper locations, seal the perimeter of the angle iron framing on both sides of the wall or slab with ULC listed and labelled sealant materials to provide a positive smoke seal.
- .4 **Inspection:** Notify the Consultant when the work is complete and ready for inspection, and prior to concealing or enclosing firestopping and smoke seal materials and service penetration assemblies. Arrange for final inspection of the work by the Municipal Building Inspector prior to concealing or enclosing work. Make any corrections required.
- .5 **Certification:** On completion of the firestopping and smoke sealing installation submit a letter of assurance to the Consultant certifying that the firestopping and smoke sealing installation has been carried out throughout the building to all mechanical service penetrations and that the installation has been done in strict accordance with the requirements of the Provincial Building Code, any applicable local Municipal Codes, ULC requirements, and the manufacturer's instructions.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Shop Drawings/Product Data:** Submit shop drawings/product data sheets are to conform to the following requirements:
 - .1 Shop drawings/product data sheets are to include all products specified in this Section except pipe and fittings, each clearly marked to indicate exactly what is being supplied.
- .2 **Installer Qualifications:** Immediately after award of Contract, submit the name of the fire protection company proposed for the work, with documentation to confirm that the company conforms to requirements of this Section of the Specification.
- .3 **Test Certificate:** Submit completed NFPA system material and test certificate(s) as specified in Part 3 of this Section.
- .4 **Installation:** In compliance with:
 - .1 NFPA 13-2019
 - .2 2024 BC Building Code

1.2 Quality Assurance

- .1 **Codes and Standards:** Fire protection system work shall be in accordance with the following Codes and Standards:
 - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
 - .2 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded.
 - .3 ASTM A106, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
 - .4 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
 - .5 ANSI/ASME B16.4, Grey Iron Threaded Fittings (Classes 125 and 250).
- .2 **Site Personnel:** All site personnel are to be Sprinkler and Fire Protection Installers licensed in the jurisdiction of the work and under the continuous supervision of a foreman who is a journeyman.
- .3 **System Installer:** The system installer shall be an experienced fire protection system company with a minimum of 5 years of experience installing fire protection systems in a complex equal to this Project. Where welding is required, they shall be certified to ISO 9001 and CSA-W47.1 for welding.
- .4 **Dimensions and Coordination:** Check and verify all dimensions and conditions at the site and ensure that the work can be performed as indicated. Co-ordinate work with all trades at the site and accept responsibility for and the cost of making adjustments to piping and/or spacing to avoid interference with other building components.
- .5 **Existing System:** Verify the working condition of all existing fire protection system equipment which has direct interface with the new work and is to remain. Replace with new equipment where necessary.
- .6 All system components must be UL and/or ULC listed and labelled, and FM approved.

1.3 Design Requirements

- .1 **Sprinkler System Design Criteria:** Fire protection sprinkler work shall be designed in accordance with NFPA 13 and Provincial Standards, and, where required, local building and fire department requirements and the standards of the Owner's Insurer.
- .2 **Sprinkler /System Occupancy – Hazard Design requirements:** As per NFPA 13 occupancy-hazard density requirements, unless otherwise specified.

1.4 Fire Alarm Connections

- .1 Connect to existing. No changes expected.

1.5 Permits, Fees, and Certificates

- .1 Apply for, obtain and pay for all permits required to complete the fire protection work.
- .2 Submit to the Consultant, all approval/inspection certificates issued by governing authorities to confirm that the work as installed is in accordance with the rules and regulations of the governing authorities. Pay any costs associated with issue of the certificates.
- .3 Include a copy of all approval/inspection certificates in each operating and maintenance manual.

1.6 Guarantee-Warranty

- .1 The Contractor shall furnish a written warranty stating that all work executed will be free from defects of material and workmanship for a period of **ONE** year from the date of total performance. 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.
- .2 The Contractor further agrees that they will, at their own expense, promptly investigate any fire protection malfunction, and repair or replace all such defective work, and all other damages thereby which becomes defective during the time of the guarantee-warranty

1.7 Seismic Consultant

- .1 Retain and pay for the services of an experienced Seismic Consultant who is a registered professional engineer licensed in the jurisdiction of the work and a member in good standing of a Professional Engineers Association in the jurisdiction of the work.
- .2 The Seismic Consultant shall:
 - .1 Determine the proper seismic hazard level, design, recommend, and review all proposed fire protection work seismic restraint shop, placement and securing drawings, and sign and stamp all drawings prior to submittal for review as specified below.
 - .2 Supervise installation of all fire protection seismic restraint and, when work is complete, certify in writing that the seismic restraint work has been installed in accordance with signed, stamped, and reviewed drawings.
 - .3 Prepare and submit to the Municipality and authorities having jurisdiction, on a form approved by the Municipality and authorities having jurisdiction, at the beginning of seismic restraint work and when the work is complete, original signed and sealed Letters of Assurance for the design, installation and field review of all seismic restraint work.
- .3 Quality Assurance
 - .1 Seismic restraints are to be designed by a Seismic Consultant as specified above, and are to be installed by qualified tradesmen under the supervision of and to the approval of the Seismic Consultant.
 - .2 Unless otherwise specified seismic control and restraints are to be designed in accordance with:
 - .1 BC Building Code.
 - .2 Seismic control and restraints for fire protection piping and equipment are to be in accordance with NFPA requirements. When specified and/or required, design is also to include Factory Mutual requirements.

1.8 Requirements for Contractor Retained Engineers

- .1 All professional engineers retained by you to perform consulting services with regard to your work, i.e. seismic engineer, are to be members in good standing with the local Association of Professional Engineers, and are to carry and pay for errors and omissions

professional liability insurance in compliance with requirements of the governing authorities in the locale of the work.

1.9 Functional Testing

- .1 Fire Protection Contractor to coordinate with General Contractor for the Testing of Fire Protection and Life Safety Systems to meet CAN/ULC S1001 Integrated Systems Testing of Fire Protection and Life Safety Systems.
 - .1 Verification is required that fire protection and life safety systems and their components (i.e. fire alarm systems, sprinklers, standpipes, smoke control, door hold-open devices, elevator recalls, smoke and fire shutters and dampers, emergency power, emergency lighting, generators, etc.), including their interconnections with other building systems, are functioning according to the intent of their design.
 - .2 CAN/ULC-S1001, "Integrated Systems Testing of Fire Protection and Life Safety Systems," provides the methodology for verifying and documenting that interconnections between building systems satisfy the intent of their design and that the systems function as intended by the Code. Clause 6.1.5 of CAN/ULC-S1001 allows the Integrated Testing Coordinator to accept documented evidence of any tests that have been performed on a system as part of its acceptance testing for the purpose of demonstrating compliance with the integrated testing requirements of that standard, so as to avoid duplication of work.

1.10 Maintenance Testing

- .1 In compliance with NFPA 25-2011 "Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems"

1.11 System Testing (New Piping)

- .1 Hydrostatic: All piping and attached appurtenances subjected to system working pressure shall be hydrostatically tested at 200 psi (13.8 bar) or 50 psi (3.5 bar) in excess of the system working pressure, whichever is greater, and shall maintain that pressure ± 5 psi (0.35 bar) for 2 hours.
- .2 Pneumatic: Establish 40 psi (2.7 bar) air pressure and measure drop, which shall not exceed $1\frac{1}{2}$ psi (0.1 bar) in 24 hours. Test pressure tanks at normal water level and air pressure and measure air pressure drop, which shall not exceed $1\frac{1}{2}$ psi (0.1 bar) in 24 hours.

1.12 Painting

- .1 All exposed fire protection piping, including hangers, brackets, fittings, etc are to be painted. Sprinkler heads are not to be painted. Mechanical trade to coordinate with the General Contractor.

1.13 Pipe Hangers and Supports

- .1 Hangers and supports used in fire protection piping systems shall be listed and labeled by Underwriters Laboratories, UL 203 "Pipe Hanger Equipment for Fire Protection Service".
- .2 Steel pipe hangers and supports shall have the manufacturers name, part number, and applicable size stamped in the part itself for identification.
- .3 Hangers shall be designed to support five times the weight of the water-filled pipe plus 250 lb (115 kg) at each point of piping support.
- .4 Supports for sprinkler piping shall be in conformance with NFPA 13 and include protection against earthquakes where in seismic zones.

1.14 Firestopping and Smoke Seal System

- .1 Review fire and smoke separations as noted on the architectural plans.
- .2 Submit digital copy of shop drawings noting all examples of fire/smoke seal penetrations required for this project.

- .3 The applicator shall have a minimum of 3 years of successful experience on projects of similar size and complexity, and shall be approved by the Consultant.

2 PRODUCTS

2.1 Pipe, Fittings and Joints

- .1 Pipe, fittings, and joints are to be as follows, with exceptions as specified in Part 3 of this Section:
 - .1 **Schedule 40 Black Steel – Grooved Coupling Joints:** Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with fittings and couplings equal to Victaulic "FireLock" fittings and Victaulic Style 009N rigid coupling joints, Mechanical T-oulets, Strap-on fittings such as Victaulic "Snap-Let" strap type fittings are not acceptable.
 - .2 **Schedule 40 Black Steel – Screwed Joints:** Schedule 40 mild black carbon steel, ASTM A53, Grade B. Screwed piping shall be complete with Class 125 cast iron screwed fittings to ANSI/ASME B16.4.
 - .3 **Schedule 10 Black Steel – Grooved Coupling Joints:** Schedule 10 mild black carbon steel, ASTM A53, Grade B, complete with grooved ends and fittings and couplings equal to Victaulic "FireLock" fittings and Victaulic Style 009N rigid coupling joints. Mechanical T-oulets, Strap-on fittings such as Victaulic "Snap-Let" strap type fittings are not acceptable.
 - .4 **Schedule 10 Black Steel – Screwed Joints:** Schedule 10 mild black carbon steel, ASTM A53, Grade B, complete with mill or site threaded ends, Class 125 cast iron screwed fittings to ANSI/ASME B16.4, and screwed joints.
 - .5 **Flexible Pipe:** Victaulic Vicflex flexible metallic hose sprinkler head connections, each complete with an attachment bracket, or equivalent.
 - .6 **Grooved Fittings:** Installation-Ready™ fittings for grooved end steel piping in fire protection applications sizes NPS 1-¼ thru 2½ (DN 32 thru DN 65). Fittings shall consist of a ductile iron housing conforming to ASTM A-536, Grade 65-45-12, with Installation-Ready™ ends, red enamel coated. Fittings complete with prelubricated Grade "E" EPDM Type 'A' gasket; and ASTM A449 electroplated steel bolts and nuts. System shall be UL listed for a working pressure of 300 psi (2065 kPa) and FM approved for working pressure 365 psi (2517kPa). Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with NFPA 13.
 - .1 Victaulic grooved mechanical pipe couplings, fittings, valves and other grooved components may be used as an option to welding, threading or flanged methods.
 - .2 All grooved components shall conform to local code approval and/or as listed by UL/ULC, cULus, FM, or NFPA.
 - .3 Approved manufacturer: Victaulic

2.2 Sprinkler Heads

- .1 Sprinkler heads, unless otherwise specified, are to be as noted on the mechanical drawings.
- .2 Recessed sprinkler heads in finished areas are to be chrome plated unless otherwise specified. Concealed sprinkler head ceiling plates are to match the ceiling colour.
- .3 Where exposed pendent heads occur in areas with suspended ceilings, they are to be complete with chrome plated escutcheon plates. Similarly, sidewall heads with concealed piping are to be complete with chrome plated escutcheon plates.
- .4 Sprinkler heads which are exposed in areas where they may be subject to damage are to be complete with listed wire guards, chrome plated where in finished areas.
- .5 Sprinkler heads located in areas or over equipment where high ambient temperature is present are to be, unless otherwise specified, 93°C (200°F) heads. All other heads, unless otherwise specified or required, are to be 68°C (155°F) rated.

- .6 Acceptable sprinkler head manufactures are:
 - .1 Tyco
 - .2 Victaulic
 - .3 Viking
 - .4 Reliable

2.3 Pipe Hangers and Support

- .1 **General:** Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with NFPA 13 requirements, UL 203 "Pipe Hanger Equipment for Fire Protection Service", as well as the Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to the following requirements:
 - .1 Unless otherwise specified, all ferrous hanger and support products are to be electro-galvanized.
- .2 **Hangers**
 - .1 Uninsulated pipes 2 inch and smaller:
 - .1 Adjustable steel swivel ring (band type) hanger, Tolco series B3170.
 - .2 Adjustable steel swivel J-hanger, Tolco series B3690.
 - .3 Malleable iron ring hanger, Tolco series B3198R or hinged ring hanger, B3198H.
 - .4 Malleable iron split-ring hanger with eye socket, Tolco series B3173 with B3222.
 - .5 Adjustable steel clevis hanger, Tolco series B3104 or B3100.
 - .2 Uninsulated pipes 2-1/2 inch and larger:
 - .1 Adjustable steel clevis hanger, Tolco series B3100.
 - .2 Pipe roll with sockets, Tolco series B3114.
 - .3 Adjustable steel yoke pipe roll, Tolco series B3110.
- .3 **Pipe Clamps**
 - .1 When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, Tolco series B3140 or B3142 with B3200. For insulated lines use double bolted pipe clamps, Tolco series B3144 or B3146 with B3200
- .4 Hangers shall be sufficient to support five times the weight of the water-filled pipe plus 250 lb (114 kg) at each point of piping support.
- .5 The points of support shall be adequate to support the system.

2.4 Firestopping and Smoke Seal System Materials

- .1 Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with CAN4-S115, Standard Method of Fire Tests of Firestop Systems and CAN/ULC-S101, Standard Method of Fire Endurance Tests of Building Construction and Materials for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal, and a fire-resistance rating (flame, hose stream and temperature) not less than the fire resistance rating of surrounding fire rated construction.
- .2 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with the firestopping manufacturer's recommendations and the ULC tested assembly.
- .3 Pipe insulation forming part of a fire and smoke seal assembly is specified in the Mechanical Insulation Section.
- .4 Products to be: 3M, Hilti or approved alternate.

3 EXECUTION

3.1 Demolition

- .1 Do all required fire protection system demolition work. Refer to demolition requirements specified in the mechanical work Section entitled Demolition and Revision Work.

3.2 Piping Installation Requirements

- .1 Provide all required fire protection system piping. Do all piping work in accordance with "Reviewed" shop drawings and NFPA requirements. Unless otherwise specified, piping shall be as follows:
 - .1 **For "wet" system piping inside building and above ground:**
 - .1 For piping up to and including 25mm (1") Schedule 40 screwed end black steel pipe with screwed fittings and joints.
 - .2 For piping 32mm (1-1/4") to 40mm (1-1/2") Schedule 40 grooved end black steel with Victaulic or equal fittings and coupling joints.
 - .3 For piping 50mm (2") and larger Schedule 40 grooved end black steel with Victaulic or equal fittings and coupling joints.
 - .2 **For branch sprinkler piping to heads in suspended ceilings, etc.:** flexible piping installed in accordance with the manufacturer's instructions.
 - .3 **For "Grooved" fittings**
 - .1 Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove.
 - .2 The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.
 - .3 See the latest copy of manufacturers Field Assembly and Installation Instruction Handbook for grooved fittings. Supplemental handbooks for specific product installations shall be provided by the manufacturer and used by the contractor.
 - .4 Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs. Sprinkler bulb protector shall be removed by hand after installation. Do not use tools or any other device(s) to remove the protector that could damage the bulb in any way.
 - .5 The manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation.
 - .6 The manufacturer's representative shall periodically visit the job site and review installation. Contractor shall remove and replace any improperly installed products.
- .2 Exceptions to piping requirements specified in paragraph .3 are as follows:
 - .1 All "wet" zone steel piping, fittings, unions, couplings, and flanges for fire protection work exposed to weather either inside or outside the building (including parking garages), are to be galvanized.
 - .2 All ferrous pipe hangers, supports, and similar hardware used for galvanized steel piping are to be electro-galvanized.
- .3 All pipe sizes, pipe routing, equipment quantities and locations, and layout of work shown on the drawings are to assist you during the tendering period. Ensure adequate fire protection system coverage. Do not reduce the size of the fire protection system main or re-route the main unless approved.
- .4 All pipe, fittings, couplings, flanges, and similar components are to be cleaned after erection is complete. Any ferrous pipe, fitting, coupling, flange, hanger, support, and similar component which exhibits rust shall be wire brush cleaned and carefully coated with suitably coloured primer.
- .5 Slope all horizontal piping so that it may be completely drained. Provide capped drain points.

- .6 When fire protection work is complete, test the system components and the overall system(s) and submit completed NFPA material and test certificate(s), and any other documentation required.

3.3 Installation of Sprinkler Heads

- .1 Provide all required sprinkler heads. Sprinkler head types are to be in accordance with the following schedule, unless otherwise specified. Sprinkler head manufacturers indicated on the schedule are for type indication purposes. Acceptable manufacturers are listed in Part 2 of this Section.
- .2 Refer to drawings for sprinkler head schedule.
- .3 Sprinkler head locations must be carefully coordinated with all drawings, including architectural reflected ceiling plan drawings, and, where applicable, electrical drawings. Coordinate sprinkler head locations in areas with suspended ceilings with the location of lighting, grilles, diffusers, and similar items recessed in or surface mounted on the ceiling as per the reflected ceiling plans. In areas with lay-in tile, centre the sprinkler head both ways in the lay-in tile wherever possible. Confirm locations prior to roughing-in.
- .4 Maintain maximum headroom in areas with no ceilings.
- .5 Provide listed guards for heads where they are subject to damage.
- .6 Provide high temperature heads in equipment rooms and similar areas over heat-producing or generating equipment.

3.4 Installation of Spare Sprinkler Head

- .1 Supply a full complement (to fill cabinet) of spare sprinkler heads of the types used (minimum four of each type) and place in a wall mounting storage cabinet located adjacent to the sprinkler system "head end" equipment where later directed.

3.5 Installation of Pipe Hangers and Supports

- .1 Provide all required pipe hangers and supports.
- .2 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting pipe. Unless otherwise shown or specified, hang or support pipes from the structure only.
- .3 The spacing between hangers shall not exceed the value given for the type of pipe as indicated in Table 17.4.2.1(a) or Table 17.4.2.1(b) of NFPA 13-2019.

3.6 Firestopping and Smoke Seal System Materials

- .1 Where fire suppression piping penetrates fire rated construction, provide ULC listed and labelled firestopping and smoke seal materials installed in accordance with requirements of CAN4-S115 (ratings F, FT, FH, and FTH as required), CAN/ULC-S101, and all other governing authorities to seal the penetrations.
- .2 **Preparation:** Abide by the following requirements:
 - .1 Examine substrates, openings, voids, adjoining construction, and conditions under which the firestop and smoke seal system shall be installed, and confirm compatibility of surfaces.
 - .2 Verify penetrating items are securely fixed and properly located with the proper space allowance between penetrations and surfaces of openings.
 - .3 Report any unsuitable or unsatisfactory conditions to the Contractor and Consultant in writing, prior to commencement of work, and note that commencement of work will mean acceptance of conditions and surfaces.
 - .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces, and remove stains on adjacent surfaces.
- .3 **Application:** Conform to the following application requirements:
 - .1 Use an experienced applicator approved by the manufacturer of the firestopping material manufacturer.

- .2 Prime substrates in accordance with the product manufacturer's written instructions.
 - .3 Provide temporary forming as required and remove only after materials have gained sufficient strength and after initial curing.
 - .4 Tool or trowel exposed surfaces to a neat, smooth, consistent finish.
 - .5 Remove excess compound promptly as work progresses and upon completion.
 - .6 At all fusible link damper locations, seal the perimeter of the angle iron framing on both sides of the wall or slab with ULC listed and labelled sealant materials to provide a positive smoke seal.
- .4 **Inspection:** Notify the Consultant when the work is complete and ready for inspection, and prior to concealing or enclosing firestopping and smoke seal materials and service penetration assemblies. Arrange for final inspection of the work by the Municipal Building Inspector prior to concealing or enclosing work. Make any corrections required.
- .5 **Certification:** On completion of the firestopping and smoke sealing installation submit a letter of assurance to the Consultant certifying that the firestopping and smoke sealing installation has been carried out throughout the building to all fire protection piping service penetrations and that the installation has been done in strict accordance with the requirements of the Provincial Building Code, any applicable local Municipal Codes, ULC requirements, and the manufacturer's instructions.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for all products specified in Part 2 of this Section except for pipe and fittings, and chlorine.
- .2 **Water Purity Data:** Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance.

1.2 NSF/ANSI/CAN 61, Drinking Water System Components-Health Effects

- .1 All products specified in this Section
 - .1 All pipe, valves, fittings, accessories, factory supplied products as well as fabricated assemblies/spools that are in contact with domestic water are to be NSF/ANSI/CAN 61 and 372 certified 372 for commercial hot and cold-water ratings.
 - .2 Listings including tested and approved water contact temperature(s).
 - .3 Any products found to be non-compliant with these requirements will be replaced at the contractor's expense.

2 PRODUCTS

2.1 Pipe, Fittings and Joints

- .1 **Soft Copper:** Type "K" soft copper to ASTM B88, supplied in a continuous coil with no joints if possible, and complete with, if joints are required, compression type flared joint couplings.
- .2 **Hard Copper - Solder Joint:** Type "K" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints using NSF/ANSI/CAN 61 certified silver alloy lead-free solder for cold water pipe, and 95% tin/5% Antimony or silver alloy lead free solder for other services.
- .3 **Copper Pressure Coupled Joint:** Type "K" hard drawn seamless copper to ASTM B88 with Viega "ProPress" copper fittings with "Smart Connect" feature, EDPM seals, and pressure type crimped joints made by use of a Rigid tool Co. Model 330-B or Model 330-C electro-hydraulic crimping tool.
- .4 **Copper Grooved Joint:** Type: "K" hard drawn seamless copper to ASTM B88.
 - .1 Grooved couplings designed with angle bolt pads to provide rigid joint at copper-tubing sizes, complete with Fluor elastomer, Grade P gasket with pipe stop to ensure proper groove engagement, alignment, and pipe insertion depth, suitable for domestic water temperatures to 180-deg F.
 - .2 Gaskets shall be suited for vacuum up to 29.9 in Hg/760 mm Hg. Installation-Ready, for direct stab installation without field disassembly. Victaulic Style 607N.
- .5 **Stainless Steel Pressed Joint:** Schedule 10 Type 304/304L to ASTM A312/A312M with Victaulic "Vic Press" couplings, fittings and valves for piping up to 50 mm (2"):
 - .1 Fittings to have grade "H" HNBR elastomer O-ring seals; suitable for working pressure up to 3450 kPa (500 psi) and listed and certified to NSF/ANSI/CAN 61 for cold +73°F/+23°C or hot +180°F/+82°C as applicable as well as NSF/ANSI 372 low lead requirements.
- .6 **Stainless Steel:** Schedule 40 Type 304/304L to ASTM A312/A312M, threaded with screwed stainless-steel fittings to ASTM A403/A403M for piping to 50 mm (2") diameter.
- .7 **Schedule 10 Roll Grooved:** Piping larger than 50 mm (2") diameter with Victaulic Co. factory grooved end Type 304/304M stainless steel fittings and cast stainless steel coupling joints with gaskets meeting NSF/ANSI/CAN 61 requirements and Type 316 stainless steel bolts, Victaulic Series 489 rigid type or Series 77S flexible type as required by the location and application.

- .8 **Schedule 10 Roll Grooved:** Type 304/304L to ASTM A312 with RX roll grooves for piping larger than 40 mm (1-1/2") diameter with Victaulic grooved end couplings, fittings, and valves.
 - .1 Couplings to have Grade "P" Fluor elastomer gaskets meeting NSF/ANSI/CAN 61 requirements, that are engineered, blended, and extruded in-house by the coupling housing manufacturer, and have an integral center leg to ensure correct alignment of the coupling key with the prepared pipe ends and that are suited for vacuum up to 29.9 in Hg/760 mm Hg.
 - .2 Ensure Victaulic RX roll sets specifically designed for grooving schedule 10 stainless steel pipe are used. Victaulic Style 807N (2"-6"), 889 (8"-12") rigid type couplings. Victaulic style 841 flange adapters 2" to 6" and Victaulic 445F 8" to 12". For flexible coupling requires contact manufacture.

2.2 Dielectric Unions

- .1 Lead-free dielectric unions, each complete with a thermoplastic liner and rated minimum 1725 kPa (250 psi) at 120° C (250° F).
- .2 Grooved dielectric transition fittings composed of a copper silicon casting conforming to UNS C87850 and are UL classified in accordance with NSF/ANSI/CAN 61 and NSF/ANSI 372 for ambient +86°F/+30°C and hot +180°F/+82°C potable water. Victaulic 647

2.3 Shut-Off Valves

- .1 **Brass & Bronze Ball Valves:** Lead free, Class 600, 4140 kPa (600 psi) non-shock WOG rated, 2-piece, full port ball type valves, each complete with a forged brass or bronze body, blowout-proof stem, solid forged brass or bronze chrome plated ball, "Teflon" or "PTFE" seat, a removable coated steel lever handle marked with valve identification and ends to suit the piping being connected.
 - .1 Valves in insulated piping are to be complete with stem extensions. Acceptable manufacturers are:
 - .1 Toyo Valve Co.
 - .2 Milwaukee Valve Co.
 - .3 Kitz Corporation.
 - .4 Combraco Industries Inc. Apollo.
 - .5 Watts Water Technologies Inc.
- .2 **Stainless Steel Ball Valve:** CF8M stainless steel body, full port ball, and stem, PTFE seats, 304 stainless steel handle, nut, and stem washer, with Schedule 10S stainless steel Vic-press and or grooved ends.
 - .1 Rated for services to 2750kPa (400 psi). Victaulic series P569.

2.4 Check Valves

- .1 **Horizontal:** Class 125, bronze, lead-free with identifying tag, 1380 kPa (200 psi) WOG rated horizontal swing type check valves with ends to suit the connecting piping. Acceptable products are:
 - .1 Toyo Valve Co.
 - .2 Milwaukee Valve Co.
 - .3 Kitz Corporation.
 - .4 Combraco Industries Inc. Apollo.
 - .5 Watt Water Technologies Inc.
- .2 **Vertical:** Equal to Kitz Corp. Code 26, bronze, lead-free, 1725 kPa (250 psi) WOG rated vertical lift check valve with ends to suit the connecting piping.
- .3 **Grooved End:** 2" – 12" (50 – 300 mm) 300 psi (2065 kPa CWP), 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 Fluor elastomer seat. Suitable for vertical or horizontal installation. Acceptable products are:
 - .1 Victaulic Series 816.

- .4 Valves in stainless steel systems shall be of stainless-steel body and disc. BFVs valves with rubber encapsulated discs or body shall not be used and will not be accepted in any application.

2.5 Balancing Valves

- .1 Solder, threaded or flanged end type as required, globe style, non-ferrous circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter.
- .2 Note: NSF approved for potable applications. Acceptable products are:
 - .1 S.A. Armstrong Model CBV Series.
 - .2 Tour and Andersson Model STAD Zero Series.
 - .3 Watts Industries (Canada) Inc. Model CSM Series.
- .3 Drinking Water applications: ½ and ¾" [15 and 20mm], NSF/ANSI/CAN 61-G rated for commercial hot water service (temperature rated to 180F) and certified by the NSF with all wetted parts stainless steel; lead-free construction in compliance with ANS/NSF/ANSI-372; Series 300 stainless steel body, nickel plated brass union nut, and tamper-resistant flow cartridge 300 series stainless steel. Acceptable products are:
 - .1 Victaulic "ICSS" Series 76X.
- .4 Thermostatic automatic balancing valves for water recirculation must be approved for domestic hot and cold water as per above.
 - .1 Provide thermostatic valve for automatic balancing on each recirculation branch.
 - .2 Thermostatic balancing valve shall have ability for manual temperature adjustment, c/w lock out feature, built in temperature display and shut off function.

2.6 Drain Valves

- .1 Refer to Part 2 of the mechanical work Section entitled Basic Mechanical Materials and Methods

2.7 Partition Stops

- .1 Equal to Dahl Brothers Canada Ltd. rough brass or bronze key operated partition stops with Teflon impregnated lifetime packing, slotted spindles, extension tubes, stainless steel access plates, and three identified keys.

3 EXECUTION

3.1 Demolition

- .1 Do all required domestic water system demolition work. Refer to demolition requirements specified in the mechanical work Section entitled Demolition and Revision Work.

3.2 Piping Installation Requirements

- .1 Provide all required domestic water piping.
- .2 Piping, unless otherwise specified, shall be as follows:
 - .1 For domestic hot and cold water mains and branch lines – Type "K" Copper with soldered joints, grooved joints, or pressure coupled mechanical joints, or 304 Stainless Steel Schedule 10 with pressure coupled joints.
 - .2 For domestic hot water recirculation mains and branch lines– 304 Stainless Steel Schedule 10 with pressure coupled joints.
 - .3 For 12 mm (½") diameter trap seal primer tubing located underground or in concrete or masonry construction - semi-rigid polyethylene.
- .3 Slope all piping so that it can be completely drained.
- .4 Provide proper dielectric fittings or unions in all connections between copper pipe and ferrous pipe or equipment.

- .5 Secure trap seal primer tubing embedded in concrete to reinforcing steel in a secure manner and be present during the concrete pour to ensure that the tubing is not damaged or dislodged.
- .6 Installation of grooved mechanical components.
 - .1 Grooved joints shall be installed in accordance with the manufacturer's latest published instructions.
 - .2 Gasket style and elastomeric material (grade) shall be verified as suitable for the intended service. Gaskets shall be blended, extruded, molded and produced by the grooved coupling manufacturer. Grooved ends shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove.
 - .3 Correct roll sets shall be used for pipe material grooved Victaulic RX rolls for Sched 10 Stainless Steel Victaulic RR roll sets for copper.
 - .4 CG1100 Cut grooving tool for CPVC/PVC PGS300 grooved system.
 - .5 Grooved coupling manufacturer's factory trained field representative shall provide on-site training for contractor's field personnel in the proper use of grooving tools, application of groove, and installation of grooved piping products.
 - .6 Factory trained representative shall periodically visit the jobsite to ensure best practices in grooved product installation are being followed.
 - .7 Provide a copy of the manufacturer's project kickoff checklist and confirmation letter of visit. Contractor shall remove and replace any improperly installed products.
 - .8 Manufacturer or Owner Rep/Engineer may request at their discretion any field grooved and installed joints be disassembled for verification of pipe groove dimensions.

3.3 Installation of Shut-Off and Check Valves

- .1 Refer to Part 3 of the mechanical work Section entitled Basic Mechanical Materials and Methods.
- .2 In weld flange applications, valves to and including 100 mm (4") diameter are to be ball type. Valves larger than 100 mm (4") diameter are to be butterfly type.
- .3 Valves in grooved end system to be grooved end and will be the same manufacturer as grooved couplings, and fittings.
- .4 Valves in stainless steel systems shall be of stainless-steel body and disc. Valves with rubber encapsulated ductile iron discs or body shall not be used and will not be accepted in any application.

3.4 Installation of Balancing Valves

- .1 Provide balancing valves in domestic hot water recirculation piping where shown or required. At a minimum, balancing valves are required on each domestic hot water recirculation branch line.
- .2 Locate each valve such that it is easily accessible.
- .3 All balancing valves to also include a check valve.
- .4 All Balancing valves used in domestic water applications must be listed and certified to NSF/ANSI/CAN 61 and NSF/ANSI 372.

3.5 Installation of Drain Valves

- .1 Refer to Part 3 of the mechanical work Section entitled Basic Mechanical Materials and Methods.

3.6 Installation of Partition Stops

- .1 Provide partition stops in domestic water piping to each group of suite washroom plumbing fixtures. Locate partition stops in piping near the floor level in inconspicuous but accessible locations. Confirm exact locations prior to roughing-in.

3.7 Piping Expansion and Contraction Facilities

- .1 Provide piping expansion loops or expansion compensators with guides and anchors where indicated for piping expansion and contraction facilities. Refer to requirements in the mechanical work Section entitled Piping Expansion Compensation.
- .2 Confirm exact locations prior to installation.

3.8 Flushing and Disinfecting Piping

- .1 Flush and disinfect all new and/or reworked domestic water piping after leakage testing is complete.
- .2 Isolate new piping from existing piping prior to flushing and disinfecting procedures.
- .3 Flush piping until all foreign materials have been removed and the flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.
- .4 When flushing is complete, disinfect the piping with a solution of chlorine in accordance with requirements of the BC Drinking Water Protection Act and Drinking Water Protection Regulation and to Municipal Requirements, under the supervision of a P. Eng. authorized by the Professional Engineers of British Columbia to perform such work.
- .5 When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of the test results and fill the systems.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for all products specified in Part 2 of this Section.
- .2 **Hydrant Keys:** Prior to Substantial Performance, submit a minimum of 3 identified keys for key operated hydrants.
- .3 **Backflow Preventer Inspection/Test Results:** Submit signed test results and inspection and test log cards for each backflow preventer as specified in Part 3 of this Section.

1.2 NSF/ANSI/CAN 61, Drinking Water System Components-Health Effects

- .1 All products, including all piping, valves, fittings, materials, methods, fabricated assemblies or spool and products specified in this Section that are in contact with domestic water are listed and certified to NSF/ANSI/CAN 61 for domestic cold and hot water as well as NSF/ANSI 372 low lead requirement (as applicable), Drinking Water System Components – Health Effects.

1.3 Base Bid and Acceptable Manufacturers

- .1 Refer to the article entitled Equipment and Material Manufacturer Requirements in the Section entitled Mechanical Work General Instructions.
- .2 The following is a list of base bid and acceptable manufacturers for products specified in this Section:
 - .1 **Lavatory supply fitting thermostatic mixing valves** - Watts Water Technologies (Canada) Ltd. "Powers", Lawler Manufacturing Co. Inc., Leonard Valve Co., and Symmons Industries Inc.

2 PRODUCTS

2.1 Lavatory Supply Fitting Mixing Valves

- .1 Forged brass, tamper-proof thermostatic mixing valve, certified to CSA-B125.3, Plumbing Fittings, adjustable for water supply between 29°C and 49°C (85°F and 120°F), sized as shown and/or to suit the number of lavatories in the grouping, and complete with:
 - .1 A valve stops and independent check valve (not integral) and a lockable handle.
 - .2 A field supplied outlet piping thermometer.
 - .3 A stainless-steel flush or surface (as shown) wall mounting cabinet with vandal-proof hinged door.
- .2 Equal to Masco Canada Ltd. "Delta" recessed wall mounting cabinet with factory installed and tested components consisting of:
 - .1 An adjustable thermostatic mixing valve certified to CSA-B125.3, Plumbing Fittings.
 - .2 Cold and hot water inlet copper piping with ball type shut-off valves.
 - .3 A water temperature sensor.
 - .4 A solenoid valve.
 - .5 A power supply box with batteries and AC adapter. Note: final low voltage wiring to the solenoid control from the electrical power 120v supply installed by the mechanical contractor.
 - .6 A hinged stainless steel lockable cover.

3 EXECUTION

3.1 Installation of Domestic Hot Water Thermostatic Mixing Valves

- .1 Provide a domestic hot water thermostatic mixing valve in a wall cabinet where shown. Confirm exact location prior to installation. Adjust the valve to design requirements and

- check and test operation. Set maximum temperature limit stops. Identify the valve and its water temperature delivery setting with an engraved nameplate.
- .2 Provide wall mounting battery and AC operated mixing valve/solenoid valve units in cabinets under lavatories where shown. Connect to each lavatory supply fitting with protected control wiring in accordance with the manufacturer's printed instructions. Check and test supply water temperatures and operation of each supply fitting and make any required adjustments.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for all products specified in this Section except pipe and fittings.
- .2 **Plumbing Inspection Certificate:** Submit a copy of the plumbing inspection certificate prior to application for Substantial Performance.

1.2 Base Bid and Acceptable Manufacturers

- .1 Refer to the article entitled Equipment and Material Manufacturer Requirements in the Section entitled Mechanical Work General Instructions.
- .2 The following is a list of base bid and acceptable manufacturers for products specified in this Section:

PRODUCT	ACCEPTABLE MANUFACTURERS
Shut-Off, Check & Drain Valves	Watts Canada, Apollo Valves, Crane & Jenkins Valve Group, Red-White Valve Corp.

2 PRODUCTS

2.1 Pipe, Fittings and Joints

- .1 Refer to Part 3 of this Section.

2.2 Shut-Off and Check Valves

- .1 **Shut-off Valves:** Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with:
 - .1 A forged brass body.
 - .2 Blowout-proof stem.
 - .3 Chrome plated solid brass ball.
 - .4 Screwed or flanged ends as required.
 - .5 A removable lever handles.
- .2 **Check Valves:** Class 125, bronze, 1725 kPa (250 psi) WOG rated vertical lift check valves with screwed ends for vertical piping, and, for horizontal piping, Class 125, bronze 1380 kPa (200 psi) WOG rated swing check valves with screwed or flanged ends as required.

3 EXECUTION

3.1 Demolition

- .1 Do all required drainage and vent piping demolition work. Refer to demolition requirements specified in the mechanical work Section entitled Demolition and Revision Work.

3.2 Drain and Vent Piping Installation Requirements

- .1 Provide all required drainage and vent piping. Pipe, unless otherwise specified, shall be as follows indicated below.
- .2 Piping Above Ground:

PIPE	FITTINGS	JOINTS
For piping to 75 mm (3") dia., Type DWV copper to ASTM B306	Forged copper solder joint drainage fittings to ASME/ANSI B16.29	50% lead/50% tine solder type
For piping 75 mm (3") dia. and larger, Class 4000 cast iron to CAN/CSA-B70	Cast iron soil pipe fittings to CAN/CSA-B602	Mechanical coupling type equal to Anaco "Husky" Series 400, 4-strap for pipe to 100 mm (4") & 6-strap for pipe larger than 100 mm (4"), all to CAN/CSA-B602

- .3 Unless otherwise specified, slope horizontal drainage piping above ground in sizes to and including 75 mm (3") diameter 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") diameter and larger 25 mm (1") in 2.4 m (8').
- .4 Unless otherwise specified, slope horizontal branches of vent piping down to the fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').
- .5 Extend vent stacks up through the roof generally where shown but with exact locations to suit site conditions and in any case a minimum of 3 m (10') from fresh air intakes. Terminate vent stacks a minimum of 330 mm (13") above the roof (including roof parapets) in vent stack covers.
- .6 Provide proper dielectric unions at connections between copper pipe and ferrous pipe or equipment.

3.3 Installation of Shut-Off and Check Valves

- .1 Provide a shut-off valve and a check valve in the discharge piping of each drainage pump.
- .2 Locate valves so that they are easily accessible without the use of ladders or other such devices.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for all products specified in this Section.
- .2 **Certification Letters:** Submit letters from product manufacturers/suppliers to certify correct installation of products as specified in Part 3 of this Section.

2 PRODUCTS

2.1 Cast Iron Drainpipe Elbow Restraints

- .1 Holdrite 117 Series no-hub stainless steel restraint kits to suit the pipe size and fitting types and locations.

2.2 Cleanouts

- .1 **Horizontal Piping:** TY pipe fitting with an extra heavy brass plug screwed into the fitting.
- .2 **Vertical Piping:** Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, "BARRETT" type cast iron cleanout tees, each gas and water-tight and complete with a bolted cover.

2.3 Floor Cleanout Terminations

- .1 Factory finished cast iron terminations, each adjustable and complete with a cast iron body with neoprene sleeve, solid, gasketed, polished nickel-bronze scoriated top access cover to suit the floor finish, a seal plug, and captive, vandal-proof, stainless steel securing hardware. Acceptable products are:
 - .1 Zurn Industries # ZN-1602-SP Series
 - .2 Jay R. Smith Mfg. Co. #4020-F-C Series
 - .3 Mifab Inc. # C1100-XR-1 or #C1000-R-3
 - .4 Watts Industries (Canada) Ltd. # CO-200-R-1
 - .5 Bibby-Ste-Croix "Wade"
- .2 All cleanout terminations in areas with a tile or sheet vinyl floor finish are to be as above but with a square top in lieu of a round top.
- .3 Where CSA healthcare standards are required: the location of cleanouts within patient care areas shall be located above the flood level rim of the sink within the patient care washroom.

3 EXECUTION

3.1 Installation of Drainage Pipe Fitting Restraints

- .1 Provide fitting restraints on cast iron drainage pipe fittings in high rise piping where indicated. Install in accordance with the manufacturer's instructions.

3.2 Installation of Cleanouts

- .1 Provide cleanouts in drainage piping in locations as follows:
 - .1 In the building drain or drains as close as possible to the inner face of the outside wall, and, if a building trap is installed, locate the cleanout on the downstream side of the building trap.
 - .2 At or as close as practicable to the foot of each drainage stack
 - .3 At maximum 15 m (50') intervals in horizontal pipe 100 mm (4") diameter and smaller
 - .4 At maximum 30 m (100') intervals in horizontal pipe larger than 100 mm (4") diameter
 - .5 In the wall at each new urinal or bank of urinals in a washroom
 - .6 Wherever else shown on the drawings

- .2 Cleanouts are to be the same diameter as the pipe in piping to 100 mm (4") diameter, and not less than 100 mm (4") diameter in piping larger than 100 mm (4") diameter.
- .3 Where cleanouts in vertical piping are concealed behind walls or partitions, install the cleanouts near the floor and so that the cover is within 25 mm (1") of the finished face of the wall or partition.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data Sheets:** Submit product data sheets (fixture cuts) for all plumbing fixtures and fittings.
- .2 **Colour Charts:** Submit fixture manufacturer's standard colour charts for all fixtures where colours are available but a particular colour is not specified.

1.2 Quality Assurance

- .1 Plumbing fixtures and fittings, where applicable, are to be in accordance with requirements of the following standards:
 - .1 CAN/CSA B45 Series, General Requirements for Plumbing Fixtures, including supplements.
 - .2 ASME A112.18.1/CSA B125.1, Plumbing Supply Fittings.
 - .3 ASME A112.18.2/CSA B125.2, Plumbing Waste Fittings.
 - .4 ASME A112.18.6/CSA B125.6, Flexible Water Connections.
 - .5 CSA B125.3, Plumbing Fittings.
 - .6 CAN/CSA-B651, Accessible Design for Self-Service Interactive Devices.
 - .7 NSF/ANSI/CAN 61, Drinking Water System Components-Health Effects.
 - .8 British Columbia Building Code, Section 3 for barrier-free requirements.

1.3 Base Bid and Acceptable Manufacturers

- .1 The following is a list of base bid and acceptable manufacturers for products specified in this Section:

PRODUCT	ACCEPTABLE MANUFACTURERS
Vitreous China Fixtures	American Standard, Kohler Co., Toto Ltd.
Fixture Water Supply and Drain Fittings	American Standard, Delta Faucet Co., Zurn Industries Ltd., Chicago Faucet, Cambridge Brass Inc., Moen Inc.
Fixture Carriers	Watts Industries (Canada) Ltd., Jay R. Smith Mfg. Co., Zurn Industries Ltd., Mifab Inc., and Bibby-Ste-Croix "Wade"

2 PRODUCTS

2.1 General Re: Plumbing Fixtures and Fittings

- .1 Unless otherwise specified, all vitreous china, porcelain enamelled, and acrylic finished fixtures are to be white.
- .2 Unless otherwise specified, all fittings and piping exposed to view are to be chrome plated and polished.
- .3 All fittings located in areas other than private washrooms are to be vandal-resistant.
- .4 All water supply fittings are to be lead-free in accordance with NSF/ANSI 61 requirements.
- .5 **Fixture Carriers:** All fixture carriers are to be suitable in all respects for the fixture they support and the construction in which they are located.
- .6 **Fixture Exposed Traps:** Exposed traps for fixtures not equipped with integral traps, such as lavatories, are to be adjustable chrome plated cast brass "P" traps with cleanouts, minimum #17 gauge chrome plated tubular extensions, and chrome plated escutcheons, all to suit the fixture type and drain connection.

- .7 **Fixture Concealed Traps:** Concealed traps for fixtures not equipped with integral traps, such as counter sinks, are to be adjustable cast brass with cleanout plugs, all to suit the fixture type and drain connection.
- .8 **Fixture Exposed Supplies:** Exposed supplies for fixtures which do not have supply trim/fittings with integral stops, i.e. lavatories, are to be solid chrome plated brass angle vales with screwdriver stops for public areas, wheel handle stops for private areas, flexible stainless steel risers, and stainless steel or chrome plated steel escutcheons, all arranged and sized to suit the fixture. Dahl Brothers Canada Ltd, chrome plated "mini-ball" valve assemblies will be acceptable.
- .9 **Fixture Concealed Supplies:** Water piping as specified, complete with ball type shut-off valves as specified with the water piping or Dahl Bros. Canada Ltd. ¼ turn "mini ball" valves.

2.2 Caulking

- .1 General Electric Series SCS 1200 Silicone Construction Sealant or Dow Corning 781 silicone sealant. Caulking colour(s) for coloured fixtures other than white, if any, will be selected by the Consultant from the sealant manufacturer's standard colour range.

3 EXECUTION

3.1 Demolition

- .1 Do all required plumbing fixture and fitting demolition work. Refer to demolition requirements specified in the mechanical work Section entitled Demolition and Revision Work.

3.2 Installation of Plumbing Fixtures and Fittings

- .1 Provide all required plumbing fixtures and fittings.
- .2 Where new fixtures and fittings are to be connected to existing piping, include for all required piping revisions.
- .3 Connect plumbing fixtures and fittings with piping sized in accordance with the drawing schedule.
- .4 Confirm the exact location of all plumbing fixtures and trim prior to roughing-in. Refer to architectural plan and elevation drawings.
- .5 When installation is complete, check and test the operation of each fixture and fitting. Adjust or repair as required.
- .6 **Barrier-Free Fixtures:** Comply with mounting height and other requirements of the governing Code.
- .7 **Electronic Lavatory Faucets:** Locate control panels for electronic faucets under the lavatories and recessed into the wall. Coordinate panel installations with the electrical trade who will provide 115 volt power wiring to the boxes.
- .8 Provide low voltage wiring in flexible conduit from each box to the faucet.
- .9 Connect tempered water piping to each box, and from each box to the faucet. Set each faucet sensor to deliver water for approximately 10 seconds.
- .10 **Mixing Valves for Emergency Fixtures:** Wall mount mixing valves for emergency fixtures approximately 1.5 m (5') above the floor and secure in place. Check and confirm valve operation and the temperature of the tempered water supply. Provide cabinets where shown. Identify each cabinet and hand three identified cabinet keys to the Consultant prior to Substantial Performance.

3.3 Caulking at Plumbing Fixtures and Fittings

- .1 Caulk around plumbing fixtures and fittings where they contact walls, floors, and any other building surface.

- .2 Clean areas/surfaces to be caulked and prime in accordance with the sealant manufacturer's instructions. Where damage to a building surface may occur, mask the surface to prevent damage and ensure a clean exact edge to the caulking bead.
- .3 Apply caulking using a gun with the proper size and shape of nozzle and force the sealant into joints to ensure good surface contact and a smooth and even finished bead of sealant.
- .4 If joints have been masked the sealant may be tooled in a continuous stroke to obtain complete void filling. Remove masking tape immediately after tooling and before the sealant begins to skin.

3.4 Commissioning

- .1 Commission plumbing fixtures and fittings by proving proper operation.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit shop drawings/product data sheets for all products specified in this Section except piping and unions.

2 PRODUCTS

2.1 Pipe, Fittings, and Joints

- .1 **Black Steel - Screwed Joint:** Mild black carbon steel, Grade B, ERW, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.
- .2 **Black Steel - Grooved End Mechanical Joint:** Mild black carbon steel, Grade B, ERW, ASTM A53, factory or site roll grooved, complete with Victaulic Co. cast ductile iron grooved end fittings, including full flow elbows, conforming to ASTM A536, and Victaulic Style 07 "Zero-Flex" rigid couplings for piping in the Mechanical Rooms and for piping risers, Style 77 standard flexible couplings for all other piping.
- .3 **Black Steel - Pressure Coupled Joint:** Schedule 10 mild black steel, ASTM A53, square cut, deburred **and clean**, complete with Viega "MegaPress" 2070 kPa (300 psi) rated, formed, cold drawn steel fittings and couplings with Grade "E" EDPM O-rings and "Smart Connect" feature, and pressure type crimped joints made by use of an electro-hydraulic crimping tool supplied by the fitting manufacturer.
- .4 **Soft Copper Pipe:** Type "L" seamless soft copper to ASTM B77.
- .5 **Hard Copper - Solder Joint:** Type "L" hard drawn seamless copper to ASTM B88, complete with wrought copper fittings to ANSI B16.22, and 95% tin/5% Antimony solder joints.

2.2 Piping Unions

- .1 **Screwed Piping:** Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).
- .2 **Flanged Piping:** forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

2.3 Piping Hangers and Supports

- .1 Refer to Part 2 of the mechanical work Section entitled Basic Mechanical Materials and Methods.
- .2 Refer to sub-section 2.4.1 Horizontal Pipe Insulation at Hangers & Supports in Section 20 05 25 Mechanical Insulation.

2.4 Shut-Off Valves

- .1 **Ball Type:** Class 600, 4140 kPa (600 psi) WOG rated full port lead free ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, ends to suit the piping being connected, and removable lever handle. Acceptable products are:
 - .1 Red-White Valve Corp. Fig. 5044AB.
 - .2 Watts Industries (Canada) Inc. #FBV-3.
 - .3 Kitz Corp. Code 58.
 - .4 Victaulic Co. of Canada Ltd. Series 722.
 - .5 Apollo Valve #77-100.

2.5 Swing Check Valves

- .1 **Bronze - Screwed:** Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends. Acceptable products are:
 - .1 Red-White Valve Corp. Fig. 238.
 - .2 Nibco #T-433-Y.
 - .3 Kitz Corp. Code No. 29.
- .2 **Steel - Grooved Ends:** Victaulic Co. of Canada Ltd. Series 716 "Vic-Check" grooved end carbon steel check valves suitable for mounting horizontally or vertically (upwards only).
- .3 **Cast Iron - Screwed and Flanged:** Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover, and screwed or flanged ends as required. Acceptable products are:
 - .1 Kitz Corp. Code No. 78.
 - .2 Red-White Valve Corp. Fig. 435. (This valve has a cast iron disc – not bronze)

2.6 Vertical Lift Check Valves

- .1 Class 150, 1380 kPa (200 psi) WOG rated bronze vertical lift check valves, each complete with screwed ends and a bronze disc. Acceptable products are:
 - .1 Toyo Valve Co. Fig. 230A.
 - .2 Kitz Corp. Code No. 36.

2.7 Water Check Valves

- .1 Threaded lug body type, full bore, ANSI Series 150, 1965 kPa (285 psi) rated at 38°C (100°F), non-slam wafer check valves, each complete with a carbon steel body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type 316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must equal the inside diameter of the connecting pipe. Acceptable products are:
 - .1 Gulf Valve Co. "WAFER CHECK".
 - .2 Watts Industries (Canada) Inc. Series ICV-125.
 - .3 The Metraflex Co. Style CVXX.

2.8 Drain Valves

- .1 Refer to Part 2 of the mechanical work Section entitled Basic Mechanical Materials and Methods.

2.9 Circuit Balancing Valves

- .1 Screwed or flanged as required, globe style, non-ferrous circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter. Acceptable products are:
 - .1 Armstrong Fluid Technologies Series "CBVI" screwed or "CBVII" flanged.
 - .2 Victaulic Co. of Canada Ltd. (Tour & Andersson) Series 787 screwed, Series 788 flanged, and 789 grooved end, and Series 78K "Koil Kit" valves.
- .2 Flow rate for valve must be suitable for flow rate of specified terminal device. Use low flow and ultra-low flow balancing valve where required.

2.10 Air Vents

- .1 Refer to Part 2 of the mechanical work Section entitled Hydronic Piping Specialties.

2.11 Pressure Gauges and Thermometers

- .1 Refer to Part 2 of the mechanical work Section entitled Basic Mechanical Materials and Methods.

2.12 Pre-Operational Chemical treatment

- .1 Refer to the mechanical work Section entitled HVAC Water Treatment.

3.1 Demolition

- .1 Do all required hydronic piping system demolition/revision work. Refer to demolition requirements specified in the mechanical work Section entitled Demolition and Revision Work.

3.2 Preparation

- .1 Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- .2 Remove scale and dirt on inside and outside before assembly.
- .3 Prepare piping connections to equipment with flanges or unions.
- .4 After completion, fill, clean, and treat systems. Refer to Division 23 Section "HVAC Water Treatment".

3.3 Piping Installation Requirements

- .1 Provide all required hydronic piping. Pipe, unless otherwise specified, shall be:
 - .1 For pipe to and including 50 mm (2") diameter, Schedule 40 black steel, screwed, or type "L" hard copper with solder joints or pressure coupled joints, or, for runout piping from mains and risers to terminal equipment, Schedule 10 black steel with Viega "MegaPress" fittings and couplings.
 - .2 For pipe 65 mm (2½") diameter and larger, Schedule 40 black steel with grooved ends and Victaulic fittings and couplings, or, Schedule 40 black steel with welding fittings and welded joints.
 - .3 For short branch connections to heating equipment where structural obstructions occur and site bending of pipe is advantageous, a single length of type "L" soft copper.
- .2 Route piping plumb and parallel to building structure and maintain gradient.
- .3 Install piping to conserve building space, and not interfere with use of space and other work.
- .4 Slope horizontal piping mains to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Slope branch supply and return piping connections to equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation and maintenance of air vents. Use eccentric reducers to maintain top of pipe level.
- .5 Group piping whenever practical at common elevations.
- .6 Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Division 23 Section "Expansion Fittings and Loops for HVAC Piping".
- .7 Provide clearance for installation of insulation, and access to valves and fittings.
- .8 Provide access where valves and fittings are not exposed.
- .9 Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
- .10 Prepare pipe, fittings, supports, and accessories for finish painting. Refer to Division 09 Section "Painting".
- .11 Install valves with stems upright or horizontal, not inverted.
- .12 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the control. Refer to drawing control diagrams and details.
- .13 Connect equipment provided as part of the work of other Sections of the Specification with piping as indicated and/or required. Refer to pipe connection details on drawings.

- .14 Do not install heating water piping in exterior walls or unheated areas of the building.

3.4 Pipe Joint Connections

- .1 Threaded Pipe: Use RectorSeal No. 5, or equal, for general service applications, temperatures from -45°C to 204°C F (-50°F to +400°F), metal or plastic threads, nontoxic, non-hardening, gas pressures to 18 MPa (2600 psi), liquid pressures to 69 MPa (10,000 psi).
- .2 **Unions:** Provide screwed unions, removable mechanical joint couplings, or weld-on or solder-on flanges in piping at all connections to valves, strainers and similar piping system components which may need maintenance or repair, at all equipment connections, in runs of piping exceeding 9 m (30') at 4.5 m (15') regular intervals to permit removal of sections of piping, and wherever else indicated on the drawings.
- .3 Copper Tubing with Solder Joint Fittings: Use silver brazed joints for piping located in or under concrete slab on ground, condensate piping located in underground conduits and manholes, and for attaching "Brazolet" fittings for service.
 - .1 Silver brazing alloy shall comply with ANSI/AWS A5.8, class BCUP-5. Use care in silver brazing to prevent overheating of pipe and fittings. Disassemble solder type valves before silver brazing and keep bodies cool.
 - .2 Make other joints with soft solder per Paragraph 2.1.5
- .4 Grooved Joint Coupling Systems:
 - .1 Install only on piping systems allowed.
 - .2 Install in accordance with manufacturer's recommendations.
 - .3 Cut grooves are acceptable, all sizes.
 - .4 Rolled grooves are acceptable for pipe sizes 3 inches (75 mm) and larger.
 - .5 Only standard full flow, long radius fittings and specified couplings are acceptable. Clamp-on, drilled-in tee connections are specifically prohibited.
 - .6 Use specified valves.
 - .7 Indicate extent of welding, if still required.
 - .8 Coordinate insulation and jacketing requirements.

3.5 Dielectric Insulating Fittings

- .1 Insulating unions or flanges shall be provided at locations described herein unless noted otherwise.
- .2 A shutoff valve shall be provided locally, upstream of dielectric insulating fittings, so that repairs can be made easily on these fittings.
- .3 Locations requiring insulating couplings or flanges are as follows:
 - .1 At connection points where copper water lines connect to steel domestic water heater tanks.
 - .2 At points in water lines where ferrous and other dissimilar metallic pipes are connected together.
 - .3 In metallic water and gas service connections into each building within 1 m (3') of the building wall. Install adjacent to the shutoff valve or cock, and aboveground where possible.
 - .4 Where steel or cast iron pipe in the ground connects to copper or brass piping above the ground, the transition from steel or cast iron pipe to the copper or brass pipe shall be made aboveground in an accessible location.
 - .5 Where copper or brass piping is connected to steel or cast iron piping and the connection is buried in the ground, the connection shall be covered with a protective coal tar tape wrap extending outward at least 1.7 m (5') on pipes, from the point of connection. The tape shall be Protecto Wrap No.200, or equal. A primer, specifically designed for use with the tape, shall be used. The piping shall be thoroughly cleaned before tape or primer is applied.

3.6 Valve Installation

- .1 Piping systems shall be supplied with valves at points shown on the drawings or herein specified, arranged so as to give shut-off and regulating control of piping systems throughout the building.
- .2 Valves shall be the full size of the line in which they are installed.
- .3 Valves shall be installed in neat arrangements with accessibility for maintenance. No valve shall be installed with its stem pointing down. Globe valves may be installed with stems horizontal, but the preferred position is vertical. All globe and angle valves shall be installed to close against pressure.
- .4 **Shut-off Valves:** Provide shut-off valves in piping connections to equipment, to isolate piping risers, to isolate other sections of systems as shown, and wherever else indicated on the drawings. Valves in piping to and including 50 mm (2") diameter are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified. Locate all valves so that they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.
- .5 **Check Valves:** Provide a check valve in the discharge piping of every pump, and elsewhere in piping where shown on the drawings. Where check valves are required in vertical piping, ensure that they are suitable in all respects for the application. Note that check valves for vertical in-line and/or base mounted circulating pumps are integral with the discharge accessory.
- .6 **Drain Valves:** Refer to Part 3 of the mechanical work Section entitled Basic Mechanical Materials and Methods.
- .7 **Balancing Valves:** Provide circuit balancing valves in piping generally where shown on the drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations prior to installation.

3.7 Pipe Sleeves

- .1 On existing concrete construction, holes for new piping shall be made with power-driven circular cutters. No pipe sleeves are required.
- .2 On new concrete construction, provide pipe sleeves where piping passes through concrete floors, walls, or ceilings. Extend sleeve for the full thickness of the concrete with 1/2-inch clearance around pipe for insulation.
- .3 On pipe penetrations below grade, caulk space between pipes and pipe sleeves with oakum and mastic, and make watertight.
- .4 On other floor and wall locations, secure sleeves to forms so they will not become displaced during pouring of concrete. Fill metal or fiber sleeves on decks with sand. Remove sleeves from openings after removal of forms. Cut-in proper sized holes in concrete to replace sleeves crushed or knocked out of position during pouring of concrete. Caulk space around pipe with mastic and oakum.

3.8 Flushing and Cleaning Piping

- .1 Flush and clean new piping in accordance with requirements specified in the mechanical work Section entitled HVAC Water Treatment.

3.9 Testing, Adjusting and Balancing

- .1 Leakage test piping as specified in the mechanical work Section entitled Basic Mechanical Materials and Requirements.
- .2 When work is complete and equipment is operating as intended, test, adjust and balance water flows in accordance with requirements specified in the mechanical work Section entitled Testing, Adjusting, and Balancing.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for all products specified in this Section.

1.2 Base Bid and Acceptable Manufacturers:

- .1 Refer to the article entitled Base Bid and Acceptable Manufacturers in the Section 20 05 10 – Basic Mechanical Materials and Methods.

2 PRODUCTS

2.1 Pressure Relief Valves

- .1 ASME tested, rated, and certified, bronze or cast iron bronze fitted, 1725 kPa (250 psi) rated pressure relief valves, each capable of relieving the full output of the equipment it is associated with, and each factory set at 415 kPa (60 psi) unless otherwise specified.

2.2 Air Vents

- .1 **Manual Air Vents:** Equal to Maid-O-Mist No. 72, 3.2 mm ($\frac{1}{8}$ ") diameter with a screwdriver slot adjustment.
- .2 **Automatic Air Vents:** Float actuated air vents, each complete with a semi-steel body and a cap, a stainless steel float assembly and seat, and a neoprene head. Acceptable products are:
 - .1 Spirax Sarco Ltd., Type 13 WS for system working pressures to 1035 kPa (150 psi), 13 WHS for system working pressures greater than 1035 kPa (150 psi).
 - .2 Armstrong International Inc. No. 1-AV.

2.3 Strainers

- .1 Refer to Part 2 of the mechanical work Section entitled Basic Mechanical Materials and Methods.

2.4 Piping Expansion & Contraction Hardware & Anchors

- .1 Refer to Part 2 of the mechanical work Section entitled Piping Expansion Compensation.

3 EXECUTION

3.1 Installation of Pressure Relief Valves

- .1 Provide factory set pressure relief valves where shown. Pipe the discharge of each water piping relief valve to drain unless otherwise shown or specified.
- .2 Pipe the discharge of each glycol solution piping relief valve back to the system expansion tank or return piping.
- .3 Confirm relief valve settings.

3.2 Installation of Air Vents

- .1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Equip each air vent with a ball type shut-off valve. Install vents in 100 mm (4") diameter and larger piping and all vents in mechanical rooms in accordance with the drawing detail.
- .2 Provide 9 mm ($\frac{3}{8}$ ") diameter copper drain piping from each automatic air vent to nearest suitable drain and terminate so the discharge is visible. Identify the drain piping.
- .3 Where manual air vents are installed, they shall consist of an isolation valve terminated with an elbow, threaded hose connection and hose cap.

3.3 Installation of Strainers

- .1 Refer to Part 3 of the mechanical work Section entitled Basic Mechanical Materials and Methods.

3.4 Installation of Piping Expansion Compensation Hardware & Anchors

- .1 Refer to Part 3 of the mechanical work Section entitled Basic Mechanical Materials and Methods.

3.5 Installation of Flexible Piping Connections

- .1 Provide flexible connections in piping connections to equipment where shown.
- .2 Install in accordance with the manufacturer's instructions.

End of Section

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for all water treatment chemical feed equipment and associated hardware.
- .2 **Product Literature:** Submit product literature sheets for all chemicals, as well as WHMIS Material Safety Data Sheets for all chemicals.
- .3 **Start-Up and Certification Letters:** Submit water treatment manufacturer/supplier certification letters as specified in Part 3 of this Section.

1.2 Base Bid and Approved Manufacturers

- .1 Refer to the article entitled Base Bid and Acceptable Manufacturers in the Section 20 05 10 – Basic Mechanical Materials and Methods.

2 PRODUCTS

2.1 Characteristics of Chemicals

- .1 All chemicals specified in this Section are to be non-toxic when released to atmosphere, non-corrosive and non-staining if a leak occurs, and compatible with all system components.
- .2 All chemicals must be approved by governing authorities for release into the Municipal sewer system.

2.2 Existing Treatment Systems

- .1 The Owner has a contract with a treatment chemical supplier to maintain proper levels of chemical in the building systems. New chemicals and/or treatment delivery hardware are to be supplied by this supplier. Obtain the supplier's name during the bidding process and obtain the required pricing information.

2.3 Piping System Flushing and Cleaning Chemical

- .1 Liquid form alkaline type cleaner consisting of a concentrated blend of highly active penetrating agents and detergents with a 12.5 pH and specifically formulated to remove oil, mill scale and oxides from piping and equipment.

3 EXECUTION

3.1 Piping System Flushing and Cleaning

- .1 After new heat transfer system piping has been installed and leakage testing has been satisfactorily completed, but before mechanical equipment start-up and performance tests, flush and chemically clean the piping systems.
- .2 Provide all required temporary piping connections, including bypass piping to isolate dirt sensitive mechanical plant equipment. Remove instrumentation such as flow meters and switches, orifice plates, meter valves and similar devices and plug pipe openings. Reinstall when flushing and cleaning work has been certified complete by the chemical manufacturer/installer. Ensure that control valves are operational and fully open during flushing and cleaning.
- .3 **Flushing Prior to Chemical Cleaning:** Flush the piping, including dead ends, with water to remove loose solids. Clean all strainers. Replace chemical feeder line filters as required. Flush and drain until the water runs clear.
- .4 **Chemical Cleaning:** When flushing with water is complete, fill the systems with fresh clean water. Meter the amount of water required to fill each system or otherwise calculate system capacity. Ensure that all air is vented from the systems. Add cleaning chemical as instructed by the chemical manufacturer and circulate the solution for a period of time and

at a temperature as required to produce a clean piping system. Conduct daily pH, conductivity, and total iron tests in accordance with the chemical supplier's instructions.

- .5 **Flushing After Chemical Cleaning:** When test results indicate a clean system, drain the solution from the piping, refill with clean water and circulate the water for a minimum of 24 hours to flush out remaining chemical solution, then drain the water from the piping using all drain points and again clean all system strainers and replace filters. Arrange for the chemical supplier to check each system after flushing and cleaning is complete and to certify in writing that flushing and cleaning procedures have been properly performed. Submit a copy of the certification letter. Fill the systems.

3.2 **Manufacturer's Certification, Start-Up, and Training**

- .1 For all water treatment equipment include for on-site certification, start-up supervision, and system training by the treatment chemical manufacturer's representative as follows:
 - .1 **Equipment and system manufacturer's certification:** refer to the article entitled Equipment and System Manufacturer's Certification in the Mechanical Work General Instructions Section.
 - .2 **Start-up:** refer to the article entitled Equipment and System Start-up in the Mechanical Work General Instructions Section.
 - .3 **Demonstration and training:** refer to the article entitled Equipment and System O & M Demonstration & Training in the Mechanical Work General Instructions Section. and include for 4 hours of on-site operation demonstration and training for 2 groups of 6 people.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for all products specified in this Section except shop fabricated ductwork and fittings.
- .2 **Test Data:** Submit duct leakage test data prior to ductwork being covered from view.

1.2 Quality Assurance

- .1 Ductwork shall be in accordance with requirements of the following Standards:
 - .1 ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ANSI/SMACNA HVAC Duct Construction Standards- Metal and Flexible.
 - .3 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilation Systems.
 - .4 CAN/ULC-S110, Standard Methods of Test for Air Ducts.
 - .5 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

2 PRODUCTS

2.1 Galvanized Steel Ductwork

- .1 **General:** Galvanized steel sheet shall be hot dipped in accordance with requirements of ASTM A653. Galvanizing for bare uncovered duct to be finish painted shall be G60. All other galvanizing shall be G90.
- .2 **Rectangular:** Lock forming grade hot dip galvanized steel, ASTM A653, shop fabricated, minimum #26 gauge.
- .3 **Round:** Factory machine fabricated, spiral, mechanically locked flat seam, single wall duct, fittings, and couplings.

2.2 Metal Duct System Joint Sealant

- .1 ULC listed and labelled, premium grade, grey colour, water base, low VOC, non-flammable duct sealer, brush, or gun applied, with a CAN/ULC S102 maximum flame spread rating of 15 and smoke developed rating of 20.
 - .1 Robson Thermal Duct Seal
 - .2 Duro Dyne Duct Sealer

2.3 Acoustic Lining

- .1 Refer to Specification 20 05 25.

3 EXECUTION

3.1 Demolition

- .1 Do all required special system ductwork system demolition/revision work. Refer to demolition requirements specified in the mechanical work Section entitled Demolition and Revision Work.
- .2 Clean all existing special system ductwork to be retained and reused in accordance with requirements of the Section entitled Ductwork Cleaning.

3.2 Fabrication and Installation of Galvanized Steel Ductwork

- .1 Provide all required standard galvanized steel ductwork, rectangular and/or round and/or flat oval as shown. Note that where rectangular ductwork is shown, round or flat oval ductwork of equivalent cross-sectional area is acceptable.
- .2 Unless otherwise specified, construct and install ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct

- pressure class designation of minimum 500 Pa (2" w.c.) positive or negative as applicable, a minimum velocity of 10 m/s (2000 fpm), and so that the ductwork does not "drum". All flat surfaces of rectangular ductwork are to be cross-broken. Duct system sealing shall meet ANSI/SMACNA Seal Class A requirements.
- .3 Prior to fabrication of ductwork, check all drawings for ceiling space, confliction with structural and architectural features and conditions, and the work of other trades, and if duct routing problems or obstructions occur, notify the Consultant immediately.
 - .4 Variable air volume ductwork from supply fans to boxes shall be as above but rectangular duct take-offs are to be double side straight taper type with a take-off length equal to 0.5 times the branch duct width but minimum 150 mm (6") length, and the double taper side shall have an included angle of minimum 60°.
 - .1 System pressures are expected to be up to **750 Pa (3" w.c.)** positive upstream of VAV terminal boxes. Install ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct pressure class designation of **minimum 750 Pa (3" w.c.)** positive.
 - .5 **Duct Routing and Dimensions:** Confirm the routing of all ductwork at the site and site measure ductwork prior to fabrication. Note that duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by the Consultant. Duct routing and/or dimension revisions to suit conditions at the site are not grounds for a claim for an extra cost.
 - .6 **Automatic Control Components:** Install (but do not connect) all duct system mounted automatic control components supplied as part of the automatic control work.
 - .7 **Heat Transfer Equipment Connections:** Where indicated, provide duct connections to fan powered heat transfer equipment with integral coils.
 - .8 **Rectangular Duct Support Inside Building:** Support horizontal rectangular ducts inside the building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, use trapeze hangers with galvanized steel channels, and galvanized steel hanger rods for all ducts that are exposed, and all concealed ducts wider than 500 mm (20").
 - .9 **Round Duct Support Inside Building:** Support round ducts inside the building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at the top of the duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If the duct is insulated, size the strap to suit the diameter of the insulated duct.
 - .10 **Flanged Duct Joints:** Where flanged duct joints are used, do not locate the joints in wall or slab openings, or immediately at wall or slab openings. **Do not use flanged joints for exposed uninsulated ducts in finished areas.**
 - .11 **Watertight Ductwork:** Where watertight horizontal ductwork is required, construct the ducts without bottom longitudinal seams. Solder or weld the joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide the drain points. Provide watertight ductwork for:
 - .1 All galvanized steel ductwork outside the building or otherwise exposed to the elements.
 - .2 Fresh air intakes.
 - .12 **Leakage Testing:** Leakage testing shall be performed in accordance with the ANSI/SMACNA HVAC Air Duct Leakage Test Manual as well as ASHRAE 90.1-2016 and shall be witnessed by the Consultant. Leakage test the following ductwork:
 - .13 **Application of Sealants:** Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of the sealant.

- .14 **Protective Coating for Exposed Exterior Ducts:** Clean exterior exposed (uninsulated on exterior of duct) ducts with a heavy full coverage of Robson Thermal RT-80 High Velocity Duct Sealant. It is a UV and weather resistant, solvent based elastomeric sealant, with aluminum finish. Install in compliance with manufacturers recommendations.
- .15 **Connection of Dissimilar Metal Ducts:** Where dissimilar metal ducts are to be connected, isolate the ducts by means of flexible duct connection material as specified in the Section entitled Duct System Dampers and Accessories.
- .16 **Cleanliness of Installed Ductwork:** Maintain all new ductwork in a clean condition. If, at Substantial Performance, in the Consultant's opinion, new ductwork is not in a clean condition, retain and pay for a certified duct cleaning company to clean all new ductwork using compressed air and vacuum cleaning equipment.
- .17 **Seismic Requirements:** In addition to ANSI/SMACNA duct construction standards specified above, ductwork shall be constructed and installed to meet seismic requirements of the Building Code and ANSI/SMACNA The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.3 Installation of Flexible Ductwork

- .1 Provide maximum 900 mm (36") long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers. Do not install flexible ductwork through walls, even if shown on the drawings.
- .2 Stretch out lengths of duct prior to cutting and installation.
- .3 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.
- .4 Install flexible ducts as straight as possible and support in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.
- .5 Do not penetrate fire barriers with flexible duct.

3.4 Installation of Acoustic Lining

- .1 Provide acoustic lining in ductwork in locations as follows:
 - .1 Wherever shown and/or specified on the drawings.
 - .2 Supply ductwork downstream of air terminal boxes for a distance of 2.4 m (8') measured along the duct and outward from the box in all directions.
 - .3 Supply ductwork downstream of air handling units or fan coil units for a distance of 2.4 m (8') measured along the duct and outward from the unit in all directions.
 - .4 Return ductwork upstream downstream of air handling units or fan coil units for a distance of 2.4 m (8') measured along the duct and outward from the unit in all directions.
 - .5 Exhaust ductwork at roof or wall discharge locations for a distance of 2.4 m (8') measured along the duct and inward from the wall or roof penetration.
 - .6 Exhaust ductwork downstream of fan connection for a distance of 2.4 m (8') measured along the duct.
 - .7 For all transfer air ducts.
- .2 Install lining in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, for all installations regardless of velocity, at leading and trailing edges of duct liner sections, provide galvanized steel nosing channel as per the detail entitled Flexible Duct Liner Installation found in the ANSI/SMACNA manual referred to above.

3.5 Duct System Protection, Cleaning and Start-Up

- .1 Temporarily cover all open ends of new ducts during construction.

- .2 Vacuum all dirt and foreign matter from the entire duct systems and clean duct system terminals and the interior of air handling units prior to operating fans.
- .3 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.
- .4 Provide cheesecloth over all duct system inlets and outlets and run the system for twenty-four hours, after which remove the cheesecloth, the construction filters, and install new permanent filters.
- .5 Include all labour for a complete site walk-through with testing and balancing personnel following the route of all duct systems to be tested, adjusted and balanced for the purpose of confirming the proper position and attitude of dampers, the location of pitot tube openings, and any other work affecting the testing and balancing procedures. Perform all corrective work required as a result of this walk-through.

3.6 Testing, Adjusting, and Balancing

- .1 When work is complete and equipment is operating as intended, test, adjust and balance air flows and temperatures in accordance with requirements specified in the mechanical work Section entitled Testing, Adjusting, and Balancing.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Shop Drawings/Product Data:** Submit shop drawings/product data sheets for all products specified in this Section.
- .2 **Test Data:** Submit duct leakage test data prior to ductwork being covered from view.
- .3 **Colour Chart(s):** Submit manufacturer's colour chart(s) for all items for which a finish colour shall be selected.
- .4 **Fire Rated Duct Installation Certification:** Submit proper installation certification from the fire rated duct manufacturer as specified in Part 3 of this Section.

1.2 Quality Assurance

- .1 Ductwork shall be in accordance with requirements of the following Standards:
 - .1 ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A240, Standard Specification for Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .3 ASTM A480, Specification for General Requirements for Flat-Trolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip.
 - .4 ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .5 ASTM D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated (Vinyl Chloride) (CPVC) Compounds.
 - .6 ASTM E814, Standard Test Method for Fire Tests of Through-Penetration Fire Stops.
 - .7 ANSI/SMACNA HVAC Duct Construction Standards- Metal and Flexible.
 - .8 ANSI/SMACNA Round Industrial Duct Construction Standards.
 - .9 ANSI/SMACNA Rectangular Industrial Duct Construction Standards.
 - .10 SMACNA Thermoplastic Duct (PVC) Construction Manual.
 - .11 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilation Systems.
 - .12 CAN/ULC-S110, Standard Methods of Test for Air Ducts.
 - .13 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .14 CAN/CGSB-41.22, Fiberglass-Reinforced Plastic Corrosion-Resistant Equipment.
 - .15 CAN3-A23.1, Concrete Materials and Methods of Concrete Construction.
 - .16 CSA S269.1, Falsework and Formwork.
 - .17 CAN/ULC-S115, Standard Methods of Test of Firestop Systems.
 - .18 UL 1978, Standard for Grease Ducts.
 - .19 UL 2221, Standard for Fire Resistive Grease Duct Enclosure Assemblies.
 - .20 American Conference of Governmental Hygienists, Industrial Ventilation: A Manual of Recommended Practice for Design.

1.3 Base Bid and Acceptable Manufacturers

- .1 Refer to the article entitled Equipment and Material Manufacturer Requirements in the Section entitled Mechanical Work General Instructions.

2 PRODUCTS

2.1 Round Stainless Steel Ductwork

- .1 Factory made, spiral, mechanically locked flat seam, single wall duct fabricated from type 316 stainless steel to ASTM A480 with metal gauges in accordance with ANSI/SMACNA HVAC Duct Construction Standards - Metal and Flexible for 2.5 kPa (0.36 psi) pressure. Fittings and couplings are to be factory made type 316 stainless steel fittings equipped with leak-proof couplings secured to the connecting duct by means of stainless steel sheet metal screws and duct sealer. Duct system performance shall meet SMACNA's Leakage Class 3 requirements at the system design static pressure. The stainless steel finish shall be a #2B

mill finish where concealed or exposed in unfinished areas, and a #4 finish where exposed in finished areas.

3 EXECUTION

3.1 Demolition

- .1 Clean all existing ductwork to be retained and reused in accordance with requirements of the Section entitled Ductwork Cleaning.

3.2 General Re: Fabrication and Installation Special Systems Ductwork

- .1 Provide all required special systems ductwork, rectangular and/or round as shown.
Note that where rectangular ductwork is shown (except for in-slab type), round or flat oval ductwork of equivalent material and cross-sectional area is acceptable.
- .2 Unless otherwise specified, construct and install special systems ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct pressure class designation of **minimum** 500 Pa (2" w.c.) positive or negative as applicable, a minimum velocity of 10 m/s (2000 fpm), and so that the ductwork does not "drum". All flat surfaces of rectangular ductwork are to be cross-broken. Duct system sealing shall meet SMACNA Seal Class A requirements.
- .3 Prior to fabrication of special systems ductwork, check all drawings for ceiling space, confliction with structural and architectural features and conditions, and the work of other trades, and if duct routing problems or obstructions occur, notify the Consultant immediately.
- .6 **Duct Routing and Dimensions:** Confirm the routing of all ductwork at the site and site measure ductwork prior to fabrication. Note that duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by the Consultant. Duct routing and/or dimension revisions to suit conditions at the site are not grounds for a claim for an extra cost.
- .7 **Automatic Control Components:** Install (but do not connect) all duct system mounted automatic control components supplied as part of the automatic control work.
- .8 **Round Duct Support Inside Building:** Support round ducts inside the building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at the top of the duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If the duct is insulated, size the strap to suit the diameter of the insulated duct. Unless otherwise specified, duct support hardware for metal duct shall be constructed of the same material as the duct, and for non-metal duct, type 316 stainless steel.
- .9 **Support of Roof Mounted Ducts:** As specified in the mechanical work Section entitled Duct System Dampers and Accessories.
- .10 **Watertight Ductwork:** Where watertight horizontal ductwork is required, construct the ducts without bottom longitudinal seams. Solder or weld the joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide the drain points. Provide watertight ductwork for:
 - .1 All ductwork outside the building or otherwise exposed to the elements.
 - .2 Dishwasher exhaust.
 - .3 Shower exhaust ducts from grilles to the duct main or riser.
 - .4 A minimum of 3 m (10') upstream and downstream of duct mounted humidifiers or humidifier manifolds.
 - .5 Wherever else shown and/or specified.
- .11 **Leakage Testing:** Leakage testing shall be performed in accordance with the SMACNA HVAC Air Duct Leakage Test Manual and shall be witnessed by the Consultant. Leakage test the following ductwork:

- .1 Exhaust air duct for BSC
- .12 **Application of Sealants:** Seal all ductwork as per SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings which does not require site applied sealant. Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of the sealant.
- .13 **Protective Coating for Exposed Exterior Ducts:** Clean exterior exposed (uninsulated) ducts with a heavy full coverage of solvent-free, fast curing, rubberized asphalt coating.
- .14 **Connection of Dissimilar Metal Ducts:** Where dissimilar metal ducts are to be connected, isolate the ducts by means of flexible duct connection material as specified in the Section entitled Duct System Dampers and Accessories.
- .15 **Cleanliness of Installed Ductwork:** Maintain all new special systems ductwork in a clean condition. If, at Substantial Performance, in the Consultant's opinion, new ductwork is not in a clean condition, retain and pay for a certified duct cleaning company to clean all new ductwork using compressed air and vacuum cleaning equipment.
- .16 **Counterflashing Duct Roof Curbs:** Do all required counterflashing work for roof curbs for special systems ductwork penetrating the roof. Counterflashing materials are to match roof flashing materials provided as part of the work of Division 07. Caulk around the top edge of the counterflashing, and attach vertical counterflashing to the curb using non-ferrous screws with coloured heads to match counterflashing if coloured material is used. Counterflashing work shall be watertight.
- .17 **Seismic Requirements:** In addition to SMACNA duct construction standards specified above, ductwork shall be constructed and installed to meet seismic requirements of the British Columbia Building Code and ANSI/SMACNA The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.3 Installation of Stainless Steel Ductwork

- .1 Provide stainless steel ductwork, round or rectangular as shown.
- .2 Provide stainless steel ductwork as follows:
 - .1 Exhaust air duct for BSC

3.4 Duct Systems Cleaning and Start-Up

- .1 Remove all dirt and foreign matter from the entire duct system and clean duct system terminals and the interior of supply air handling units prior to operating fans.
- .2 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.
- .3 Provide cheesecloth over all duct system inlets and outlets inside the building and run the system for 24 hours, after which remove the cheesecloth, the construction filters, and install new permanent filters.
- .4 Include all labour for a complete site walk-through with testing and balancing personnel following the route of all duct systems to be tested, adjusted and balanced for the purpose of confirming the proper position and attitude of dampers, the location of pitot tube openings, and any other work affecting the testing and balancing procedures. Perform all corrective work required as a result of this walk-through.

3.5 Testing, Adjusting, and Balancing

- .1 When work is complete and equipment is operating as intended, test, adjust and balance air flows and temperatures in accordance with requirements specified in the mechanical work Section entitled Testing, Adjusting, and Balancing.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for all products specified in this Section.
- .2 **Colour Chart(s):** Submit manufacturer's colour chart(s) for all items for which a finish colour shall be selected.

1.2 Quality Assurance

- .1 Duct system dampers and accessories are to be in accordance with requirements of the following Standards:
 - .1 ASTM A653, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM A240, Standard Specification for Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .3 ASTM A480, Specification for General Requirements for Flat-Trolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip.
 - .4 ASTM B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
 - .5 ANSI/SMACNA HVAC Duct Construction Standards- Metal and Flexible.
 - .6 ANSI/SMACNA Round Industrial Duct Construction Standards.
 - .7 ANSI/SMACNA Rectangular Industrial Duct Construction Standards.
 - .8 NFPA 90A, Standard for the Installation of Air-Conditioning and Ventilation Systems.
 - .9 CAN/ULC-S110, Standard Methods of Test for Air Ducts.
 - .10 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
 - .11 American Conference of Governmental Hygienists, Industrial Ventilation: A Manual of Recommended Practice for Design.

1.3 Base Bid and Acceptable Manufacturers

- .1 Refer to the article entitled Equipment and Material Manufacturer Requirements in the Section entitled Mechanical Work General Instructions.
- .2 The following is a list of base bid and acceptable manufacturers for products specified in this Section:

PRODUCT	MANUFACTURERS
Manual Balancing (Volume) Dampers	Nailor Industries Inc., T. A. Morrison & Co. Inc. "TAMCO", NCA Manufacturing Ltd., Greenheck Fan Corp., Ruskin Co.
Backdraft Dampers	Nailor Industries Inc., T. A. Morrison & Co. Inc. "TAMCO", NCA Manufacturing Ltd., Greenheck Fan Corp., Ruskin Co.
Fusible Link Dampers	Nailor Industries Inc., NCA Manufacturing Ltd., Greenheck Fan Corp., Ruskin Co.
Combination Fire/Smoke Dampers	Nailor Industries Inc., NCA Manufacturing Ltd., Greenheck Fan Corp., Ruskin Co.
Flexible Connection Material	Duro Dyne Canada Inc., Dyn Air Inc.
Motorized Control Dampers	Nailor Industries Inc., T. A. Morrison & Co. Inc. "TAMCO", NCA Manufacturing Ltd., Greenheck Fan Corp., Ruskin Co.

2 PRODUCTS

2.1 Round to Rectangular Duct Connections

- .1 Galvanized steel, flared, flanged or notched as required, "SPIN-IN" round duct take-off collars with locking dampers in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.2 Splitter Dampers

- .1 Minimum #20 gauge damper blade constructed of the same material as the duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware equal to Dyn Air Inc. #Q-50 "DYN-A-QUAD S-S" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin.

2.3 Air Turning Vanes

- .1 For square elbows - multiple-radius turning vanes with runner channels, interconnected with bars, adequately reinforced to suit the pressure and velocity of the system, constructed of the same material as the duct they are associated with, and in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 For short branch ducts at grille and diffuser connections - air extractor type, each equipped with a matching bottom operated 90° opposed blade volume control damper, constructed of the same material as the duct it is associated with and in accordance with requirements and details in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.4 Manual Balancing (Volume) Dampers

- .1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of the same material as the connecting ductwork unless otherwise specified, each designed to maintain the internal free area of the connecting duct, and each complete with:
 - .1 A hexagonal or square shaft extension through the frame.
 - .2 Non-stick, non-corrosive synthetic bearings for rectangular dampers, flange stainless steel bearings for round dampers.
 - .3 Blade stops for single blade dampers, designed to prevent the blade from moving more than 90°.
 - .4 Linkage for multiple blade dampers.
 - .5 A locking hand quadrant damper operator with, for insulated ducts 50 mm standoff mounting.
- .2 **Rectangular Dampers:** Maximum size 1.2 m x 1.2 m (4' x 4') for a single damper.
- .3 **Round Dampers:** Maximum 600 mm (24") diameter, equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.
- .4 **Multiple Rectangular Damper Section Assembly:** Rectangular assembly supplied with the dampers or site constructed of the same material as the damper and designed for tight and secure mounting of the individual dampers.

2.5 Backdraft Dampers

- .1 Counterbalanced backdraft dampers, 65 mm (2½") deep, sized as shown and complete with:
 - .1 Extruded aluminum frame and blades, minimum 1.58 mm (1/16") thick, with captive extruded silicone blade gaskets and side seals in slots integral with the aluminum extrusions.
 - .2 Damper blade counterweights internal to the frame and consisting of adjustable weights fastened to brackets which are riveted to the blades.

- .3 Dual PVC linkage tracks at each end of the blades, and non-corrosive linkage with hard alloy aluminum pivot arm and bearings equal to Ticona "Celcon" acetal copolymer bearings.

2.6 Fusible Link Dampers

- .1 Curtain blade type, dynamic, galvanized steel (unless otherwise specified) fusible link dampers, ULC classified to Standard CAN/ULC-S112 and in accordance with NFPA 90A requirements, factory tested for closure under airflow, 1 1/2 hour or 3 hour rated as required, and complete with a constant force type 301 stainless steel closure spring, a blade lock assembly, a steel sleeve, retaining angles, and, unless otherwise specified, a 74°C (165°F) rated standard fusible link.
- .2 Fusible link dampers are to be Type "B" or Type "C" (as required) with the folded curtain blade out of the air stream. If the damper size or location requires the use of type "A" dampers with the curtain blade in the air stream, review with the Engineer prior for approval.
- .3 Fusible link dampers in ductwork other than galvanized steel are to be as specified above but constructed of Type 316 stainless steel.

2.7 Combination Fire/Smoke Dampers

- .1 Multi-blade type, fail-safe, dynamic, galvanized steel (unless otherwise specified) combination fire/smoke dampers, ULC classified to Standard CAN/ULC-S112, 1 1/2 hour fire rated, leakage Class I smoke rated, normally closed, low pressure drop design, dynamically tested, type "B" or "C" as required, each complete with jamb and blade seals, linkage concealed in the frame, a steel sleeve to suit the fire barrier opening, a fusible link to close and lock the damper without disengaging the actuator, and an electric 115 volt actuator to automatically close the damper upon receiving an external signal, and to automatically open the damper when the system is reset.

2.8 Flexible Connection Material

- .1 Waterproof, indoor-outdoor type flexible connection material meeting requirements of NFPA 90A, consisting of woven glass fibre fabric coated on both sides with synthetic rubber.
- .2 Waterproof, flameproof, high temperature flexible connection material meeting requirements of NFPA 90A, consisting of a woven glass fibre fabric coated on both sides with silicone rubber.

2.9 Duct Access Doors

- .1 In accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, generally with sizes suitable in all respects for the purpose for which they are provided but minimum 225 mm x 225 mm (9" x 9") for hand access and 450 mm x 450 mm (18" x 18") for man access, and, unless otherwise specified, constructed of the same material as the duct they are associated with.

2.10 Ductwork Drain Points

- .1 Equal to Ductmate Canada Ltd. "DUCTMATE MOISTURE DRAIN", 20 mm (3/4") diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut and cap.

2.11 Instrument Test Ports

- .1 Equal to Duro-Dyne of Canada Ltd. #IP1 or #IP2 (to suit insulation thickness where applicable) gasketed, leak-proof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

2.12 Motorized Control Dampers

- .1 Factory assembled, 100 mm (4") deep, flanged aluminum control dampers with AMCA certified maximum leakage through a 1.2 m x 1.2 m (4' x 4') damper of 52 L/s/m² (110 ft³/min) against 1 kPa (0.145 psi) differential static pressure. Control dampers for mixing

applications are to be parallel blade type. Control dampers for open-shut service are to be opposed blade type.

- .2 **Standard Damper:** Standard dampers are to be complete with:
 - .1 Extruded 6063T5 aluminum frame and blades, each with an integral slot to receive a gasket.
 - .2 Extruded silicone frame gaskets and extruded EPDM blade gaskets.
 - .3 Slip-proof aluminum and corrosion resistant plated steel linkage concealed in the frame, equipped with self-sealing and self-lubricating bearings consisting of an inner bearing equal to a Ticona "Celcon" bearing fixed on the hexagonal blade pin and rotating in a polycarbonate outer bearing inserted in the frame.
- .3 **Insulated Damper:** As specified for standard dampers but with all 4 sides of the frames insulated with injected polyurethane foam, and with the blades thermally broken and insulated with expanded polyurethane foam.
- .4 **Damper Motor:** Equal to Belimo CSA certified, spring return, direct coupled electric motor damper actuator, 120 volt or 24 volt as required, electronic overload protected, complete with position indicator, a housing to suit the mounting location, and additional features as required to suit the application and control sequence.

3 EXECUTION

3.1 Installation of Round to Rectangular Duct Connections

- .1 Cut round holes in rectangular ducts using a purpose made hole cutter and provide round to rectangular "Spin-In fittings with dampers for connection of flexible round ductwork. Seal the cut duct around the fitting.

3.2 Installation of Splitter Dampers

- .1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on the drawings. Install splitter dampers so they cannot vibrate and rattle and so that the damper operation mechanisms are in an easily accessible and operable location. Ensure that operators for dampers in insulated ducts are equipped with stand-off mounting brackets.

3.3 Installation of Turning Vanes

- .1 Provide turning vanes in ductwork square elbows where shown on the drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified.

3.4 Installation of Manual Balancing (Volume) Dampers

- .1 Provide manual balancing dampers in all open end ductwork, in all duct mains, and wherever else shown and/or specified.
- .2 Install balancing dampers at least 2 m (6') upstream of grilles and diffusers where space permits.
- .3 Install the dampers so that the operating mechanism is accessible and positioned for easy operation, and so that the dampers cannot move or rattle. Ensure that operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.
- .4 Where a duct for which a balancing damper is required has dimensions larger than the dimensions of the maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.

- .5 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit. Include for providing 5 additional dampers at no additional cost.

3.5 Installation of Backdraft Dampers

- .1 Provide backdraft dampers where shown, including at the inlet to any exhaust fan not equipped with an automatic control damper.
- .2 Install and secure the dampers so that they cannot move or rattle.

3.6 Installation of Fusible Link Dampers

- .1 Provide fusible link dampers where shown and/or specified on the drawings. Ensure that the damper rating (1½ or 3 hr.) is suitable for the fire barrier it is associated with.
- .2 Install dampers with retaining angles on all four sides of the sleeve on both sides of the damper and connect with ductwork in accordance with the damper manufacturer's instructions and details to meet Code requirements.
- .3 Provide expansion clearance between the damper or damper sleeve and the opening in which the damper is required. Ensure that the openings are properly sized and located, and that all voids between the damper sleeve and the opening are properly sealed to maintain the rating of the fire barrier.
- .4 When requested by the Owner or Consultant, demonstrate operation of several randomly picked fire dampers, and reset after successful demonstration.
- .5 Where the size of the fire barrier opening requires the use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC - S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

3.7 Installation of Combination Fire/Smoke Dampers

- .1 Provide combination fire/smoke dampers where shown and/or specified on the drawings. Install dampers with retaining angles on all four sides of each side of the damper, and, where required, connect with ductwork, all in accordance with the damper manufacturer's instructions and details, and Code requirements.
- .2 Coordinate damper installation with the electrical work where electrical connections to damper actuators are specified.

3.8 Installation of Flexible Connection Material

- .1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or casings connect to fans, and wherever else shown or specified.
- .2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum #24 gauge) to each edge of the flexible fabric and to the fan, duct, plenum, etc., in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Ensure that connections to the flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.
- .3 For any system carrying high temperature exhaust or process air, use high temperature flameproof flexible connection material suitable for the application.

3.9 Installation of Duct Access Doors

- .1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils. Locate access doors at both the air entering and leaving side of each device.
- .2 Install in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

- .3 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure that the doors are properly located for damper maintenance.
- .4 When requested, submit a sample of proposed duct access doors for review.
- .5 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce the ductwork to suit the access door installed.

3.10 Installation of Instruments Test Ports

- .1 Provide instrument test ports in all main ducts at connections to fans, plenums, or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.
- .2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

3.11 Installation of Motorized Control Dampers

- .1 Provide motorized control dampers where shown. Secure in place to prevent movement or rattle, and to prevent air bypass around the damper.
- .2 Provide insulated dampers in fresh air intake ductwork or openings, and for exhaust air service at exterior walls.
- .3 Equip each damper with an electric motor actuator, 120 volt or 24 volt as required. Ensure that each actuator is equipped with all required features to suit the application.

3.12 Control Wiring

- .1 Provide all required power wiring for controls from 15A-1P circuits terminated in junction boxes adjacent to the control work, and do all control wiring to connect control components.
- .2 Install wiring in conduit in accordance with electrical work wiring material and installation requirements.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for the fans and accessories. Include the following:
 - .1 Certified fan performance curves.
 - .2 Product data for all accessories.
 - .3 Product data for fan motors.

1.2 Quality Assurance

- .1 Utility fan manufacturers are to be current members of the Air Movement and Control Association International Inc. (AMCA), and the fans are to be rated (capacity and sound performance) and certified in accordance with requirements of the following standards:
 - .1 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating.
 - .2 AMCA Standard 211, Product Rating Manual for Fan Air Performance.
 - .3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.
 - .4 AMCA Standard 311, Product Rating Manual for Fan Sound Performance.
 - .5 AMCA Standard 99-2408, Operating Limits for Centrifugal Fans.

1.3 Base Bid and Approved Manufacturers

- .1 Refer to the article entitled Base Bid and Acceptable Manufacturers in the Section 20 05 10 – Basic Mechanical Materials and Methods.

2 PRODUCTS

2.1 Utility Fans

- .1 Centrifugal, single width and inlet, factory run tested utility fans as per the drawing schedule, and capable of operating over the complete pressure class limits as specified in AMCA Standard 2408.
- .2 **Housing Assembly:** Rotatable, continuously welded heavy-gauge steel housing, coated with a minimum of 2-4 mils of Permator (Polyester Urethane), electrostatically applied and baked, braced and reinforced with structural steel members to prevent vibration or pulsation, equipped with a spun, aerodynamically designed inlet cone, and an attached welded steel bearing and motor support platform.
- .3 **Wheel:** Welded aluminum or welded steel wheel coated with a minimum of 2-4 mils of Permator (Polyester Urethane), electrostatically applied and baked, statically and dynamically balanced.
- .4 **Fan Shaft, Bearings, Drive and Guard:** for belt driven fans only, AISI C-1040 or C-1045 hot rolled steel shaft, accurately turned, ground, polished, and ring gauged for accuracy, and sized for a first critical speed of at least 1.43 times the maximum rated speed for the fan, equipped with heavy-duty, grease lubricated, ball, pillow block type bearings, selected for a minimum average AFBMA L-50 bearing life of 200,00 hours at the maximum fan RPM, and secured to the bearing support platform, and an adjustable V-belt drive with OSHA guard (weather cover) in accordance with requirements of the mechanical work Section entitled Basic Mechanical Materials and Methods.
- .5 **Motor:** NEMA Premium TEFC motor conforming to requirements of the mechanical work Section entitled Basic Mechanical Materials and Requirements.
- .6 **Finish:** Unless otherwise specified, the finish shall consist of rust inhibiting primer applied to cleaned and deburred metal surfaces prior to assembly, then a second coat of primer after assembly and an air dried epoxy enamel finished coat both inside and outside to a 3 mil dry film thickness.
- .7 **Seismic Restraint Hardware:** Factory secured seismic restraint connection hardware.

3 EXECUTION

3.1 Installation of Utility Fans

- .1 Provide utility fans where shown.
- .2 Secure each indoor base mounted fan in place, level, and plumb, on vibration isolation on a concrete housekeeping pad.
- .3 Secure suspended units in place from the structure, level, and plumb, by means of vibration isolation spring hangers, properly sized galvanized steel hanger rods, and galvanized structural steel angle or channel trapeze supports.
- .4 Secure each outdoor fan in place, level, and plumb, on vibration isolation on a site fabricated base.
- .5 Brace and secure each unit in accordance with requirements specified in the mechanical work Section entitled Seismic Control and Restraint.
- .6 **Equipment and System Manufacturer's Certification:** Refer to the article entitled Equipment and System Manufacturer's Certification in the Mechanical Work General Instructions Section.
- .7 **Start-Up:** Refer to the article entitled Equipment and System Start-up in the Mechanical Work General Instructions Section.
- .8 **Commissioning:** Refer to commissioning requirements specified in the Mechanical Work General Instructions Section.
- .9 **Demonstration and Training:** Refer to the article entitled Equipment and System O & M Demonstration & Training in the Mechanical Work General Instructions Section. Include for 4 hours of on-site operation demonstration and training for 2 groups of 6 people.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for inline fans and accessories. Include the following:
 - .1 Certified fan performance curves.
 - .2 Product data for all accessories.
 - .3 Product data for fan motors.

1.2 Quality Assurance

- .1 Inline fan manufacturers are to be current members of the Air Movement and Control Association International Inc. (AMCA), and the fans are to be rated (capacity and sound performance) and certified in accordance with requirements of the following standards:
 - .1 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating.
 - .2 AMCA Standard 211, Product Rating Manual for Fan Air Performance.
 - .3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.
 - .4 AMCA Standard 311, Product Rating Manual for Fan Sound Performance.
 - .5 AMCA Standard 99-2408, Operating Limits for Centrifugal Fans.

1.3 Base Bid and Approved Manufacturers

- .1 Refer to the article entitled Base Bid and Acceptable Manufacturers in the Section 20 05 10 – Basic Mechanical Materials and Methods.

2 PRODUCTS

2.1 Centrifugal Inline Fans

- .1 Centrifugal, ULC listed, factory run tested rectangular inline fans as per the drawing schedule.
- .2 **Housing:** Heavy-gauge galvanized steel with removable side panels to permit removal of the power assembly without disturbing duct connections, universal mounting brackets and hardware including spring vibration isolators to accommodate horizontal or vertical mounting as required, a flanged inlet panel with inlet venturi, a flanged outlet panel, both with integral duct connection collars, and galvanized steel wire grid fan inlet/outlet guard(s), corrosion resistant fasteners.
- .3 **Fan Wheel:** Non-overloading aluminium wheel with backward inclined blades with matching inlet venturi, statically and dynamically balanced as an assembly, inlet shall overlap an aerodynamic aluminum inlet cone.
- .4 **Fan Shaft, Bearings, Drive and Guard:** for belt-drive fans only, hot rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times the maximum rated speed for the fan, and heavy-duty, self-aligning pillow block type bearings selected for an AFBMA L-50 minimum average life in excess of 500,000 hours and equipped with lubrication line and fitting, and an adjustable V-belt drive with guard conforming to requirements of the mechanical work Section entitled Basic Mechanical Materials and Methods.
- .5 **Motor and Disconnect Switch:** TEFC motor conforming to requirements specified in the mechanical work Section entitled Basic Mechanical Materials and Methods, completes with a minimum of class B insulation for continuous duty, mounted out of the airstream, complete with a cover, and factory prewired to a NEMA 4 disconnect switch.
- .6 **Accessories:** for fans as scheduled, factory supplied accessories as follows:
 - .1 For fans as scheduled, housing insulation (lining), consisting of neoprene spray coated glass fibre semi-rigid insulation meeting NFPA 90A requirements and 25/50 smoke developed/flame spread requirements of CAN/ULC S102, permanently secured in place with no exposed edges.

- .2 Factory secured seismic restraint connection hardware and ceiling mounted type spring isolator.

3 EXECUTION

3.1 Installation of Centrifugal Inline Fans

- .1 Provide inline centrifugal fans where shown.
- .2 Secure each fan in place from the structure with vibration isolation, either horizontally or vertically as indicated, independent of connecting ductwork and in accordance with the fan manufacturer's published instructions.
- .3 Brace and secure each unit in accordance with requirements specified in the mechanical work Section entitled Seismic Control and Restraint.
- .4 Ensure that duct connections are made using flexible connection material.
- .5 **Equipment and System Manufacturer's Certification:** Refer to the article entitled Equipment and System Manufacturer's Certification in the Mechanical Work General Instructions Section.
- .6 **Start-Up:** Refer to the article entitled Equipment and System Start-up in the Mechanical Work General Instructions Section.
- .7 **Commissioning:** Refer to commissioning requirements specified in the Mechanical Work General Instructions Section.
- .8 **Demonstration and Training:** Refer to the article entitled Equipment and System O & M Demonstration & Training in the Mechanical Work General Instructions Section. Include for 4 hours of on-site operation demonstration and training for 2 groups of 6 people.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for air terminals. Include the following:
 - .1 Capacity and pressure drop.
 - .2 Sound power data to verify conformance with specified sound power levels.
 - .3 Leakage and dimensions.
 - .4 Mounting details to suit locations shown, indicating methods and hardware to be used.
 - .5 Control components and a control wiring schematic.
- .2 **Test Report:** Submit with shop drawings/product data, a test report in accordance with ANSI/AMCA Standard 210 requirements and ISO 3741, published test data on DIN (Direct Internal Noise) made by an independent testing agency for 2.5 and 6 m/s (8.2 and 19.7 ft/min) branch velocity or inlet velocity, sound power levels with a minimum inlet pressure of 0.25 kPa (0.036 psi) as per ISO 3741 for the second through seventh octave bands, and confirmation that pressure loss through a silencer will not exceed 60% of inlet velocity pressure maximum. For venturi valve, each airflow control device shall be factory calibrated to the job specific airflows as detailed on the plans and specifications using NIST traceable air stations and instrumentation having a combined accuracy of no more than plus or minus one percent of signal over the entire range of measurement. Airflow control devices shall be further calibrated and their accuracy verified to plus or minus five percent of signal at a minimum of 48 different airflows across the full operating range of the device.
- .3 **Site Inspection and Start-Up Report:** Submit a site inspection and start-up report from the manufacturer's representative as specified in Part 3 of this Section.

1.2 Quality Assurance

- .1 Air terminals manufacturers are to be current members of the Air-Conditioning, Heating and Refrigeration Institute (AHRI), and the terminals are to be in accordance with requirements of the following standards:
 - .1 AHRI Standard 880, Performance Rating for Air Terminals.
 - .2 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating.
 - .3 International Organization of Standardization (ISO) Standard IS) 3741, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure-Precision Methods for Reverberation Rooms.
- .2 **Seismic Restraint Hardware:** Boxes are to be equipped with factory secured seismic restraint connection hardware.

1.3 Base Bid and Approved Manufacturers

- .1 Refer to the article entitled Base Bid and Acceptable Manufacturers in the Section 20 05 10, **1.6 – Basic Mechanical Materials and Methods.**

2 PRODUCTS

2.1 Variable Air Volume Terminal Units

- .1 Single duct, controller type, pressure independent variable air volume boxes as per the drawing schedule, each individually field adjustable to minimum and maximum air volumes. Terminal box sound power levels with an attenuator or lined discharge duct in place are not to exceed sound power levels, in decibels, of 61, 53, 48, 44, 42 and 41 in octave bands 2 to 7 respectively at specified air quantities and 370 kPa (55 psi) entering static pressure. Each box shall be complete with:
 - .1 **Housing:** #22 gauge galvanized steel, sealed and gasketed, internally lined with minimum 25 mm (1") thick duct lining material with a neoprene coating meeting NFPA 90A and CAN/ULC-S102 25/50 flame spread and smoke developed requirements, and complete with:

- .1 Exposed cut edges of the liner material factory coated with NFPA 90A and CAN/ULC-S102 approved sealant.
- .2 A 50 mm (2") long, round inlet duct connection.
- .3 A rectangular discharge opening with slip and drive cleat duct connection facilities.
- .4 A protective galvanized steel shroud for the controller and damper actuator.
- .5 Casing leakage shall be tested in accordance with ASHRAE 130.
- .2 **Fiber-free Insulation:** Insulation shall comply with the requirements of UL 181 (erosion, mold growth and humidity) and ASHRAE 62.1, and shall have a maximum flame/smoke spread of 25/50 for both the insulation and the adhesive when tested in accordance with ASTM E84. The insulation shall be secured with adhesive.
- .3 **Air valve damper:** normally open, galvanized steel blade with peripheral gasket, pivoting in self-lubricating bearings and with air leakage past a closed damper of 2% or less of rated capacity at 750 Pa (3" wc) inlet static pressure.
- .4 **Air flow sensor:** located at the box inlet, complete with gauge taps, multiple pressure sensing ports, and an averaging chamber designed to accurately average the flow across the inlet of the box with an accuracy of within +/- 5% with a 90° sheet metal elbow located directly at the inlet, and amplify the sensed air flow signal.
- .5 **Controller/actuator:** supplied as part of the controls work specified in mechanical work Automatic Controls Section, shipped to the box manufacturer's plant by the controls supplier, and factory installed, connected, tested, calibrated and set by the box manufacturer.
- .6 **Attenuators:** #22 gauge galvanized steel c/w minimum 25mm (1") thick internally lined fibre free attenuators, housings, each factory supplied loose and with a minimum 1500mm (60") length or as per the drawing schedule.
- .7 **Thermostat and accessories:** wall mounting thermostat with thermometer and guard, supplied with the Terminal Unit by the manufacturer or controls contractor, suitable in all respects for the Terminal unit controls and the control sequence, and complete with all required installation and connection accessories.

2.2 Venturi Valve

- .1 Single duct, controller type, pressure independent venturi valve as per the drawing schedule, each individually field adjustable to minimum and maximum air volumes. Each box shall be complete with:
 - .1 **Housing:** non-corrosive 14-gauge aluminum (valve body) and 16-gauge aluminum (valve cone) construction. The center shaft shall be PTFE Teflon coated 316 stainless steel. The center shaft support brackets shall be 316 stainless steel. The pivot arm and internal mounting link shall be 316 Stainless Steel. The pressure independent springs shall be spring-grade stainless steel. All shaft bearing surfaces shall be Teflon.
 - .1 Supply valves shall be insulated with ¾ inch flexible closed-cell polyethylene insulation with a flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84.
 - .2 Sound attenuating devices used in conjunction with general exhaust or supply airflow control devices shall be constructed using 24 gauge galvanized steel or other suitable material used in standard duct construction.
- .2 **Actuation:**
 - .1 For electrically actuated VAV operation for tracking pairs (supply and exhaust valves), and two-position valves in laboratory spaces without fume hoods, a low-speed electric actuator shall be used to modulate the airflow over the range of the specific valve size.
 - .2 A UL or CSA listed electronic actuator shall be factory mounted to the valve. The actuator shall have sufficient torque to modulate the airflow against the maximum duct static pressure (within product specifications). Loss of main power shall cause the valve to maintain its last airflow position. This position shall be maintained until power is restored.

- .3 For electrically actuated VAV operation for fume hood laboratories (includes all supply, general exhaust, and fume hood valves in the space), a high speed UL 916 listed electronic actuator shall be factory mounted to the valve. Loss of main power shall cause the valve to position itself in an appropriate failsafe state:
 - .1 Supply/make-up air valves:
 - .1 Fail to last airflow position.
 - .2 General exhaust air valves:
 - .1 Fail to last airflow position.
 - .3 Fume Hood air valves:
 - .1 Fail to last airflow position.
- .4 This position shall be maintained constantly without external influence, regardless of external conditions on the valve (within product specifications).
- .5 Constant volume valves for biosafety cabinets, snorkel exhaust, canopy exhaust, etc. shall maintain a constant volume pressure independent, manually adjustable, volume airflow setpoint. It shall be factory calibrated and set for desired airflow rate. It shall also be capable of field adjustment for future changes of desired airflow rate. Valve shall not be equipped with any pneumatic or electronic control actuator requirements. Valve airflow and pressure feedback is not required for constant volume valves.
- .3 **Thermostat and accessories:** wall mounting thermostat with thermometer and guard, supplied with the Terminal Unit by the manufacturer or controls contractor, suitable in all respects for the Terminal unit controls and the control sequence, and complete with all required installation and connection accessories.

3 EXECUTION

3.1 Installation of Air Terminal Units

- .1 Provide/Install ceiling mounted terminal units where shown.
- .2 Secure each unit in place from the structure by means of galvanized steel angles and hanger rods, independent of connecting ductwork.
- .3 Brace and seismically secure each unit in accordance with requirements specified in the mechanical work Section entitled Seismic Control and Restraint.
- .4 Connect each unit with ductwork as indicated. Provide straight inlet duct the same size as the unit inlet and of a length equal to a minimum of four duct diameters. Refer to the drawing detail. Co-ordinate final Terminal Unit adjustments and settings with personnel doing system testing and balancing work.
- .5 **Testing, Adjusting and Balancing:** When work is complete and equipment is operating as intended, test, adjust and balance air flows and temperatures in accordance with requirements specified in the mechanical work Section entitled Testing, Adjusting, and Balancing.
- .6 **Start-Up:** Refer to the article entitled Equipment and System Start-up in the Mechanical Work General Instructions Section.
- .7 **Commissioning:** Refer to commissioning requirements specified in the Mechanical Work General Instructions Section.
- .8 **Demonstration and Training:** Refer to the article entitled Equipment and System O&M Demonstration & Training in the Mechanical Work General Instructions Section. Include for 3 hours of on-site operation demonstration and training for 2 groups of 6 people.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for grilles and diffusers. Product data shall include capacity, throw and terminal velocity, noise criteria, pressure drops, and neck velocity.
- .2 **Damper Adjustment Keys:** Supply and hand to the Owner at Substantial Performance, a minimum of 10 identified (with tags) grille/diffuser volume control damper and flow pattern adjustment keys.
- .3 **Colour Chart(s):** Submit manufacturer's colour chart(s) for all grilles and diffusers for which a finish colour shall be selected.

1.2 Quality Assurance

- .1 Grilles and diffusers are to be tested and performance certified to the Air-Conditioning and Refrigeration Institute Standard ARI 650, Standard for Air Outlets and Inlets.
- .2 Acceptable manufacturers are:
 - .1 Price Industries Inc.
 - .2 Tuttle & Bailey
 - .3 Krueger Division of Air System Components Inc.
 - .4 Titus
 - .5 Nailor Industries Inc.

2 PRODUCTS

2.1 Grilles and Diffusers

- .1 Grilles and diffusers of the type, size, capacity, finish, and arrangement as shown on the drawings and as per the drawing schedule, each equipped with all required mounting and connection accessories to suit the mounting location and application.
- .2 Deflection and spacing shall be as identified in the equipment schedule.
- .3 Grilles and diffusers shall be of steel and aluminum construction, unless otherwise scheduled.
- .4 Where specified, provide grilles with integral, gang-operated opposed blade dampers with removable key operator, operable from face.
- .5 All grilles installed in gymnasiums shall be "heavy duty" steel construction with fully welded perimeter and mandrel tubes that support the blades.

2.2 Laminar Flow Diffuser with HEPA Filter

- .1 Diffuser shall be as per Equipment Schedule on the drawings.
- .2 Construction:
 - .1 The diffuser shall consist of a ceiling mounting frame, a perforated face, an airtight filter housing, a remote operated volume control damper, and a replaceable high efficiency filter.
 - .2 The border shall be extruded aluminum construction with an integral knife edge flange which penetrates gel in the filter frame to provide a leak-proof seal.
 - .3 Plenum and knife edge shall be factory PAO scanned according to standard IEST-RP-CCO34.3 to ensure a leak free assembly.
 - .4 A static pressure port accessible from the room side shall be factory supplied to measure pressure drop across the filter, and to sample aerosol concentrations before the filter.
 - .5 Air shall be admitted to the plenum through an inlet collar and an optional butterfly style volume control damper.

- .6 The diffuser plenum shall feature four (4) integral hanger tabs for securing the unit to structural supports above the ceiling.
- .7 Mounting frames shall utilize corner alignment brackets.
- .8 Four (4) thumb wheel retainers hold the filter in the housing, allowing filter removal and replacement without disturbing the ceiling seal or duct connections.
- .9 The 51% free-area perforated distribution plate shall be secured to the face using quarter-turn fasteners with anti-slip, snap-in retainers and stainless steel retainer cables for ease of installation and removal.
- .3 Finish:
 - .1 The perforated face, plenum, and damper shall have a white B12 baked-on powder coat finish.
 - .2 The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.
 - .3 The paint film thickness shall be a minimum of 2.0 mils.
 - .4 The finish shall have a hardness of 2H.
 - .5 The finish shall withstand a minimum salt spray exposure of 1000 hours.
 - .6 The finish shall have an impact resistance of 80 in-lb.
 - .7 The filter housing and inlet connection shall be mill finish coated steel.
- .4 Filter:
 - .1 The filter shall be a two inch thick pleated microglass element in a three inch deep anodized aluminum frame.
 - .2 The filter shall have an integral cavity filled with gel which shall provide a leak tight seal between the filter frame and the border.
 - .3 Filters shall be packaged separately from the filter housing in a factory carton until site conditions are appropriate for installation (by others) of the filter in the housing.
 - .4 The filter shall be held in place by four cam-type retainers which can be turned 90 degrees by hand, providing an easy means of removing and replacing filters without disturbing the filter housing in the ceiling or the duct connection.
 - .5 The filter shall be individually tested for particle penetration and initial air flow resistance, and shall be of type (select one):
 - .6 High Efficiency Particulate Air (HEPA) filter shall provide 99.99% efficiency on 0.30 µm particulate.
- .5 Diffuser Finish:
 - .1 As scheduled or otherwise required by architect, confirm prior to ordering.
 - .1 The paint finish must demonstrate no degradation when tested in accordance with ASTM D1308 (covered and spot immersion) and ASTM D4752 (MEK double rub) paint durability tests.
 - .2 The paint film thickness shall be a minimum of 2.0 mils.
 - .3 The finish shall have a hardness of 2H.
 - .4 The finish shall withstand a minimum salt spray exposure of 1000 hours.
 - .5 The finish shall have an impact resistance of 80 in-lb.
- .6 Inlet damper:
 - .1 Steel construction with standard white B12 baked-on powder coat finish.
 - .2 Stainless steel construction with brushed finish.

3 EXECUTION

3.1 General

- .1 Install in accordance with manufacturers instructions.
- .2 Provide grilles and diffusers where shown on the drawings. Wherever possible and unless scheduled otherwise, grilles and diffusers are to be the product of one manufacturer.
- .3 Contractor is responsible to determine the final quantity of the grilles and diffusers to suit the requirements of the drawings.

- .4 Unless otherwise specified connect grilles and diffusers in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .5 Exactly locate grilles and diffusers to conform to the final architectural reflected ceiling plans and detailed wall elevations, and to conform to the final lighting arrangement, ceiling layout, ornamental and other wall treatment.
- .6 Coordinate grille and diffuser accessories to suit ceiling systems, ie flanges, t-bar lay-in, etc.
- .7 Where possible, mount grilles such that the blades of the grille are oriented to reduce visual impact, so that interior of duct systems, ceiling systems, etc cannot be seen. Paint inside of connecting duct black should it not be possible to avoid visual impact noted above.
- .8 Order imperial or metric grilles and diffusers to suit actual ceiling dimensions.
- .9 Do not locate supply air terminals within 1200mm (48") of return or transfer terminals unless explicitly shown on the drawings.
- .10 Do not locate grilles and diffusers behind furniture. Notify Consultant immediately for furniture arrangements that will block air diffusers and grilles.
- .11 Contractor shall cover and protect grilles and diffusers during construction to prevent from damage and entrainment of construction dust into ductwork systems.
- .12 Thoroughly clean all grilles and diffusers prior to placing into service.
- .13 Install with flat head stainless steel screws in countersunk holes where fastenings are visible.
- .14 Do not support components from ductwork.

3.2 Installation of Grilles and Diffusers

- .1 Where louvered face grilles are installed in occupied spaces, orient louvered blades such that sightlines into ductwork are obstructed by the blades, unless noted specifically otherwise on the drawings.
- .2 Equip supply diffusers having a basic four-way or all-round air pattern for operation in one, two, or three way pattern where indicated on the drawings.
- .3 Attach troffer type diffusers associated with typical ceiling mounted fluorescent lighting fixtures to the fixtures on the floor prior to fixture installation in the ceiling. When fixtures are installed, connect diffuser boots with flexible ductwork.
- .4 Provide sheet metal plenums, constructed of the same material as the connecting duct, for linear grilles and/or diffusers where shown. Construct and install the plenums in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible. Where individual sections of linear grilles or diffusers are not equipped with a volume control device, equip the duct connection collar(s) with volume control device(s).
- .5 Where linear type diffusers/grilles are installed in suspended T-bar ceilings, clip the diffusers/grilles in place using clip supplied by the diffuser/grille manufacturer.
- .6 Confirm grille and diffuser finishes prior to ordering.
- .7 Bolt grilles, registers, and diffusers in place and provide safety chains in gymnasiums and similar rooms or areas where the grille, register and diffuser may be subject to damage.

3.3 Installation of Laminar Flow Diffuser with HEPA filter

- .1 Exactly locate radial flow diffusers to suit mechanical drawings to optimal air pattern in associated space. Diffusers are not to be relocated unless approved by the Consultant.
- .2 Contractor to conform to the final architectural reflected ceiling plans, and to conform to the final lighting arrangement and locations of ceiling equipment.

- .3 Replace, at the Contractor's cost, any damaged HEPA filters regardless of the severity of the damage. At the Consultants request for concerns with the installation, coordinate and pay for any DOP filter performance testing.
- .4 **Testing:** Prior to putting into service, complete DOP HEPA filter testing to verify proper installation and performance. Replace any filters that fail testing. Testing shall be carried out in accordance with AS1807.6 and 1807.7.
- .5 **Demonstration and Training:** Refer to the article entitled Demonstration and training in the Mechanical Work General Instructions Section. Include for a demonstration on proper use and care for fan filter diffusers to protect filters from damage during service and maintenance.

3.4 Seismic Restraint

- .1 Brace and secure each unit in accordance with requirements specified in the mechanical work Section entitled Seismic Control and Restraint.
- .2 All air outlets mounted in a T-bar ceiling shall be seismically restrained by:
 - .1 Secure attachment to solid ductwork that is braced at the outlet
 - .2 Wire hangers attached to structure. Minimum of two (2) per outlet and one per 1200mm (48") length.
- .3 Air outlets other than T-bar mounting must be securely fastened to the building elements.

END OF SECTION

1 GENERAL

1.1 Submittals

- .1 **Product Data:** Submit product data sheets for all products specified in this Section.
- .2 **Spare Filters:** Prior to Substantial Performance submit a set of spare filters in original identified packaging for each air handling unit requiring filters. Store filters on the site where directed by the Consultant or Owner.
- .3 **Spare Filter Gauge Oil:** Prior to Substantial Performance submit a spare bottle of red manometer filter gauge oil, with instructions, to the Owner for each manometer type gauge installed.

2 PRODUCTS

2.1 General

- .1 Unless otherwise specified or noted, filters are to be synthetic and/or glass fibre disposable media type in accordance with the drawing schedule(s).
- .2 Minimum Efficiency Reporting Values (MERV) ratings are to be as per ASHRAE Standard 52.2, Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Sizes.
- .3 Unless otherwise specified or noted, filters are to be in accordance with UL Standard 900, Air Filter Units.
- .4 Acceptable filter manufacturers are:
 - .1 AAF International.
 - .2 Camfil Farr Inc.
 - .3 Modern Air Filter Corp.

2.2 Construction Filters

- .1 Roll type, disposable, MERV 7 to 9 woven glass fibre media.

2.3 HEPA Filters

- .1 HEPA high capacity filters as per the drawing schedule, in accordance with UL Standard 586, High-Efficiency, Particulate, Air Filter Units, 99.995% efficient on 0.12 µm particles, consisting of a continuous pleating of water-proof micro glass fibre media with pleats uniformly separated by aluminum separators, urethane sealant to encapsulate the filter pack in the minimum #16 gauge galvanized steel frame with one-piece urethane gasket or neoprene dove-tailed gasket for positive leak-free filter-to-holding mechanism seal.

2.4 Filter Framing and Racks

- .1 No. 16 gauge galvanized steel filter framing/racks, sized and arranged to suit the filters and filter bank, easily accessible for filter service and replacement, and complete with slide-in tracks or lay-in flanges as required for filter placement, and all required gasketing and facilities to prevent air by-pass.

3 EXECUTION

3.1 Installation of Construction Filters

- .1 Provide roll type medium efficiency disposable media filter(s) across the entire filter bank of each supply air handling unit, either at the factory where the fan is produced or at the site as soon as the fan is installed. Secure the media in place so it will not be dislodged by fan operation. Replace the roll media periodically if it becomes loaded and clogged.
- .2 For exhaust systems, secure the filter media across exhaust air openings and ductwork to prevent construction dirt and dust from fouling the fan

- .3 Leave the media in place until fan start-up, at which time remove and dispose of the construction media.

3.2 Installation of Filters

- .1 Provide all required filter media when fan equipment is ready for start-up and performance testing. Provide any required filter framing/racks.
- .2 Prior to Substantial Performance supply a complete spare set of filter media in original packaging and clearly identified as to the applicable system for each air handling system with filters. Store the filters at the site where directed by the Owner.

END OF SECTION

1 GENERAL

- .1 Existing building DDC control is Delta Controls by Ainsworth.

1.2 Submittals

- .1 **Shop Drawings/Product Data:** Submit shop drawings/product data sheets for the following:
 - .1 All control system components.
 - .2 Identified schematic control diagrams with component identification, catalogue numbers, and sequence of operation for all systems.
 - .3 Certified wiring diagrams for all systems.
- .2 **Site Inspection and Start-Up Report:** Submit a site inspection and start-up report from the manufacturer's representative as specified in Part 3 of this Section.
- .3 **Confirmation of Installation Personnel Qualifications:** Submit written confirmation from the control component manufacturer that the site installation personnel are qualified and experienced in the installation of the components, and have parts and service availability on a 24/7 basis.

1.3 Quality Assurance

- .1 The control systems are to be installed by the control component manufacturer or by licensed personnel authorized by the control component manufacturer. Submit written confirmation from the control component manufacturer.
- .2 The control system installation company shall have local parts and service availability on a 24/7 basis.
- .3 All control wiring work shall be performed by licensed journeyman electricians, or under direct daily supervision of journeyman electricians.

2 PRODUCTS

2.1 Control Dampers and Operators

- .1 **Standard Damper:** T. A. Morrison & Co. Inc. "TAMCO" Series 1000, 100 mm (4') deep, flanged, AMCA low leakage certified aluminium dampers. Dampers for modulating and mixing applications are to be parallel blade type. Dampers for open-shut service are to be opposed blade type. Maximum blade length shall be 1 m (4'). Dampers greater than two sections wide are to be complete with a jackshaft. Each damper shall be complete with:
 - .1 An extruded 6063T5 aluminum frame and airfoil blades, each with an integral slot to receive a gasket.
 - .2 Extruded TPE frame gaskets and extruded EPDM blade gaskets.
 - .3 Slip-proof aluminium and corrosion resistant plated steel linkage of a metal thickness to prevent warping or bending during damper operation, concealed in the frame, equipped with seal-sealing and self-lubricating bearings consisting of a Celcon inner bearing fixed on the hexagonal blade pin and rotating in a polycarbonate outer bearing inserted in the frame.
- .2 **General Re: Damper Operators:** Each damper motor shall be shaft mounted, spring return, fail safe in the normally open or normally closed position, sized to control the damper against maximum pressure or dynamic closing pressure, whichever is greater, to suit the sizes of dampers involved, and to provide sufficient force to maintain the damper rated leakage characteristics. Each operator shall be complete with a damper position indicator, and external adjustable stops to limit the length of stroke in either direction, and shall be mounted on a corrosion resistant adjustable bracket. Operating arms are to have double yoke linkages and double set screws for fastening to the damper shaft. Operators for dampers to be connected to the building fire alarm system or to freeze protection devices are to be equipped with additional relays to permit the dampers to respond and go to the

required position in less than 15 seconds upon receipt of a signal. Operator enclosures are to be suitable in all respects for the environment in which they are located.

- .3 **Electric Damper Operators:** Equal to Belimo EF Series 24 volt or 120 volt AC spring return, direct coupled electric motor operators for either modulating or two position control as required. Each operator shall be overload protected and complete with an enclosure to suit the mounting location.

2.2 Local Control Panels

- .1 NEMA/EEMAC 1 (NEMA/EEMAC 2 in sprinklered areas) wall mounting, enamelled steel barriered enclosures sized to suit the application with 20% spare capacity, a perforated sub-panel, numbered terminal strips for all low and line voltage wiring, hinged door, and slotted flush latch.

2.3 Control System Components

- .1 Components specified below are required for control of equipment and systems as per the drawing control diagrams and sequences of operation. Not all required components may be specified.
- .2 **Building Automation System Interface Hardware:** Hardware to permit building automation system control and monitoring of input/output points as per the mechanical work Section entitled Building Automation System, the points schedule, and drawing control diagrams and operation sequences. All such hardware shall be suitable in all respects for interface with the building automation system.

2.4 Room Pressure Monitor

- .1 Description:
 - .1 The Room Pressure Monitor shall be an electronic device utilizing a flow-through style sensor, furnished and installed to measure differential room pressure between adjacent spaces and display the information on a digital interface mounted outside the critical space.
- .2 Construction:
 - .1 Digital Display Unit:
 - .1 The device shall be wall mounted in close proximity immediately outside the space being monitored.
 - .2 Each monitor shall have a 4.3 inch thin-film-transistor (TFT), dimmable, full-color touch-screen display with a 480 x 800 resolution.
 - .3 The device must utilize a password-protected menu format to permit access for programming or setpoint changes. Different levels of secure access shall be available using different passwords.
- .3 Room Pressure Sensor:
 - .1 The device shall be mounted above the door separating the spaces for which differential room pressure is being measured.
 - .2 The sensor shall include cover plates on both sides of the wall for protection from drafts and/or cleaning solvents. The sensor cover plate shall be secured with security fasteners to prevent tampering.
 - .3 The sensor shall maintain an accuracy of $\pm 3\%$ of reading. Sensors with accuracy rated as a percentage of full scale shall not be acceptable.
 - .4 The sensor shall be capable of monitoring pressure from -0.25 to +0.25 in.w.c.
 - .5 The device must utilize digital sensor technology. Flutter strips, ball-in-tube monitors or similar approaches that do not display actual quantitative differential room pressure information are not acceptable.
 - .6 Sensor drift shall be less than 0.0004 in.w.c. (0.1 Pa) per year. Sensors with yearly drift specified as a percentage of their full scale range shall not be acceptable.

- .7 The sensor element shall be constructed in such a way that it is protected from the effects of dust or lint. Sensors with elements exposed to the airstream are not acceptable.
- .4 Alarm:
 - .1 The monitor shall include the ability for both audible and visual alarming during a user defined event, including low pressure, high pressure, emergency condition, and door status.
 - .2 The alarm shall incorporate a user defined delay between time when the alarm setpoint is met and when the alarm initiates.
 - .3 The monitor shall include a mute button which, when depressed during an alarm event, shall disable the audio alarm for a user defined length of time.
- .5 Door Switches:
 - .1 Magnetic door switches shall be utilized to prevent nuisance alarms during room cleaning, patient transfer, or other situations requiring door(s) to be kept open for extended periods of time.
 - .2 The door switches shall be wired directly to the room pressure monitor, and the alarm delay duration shall be field adjustable through the service menu on the monitor display interface.
- .6 Commissioning:
 - .1 Configuration:
 - .1 All available settings shall be adjustable through the touch-screen display. Commissioning shall be fully supported through the interface without the use of any additional tools or software.
 - .2 Duplication:
 - .1 Each device shall permit the configuration to be copied, and this configuration can be uploaded to additional units if applicable. This is to be done through an Ethernet based connection to a computer.
 - .3 Reports:
 - .1 Each device shall have a programmatically generated commissioning report that details all device settings. This is to be done through an Ethernet based connection to a computer.
- .7 Building Management System Interface:
 - .1 The room pressure monitor shall interface with the building management system (BMS) to allow remote monitoring of room parameters or permit settings adjustments over the building network.
 - .2 The BMS shall use either analog inputs, digital inputs, or utilize BACnet network protocol to view points or status of the room being measured. The use of BACnet protocol shall be native to the device and shall not require the use of an external gateway.
 - .3 The monitor shall include the ability to change MAC address, device instance, and baud rate (9600, 19200, 38400, 76800) for proper interfacing to BACnet network.
 - .4 The manufacturer shall be a member of BACnet International and the room pressure monitor shall be BTL listed.

2.5 Touchscreen Multi Variable Room Pressure Monitor

- .1 Description:
 - .1 The Multi Variable Monitor shall be an electronic, touchscreen device capable of displaying a customized graphical user interface.
- .2 Construction:
 - .1 Digital Display Unit:
 - .1 Each monitor shall have a (7)/(15) inch thin-film-transistor (TFT), dimmable, full-color touch-screen display with a (800 x 480)/(1024 x 768) resolution.
 - .2 The device shall have an IP54 rating for cleaning of the display surface.

- .3 The device shall be able to display information for up to 8 rooms on a single screen
- .4 The device shall support the ability to swipe between multiple display screens.
- .5 The device must utilize a password-protected menu format to permit access for programming or set-point changes. Different levels of secure access shall be available using different passwords.
- .6 The device shall support up to 512 BACnet server points.
- .7 The device shall support the following graphic file formats: GIF, JPEG, BMP, TIFF, PNG, MNG, ICO
- .2 Multi Variable Monitor:
 - .1 The device shall support both BACnet MS/TP and BACnet IP network types.
 - .2 The device shall be capable of displaying any available BACnet point. At minimum this includes alarm status, room temperature and humidity, room pressure, air change rate and occupancy.
 - .3 The Multi Variable Monitor shall support fully customizable user interfaces. The user interface shall be able to display up to 8 rooms simultaneously.
- .3 Alarm:
 - .1 The monitor shall include the ability for both audible and visual alarming during a user defined event.
 - .2 The alarm shall incorporate a user defined delay between time when the alarm set-point is met and when the alarm initiates.
 - .3 The monitor shall include a mute button which, when depressed during an alarm event, shall disable the audio alarm for a user defined length of time.
- .3 Building Management System Interface:
 - .1 The BMS shall use BACnet network protocol to view points or status of the room being measured. The use of BACnet protocol shall be native to the device and shall not require the use of an external gateway.
 - .2 The monitor shall include the ability to change MAC address, device instance, and baud rate (9600, 19200, 38400, 76800) for proper interfacing to BACnet network.

2.6 System Wiring Materials

- .1 System wiring, conduit, boxes, and similar materials are to be in accordance with requirements specified in the appropriate Section(s) of the Electrical Work Division of the Specification.

3 EXECUTION

3.1 Demolition

- .1 Do all required control system demolition work.
- .2 Refer to demolition requirements specified in the mechanical work Section entitled Demolition and Revision Work.

3.2 General Re: Installation of Controls

- .1 Provide complete systems of control and instrumentation to control and supervise building equipment and systems in accordance with this Section of the Specification and the drawings.
- .2 The control systems are to generally be as indicated on drawing control diagrams and are to have all the elements therein indicated or implied.
- .3 The control diagrams show only the principal components controlling the equipment and systems. Supplement each control system with all relays, transformers, sensors, etc., required to enable each system to perform as specified and to permit proper operation and supervision.
- .4 Brace and secure control system equipment in accordance with requirements specified in the mechanical work Section entitled Seismic Control and Restraint.

3.3 Supply of Control Air Dampers and Operators

- .1 Unless otherwise specified, supply all required control dampers. Hand the dampers to the sheet metal trade at the site in the location where they are required for installation as part of the sheet metal work. Ensure that each damper is correctly located and mounted.
- .2 Provide linkage and operators for the dampers. Wherever possible locate damper operators so that they are accessible from outside duct, plenum, and equipment casings. Bracket mount operators on ducts or plenums clear of insulation where applicable.
- .3 Where sequence operation is indicated, or where multiple operators drive a series of dampers, provide pilot positioners to couple their action.
- .4 Ensure that dampers located in ductwork other than galvanized steel are constructed of type 316 stainless steel.

3.4 Supply of Automatic Control Valves and Operators

- .1 Unless otherwise specified, supply all required automatic control valves. Hand the valves to the appropriate piping trades at the site in the locations they are required for installation as part of the piping work. Ensure that each valve is properly located and installed.
- .2 Provide an operator for each valve.

3.5 Installation of Control System Components

- .1 Provide all required control system components and related hardware. Refer to drawing control diagrams, points lists, and sequences.
- .2 Where components are pipe, duct, or equipment mounted supply the components at the proper time, coordinate installation with the appropriate trade, and ensure that the components are properly located and mounted.

3.6 Control Wiring

- .1 Do all required control wiring from 15A-1P circuits terminated as part of the electrical work in junction boxes in equipment rooms/areas. Coordinate exact junction box locations at the site with the electrical trade.
- .2 Except as specified below, install all wiring in conduit. Unless otherwise specified the final 600 mm (2') connections to sensors and transmitters, and wherever conduit extends across flexible duct connections shall be liquid-tight flexible conduit.
- .3 Control wiring in ceiling spaces and wall cavities may be plenum rated cable installed without conduit but neatly harnessed, secured, and identified.
- .4 All wiring work shall be in accordance with certified wiring schematics and instructions, and the wiring standards specified in the appropriate Sections of the Electrical Work Division of this Specification.

3.7 Identification and Labelling of Equipment, Systems and Circuits

- .1 Refer to identification requirements specified in the mechanical work Section entitled Basic Mechanical Materials and Methods.
- .2 Identify equipment as follows:
 - .1 **Enclosures and components:** engraved laminated nameplates with all wording listed and approved prior to manufacture of the nameplates.
 - .2 **Wiring:** numbered sleeves or plastic rings at both ends of the conductor, with numbering corresponding to conductor identification on shop drawings and "as-built" record drawings.
 - .3 Provide a control system glazed and framed flow diagram with component identification and sequence for each control system. Locate the diagrams in the Equipment Rooms housing the system equipment.

3.8 Testing, Adjusting, Certification, Start-Up, Commissioning and Training

- .1 **Testing and Adjusting:** When control work is complete, check the installation of components and all wiring connections, make any required adjustments, and coordinate adjustments with personnel doing HVAC testing, adjusting and balancing work.
- .2 **Equipment and System Manufacturer's Certification:** Refer to the article entitled Equipment and System Manufacturer's Certification in the Mechanical Work General Instructions Section.
- .3 **Start-Up:** Refer to the article entitled Equipment and System Start-up in the Mechanical Work General Instructions Section.
- .4 **Commissioning:** Refer to commissioning requirements specified in the Mechanical Work General Instructions Section.
- .5 **Demonstration and Training:** Refer to the article entitled Equipment and System O & M Demonstration & Training in the Mechanical Work General Instructions Section. Include for 2 full day on-site operation demonstration and training sessions for 2 groups of 6 people.
- .6 **Additional Training and Troubleshooting:** Include for 2 follow-up site training and troubleshooting visits, 1 six months after Substantial Performance and the other at the end of the warranty period, both when arranged by the Owner and for a full 8 hour day to provide additional system training as required, and to demonstrate troubleshooting procedures.

END OF SECTION

1 GENERAL

1.1 Sequences of Operation

- .1 The following sequences of operation are to be read in conjunction with the building automation points list. Some inputs and outputs such as current sensors, air and water temperature sensors for information and diagnostics are not identified in the sequence of operation but included in the points list.
- .2 Additional virtual points and variables may be required in addition to the items identified in the points list and sequences of operation to achieve the desired equipment operation and performance.
- .3 These sequences of operation provide the design intent with respect to the desired operating conditions of the equipment and mechanical systems and do not represent the programming to achieve the sequence.
- .4 In general all BACnet points are to be mapped to the DDC system and the Owner/Consultant will select the BACnet points to display on the system graphic. In general BACnet points are to be used for information purposes only and not part of a control sequence. All control points are to be hard wired and they are not to be replaced by BACnet control without the approval of the owner and consultant.

1.2 Graphics Points/Display

- .1 In general, all DDC system points and global variables for each piece of mechanical equipment shall appear on the DDC system graphics.
- .2 The mechanical consultant and Owner may request additional points on each graphic screen to facilitate ease of monitoring of the systems.
- .3 In some cases the owner and consultant may request specific BACnet points to also be displayed on the graphics.
- .4 Update graphics for deleted and added mechanical equipment within the project scope of work.

1.3 Occupancy Scheduling

- .1 Occupancy schedule will remain unchanged.

1.4 Temperature Setpoint Scheduling

- .1 All room setpoint temperatures shall be fully adjustable through the BMS (including setpoints outside of the room-level adjustable range indicated in the Room Temperature Setpoint Table).
- .2 Limit the range of selectable room setpoint temperatures by the room occupants through the room temperature sensors for each room in accordance with the Room Temperature Setpoint Table.
- .3 Set the initial Room Setpoint Temperature in accordance with the Room Temperature Setpoint Table. Building temperature setpoints shall be scheduled as follows:

	Room Setpoint Temperature	Room-Level Adjustable Range
Compounding and Ante Rooms	Less than or equal to 20°C	18.0°C - 20.0°C
HD Storage	Less than or equal to 25°C	20.0°C - 25.0°C
Staging Area and Store Room	22°C	20.0°C - 24.0°C

1.5 Room Monitoring Requirements

- .1 All project areas require continuous monitoring of room temperature and relative humidity with DDC graphics to display these parameters.

- .2 Provide continuous monitoring of relative pressurization for ISO rated rooms.
 - .1 Pressure is measured among ISO & non ISO rated spaces.
 - .2 Provide an on-wall local display at each ISO rated spaces to display space temperature, relative humidity, relative pressurization and room mode with graphics at DDC system.
 - .3 Provide multi-variable touch display at storeroom to monitor each room. Parameters include space temperature, relative humidity, relative pressurization and room mode.
- 1.6 BSC Cabinet Exhaust Fan (EF-2)**
 - .1 EF-2 provides exhaust to the BSC cabinet at compounding room.
 - .2 Fans shall be enabled and disabled on the DDC schedule, shall run continuously.
 - .3 Fans interlock with BSC cabinet via fan relay contacts.
 - .4 Monitor fan status through BMS.
- 1.7 Pharmacy Exhaust Fan (EF-11)**
 - .1 EF-11 provides exhaust to the pharmacy area.
 - .2 Fan shall be enabled and disabled on the DDC schedule, shall run continuously.
 - .3 Modulate the VFDs at the fan to maintain airflows and duct static pressure at the furthest ventrui valve.
 - .4 Monitor fan status through BMS.
- 1.8 Single Duct VAV Boxes (VAV-PS-004 and VAV-PR-004)**
 - .1 Air terminal units shall be pressure independent, single duct VAV, complete with custom programmable application controllers.
 - .2 Occupancy state shall be determined by DDC schedule, or from the local temperature sensor.
 - .3 Occupied Operation (variable volume, constant temperature)
 - .1 Maintain space temperature setpoint by modulating the variable volume damper to increase flow rate to the maximum setting as needed to satisfy space temperature.
 - .4 Unoccupied Operation (variable volume, variable temperature)
 - .1 During unoccupied periods, supply and return air rates may be reduced to 60% of occupied conditions where advised by owner for energy savings.
 - .2 Upon call for cooling, the VAV shall modulate the variable volume damper to increase flow rate to the maximum setting as needed to satisfy space temperature.
 - .3 After the temperature has been satisfied, the flow rate will return to the minimum setting.
 - .4 Return VAV boxes shall modulate air flow proportionally between minimum and maximum setpoints in conjunction with supply units to maintain relative space pressurization.
 - .5 The DDC system shall provide monitoring and control for:
 - .1 Status/position
 - .2 Space temperature setpoint
 - .3 Actual space temperature
 - .4 Alarm monitoring
- 1.9 Ventrui Valve (VAV-PS-001 to 003 & VAV-PE-002 to 003)**
 - .1 Air terminal units shall be pressure independent, complete with custom programmable application controllers.
 - .2 Occupancy state shall be determined by the local temperature and pressure sensors.
 - .3 Operation (constant volume, variable temperature)
 - .1 Maintain space temperature setpoint by modulating cooling coil (VAV-PS-001 only).
 - .2 Venturi valves shall modulate air flow proportionally between minimum and maximum setpoints in conjunction with supply units to maintain relative space pressurization at all time.
 - .4 The DDC system shall provide monitoring and control for:
 - .1 Status/position
 - .2 Space temperature setpoint
 - .3 Actual space temperature

.4 Alarm monitoring

1.10 Coiling Coil (CC-106)

- .1 Provide new chilled water control valves. Modulate control valve to achieve air temperature setpoint.

END OF SECTION