University Hospital of Northern British Columbia (UHN) Cardiac Diagnostic Services - Phase 3

SPECIFICATIONS

1475 Edmonton Street, Prince George, BC

NHA Project No. N662030002

Stantec Project No. 144320012

ISSUED FOR CONSTRUCTION

April 28th, 2025

APPENDICES

END OF SECTION

INVITATION TO BID

Tenders marked "UHN Cardiac Diagnostic Phase 3 – NHA project No. N662030002" will be received electronically through bids & tenders, up to **3:00 pm local time on Friday, February 28, 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 bid&tenders to receive notification of Addenda.

The work to be undertaken generally includes the following:

1. Demolition of an existing space as noted on the drawings.
2. New fit up of the space to convert it into a new Burn Unit.
3. All associated Mechanical work.
4. All associated Electrical work.

There will be an opportunity to view the facility during a MANDATORY Site Tour to be held on **11:00 am local time on Tuesday, February 11, 2025**. Contractors to meet at the main entrance lobby.

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

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

Technical inquiries should be directed to:

Contact: David Kury, Architect AIBC

Phone: 250-389-2361 Email: David.Kury@stantec.com

Part 1.1: DIVISION 00
Procurement and Contracting Requirements

For use with CCDC 2-2020 Stipulated Price Contract

00 11 13 - ADVERTISEMENT FOR BIDS

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1. BID CALL

.1 *Name of Bidding Authority*
will receive bids for this *Project* on or before *Time & Time Zone* on *Month, Day, Year* (unless modified by addendum) at:

❒ .1a *Physical Address Location*

❒ .1b *Web address of online bidding system*

.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:

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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:

.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 :

Include details such as contact person, information on deposits

3. PROJECT DESCRIPTION

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

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: UHN - Cardiac Diagnostic Services - Phase 3

.2 Project / Contract No.: N662030002

.3 *Owner*: Project No. NHA N662030002 / SAL 144320012

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

.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:

Refer to the Invitation to Bid for instructions.

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

3. PRE-BID SITE VISIT

☒ ~~.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 1:00 local time on April 17 , 20 24 . Attendees will meet at

Front entrance of 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

Additional requirements

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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 *5* 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: PAPER SUBMISSIONS

8P. COMPLETION OF BID FORM & APPENDICES

.1 The Bidder must:

1. Complete the bid on the Bid Form included with the Bid Documents in a non-erasable medium and execute in accordance with provisions of Clause 9 of the Instructions to Bidders, - EXECUTION OF THE BID.
2. If required, state the number of weeks within which the Bidder will achieve *Ready-for-Takeover*.
3. Initial erasures or corrections to entries on the Bid Form.
4. Indicate receipt of Addenda.
5. Complete all appendices as required by the *Owner*.
   - ☐ Appendix 'A' – List of Subcontractors
   - ☐ Appendix 'B' – Alternate Prices
   - ☐ Appendix 'C' – List of Unit Prices
   - ☐ Appendix 'D' – List of Cash Allowances

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

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

9P. EXECUTION OF THE BID

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

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

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

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

10P. DELIVERY OF THE BID

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

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

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

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

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

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

11P. BID WITHDRAWAL AND MODIFICATION

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

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

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

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

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

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

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

.8 Bid modifications:

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

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

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

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

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

12P. BID SECURITY REQUIREMENTS

.1 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.

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

.3 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.

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

.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.

❒ 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 oblige 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: UHN - Cardiac Diagnostic Services - Phase 3

Project/Contract No.: N662030002

From (Bidder): _____
company name

_____
street address or postal box number city/town

_____
province and postal code

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

Bidders Email _____

To (Owner): Project No. NHA N662030002 / SAL 144320012

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: UHN - Cardiac Diagnostic Services - Phase 3

Project/Contract No.: N662030002

From (Bidder): _____
company name

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

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

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

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

~~❒ **BOBS Section/Division**~~	~~**Name of Subcontractor**~~
~~***Closing via BOBS per Section 00 21 13 Clause 7.2***~~	~~***Closing via BOBS per Section 00 21 13 Clause 7.2***~~
~~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: UHN - Cardiac Diagnostic Services - Phase 3

Project/Contract No.: N662030002

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

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Alternate Price No. 2

$_____ $_____

_____

Time (in Days) _____ _____

Alternate Price No. 3

$_____ $_____

_____

Time (in Days) _____ _____

Alternate Price No. 4

$_____ $_____

_____

Time (in Days) _____ _____

Alternate Price No. 5

$_____ $_____

_____

Time (in Days) _____ _____

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❒ Appendix 'C' – LIST OF UNIT PRICES

Project/Contract: UHN - Cardiac Diagnostic Services - Phase 3

Project/Contract No.: N662030002

From (Bidder): _____

company name

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

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

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

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

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❒ Appendix 'D' – LIST OF CASH ALLOWANCES

Project/Contract: UHN - Cardiac Diagnostic Services - Phase 3

Project/Contract No.: N662030002

From (Bidder): _____

company name

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

Description of Cash Allowance	**Amount $**
No.1 Unforeseen site conditions:	$10,000.00
No.2 Unforeseen Fire-stopping conditions:	$2,500.00
No. 3 Lighting Control Devices	$5,000.00

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❒ Appendix 'E' – ITEMIZED PRICES

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

Project/Contract: UHN - Cardiac Diagnostic Services - Phase 3

Project/Contract No.: N662030002

From (Bidder): _____
company name

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

Item of Work	Itemized Price

Reset

❒ Appendix 'F' - BID MODIFICATION

(To be used where required)

Project/Contract: UHN - Cardiac Diagnostic Services - Phase 3

Project/Contract No.: N662030002

Owner: Project No. NHA N662030002 / SAL 144320012

From (Bidder): _____

Date: _____

Submit by:

❒ Fax _____

❒ Email _____

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

❒ Physical Address _____

_____

_____

WE HEREBY MODIFY OUR BID PRICE AS FOLLOWS:

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

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 oblige on the bonds is the *Owner.*

END OF SECTION

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

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

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

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

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

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.

PART 1.3 PROJECT SPECIFIC AMENDMENTS

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

AMENDMENTS TO DIVISION 00

PART 1.1 Division 00 21 13 – INSTRUCTIONS TO BIDDERS

Add:

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

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

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

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

PART 1.1 Division 00 73 63 – CONTRACT SECURITY REQUIREMENTS

Replace entirely with the following:

PERFORMANCE BONDS AND LABOUR AND MATERIAL PAYMENT BONDS

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

AMENDMENTS TO ARTICLES OF AGREEMENT BETWEEN OWNER AND CONTRACTOR

ARTICLE A-5 PAYMENT
5.2.1 Replace “2%” with “0%”; Replace “4%” with “0%”.

AMENDMENTS TO GENERAL CONDITIONS

PART 3 EXECUTION OF THE WORK
GC 3.3.1 Temporary Wok
3.3.1 Add, after the first sentence "For further clarity, the *Contractor* acknowledges and agrees that the *Contract Price* is inclusive of all costs associated with the design, erection, operation, maintenance, and removal of *Temporary Work*, including any *Construction Equipment* required for the same. The *Contractor* is not entitled to any additional payment for any such *Temporary Work,* including any *Construction Equipment.*"

PART 5 PAYMENT

GC 5.2 APPLICATIONS FOR PAYMENT
Add:
5.2.10 The *Contractor* shall with each and every application for payment have an up-to-date red-lined as-built drawing available on site for *Consultant* review.

GC 5.3 PAYMENT
Delete: Section 5.3.1.2 in its entirety.
Add:

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

GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

Add:

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

Add new:

GC 5.8 WITHHOLDING OF PAYMENT

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

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

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

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

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

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

PART 6 CHANGES IN THE WORK

GC 6.2 CHANGE ORDER

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

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

PART 9 PROTECTION OF PERSONS AND PROPERTY

GC 9.4 – CONSTRUCTION SAFETY

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

9.4.1 The Contractor agrees to be the "Prime Contractor" for the purposes of all applicable occupational health and safety laws, including the *Workers Compensation Act* (British Columbia), and the Contractor is responsible for filing any documents necessary to comply with the *Workers Compensation Act* (British Columbia), including a Notice of Project. The Contractor shall be solely responsible for construction safety at the Place of the Work and for compliance with the rules, regulations and practices required by the applicable construction health and safety legislation and shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Work.

Add new paragraphs 9.4.6, 9.4.7 and 9.4.8:

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

.1 a current Worksafe BC clearance letter;

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

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

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

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

PART 11 INSURANCE

GC 11.1 INSURANCE, replace entirely with the following:

GC 11.1 - INSURANCE

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

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

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

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

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

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

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

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

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

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

(e) Hot Roofing or Installation of Hot Membranes

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

Such insurance shall include, but not be limited to:

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

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

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

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

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

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

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

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

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

Such insurance shall include, but not be limited to:

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

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

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

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

1.1 PROJECT

.1 Project Name: University Hospital of Norther British Columbia (UHNBC) Cardiac Diagnostic Services - Phase 3.

.2 Project Location: 1475 Edmonton Street, Prince George, BC

.3 Project Description: The UHNBC Cardiac project is a multiphase renovation that will renovate/expand two departments located throughout Level 1 of the existing hospital building. This portion of the project is confined to Phase 3 which is the renovation to the space as indicated on Drawings.

.4 Separate Price items: Submit separate price for Wall Coverings/ graphic image for clients review and approval.

1.2 CONTRACT DESCRIPTION

.1 Contract Type: Design Bid Build

1.3 CHANGE ORDER PRICING

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

1.4 DESCRIPTION OF ALTERATIONS WORK

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

1.5 WORK BY OWNER

.1 Owner will supply and install the following:

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

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

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

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

1.6 OWNER OCCUPANCY

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

1.7 CONTRACTOR USE OF SITE AND PREMISES

.1 Coordinate use of premises under direction of Owner.

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

1.8 COMMUNICATIONS - REQUESTS FOR INFORMATION

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

1.9 HOURS OF WORK

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Cash allowances.

1.2 RELATED SECTIONS

.1 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 #1:** Unforeseen site conditions: **$10,000.00**
- .2 **Cash Allowance #2**: Unforeseen Firestopping: **$2,500.00** for unknown conditions thru existing walls that are not known until after demolition happens. All new conditions shall be carried out as specified in Section 07 84 00.
- .3 **Cash Allowance #3:** Contractor to allow for a **$5,000.00** cash allowance for the scope of work listed below. Refer to electrical drawings for exact scope of work.
  - .1 Provide room controllers, low voltage switches, occupancy sensors and control modules as indicated in the electrical drawings.
  - .2 Programming and commissioning for the lighting control system.

.3 Shop drawings for review prior to purchasing devices.

.4 All conduit raceway infrastructure with wiring related to the above scope is to be carried in the tender package.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

.1 Section 01 61 00 - Product Requirements.

1.2 ADMINISTRATIVE

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

.2 Prepare agenda for meetings.

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

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

.5 Make arrangements for and preside at meetings.

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

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

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

1.3 MEETINGS

.1 PRECONSTRUCTION MEETING

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

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

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

.4 Agenda to include the following:

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

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

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

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

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

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

.7 Confirmation that affected utility services will be disconnected.

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

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

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

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

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

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

.14 Insurances, transcript of policies (GC).

.15 Review of certified professional related items.

.2 PROGRESS MEETINGS

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

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

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

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

.5 Agenda to include the following:

.1 Review, approval of minutes of previous meeting.

.2 Review of Work progress since previous meeting.

.3 Field observations, problems, conflicts.

.4 Problems which impede construction schedule.

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

.6 Corrective measures and procedures to regain project schedule.

.7 Revisions to construction schedule.

.8 Progress schedule, during succeeding work period.

.9 Review submittal schedules and expedite as required.

.10 Maintenance of quality standards.

.11 Review of constuction waste management procedures.

.12 Pending changes and substitutions.

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

.14 Materials delivered.

.15 Site Safety.

.16 Shut Down requests.

.17 Inspections called for.

.18 Witnesses required.

.19 Action required by.

.20 Pending action.

.21 Overdue action.

.22 Other business.

.23 List of outstanding claims.

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Schedules, form, content, submission.

.2 Critical path scheduling.

.3 Progress photographs.

.4 Submittals schedule.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

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

1.3 SCHEDULES

.1 Submit schedules as follows:

- .1 Submittal Schedule for Shop Drawings and Product Data.
- .2 Submittal Schedule for Samples.
- .3 Submittal Schedule for timeliness of Owner-furnished Products.
- .4 Product Delivery Schedule.
- .5 Shutdown or closure activity.

.2 Schedule Format

- .1 Prepare schedule in form of a horizontal Gantt bar chart.
- .2 Provide a separate bar for each major item of work.
- .3 Split horizontally for projected and actual performance.
- .4 Provide horizontal time scale identifying last Working Day of each week.
- .5 Format for listings: Chronological order of start of each item of work.
- .6 Identification of listings: By systems description.

.3 Schedule Submission

- .1 Submit initial format of schedules within fifteen (15) working days after award of Contract.
- .2 Submit schedules in electronic format, forward through e-mail files.
- .3 Consultant will review schedule and return review copy within ten (10) days after receipt.
- .4 Resubmit finalized schedule within seven (7) days after return of review copy.
- .5 Submit revised progress schedule with each application for payment.
- .6 Distribute copies of revised schedule to:
  - .1 Job site office.
  - .2 Subcontractors.
  - .3 Other concerned parties.
- .7 Instruct recipients to report to Contractor within ten (10) days, any problems anticipated by timetable shown in schedule.

1.4 CONSTRUCTION PROGRESS SCHEDULING

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

.2 Revise and resubmit as required.

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

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

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

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

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

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

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

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

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

.11 Indicate changes occurring since previous submission of schedule:

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

.12 Provide a narrative report to define:

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

1.5 CRITICAL PATH SCHEDULING

.1 Include complete sequence of construction activities.

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

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

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

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

.5 Show changes occurring since previous submission of schedule:

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

.6 Provide a narrative report to define:

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

1.6 PROGRESS PHOTOGRAPHS

.1 Digital Photography:

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

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

.3 Frequency: Weekly construction review.

1.7 SUBMITTALS SCHEDULE

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

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Shop drawings and product data.

.2 Samples.

.3 Certificates and transcripts.

1.2 RELATED SECTIONS

.1 Other sections requesting submittals.

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

1.3 ADMINISTRATIVE

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

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

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

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

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

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

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

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

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

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

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

1.4 SHOP DRAWINGS AND PRODUCT DATA

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

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

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

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

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

.6 Accompany submissions with duplicate transmittal letter, containing:

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

.7 Submissions shall include:

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

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to other parts of the Work.

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

.9 Delete information not applicable to project.

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

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

1.5 SAMPLES

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

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

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

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

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

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

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

1.6 MOCK-UP

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

1.7 CERTIFICATES AND TRANSCRIPTS

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

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

END OF SECTION

Part 1 General

1.1 GENERAL

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

1.2 REFERENCES

.1 Health Canada Publication:

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

.2 Canadian Standards Association:

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

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

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

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

.3 Northern Health:

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

1.3 CONSTRUCTION SAFETY MEASURES

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

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

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

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

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

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

1.4 OVERLOADING

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

1.5 INFECTION CONTROL AND PREVENTION

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

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

1.6 DEFINITIONS

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

1.7 QUALITY ASSURANCE

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

1.8 PRECONSTRUCTION PREVENTIVE MEASURES

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

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

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

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

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

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

1.9 DEMOLITION RESTRICTIONS

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

1.10 HAZARDOUS DESIGNATED SUBSTANCES

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

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

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

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

1.11 PERFORMANCE OF THIS WORK

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

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

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

1.12 PARKING

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

1.13 MAINTENANCE OF EXISTING BUILDING SERVICES

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

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

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

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

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

1.14 EXISTING FACILITIES AND REGULATIONS

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

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

.3 Smoking is not permitted on the Hospital property.

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

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

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

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

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

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

1.15 SPECIAL PROTECTION

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

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

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

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

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

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

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

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

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

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

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

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

1.16 DISPOSAL AND RECYLING CONTAINERS/BINS

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

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

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

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

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

1.17 DUST AND DEBRIS

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

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

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

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

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

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

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

1.18 FIRE TRUCK / AMBULANCE / PUBLIC TRANSIT ACCESS

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

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

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

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

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

1.19 FIRE SAFETY REQUIREMENTS

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

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

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

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

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

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

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

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

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

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

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

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

1.20 CUTTING OPENINGS IN EXISTING BUILDINGS

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

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

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

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

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

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

.7 Jackhammering will not be permitted.

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

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

1.21 NOISE AND VIBRATION

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

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

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

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

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

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

1.22 DAMAGE DOCUMENTATION OF EXISTING WORK

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

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

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

1.23 FUMES, FLAME AND VOLATILE SUBSTANCES USE

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

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

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

1.24 SEISMIC RESTRAINT

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

Part 2 Products

Not Used.

Part 3 Execution

Not Used.

END OF SECTION

Part 1 General

1.1 MOISTURE AND MOULD CONTROL

.1 This section is to be read in conjunction with all other specification sections and does not remove, limit, or reduce the Subcontractor's responsibilities specified elsewhere.

1.2 GENERAL RESPONSIBILITIES

.1 The prevention of mould and/or the conditions that can develop mould is necessary. All Subcontractors shall be knowledgeable regarding the propagation of mould as it pertains to new building construction.

.2 Ensure that moist or wet surfaces are not covered or enclosed.

.3 Seal all floor slab penetrations before they are enclosed. Ensure all floor penetrations, within wall depth, are sealed before the second closing layer of drywall is applied.

.4 Report to the Contractor any activities or conditions that may have potential for mould/fungus development.

1.3 REPORTING

.1 Immediately report to the Contractor all water spills, leaks, and any occurrence introducing moisture into the building, building materials, or stored materials.

.2 Regularly inspect areas of work and stored materials to ensure conditions that can lead to mould propagation do not exist. Report any adverse conditions to the Contractor.

.3 Failure to immediately report incidents or unfavourable conditions will delay clean up and correction, and may result in the necessity of independent inspection for contamination. Any and all costs for independent inspection and if necessary mould remediation will be charged to the Subcontractor who is found to be responsible.

1.4 MATERIAL DELIVERY AND STORAGE

.1 Inspect materials being delivered to site for moisture damage or mould contamination. Materials that are damp or show signs of mould contamination shall be returned to the supplier. Do not allow these materials into the project.

.2 Moulds are usually visible as colourful growths and they can be virtually any colour; red, blue, brown, green, white, or black.

.3 Prior to removal of materials from shipping packaging:

.1 Inspect packaging for mould contamination;
.2 Inspect materials for mould contamination;
.3 Immediately remove the packaging from the project and place in a waste material container.

.4 If mould contamination is discovered on the packaging or material, do not disturb. Advise the Contractor immediately.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Laws, notices, permits and fees.

.2 Discovery of hazardous materials.

1.2 RELATED SECTIONS

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

1.3 LAWS, NOTICES, PERMITS AND FEES

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

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

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

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

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

1.4 HAZARDOUS MATERIAL DISCOVERY

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

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

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

1.5 PERSONNEL SMOKING

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 References and standards.

.2 Standards producing industry organizations and their addresses.

1.2 RELATED SECTIONS

.1 Section 01 61 00 - Product Requirements.

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

1.3 REFERENCES

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

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

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

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

1.4 STANDARDS PRODUCING INDUSTRY ORGANIZATIONS

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

.2 Prominent Canadian Organizations:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

.3 Commonly Referenced USA Organizations:

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

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

1.2 REFERENCES

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

1.3 QUALITY ASSURANCE

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

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

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

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

.5 Qualifications:

.1 Provide adequate workforce training through meetings and demonstrations.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Inspection and testing, administrative and enforcement requirements.

.2 Tests and mix designs.

.3 Mock-up criteria.

.4 Mill tests.

.5 Written and electronic submitted reports.

.6 Equipment and system adjustments and balance.

1.2 RELATED SECTIONS

.1 Section 01 43 00 - Quality Assurance.

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

1.3 REFERENCES

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

.2 SCC (Standards Council of Canada).

1.4 INSPECTION BY AUTHORITY

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

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

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

1.5 REVIEW BY CONSULTANT

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

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

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

1.6 INDEPENDENT INSPECTION AGENCIES

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

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

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

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

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

1.7 ACCESS TO WORK

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

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

1.8 PROCEDURES

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

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

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

1.9 REJECTED WORK

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

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

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

1.10 REPORTS

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

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

1.11 TESTS AND MIX DESIGNS

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

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

1.12 MOCK-UP

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

.2 Construct in all locations acceptable to Consultant.

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

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

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

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

1.13 MILL TESTS

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

1.14 EQUIPMENT AND SYSTEMS

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 07 84 00 – Firestopping and Smoke Seals

.2 Section 09 21 16 – Gypsum Board Assemblies

.3 Section 23 33 00 – Air Duct Accessories: Fire rated dampers and fire suppression systems

.4 Section 28 31 00 – Fire Detection and Alarm: Fire alarm and detection systems

.5 Division 26

1.2 REQUIREMENTS

.1 Conform to the following requirements to maintain the continuity of fire separations whether or not shown on the drawings.

.2 Fire separations may not be pierced by electrical or similar service outlets except in accordance with British Columbia Building Code.

.3 Non-combustible construction shall not be supported on combustible construction.

.4 Where a fire separation is required to be of non-combustible construction and terminates at the exterior wall, the underside of floor, ceiling, or roof structures, and at floors, the opening shall be firestopped with non-combustible material as specified in Section 07 84 00 Firestopping and Smokeseals.

.5 Combustible members, fastenings, and similar items shall not be used to anchor fixtures to fire separations.

.6 Openings for non-combustible pipes and ducts shall be firestopped to prevent the passage of smoke and flame. Subcontractor shall be responsible for ensuring that where their work passes through a fire separation, the opening shall be sealed with ULC labelled and approved firestopping sealant, insulation or other material approved by local authorities having jurisdiction to maintain the integrity of the fire separations.

.7 Refer to technical sections for specific requirements for sealing penetrations and joints of smoke and fire separations.

1.3 Fire Test Response Characteristics

.1 For assemblies or materials having fire resistance ratings, provide materials and construction identical to those tested in assembly indicated according to CAN/ULC S101 as verified by an independent testing and inspecting agency acceptable to authorities having jurisdiction for fire resistance ratings of specific assemblies indicated on drawings:

.2 Fire resistance rated assemblies and materials shall bear a label and proof of acceptance as indicated by design designations from ULC List of Equipment and Materials or Warnock Hersey-Intertek Directory of Listed Products. Where no design designation is provided, use only time assigned to materials listed in Appendix D of the Building Code.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Temporary utilities.

1.2 RELATED SECTIONS

.1 Section 01 45 00 – Quality Control.

.2 Section 01 52 00 - Construction Facilities.

1.3 INSTALLATION AND REMOVAL

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

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

.3 Remove from site all such work after use.

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

1.4 WATER SUPPLY

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

1.5 TEMPORARY HEATING AND VENTILATION

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

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

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

.1 Facilitate progress of Work.

.2 Protect Work and products against dampness and cold.

.3 Prevent moisture condensation on surfaces.

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

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

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

.5 Ventilating:

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

.2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.

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

.4 Ventilate storage spaces containing hazardous or volatile materials.

.5 Ventilate temporary sanitary facilities.

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

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

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

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

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

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

.1 Conform with applicable codes and standards.

.2 Enforce safe practices.

.3 Prevent abuse of services.

.4 Prevent damage to finishes.

.5 Vent direct-fired combustion units to outside.

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

1.6 TEMPORARY POWER AND LIGHT

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

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

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

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

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

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

1.7 TEMPORARY COMMUNICATION FACILITIES

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Construction aids.

.2 Office and sheds.

.3 Parking.

.4 Project identification.

1.2 RELATED SECTIONS

.1 Section 01 51 00 - Temporary Utilities.

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

1.3 REFERENCES

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

1.4 INSTALLATION AND REMOVAL

.1 Provide construction facilities to execute work expeditiously.

.2 Remove from site all such work after use.

1.5 SCAFFOLDING

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

1.6 HOISTING

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

.2 Qualified operator shall operate hoists and cranes.

1.7 USE OF THE WORK

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

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

1.8 CONSTRUCTION PARKING

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

.2 Provide and maintain adequate access to project site.

.3 Clean areas used by Contractor's equipment.

1.9 SECURITY

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

1.10 HOARDING

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

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

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

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

1.11 OFFICES

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

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

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

1.12 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

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

1.13 SANITARY FACILITIES

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

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

.2 Product substitution procedures.

.3 Manufacturer's instructions.

.4 Quality of Work, coordination, and fastenings.

.5 Existing facilities.

1.2 RELATED SECTIONS

.1 Section 01 42 00 - References:

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

1.3 TERMINOLOGY

.1 New: Produced from new materials.

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

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

1.4 PRODUCT QUALITY

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

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

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

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

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

1.5 AVAILABILITY

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

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

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

1.6 STORAGE AND PROTECTION

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

.2 Store with seals and labels intact and legible.

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

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

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

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

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

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

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

1.7 TRANSPORTATION AND HANDLING

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

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

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

1.8 EXISTING UTILITIES

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

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

1.9 MANUFACTURER'S WRITTEN INSTRUCTIONS

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

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

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

1.10 QUALITY OF WORK

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

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

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

1.11 COORDINATION

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

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

1.12 CONCEALMENT

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

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

1.13 REMEDIAL WORK

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

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

1.14 LOCATION OF FIXTURES

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

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

1.15 FASTENINGS

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

.2 Prevent electrolytic action between dissimilar metals and materials.

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

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

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

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

1.16 FASTENINGS - EQUIPMENT

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

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

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

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

1.17 PROTECTION OF WORK IN PROGRESS

.1 Prevent overloading of any part of the Project.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Substitutions.

1.2 RELATED SECTIONS

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

1.3 SUBSTITUTIONS

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

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

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

.4 A request constitutes a representation that the Bidder:

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

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

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

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

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

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

.6 Substitution Submittal Procedure:

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

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

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

Part 2 Products

Not used.

Part 3 Execution

Not used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 11 00 - Summary of Work.

.2 Section 01 32 00 - Construction Progress Documentation.

.3 Section 01 33 00 - Submittal Procedures.

.4 Section 01 45 00 - Quality Control.

.5 Section 01 61 00 - Product Requirements.

.6 Section 01 74 19 - Construction Waste Managing and Disposal.

.7 Section 01 78 00 - Closeout Submittals

.8 Appendix: Owner Supplied Equipment List

1.2 OWNER'S EQUIPMENT LIST

.1 Refer to Owner Supplied Equipment List in appendix.

1.3 DEFINITIONS

.1 Owner Furnished Products (OFP).

.1 New equipment purchased and delivered to site by Owner, to be received, unloaded, unpackaged, delivered to designated room, assembled, roughed-in, installed, and connected by Contractor.

.2 New equipment purchased and delivered to site by Owner, to be received, unloaded, delivered to designated room, unpackaged, assembled, installed, and connected by Equipment Vendor. Building services roughed-in by Contractor.

.3 Transfer Equipment: Existing relocated equipment, to be disconnected, relocated to designated room, re-assembled, roughed-in, installed, and connected by Contractor.

.2 Assemble or Assembly: fitting together of multiple components and accessories in accordance with manufacturer's instructions and specifications.

.3 Install or Installation: providing structural support and/or blocking, placing into position, anchorage and adjusting of product as indicated by drawings, specifications and manufacturer's instruction.

.4 Connect or Connection: providing mechanical and electrical services as indicated and required to interface with building services for proper operation.

.5 Abbreviations:

.1 OSVI - Owner supplied, Vendor installed.

.2 OSOI - Owner supplied, Owner installed.

.3 OSCI - Owner supplied, Contractor installed.

1.4 OWNER'S RESPONSIBILITIES

.1 Arrange for delivery of shop drawings, product data, samples, manufacturer's instructions, and certificates to Contractor in accordance with Construction Progress Schedule.

.2 Deliver supplier's bill of materials to Contractor.

.3 Arrange and pay for delivery to the Place of the Work in accordance with Construction Progress Schedule.

.4 Arrange for Vendor to receive and deliver OSVI-designated products to designated rooms.

.5 Inspect deliveries jointly with Contractor and Equipment Vendor.

.6 Submit claims for transportation damage.

.7 Arrange for replacement of damaged, defective or missing items.

.8 Arrange for manufacturer's field services; arrange for and deliver manufacturer's warranties and bonds to Contractor.

.9 Install OSOI-designated products in designated rooms.

1.5 CONTRACTOR'S RESPONSIBILITIES

.1 Obtain the necessary shop drawings from the Owner and proceed to coordinate details for installation.

.2 Designate submittals and delivery date for each Product in Construction Progress Schedule.

.3 Coordinate with Owner to expedite delivery of products in accordance with delivery date for each product in accordance with Construction Progress Schedule.

.4 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.

.5 Provide support framing for suspended products; backing/blocking and rough openings in walls and partitions to support wall mounted and recessed products; and service connections for OFP.

.6 Inspect deliveries jointly with Owner; record shortages, and damaged or defective items.

.7 Receive and handle products designated OSCI and OSVI at site, including uncrating, storage until installation, installation, connection, and testing of products. Be responsible for warranty.

.8 Protect Products from damage, and from exposure to elements.

.9 Assemble, install, connect, adjust, and finish OSCI-designated products.

.10 Coordinate and arrange with Owner for Equipment Vendor to receive and deliver OSVI-designated products to designated rooms.

.11 Arrange for installation inspections required by public authorities.

.12 Repair or replace items damaged by Contractor.

.13 This facility is a post disaster building. Contractor to coordinate and install all seismic restraints and solid blocking/backing for new and relocated owner supplied medical equipment. If seismic restraints are missing coordinate with owner to procure appropriate seismic restraints. Loose furniture does not require seismic restraint.

1.6 SUBMITTALS

.1 Shop Drawings.

.1 Owner to obtain and issue to Contractor 1 electronic copy of manufacturer's product data, shop drawings, electrical and mechanical connections, installation instructions, and all other relevant information for each Owner Furnished Product (OFP) to assist Contractor with his work.

.2 Closeout Submittals.

.1 Obtain operating and maintenance instructions, parts lists and wiring diagrams and incorporate into Operations and Maintenance Manual specified in Section 01 77 00.

.2 Turn over to Owner spare parts, maintenance materials, maintenance manuals that were included in product delivery, in accordance with Section 01 77 00.

.3 Certificates of Insurance:

.1 Obtain and issue to Owner, certificates of insurance on new and existing OFP.

.4 Record Drawings.

.1 Incorporate new and existing OFP into Project Record Drawings as specified in Section 01 77 00.

1.7 QUALITY ASSURANCE

.1 Assemble and install OFP using manufacturer's representative or trade specializing in work or assembling and installing manufacturer's products and having minimum of 3 years documented experience and written approval from manufacturer.

.2 Submit proof of installer’s qualifications.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Owner will arrange and pay for delivery of new OFP to site in accordance with construction schedule. Contractor to provide Owner with delivery and packing slips accompanying deliveries.

.2 If necessary, be responsible for costs Owner incurs, such as demurrage, warehousing and storage and delivery charges that are due to Contractor's failure to conform to mutually agreed-upon schedule for the Work, or to delays for which Contractor is responsible.

.3 Inspect deliveries jointly with Owner and jointly record shortages, and damaged or defective OFP. Owner will submit claims for transportation damage and arrange for replacement of damaged, defective or missing OFP.

.4 Receive, unload, unpackage and handle OFP on site in accordance with Section 01 61 00.

.5 Construction Waste Managing and Disposal: in accordance with Section 01 74 19.

1.9 SCHEDULING

.1 Provide Owner with dates required for receipt of submittals as specified, and for delivery of OFP to site for incorporation into project. Incorporate OFP installation dates into construction schedule specified in Section 01 32 00.

.2 Be responsible for overall coordination of OFP and associated installers within overall project schedule.

.3 Be responsible for all safety provisions of Owner-installers and ensure their attendance at regular project safety and toolbox meetings.

1.10 WARRANTY

.1 Owner will obtain and issue to Contractor, copy of manufacturer's standard warranty document.

.2 Collect and assemble all warranties and include in Maintenance Manual specified in Section 01 78 10.

1.11 INSURANCE

.1 New OFP:

.1 Include new Owner supplied - Contractor installed OFP under the Base Building Contract insurance policies.

.2 Insurance coverage for any individual piece of new OFP shall commence on the date said item is delivered to the Base Building site and has been accepted by the Base Building Contractor.

.2 Existing OFP (Transfer Equipment):

.1 Include Contractor installed existing OFP under the Base Building Contract insurance policies.

.2 Insurance coverage for any individual piece of existing OFP shall commence on the date the Base Building Contractor commences removal of the item from the existing hospital building.

.3 Owner shall provide the Contractor an estimate of the value of each piece of new and existing OFP to be included in the Base Building Contract insurance policies.

Part 2 Products

2.1 EQUIPMENT - OWNER SUPPLIED, VENDOR INSTALLED (OSVI)

.1 Refer to appendix for Owner Supplied Equipment List

2.2 WASHROOM ACCESSORIES - OWNER SUPPLIED, CONTRACTOR INSTALLED (OSCI)

.1 Paper Towel

.2 Soap Dispensers

.3 Hand Sanitizer

.4 Glove Dispenser

.5 Refer to appendix for Owner Supplied Equipment List

Part 3 Execution

3.1 PREPARATION

.1 Coordinate and prepare all required services for new and existing relocated OFP.

.2 Refer to manufacturer's shop drawings provided by Owner, for mechanical and electrical requirements for OFP relating to details of service connections or rough-ins. Provide frames and anchors for placement in other work.

3.2 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.3 INSTALLATION

.1 Coordinate with Owner, acceptable dates for removal and relocation of existing OFP. Verify condition and functioning of existing OFP with Owner prior to removal.

.2 Disconnect existing OFP from existing building services. Cap-off existing services abandoned as result of relocating OFP and as required.

.3 Dismantle walls, ceiling and other items necessary for relocation of OFP. Reassemble or repair to as-built condition walls, ceiling and other items that were dismantled and as required. Dispose of debris and clean areas affected by removal of existing OFP.

.4 Provide necessary rough-ins for new and existing relocated equipment including but not limited to, blocking, backing, conduits, wiring, electrical boxes, piping, inserts, depressions, trimming, openings, drains, canting and core drilling as indicated on shop drawings and as directed by manufacturer.

.5 Employ services of qualified installer, in accordance with paragraph 1.6.1 of this Section, to assemble, install, connect, commission and certify OFP.

.6 Install OFP products in strict accordance with manufacturer's printed instructions.

.7 Final locations of services and equipment as shown on reviewed shop drawings and Contract Documents. Report any discrepancies to Consultant

.8 Anchor fixed components firmly, square, level, plumb.

.9 Install supplied trim pieces as specified and in accordance with manufacturer's printed instructions.

.10 Repair or replace OFP damaged by own forces on site (under Contractor control).

3.4 INTERFACE WITH OTHER PRODUCTS

.1 Coordinate installation of mechanical and electrical services, rough openings, adjacent materials and equipment.

3.5 FIELD QUALITY CONTROL

.1 Manufacturer's Field Services.

.1 Arrange for manufacturer's field services to coordinate mechanical and electrical rough-ins prior to and during installation and connection of OFP.

.2 Site Tests, Inspection.

.1 Perform initial start-up of new and existing relocated OFP with Owner and manufacturer's representative present.

.2 Request inspection of installation as required by Authorities Having Jurisdiction.

3.6 OPERATIONAL CHECK

.1 When the installation is complete test equipment to confirm functionality.

.2 Test each individual item to ensure proper function.

.3 Provide commissioning report and submit copies, signed by authorized installer, to Consultant. Include one copy in operation and maintenance manual.

3.7 SYSTEM DEMONSTRATION AND TRAINING

.1 At completion of installation clean and adjust systems and controls for correct function.

.2 After final adjustment and cleaning, arrange for and provide orientation instructions and systems demonstration with Owner's designated personnel in accordance with Section 01 79 00 - Demonstration and Training.

3.8 ADJUSTING

.1 Adjust components to assure proper alignment and operation.

.2 Repair, if acceptable, or replace damaged or improperly operating items.

3.9 CLEANING

.1 Clean in accordance with Section 01 74 00.

.2 Immediately after installation and adjustment; clean surfaces to remove marks, soil and foreign matter.

.3 Prior to Substantial Completion, recheck components and perform required additional cleaning.

.4 Remove labels, protective coverings, surplus materials, excess materials, rubbish, tools and equipment.

3.10 DEMONSTRATION

.1 Owner will arrange for demonstration and testing of OFP in accordance with Section 01 79 00.

3.11 PROTECTION

.1 Protect installed products from damage until substantial performance of the Work.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Recording of subsurface conditions found.

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

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

1.2 RELATED SECTIONS

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

1.3 REFERENCES

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

1.4 SUBMITTALS

.1 Submit name and address of Surveyor to Consultant.

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

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

1.5 CONTROL OF THE WORK

.1 Prior to commencing the Work, the Contractor shall verify, at the Place of the Work, all relevant measurements and levels necessary for the proper completion of the Work and shall further carefully compare such field measurements and conditions with the requirements of the Contract Documents. Where dimensions are not included, or exact locations are not apparent in the Contract Documents, the Contractor shall immediately notify the Consultant in writing and obtain Supplemental Instructions from the Consultant before proceeding with any part of the affected work.

1.6 EXAMINATION

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

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

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

1.7 PREPARATION

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

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

1.8 EXISTING SERVICES

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

1.9 LOCATION OF EQUIPMENT AND FIXTURES

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

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

.2 Execution requirements for all Work.

1.2 RELATED SECTIONS

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

1.3 SUBMITTALS - ATTACHING TO EXISTING WORK

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

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

.2 Include in request:

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

1.4 TOLERANCES

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

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

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

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

1.5 EXECUTION

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

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

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

.4 Uncover Work to install ill-timed Work.

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

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

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

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

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

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

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

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

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

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

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

.1 Section 01 61 00 - Product Requirements.

.2 Section 07 84 00 - Firestopping.

.3 Individual Product Specification Sections:

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

1.3 SUBMITTALS

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

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

.2 Include in request:

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

Part 2 Products

2.1 MATERIALS

.1 Primary Products: Those required for original installation.

Part 3 Execution

3.1 EXAMINATION

.1 Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

.2 After uncovering existing Work, assess conditions affecting performance of work.

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

3.2 PREPARATION

.1 Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

.2 Provide protection from elements for areas which may be exposed by uncovering work.

.3 Maintain excavations free of water.

3.3 CUTTING

.1 Execute cutting and fitting including excavation and fill to complete the Work.

.2 Uncover work to install improperly sequenced work.

.3 Remove and replace defective or non-conforming work.

.4 Remove samples of installed work for testing when requested.

.5 Provide openings in the Work for penetration of mechanical and electrical work.

.6 Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

.7 Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

3.4 PATCHING

.1 Execute patching to complement adjacent Work.

.2 Fit Products together to integrate with other Work.

.3 Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.

.4 Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.

.5 Restore work with new Products in accordance with requirements of Contract Documents.

.6 Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

.7 At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material to Section 07 84 00, to full thickness of the penetrated element.

.8 Refinish surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Progressive cleaning.

.2 Cleaning prior to acceptance.

1.2 RELATED SECTIONS

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

Part 2 Products

2.1 CLEANING MATERIALS

.1 Cleaning Agents and Materials: Low VOC content.

Part 3 Execution

3.1 PROGRESSIVE CLEANING

.1 Maintain Work in tidy condition, free from accumulation of waste products and debris.

.2 Remove waste materials from site at regularly scheduled times or dispose of as directed by Consultant. Do not burn waste materials on site, unless approved by Consultant.

.3 Clear snow and ice from area of construction. Remove from site as necessary

.4 Remove waste material and debris from site and deposit in waste container at end of each working day.

.5 Dispose of waste materials and debris off site.

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

.7 Store volatile waste in covered metal containers and remove from premises at end of each working day.

.8 Provide adequate ventilation during use of volatile or noxious substances. Use of enclosure ventilation systems is not permitted for this purpose.

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

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

3.2 CLEANING PRIOR TO ACCEPTANCE

.1 Prior to applying for Substantial Performance of the Work, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.

.2 Remove waste products and debris and leave Work clean and suitable for occupancy.

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

.4 Remove waste materials from site at regularly scheduled times. Do not burn waste materials on site. Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.

.6 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.

.7 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors.

.8 Clean lighting reflectors, lenses, and other lighting surfaces.

.9 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

.10 Clean and polish surface finishes, as recommended by manufacturer.

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

.12 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.

.13 Remove dirt and other disfiguration from exterior surfaces.

.14 Clean and sweep roofs, gutters, areaways, and sunken wells.

.15 Sweep and wash clean paved areas.

.16 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.

.17 Clean roof surfaces, down-spouts, and drainage components.

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

.19 Remove snow and ice from access to facilities.

3.3 FINAL PRODUCT CLEANING

.1 Execute final cleaning prior to final project assessment.

.2 Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum and wash flooring surfaces.

.3 Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

.4 Replace filters of operating equipment.

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

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Adjusting products and equipment required by all specifications sections for this Project.

1.2 RELATED SECTIONS

.1 Section 01 74 00 - Cleaning and Waste Processing.

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

1.3 PURPOSE

.1 Perform testing adjusting and balancing of operating systems.

.2 Prior to start of balancing, ensure systems are:

.1 Piped, ducted, wired and wireless services and systems, including components and equipment forming part thereof.

.2 Manually and mechanically operated, including components and equipment forming any part.

.3 Testing, adjusting and balancing will not be started until after all static checks have been completed for the system being balanced and signed off on the commissioning report forms.

.4 Contractor to ensure systems are operated at designated times, under conditions required for proper testing, adjusting, and balancing.

.5 Report any deficiencies or defects which may affect the balancing or noted during testing, adjusting and balancing, which cannot be promptly corrected.

Part 2 Products

2.1 NOT USED.

Part 3 Execution

3.1 PREPARATION

.1 Prepare each system and item of equipment for testing, adjusting and balancing.

.2 Verify that each system and equipment installation is complete and in functional operation.

.3 Verify appropriate ambient conditions.

3.2 TESTING

.1 Tests will be conducted to confirm compliance with requirements of Contract Documents. Take corrective action as necessary.

3.3 ADJUSTING

.1 Adjust operating Products and equipment to ensure smooth and unhindered operation.

.2 Provide equipment required to ensure proper, efficient and safe operation of all equipment including belts and sheaves.

3.4 BALANCING

.1 Cooperate with and assist the balancing agent to ensure that the various parts of system are in a proper state of equilibrium.

END OF SECTION

PART 1 GENERAL

1.1 OPERATING AND MAINTENANCE MANUALS

.1 Submit to the Consultant one (1) copy of maintenance, operating and instruction manuals.

.2 Separately bound manuals are to be prepared for the following trade work:

1) Building: Architectural elements, fixtures, finishes, casework, hardware, specialties, etc.

2) Mechanical: Heating ventilating, air conditioning, etc.

3) Plumbing: Plumbing, fire sprinklers, etc.

4) Electrical: Power, lighting, fire alarm system, data, communications, security, etc.

.3 Provide maintenance manuals in hard and electronic format as specified hereafter, giving full operating and maintenance instructions for each system and major piece of equipment, as well as, maintenance instructions for building elements, fixtures and finishes.

.4 Manuals are to contain pertinent maintenance operational and installation instruction information on equipment, materials cleaning and lubrication schedules, filters, overhaul, replacement, adjustment schedules, and emergency procedures as applicable. Instructions in manuals shall be in simple language so as to guide the Owner in the proper operation and maintenance of building material, components, equipment and systems.

.5 Include all items covered by Change Orders.

.6 Update the manuals periodically during the installation and commissioning phase of the Work so that the manuals are final by the scheduled turnover date.

.7 Include equipment supplied by the Owner and pre-tendered equipment.

.8 Binders:

1) Binders shall be ACCO Canadian Co. Ltd. or approved substitution as follows:

2) ACCO Inview D-Ring Binders – color Black
1 inch – 41805-0
2 inch - 41807

3) ACCO expanding bar-lock catalogue binder - color Black
3 to 5.5 inches – 05436-0

.9 Pages:

1) Descriptions and lists are to be neatly typed or printed on 216 mm x 280 mm heavy bond paper. Duplicate pages shall be made by electrostatic dry copier.

2) The maximum paper size for schedules and diagrams is 280 mm x 432 mm. Larger paper sizes will be accepted for diagrams only if a mylar sepia is provided for each sheet.

3) Alphabetical index tab separators are to be used in each manual to identify each information “Section”.

.10 Manual contents shall be organized into applicable categories of Work, parallel to specifications divisions and sections.

.11 Architectural manuals shall include in general, but shall not necessarily be limited to, the following:

1) List of all Subcontractors, manufacturers, suppliers, complete with addresses and telephone and facsimile numbers.

2) Copy of hardware schedule and paint schedules, complete with the actual manufacturer, supplier and identification names and numbers.

3) All manufacturer’s equipment, materials, products, data, details, identification, list, schedules of maintenance, operational and installation instruction information as required in accordance with the various sections of the specification.

4) All extended guarantees, warranties, maintenance bonds, certificates, letters of guarantees, registration cards, as called for in the various sections of the specification, with the following information:

.1 Name and address of subject.
.2 Commencement date (Substantial Performance of the Work) of guarantees and warranties.
.3 Duration and expiry date of guarantees and warranties.
.4 Signature and seal of the Contractor, installer, manufacturer and/or supplier as applicable.

5) Complete set of all final reviewed shop drawings.

6) Certificates of Inspection.

7) Test reports and certificates as applicable.

8) Confirmation letters of all extra, reserve, replacement materials as required in accordance with various sections of the specification has been properly handed over and received by the Owner in good order.

9) Confirmation letters of all portable units, equipment, materials such as fire extinguishers, special tools, keys for all equipment and/or panels, elevator pads/accessories, keys to millwork, casework, has been properly handed over and received by the Owner in good order.

10) Submit to the Consultant one (1) copy of plumbing/mechanical and electrical manuals in accordance with this section and to detailed requirements specifically set out in the various sections of the specification as applicable.

1.2 ELECTRONIC COPIES OF MANUALS

.1 In addition to the printed copies, submit electronic copies of all operating and maintenance data.

.2 Submit data on “read only” CDs. Provide one (1) copy of each CD for the Owner and 1 copy to the Consultant.

.3 Do not provide separate CDs for each major section. Use more than one CD only if the volume of data exceeds the capacity of a single CD. Professionally label each CD and CD jewel case, including the name of the Owner, project and CD title.

.4 Organize electronic data using directories and sub-directories. Prior to assembling the electronic data, submit to the Consultant a detailed list of the proposed directory/sub-directory structure including proposed files names. File names to be easily recognizable without the need to open the document to know what information the file contains. Directory structure and file naming is subject to the approval of the Consultant.

.5 Provide information in Portable Document Format (PDF). Break down large files into sections and use bookmark structure for easy navigation.

PART 2 PRODUCTS

2.1 NOT USED

.1 Not used

PART 3 EXECUTION

3.1 NOT USED

.1 Not used

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Inspections and declarations.

.2 Closeout submittals

.3 Operation and maintenance manual format.

.4 Contents each volume.

.5 Recording actual site conditions.

.6 Record (as-built) documents and samples.

.7 Record documents.

.8 Final survey.

.9 Warranties and bonds.

1.2 RELATED SECTIONS

.1 Section 01 33 00 - Submittal Procedures.

.2 Section 01 45 00 - Quality Control.

.3 Section 01 79 00 - Demonstration and Training.

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

1.3 INSPECTIONS AND DECLARATIONS

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

.1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.

.2 Request Consultant's Inspection.

.2 Consultant's Inspection: Consultant and Contractor will perform inspection of Work to identify defects or deficiencies. Correct defective and deficient Work accordingly.

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

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

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

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

.4 Certificates required by authorities having jurisdiction have been submitted.

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

.6 Work is complete and ready for Final Inspection.

.4 Final Inspection: When items noted above are completed, request final inspection of Work by Owner, Consultant and Contractor. If Work is deemed incomplete by Consultant, complete outstanding items and request re-inspection.

.5 Declaration of Substantial Performance: when Consultant considers deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for Substantial Performance of the Work.

.6 Commencement of Warranty Periods: the date of Substantial Performance of the Work shall be the date for commencement of the warranty period.

.7 Commencement of Lien Periods: the date of publication of the certificate of Substantial Performance of the Work shall be the date for commencement of the lien period, unless required otherwise by the lien legislation applicable at the Place of the Work.

.8 Final Payment: When Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been completed, make application for final payment.

.9 Payment of Hold-back: After issuance of certificate of Substantial Performance of the Work, submit an application for payment of hold-back amount.

1.4 CLOSEOUT SUBMITTALS

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

.1 Guarantees;

.2 warranties;

.3 certificates;

.4 testing and balancing reports;

.5 distribution system diagrams;

.6 spare parts;

.7 maintenance manuals;

.8 samples;

.9 existing reports and correspondence from authorities having jurisdiction in the Place of the Work.

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

.2 Where the Contractor is unable to deliver the documents and materials described in paragraph 5.4.4, then, provided that none of the missing documents and materials interferes with the use and occupancy of the Project in a material way, the failure to deliver shall not be grounds for the Consultant to refuse to certify Substantial Performance of the Work.

1.5 OPERATION AND MAINTENANCE MANUAL SUBMITTALS

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

.2 Copy will be returned after final inspection with Consultant's comments.

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

.4 Two (2) weeks prior to Substantial Performance of the Work, submit to the Consultant, two (2) final copies of operating and maintenance manuals in Canadian English.

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

.6 If requested, furnish evidence as to type, source and quality of products provided.

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

.8 Pay costs of transportation.

1.6 OPERATION AND MAINTENANCE MANUAL FORMAT

.1 Organize data in the form of an instructional manual.

.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.

.3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.

.4 Cover: Identify each binder by discipline: list title of project and identify subject matter of contents.

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

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Provide manufacturer's product data, including stamped shop drawings, colour selections, cleaning and care documentation, etc.

.8 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.7 CONTENTS - EACH VOLUME

.1 Table of Contents: Provide:

.1 Title of project.

.2 Date of submission.

.3 Names, addresses, and telephone numbers of Consultant and Contractor with name of responsible parties.

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

.2 For each product or system, list names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00.

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

.5 Certificate of Acceptance: Relevant certificates issued by authorities having jurisdiction, including code compliance certificate.

.6 Training: Refer to Section 01 79 00.

1.8 RECORDING ACTUAL SITE CONDITIONS

.1 Record information on set of black line opaque drawings, and within the Project Manual, provided by Consultant.

.2 Annotate with coloured felt tip marking pens, maintaining separate colours for each major system, for recording changed information.

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

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

.1 Measured depths of elements of foundation in relation to finish first floor datum.

.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

.3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.

.4 Field changes of dimension and detail.

.5 Changes made by change orders.

.6 Details not on original Contract Drawings.

.7 References to related shop drawings and modifications.

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

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

.2 Changes made by Addenda and change orders.

.6 Other Documents: Maintain manufacturer's certifications, inspection certifications and field test records required by individual specifications sections.

1.9 RECORD (AS-BUILT) DOCUMENTS AND SAMPLES

.1 In addition to requirements in General Conditions, maintain at the site for Consultant, one (1) record copy of:

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

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

.3 Label as-built documents and file in accordance with section number listings in List of Contents of the Project Manual. Label each document "AS-BUILT DOCUMENTS" in neat, large, printed letters.

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

.5 Keep as-built documents and samples available for inspection by Consultant.

.6 Submit to Consultant for inclusion in electronic documents.

1.10 WARRANTIES AND BONDS

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

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

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten (10) days after completion of the applicable item of work.

.4 Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Performance is determined.

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

.6 Co-execute submittals when required.

.7 Retain warranties and bonds until time specified for submittals.

1.11 RECORDS/DAILY REPORTS/DAILY LOGS

.1 The Contractor shall maintain and keep accurate Project records (which means all tangible records, documents, computer printouts, electronic information, books, plans, Drawings, Specifications, accounts or other information relating to the Work) in its office in accordance with the requirements of law, but in any event for not less than 6 years from Substantial Performance of the Work or until all claims have been settled. During this time, the Contractor shall allow Owner and Consultant access to the Project records during normal business hours upon the giving of reasonable notice. The Contractor shall ensure that equivalent provisions to those provided herein are made in each subcontract and shall require the Subcontractors and Suppliers to incorporate them into every level of contract thereunder for any part of the Work.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Equipment and systems.

.2 Materials and finishes.

.3 Spare parts.

.4 Maintenance manuals.

.5 Special tools.

.6 Storage, handling and protection.

1.2 RELATED SECTIONS

.1 Section 01 45 00 - Quality Control.

.2 Section 01 78 30 – Spare Parts Maintenance Materials.

1.3 EQUIPMENT AND SYSTEMS

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

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

.3 Include installed colour coded wiring diagrams.

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

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

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

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

.8 Include sequence of operation by controls manufacturer.

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

.10 Provide installed control diagrams by controls manufacturer.

.11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.

.12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

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

.14 Include test and balancing reports as specified in Section 01 45 00 and 01 75 19.

.15 Additional requirements: As specified in individual specification sections.

Part 2 Products

2.1 MATERIALS AND FINISHES

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

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

.3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

.4 Building Envelope: include copies of drawings of building envelope components, illustrating the interface with similar or dissimilar items to provide an effective air, vapour and thermal barrier between indoor and outdoor environments. Include an outline of requirements for regular inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.

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

2.2 SPARE PARTS

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

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

.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

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

2.3 MAINTENANCE MATERIALS

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

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

.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

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

2.4 SPECIAL TOOLS

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

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

.3 Receive and catalogue all items. Submit inventory listing to Consultant. Include approved listings in Maintenance Manual.

Part 3 Execution

3.1 DELIVER TO SITE

.1 Deliver to site; place and store. Turn maintenance materials over to Owner in one transaction.

3.2 STORAGE, HANDLING AND PROTECTION

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

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

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

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

.5 Remove and replace damaged products at own expense and to satisfaction of Consultant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 77 00 – Contract Closeout Procedures

.2 Divisions 2 through 28 of the Project Manual for individual products or systems as specified in individual sections and not otherwise listed in this section.

1.2 SOURCE OF SUPPLY

.1 Provide spare parts manufactured by original equipment manufacturer.

.2 Provide maintenance materials identical to those installed.

1.3 DELIVERY, STORAGE, AND HANDLING

.1 Deliver required items to the Place of the Work and store in temporary locations determined by Contractor or permanent locations designated by Owner.

.2 Deliver and store items in original factory packaging or other securely packaged form.

.3 Identify, on carton or package, name of item, colour or part number, as applicable. Identify equipment, system, area, room no., etc. for which each item is intended.

.4 Maintain an inventory list of all items delivered. For each item, record description of item, quantity, and location where stored.

.5 Stored items shall remain in Contractor's care, custody, and control until Substantial Performance of the Work. Protect stored items against theft or damage.

.6 Handle items as necessary, until stored in permanent locations designated by Owner.

1.4 ACCEPTANCE

.1 Prior to requesting inspection for Substantial Performance, do the following:

- .1 Review Contract Documents and compare with inventory list to verify that all required items have been delivered.
- .2 Verify that items listed on inventory list are in their designated storage locations.
- .3 Inspect items to verify that they meet specified requirements and are in serviceable condition.
- .4 Arrange for delivery of any missing items.
- .5 Arrange for replacement of items not meeting specified requirements or not in serviceable condition.
- .6 Provide Owner with copy of inventory list indicating status of all required items.

.2 Review inventory list with Owner for Substantial Performance.

1.5 SCHEDULE

.1 Provide spare parts and maintenance materials specified in the following Sections. Maintenance materials shall be whole pieces, boxed and packaged in original wrapping or wrapped and identified for material and location within the building:

Section Number (Regardless of Trade Package)	Material	Quantity
08 71 00	Door Hardware	Turn over all spare parts and misc. adjustment tools as required.
09 51 13	Acoustic Panel Ceilings	1% of total installation with minimum 3 boxes of acoustic tile. Provide 5 wood ceiling tiles for repairs.
09 65 16	Resilient Flooring: Sheet Vinyl	2% of total installation with a minimum of 10m^2 of each colour and type. 7.62m (25') of rubber base min. of each colour (Not short scraps)
09 91 00	Painting	Minimum of 4-4 L containers of field colours and 4-1 L containers of each accent colour, and all remnants.
10 26 13	Wall Protection	3 sheets of each panel colour and type including weld materials. Including spare parts for hand rail and bumper rails.

.2 Mechanical spare parts and maintenance materials as specified in Division 22.

.3 Electrical spare parts and maintenance materials as specified in Division 26 and 27.

.4 Other Sections that may specify spare parts and maintenance materials.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 73 00 –Execution

.3 Section 01 77 00 –Closeout Procedures

1.2 DESIGNATION OF PROJECT RECORD DOCUMENTS

.1 Designate one copy of the following documents to be retained as project record documents:

.1 One copy of Project Manuals (specifications).
.2 One complete set of Drawings.
.3 One set of all Addenda issued.
.4 One set of approved Change Orders and Supplementary Instructions.

.2 Subtrades shall report to the Contractor all required information for recording of information on Project Record Drawings.

.3 Record Documents shall consist of Division 1 to 28 of the Project Manual and all Drawings issued for construction and as modified.

1.3 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

.1 Provide red-line drawings to the Owner with the exception of both Mechanical and Electrical Subcontractors.

.2 Mechanical and Electrical Subcontractors shall record their information on red-line drawings and return to Contractor for final coordination.

.3 Use coloured erasable pencils to record information.

.4 Subcontractors shall report to Contractor all changes and variations from Contract Drawings concurrently with construction process. Do not conceal any work until required information is recorded.

.5 Subcontractor shall provide sufficient information so that Contractor can legibly mark project record drawings to record actual construction including, but not limited to the following:

.1 Measured locations of internal utilities and appurtenances concealed in construction. Reference to visible and accessible features of construction.
.2 Field changes of dimension and detail.
.3 Changes to equipment layout and services.
.4 Deviations in piping, duct runs, wiring, and utility connections.
.5 **Actual locations** of mechanical and electrical equipment, plumbing lines, electrical, data and communications lines **referenced to fixed structural elements** for items that are schematically indicated in Contract Documents.
.6 Clearly identify locations of fire dampers, major control lines, access doors, tagged valves, and actual final room names or numbers.
.7 Changes in construction materials or locations required by on-site conditions and to make components of the Work come together.

.8 Changes required by Addenda, Bid Revisions, Change Orders, Work Orders and Construction Communications.
.9 Other information identified in specific sections of the Specifications.

.6 Contractor shall maintain Record Documents at the site office and make available for review during all site meetings.

.7 Subcontractor shall make recordings immediately after the respective Work is completed and not less than once a week. Each recording shall be dated.

.8 Changes to specification sections shall be legibly noted in the margins of the document or by stapling a sheet of white paper to the margin and referencing the affected article(s). Use of adhesive tape or self-sticking removable notes will not be acceptable for this purpose.

.9 The Contractor shall provide a paper or electronic copy (PDF) of the as-built drawings to the consultant for the preparation of the final record documents..

.10 The Consultant's review of Record Documents is not a verification of the accuracy of the record drawings. Responsibility for accuracy lies solely with the Contractor:

.1 Where subsequent reviews or modifications to the Work occur during the Warranty Period indicate that the Record Drawings contain inaccuracies, the Owner reserves the right to verify or survey as-built conditions by an independent agency.
.2 Where inaccuracies are contained within the Record Drawings, the Contractor will be responsible for costs of independent survey agency and costs related to revisions to the Record Drawings.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

.2 Seminars and demonstrations.

1.2 RELATED SECTIONS

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

1.3 DESCRIPTION

.1 Demonstrate scheduled operation and maintenance of equipment and systems to Owner's personnel two (2) weeks prior to date of final inspection.

.2 Owner will provide list of personnel to receive instructions and will coordinate their attendance at agreed-upon times.

1.4 COMPONENT DEMONSTRATION

.1 Manufacturer to provide authorized representative to demonstrate operation of equipment and systems.

.2 Instruct Owner's personnel and provide written report that demonstration and instructions have been completed.

1.5 SUBMITTALS

.1 Submit schedule of time and date for demonstration of each item of equipment and each system two (2) weeks prior to designated dates, for Consultant's approval.

.2 Submit reports within one (1) week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

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

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

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 PREPARATION

.1 Verify that suitable conditions for demonstration and instructions are available.

.2 Verify that designated personnel are present.

.3 Prepare agendas and outlines.

.4 Establish seminar organization.

.5 Explain component design and operational philosophy and strategy.

.6 Develop equipment presentations.

.7 Present system demonstrations.

.8 Accept and respond to seminar and demonstration questions with appropriate answers.

3.2 PREPARATION OF AGENDAS AND OUTLINES

.1 Prepare agendas and outlines including the following:

.1 Equipment and systems to be included in seminar presentations.

.2 Name of companies and representatives presenting at seminars.

.3 Outline of each seminar's content.

.4 Time and date allocated to each system and item of equipment.

.5 Provide separate agenda for each system

3.3 SEMINAR ORGANIZATION

.1 Coordinate content and presentations for seminars.

.2 Coordinate individual presentations and ensure representatives scheduled to present at seminars are in attendance.

.3 Arrange for presentation leaders familiar with the design, operation, maintenance and troubleshooting of the equipment and systems. Where a single person is not familiar with all aspects of the equipment or system, arrange for specialists familiar with each aspect.

.4 Coordinate proposed dates for seminars with Owner and select mutually agreeable dates.

3.4 EXPLANATION OF DESIGN STRATEGY

.1 Explain design philosophy of each system. Include following information:

.1 An overview of how system is intended to operate.

.2 Description of design parameters, constraints and operational requirements.

.3 Description of system operation strategies.

.4 Information to help in identifying and troubleshooting system problems.

3.5 DEMONSTRATION AND INSTRUCTIONS

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

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

.3 Instruct personnel on control and maintenance of sensory equipment and operational equipment associated with maintaining energy efficiency and longevity of service.

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

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

.6 Video record the demonstration and provide copy to Owner.

END OF SECTION

1.0 PART 1 – GENERAL

1.1 GENERAL

.1 Commissioning Authority:

.1 An independent firm (CES Engineering Ltd) specializing in building systems commissioning type of work has been retained by the Owner (Interior Health) to act as the project Commissioning Authority (CA). This firm will be responsible to manage and administrate the commissioning process on this project.

.2 The CA directs and coordinates the commissioning activities and the reports to the Owner and Architect and Design Engineers (A/E). All members work together to fulfill their contracted responsibilities and meet the objectives of the Contract Documents.

.2 Commissioning Definition:

.1 Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the owner's operational needs. This is achieved by beginning in the design phase and documenting the owner's project requirements, design intent and continuing through construction, acceptance and the warranty period with actual verification of performance. The commissioning process shall encompass and coordinate the traditionally separate functions of system documentation, equipment startup, control system calibration, testing and balancing, performance testing and training.

.3 Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents:

.1 Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.

.2 Verify and document proper performance of equipment and systems.

.3 Verify that O&M documentation left on site is complete and

.4 Verify that the Owner's operating personnel are adequately trained.

.4 The commissioning process does not take away from or reduce the responsibility of the installing contractors to provide a finished and fully functioning product.

.5 Abbreviations:

.1 The following are common abbreviations used in the Commissioning Specifications and in the Commissioning Plan. Definitions are found in subsequent paragraphs.

OW:	Owner/Owner's Representative	PM:	Project Manager (of the Owner)
CA:	Commissioning Authority	GC:	General Contractor (prime)
Cx:	Commissioning	MC:	Mechanical Contractor
Cx Plan:	Commissioning Plan Document	CC:	Controls Contractor
PC:	Pre-functional Checklist	TAB:	Test and Balance Contractor
FT:	Functional Performance Test	EC:	Electrical Contractor
A/E:	Architect and Design Engineers	Subs:	Subcontractors

1.2 CODES, REFERENCES AND STANDARDS

.1 Commissioning Standards:

.1 The administration of the commissioning process is based on the CSA Z8001-13 Commissioning of Healthcare Facilities.

.2 Comply with applicable Municipal, Provincial, and National Codes, Standards and bylaws, including Federal Environmental Health standards as specified in other sections.

1.3 RELATED WORK

.1 Specific commissioning requirements are given in the following sections of these specifications or are directly related to the commissioning process. All of the following sections apply to the Work of this section.

.1 01 91 14 – Commissioning Plan

.2 01 91 15 – Commissioning Training

.3 21 05 93 – Testing and Adjusting for Fire Protection Systems

.4 21 08 00 – Commissioning for Fire Suppression Systems

.5 22 05 93 – Testing and Adjusting for Plumbing Systems

.6 22 08 00 – Commissioning of Plumbing Systems

.7 23 05 93 – Testing, Adjusting and Balancing for HVAC Systems: Alerts balancer of Cx responsibilities in 01 91 13 and 23 08 00.

.8 25 05 10 – Building Automation System: Alerts the BAS contractor of Cx responsibilities in 01 91 13 and 23 08 00.

.9 23 08 00 – Commissioning of HVAC Systems

.10 26 05 03 – Commissioning of Electrical

1.4 SYSTEMS TO BE COMMISSIONED

.1 Mechanical Systems

.1 Division 21: Fire Suppression

.2 Division 22: Plumbing

.3 Division 23: Heating Ventilation and Air Conditioning (HVAC)

.4 Division 25: Integrated Automation

.2 Electrical Systems

.1 Division 26: Electrical

.3 Communication Systems

.1 Division 27: Communication System

.4 Electronic Safety and Security

.1 Division 28: Electronic Safety and Security

1.5 COMMISSIONING TEAM:

.1 The members of the commissioning team consist of the Commissioning Authority (CA), the Project Manager (PM), the designated representative of the Owner's firm (OW), the General Contractor (GC), the architect and design engineers (A/E), the Mechanical Contractor (MC), the Electrical Contractor (EC), the TAB Contractor, the Controls Contractor (CC), any other installing subcontractors (Subs) or suppliers of equipment. The Owner's building or plant operator/engineer is also a member of the commissioning team.

.2 The commissioning team for this project includes the following members:

.1 Owner/Owner's Project Manager (OW/PM): Interior Health Authority
.2 Commissioning Authority (CA): CES Engineering Ltd
.3 Architect (A): Stantec Architecture Ltd.
.4 Mechanical Consultant (ME): Stantec Consulting Ltd.
.5 Electrical Consultant (EE): Stantec Consulting Ltd.
.6 Structural Consultant (SE): Stantec Consulting Ltd.
.7 General Contractor (GC)
.8 Mechanical Contractor (MC)
.9 Sheet Metal Contractor
.10 Fire Protection Contractor
.11 Controls Contractor (CC)
.12 Testing and Balancing Agency (TAB)
.13 Division(s) 20 - 25 Specialty Equipment Vendor Specialists
.14 Electrical Contractor (EC)
.15 Division 26 Specialty Equipment Vendor Specialists

1.6 COMMISSIONING PROCESS OVERVIEW

.1 Commissioning Plan:

.1 The Commissioning Plan provides guidance in the execution of the commissioning process. The CA will develop the draft Commissioning Plan in early construction and circulate to the project team for review. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the "final" plan, though it will continue to evolve and expand as the project progresses. The Specifications will take precedence over the Commissioning Plan.

.2 Commissioning Process: The following provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.

.1 Commissioning during construction begins with a scoping meeting conducted by the CA where the commissioning process is reviewed with the commissioning team members.
.2 Additional meetings will be required throughout construction, scheduled by the CA with necessary parties attending, to plan, scope, coordinate, schedule future activities and resolve problems.
.3 Equipment documentation is submitted to the CA during normal submittals, including detailed start-up procedures.

.4 The CA works with the MC, EC and the Subs in developing startup plans and startup documentation formats, including providing the MC, EC and the Subs with pre-functional checklists to be completed, during the startup process.

.5 In general, the checkout and performance verification proceeds from simple to complex; from component level to equipment to systems and intersystem levels with Pre-functional checklists being completed before functional testing.

.6 The MC, EC and the Subs, under GC direction, execute and document the Pre-functional checklists and perform startup and initial checkout. The CA documents that the checklists and startup were completed according to the approved plans. This may include the CA witnessing start-up of selected equipment.

.7 The CA develops specific equipment and system functional performance test procedures. The MC, CC and the Subs review the procedures.

.8 The procedures are executed by the MC, EC and the Subs, under the direction of, and documented by the CA.

.9 Items of non-compliance in material, installation or setup are corrected at the MC, EC and the Sub's expense and the system retested.

.10 The CA reviews the O&M documentation for completeness.

.11 Commissioning shall be completed before Substantial Completion.

.12 The CA reviews, pre-approves and coordinates the training provided by the MC, EC and the Subs and verifies that is was completed.

.13 Deferred testing is conducted, as specified or required.

1.7 RESPONSIBILITIES

.1 Overview

.1 The responsibilities of various parties in the commissioning process are provided in this section. The responsibilities of the mechanical contractor, TAB and controls contractor are in *Section 23 08 00* and those of the electrical contractor in *Section 26 05 03*.

.2 It is noted that the commissioning services for the Project Manager, General Contractor, Architect, HVAC mechanical and electrical Consultants / engineers, and Commissioning authority are not provided by the contractors in this contract. That is, the Contractor is not responsible for providing their services. Their responsibilities are listed here to clarify the commissioning process.

.2 All Parties

.1 Follow the Commissioning Plan.

.2 Attend commissioning scoping meeting and additional meetings, as necessary.

.3 Architect (of A/E)

.1 Construction and Acceptance Phase

.1 Attend the commissioning scoping meeting and selected commissioning team meetings.

.2 Perform normal submittal review, construction observation, as-built drawing preparation, O&M manual review, etc., as contracted.

.3 Provide any design narrative documentation requested by the CA.

.4 Coordinate resolution of system deficiencies identified during commissioning, according to the contract documents

.2 Warranty Period

.1 Coordinate resolution of design non-conformance and design deficiencies identified during warranty-period commissioning.

.4 Mechanical and Electrical Consultants (of the A/E)

.1 Construction and Acceptance Phase

.1 Perform normal submittal reviews, construction observation, O&M manual review etc., as contracted. One site observation should be completed just prior to system startup.

.2 Provide any design narrative and sequences documentation requested by the CA. The Consultants shall assist (along with the contractors) in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.

.3 Attend commissioning scoping meetings and other selected commissioning team meetings as required or via conference call.

.4 Participate in the resolution of system deficiencies identified during commissioning, according to the contract documents

.5 Provide a design overview presentation if requested at one of the training sessions for the Owner's personnel.

.6 Witness testing of selected pieces of equipment and systems

.2 Warranty Period

.1 Participate, as required, in the resolution of non-compliance, non-conformance and design deficiencies identified during commissioning during warranty-period commissioning.

.5 Commissioning Authority (CA)

.1 The primary role of the CA is to develop and coordinate the execution of a testing plan, observe and document performance—that systems are functioning in accordance with the documented design intent and in accordance with the Contract Documents. The Contractors will provide all tools or the use of tools to start, check-out and functionally test equipment and systems. The CA is not responsible for design concept, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management. The CA may assist with problem-solving non-conformance or deficiencies, but ultimately that responsibility resides with the General Contractor.

.2 Construction and Acceptance Phase

.1 Coordinates and directs the commissioning activities in a logical, sequential and efficient manner using consistent protocols and forms, centralized documentation, clear and regular communications and consultations with all necessary parties, frequently updated timelines and schedules and technical expertise.

.2 Coordinate the commissioning work with the GC, ensure that commissioning activities are being scheduled into the master schedule.

.3 Revise, as necessary, *Commissioning Plan.*

.4 Plan and conduct a commissioning scoping meeting and other commissioning meetings.

.5 Request and review additional information required to perform commissioning tasks, including O&M materials, contractor start-up and checkout procedures.

.6 Before startup, gather and review the current control sequences and interlocks and work with contractors and design engineers until sufficient clarity has been obtained, in writing, to be able to write detailed testing procedures.

.7 Review normal Contractor submittals applicable to systems being commissioned for compliance with commissioning needs, concurrent with, or upon completion of, the A/E reviews.

.8 Write and distribute pre-functional tests and checklists.

.9 Develop an enhanced start-up and initial systems checkout plan with Subs.

.10 Perform site visits, as necessary, to observe component and system installations. Attends selected planning and job-site meetings to obtain information on construction progress. Review construction meeting minutes for revisions/substitutions relating to the commissioning process. Assist in resolving any discrepancies.

.11 Witness all or part of the HVAC piping test and flushing procedure, sufficient to be confident that proper procedures were followed. Notify owners project manager of any deficiencies in results or procedures.

.12 Witness all or part of any ductwork testing and cleaning procedures, sufficient to be confident that proper procedures were followed. Notify owner's project manager of any deficiencies in results or procedures.

.13 Approve pre-functional tests and checklist completion by reviewing pre-functional checklist reports and by selected site observation and spot checking.

.14 Approve systems startup by reviewing start-up reports and by selected site observation.

.15 Review TAB execution plan.

.16 Oversee sufficient functional testing of the control system and approve it to be used for TAB, before TAB is executed.

.17 Approve air and water systems balancing by spot testing, by reviewing completed reports and by selected site observation.

.18 With necessary assistance and review from installing contractors, write the functional performance test procedures for equipment and systems. This may include energy management control system trending, stand-alone datalogger monitoring or manual functional testing. Submit to GC for review, and for approval if required.

.19 Analyze any functional performance trend logs and monitoring data to verify performance.

.20 Coordinate, witness and approve manual functional performance tests performed by installing contractors. Coordinate retesting as necessary until satisfactory performance is achieved.

.21 Maintain a master deficiency and resolution log and a separate testing record. Provide the GC with written progress reports and test results with recommended actions.

.22 Witness performance testing of fire / smoke dampers and other fire alarm systems by others and other owner contracted tests or tests by manufacturer's personnel over which the CA may not have direct control. Document these tests and include this documentation in the Commissioning Report.

.23 Review equipment warranties to ensure that the Owner's responsibilities are clearly defined.

.24 Oversee and approve the training of the Owner's operating personnel.

.25 Review and approve the preparation of the O&M manuals.

.26 Provide a final Commissioning Report (as described in this section).

.27 Prepare a standard trend logging package of primary parameters that will provide the operations staff clear indications of system function in order to identify proper system operation and trouble shoot problems. The CA shall also provide any needed information on interpreting the trends.

.3 Warranty Period

.1 Coordinate and supervise required seasonal or deferred testing and deficiency corrections.

.2 Return to the site at 10 months into the 12 month warranty period and review with facility staff the current building operation and the condition of outstanding issues related to the original and seasonal commissioning. Also interview facility staff and identify problems or concerns they have operating the building as originally intended. Make suggestions for improvements and for recording these changes in the O&M manuals. Identify areas that may come under warranty or under the original construction contract. Assist facility staff in developing reports, documents and requests for services to remedy outstanding problems.

.6 Owner/Owner's Representative (OW)

.1 Construction and Acceptance Phase

.1 Review and approve the final Commissioning Plan—Construction Phase.

.2 Attend a commissioning scoping meeting and other commissioning team meetings.

.3 Perform the normal review of Contractor submittals.

.4 When necessary, observe and witness pre-functional checklists, startup and functional testing of selected equipment.

.5 Assist the GC in coordinating the training of owner personnel.

.2 Warranty Period

.1 Assist the CA as necessary in the seasonal or deferred testing and deficiency corrections required by the specifications.

.7 Project Manager (PM)

.1 Construction and Acceptance Phase

.1 Manage the contract of the A/E and of the GC.

.2 Arrange for facility operating and maintenance personnel to attend various field commissioning activities and field training sessions according to the *Commissioning Plan*.

.3 Provide final approval for the completion of the commissioning work.

.2 Warranty Period

.1 Ensure that any seasonal or deferred testing and any deficiency issues are addressed.

.8 General Contractor (GC)

.1 Construction and Acceptance Phase

.1 Facilitate the coordination of the commissioning work by the CA and ensure that commissioning activities are being scheduled into the master schedule.

.2 Include the cost of participating in the commissioning process as outlined in the specifications in the total contract price.

.3 Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings related to commissioned equipment to the CA.

.4 In each purchase order or subcontract written, include requirements for submittal data, O&M data, commissioning tasks and training.

.5 Ensure that all Subs execute their commissioning responsibilities according to the Contract Documents and schedule.

.6 A representative shall attend a commissioning scoping meeting and other necessary meetings scheduled by the CA to facilitate the Cx process

.7 Coordinate the training of owner personnel.

.8 Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.

.2 Warranty Period

.1 Ensure that Subs execute seasonal or deferred functional performance testing, witnessed by the CA, according to the specifications.

.2 Ensure that Subs correct deficiencies and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

.9 Equipment Suppliers

.1 Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.

.2 Assist in equipment testing per agreements with Subs.

.3 Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone datalogging equipment that may be used by the CA.

.4 Through the contractors they supply products to, analyze specified products and verify that the Consultant has specified the newest most updated equipment reasonable for this project’s scope and budget.

.5 Provide information requested by CA regarding equipment sequence of operation and testing procedures.

.6 Review test procedures for equipment installed by factory representatives.

1.8 DEFINITIONS

.1 Acceptance Phase: Phase of construction after startup and initial checkout when functional performance tests, O&M documentation review and training occurs.

.2 Approval: Acceptance that a piece of equipment or system has been properly installed and is functioning in the tested modes according to the Contract Documents.

.3 Architect / Engineer (A/E): The prime consultant (architect – Stantec Architecture Ltd.) and sub-consultants who comprise the design team, generally the HVAC mechanical Consultant/engineer and the electrical Consultant/engineer.

.4 Basis of Design: The basis of design is the documentation of the primary thought processes and assumptions behind design decisions that were made to meet the design intent. The basis of design describes the systems, components, conditions and methods chosen to meet the intent. Some reiterating of the design intent may be included.

.5 Commissioning Authority (CA): An independent agent, not otherwise associated with the A/E team members or the Contractor. The CA directs and coordinates the day-to-day commissioning activities. The CA does not take an oversight role like the GC. The CA is part of the Owner's team and reports directly to the OW/PM.

.6 Commissioning Plan: An overall plan, developed before or after bidding, that provides the structure, schedule and coordination planning for the commissioning process.

.7 Contract Documents: The documents binding on parties involved in the construction of this project (drawings, specifications, change orders, amendments, contracts, *Cx Plan*, etc.).

.8 Contractor: The contractor in general or authorized representative.

.9 Control system: The central building energy management control system.

.10 General Contractor (GC): The General Contractor is responsible for providing all of the material, labor, equipment and services necessary for the construction of the project. The general contractor hires specialized subcontractors to perform all or portions of the construction work.

.11 Datalogging: Monitoring flows, currents, status, pressures, etc. of equipment using stand-alone dataloggers separate from the control system.

.12 Deferred Functional Tests: FTs that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.

.13 Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).

.14 Design Intent: A dynamic document that provides the explanation of the ideas, concepts and criteria that are considered to be very important to the owner. It is initially the outcome of the programming and conceptual design phases.

.15 Design Narrative or Design Documentation: Sections of either the Design Intent or Basis of Design.

.16 Factory Testing: Testing of equipment on-site or at the factory by factory personnel with an Owner's representative present.

.17 Functional Performance Test (FT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems (rather than just components) under full operation (e.g., the chiller pump is tested interactively with the chiller functions to see if the pump ramps up and down to maintain the differential pressure setpoint). Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing, in the commissioning sense of the word. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The commissioning authority develops the functional test procedures in a sequential written form, coordinates, oversees and documents the actual testing, which is usually performed by the installing contractor or vendor. FTs are performed after pre-functional checklists and startup are complete.

.18 Indirect Indicators: Indicators of a response or condition, such as a reading from a control system screen reporting a damper to be 100% closed.

.19 Manual Test: Using hand-held instruments, immediate control system readouts or direct observation to verify performance (contrasted to analyzing monitored data taken over time to make the "observation").

.20 Monitoring: The recording of parameters (flow, current, status, pressure, etc.) of equipment operation using dataloggers or the trending capabilities of control systems.

.21 Non-Compliance: See Deficiency.

.22 Non-Conformance: See Deficiency.

.23 Over-written Value: Writing over a sensor value in the control system to see the response of a system (e.g., changing the outside air temperature value from 50F to 75F to verify economizer operation). See also "Simulated Signal."

.24 Owner-Contracted Tests: Tests paid for by the Owner outside the GC's contract and for which the CA does not oversee. These tests will not be repeated during functional tests if properly documented.

.25 Phased Commissioning: Commissioning that is completed in phases (by floors, for example) due to the size of the structure or other scheduling issues, in order minimize the total construction time.

.26 Pre-functional Checklist (PC): A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CA to the Sub. Pre-functional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operation (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.). However, some pre-functional checklist items entail simple testing of the function of a component, a piece of equipment or system (such as measuring the voltage imbalance on a three phase pump motor of a chiller system). The word pre-functional refers to before functional testing. Pre-functional checklists augment and are combined with the manufacturer's start-up checklist. Even without a commissioning

process, contractors typically perform some, if not many, of the pre-functional checklist items a commissioning authority will recommend. However, few contractors document in writing the execution of these checklist items. Therefore, for most equipment, the contractors execute the checklists on their own. The commissioning authority only requires that the procedures be documented in writing, and does not witness much of the pre-functional check-listing, except for larger or more critical pieces of equipment and some spot checking.

.27 Project Manager (PM): The contracting and managing authority for the owner over the design and/or construction of the project.

.28 Sampling: Functionally testing only a fraction of the total number of identical or near identical pieces of equipment. Refer to this Section, Part 3.6, F for details.

.29 Seasonal Performance Tests: FT that are deferred until the system(s) will experience conditions closer to their design conditions.

.30 Simulated Condition: Condition that is created for the purpose of testing the response of a system (e.g., applying a hair blower to a space sensor to see the response in a VAV box).

.31 Simulated Signal: Disconnecting a sensor and using a signal generator to send an amperage, resistance or pressure to the transducer and DDC system to simulate a sensor value.

.32 Specifications: The construction specifications of the Contract Documents.

.33 Startup: The initial starting or activating of dynamic equipment, including executing pre-functional checklists.

.34 Subs: The subcontractors to the GC who provide and install building components and systems.

.35 Test Procedures: The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CA.

.36 Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test requirements are not the detailed test procedures. The test requirements are specified in the Contract Documents.

.37 Trending: Monitoring using the building control system.

.38 Vendor: Supplier of equipment.

.39 Warranty Period: Warranty period for entire project, including equipment components. Warranty begins at Substantial Completion and extends for at least one year, unless specifically noted otherwise in the Contract Documents and accepted submittals.

2.0 PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

.1 All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested. For example, the mechanical contractor of Division(s) 20 - 25 shall ultimately be responsible for all standard testing equipment for the Fire Protection, Plumbing, Mechanical (HVAC) and controls systems in this Division, except for equipment specific to and used by TAB in their commissioning responsibilities. Two-way radios shall be provided by the control contractor (CC).

.2 Special equipment, tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site.

.3 All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the Specifications. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have a certified calibration within the past year to an accuracy of 0.5°F and a resolution of + or - 0.1°F. Pressure sensors shall have an accuracy of + or - 2.0% of the value range being measured (not full range of meter) and have been calibrated within the last year. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

3.0 PART 3 - EXECUTION

3.1 MEETINGS

.1 Scoping Meeting

.1 Within 90 days of commencement of construction, the CA will schedule, plan and conduct a commissioning scoping meeting with the entire commissioning team in attendance. Meeting minutes will be distributed to all parties by the CA. Information gathered from this meeting will allow the CA to revise the Draft Commissioning Plan to its "final" version, which will also be distributed to all parties.

.2 Miscellaneous Meetings

.1 Other meetings will be planned and conducted by the CA as construction progresses. These meetings will cover coordination, deficiency resolution and planning issues with particular Subs. The CA will plan these meetings and will minimize unnecessary time being spent by Subs. Within final 3 months of construction these meetings may be held as frequently as one per week.

3.2 REPORTING

.1 The CA will provide regular reports to the PM and GC, with increasing frequency as construction and commissioning progresses.

.2 The CA will regularly communicate with all members of the commissioning team, keeping them apprised of commissioning progress and scheduling changes through memos, field reviews, progress reports, etc.

.3 Field Reviews will be conducted and used to validate construction progress, equipment start-up progress and O&M requirements for the building systems. The CA shall complete Field Reviews at regular intervals throughout construction, and issue to PM and GC through appropriate channels.

.4 Testing or review approvals and non-conformance and deficiency reports are made regularly with the review and testing as described in later sections.

.5 A Final Commissioning Report will be compiled by the CA and submitted to the Owner/PM, which will include all acquired documentation, logs, minutes, reports, deficiency lists, communications, findings, unresolved issues, etc.

3.3 SUBMITTALS

.1 The CA will provide appropriate contractors with a specific request for the type of submittal documentation the CA requires to facilitate the commissioning work. These requests will be integrated into the normal submittal process and protocol of the construction team. At minimum, the request will include the manufacturer and model number, the manufacturer's printed installation and detailed start-up procedures, full sequences of operation, O&M data, performance data, any performance test procedures, control drawings and details of owner contracted tests. In addition, the installation and checkout materials that are actually shipped inside the equipment and the actual field checkout sheet forms to be used by the factory or field technicians shall be submitted to the Commissioning authority. All documentation requested by the CA shall also be included by the Subs in their O&M manual contributions.

.2 The CA will review submittals related to the commissioned equipment for conformance to the Contract Documents as it relates to the commissioning process, to the functional performance of the equipment and adequacy for developing test procedures. This review is intended primarily to aid in the development of functional testing procedures and only secondarily to verify compliance with equipment specifications. The Commissioning authority will notify the GC, PM or A/E as requested, of items missing or areas that are not in conformance with Contract Documents and which require resubmission.

.3 The CA may request additional design narrative from the A/E and Controls Contractor, depending on the completeness of the design intent documentation and sequences provided with the Specifications.

.4 These submittals to the CA do not constitute compliance for O&M manual documentation. The O&M manuals are the responsibility of the Contractor, though the CA will review and approve them.

3.4 SCHEDULING

.1 Provide detailed Commissioning Schedule part of the construction schedule, following the same requirements of Section 01 32 00.

.2 The CA will work with the GC according to established protocols to define a schedule for commissioning activities. The GC will integrate all commissioning activities into the master schedule. All parties will address scheduling problems and make necessary notifications in a timely manner in order to expedite the commissioning process. The schedule shall include all necessary time-points and milestones, testing, documentation, training and commissioning activities.

.3 The CA will provide the format for the initial schedule of primary commissioning events at the commissioning scoping meeting. The *Commissioning Plan* provides the format for this schedule.

.4 A detailed commissioning schedule in day-by-day format shall be provided by the Contractor for pre-functional testing of all individual components, equipment and subsystems; and functional and integration testing of each completed system. This schedule shall include a detailed training schedule to demonstrate that there will be no conflicts with testing.

.5 The schedule of commissioning activities shall be produced in a Gantt chart format to a scale that will ensure legibility. This Gantt chart will show sequences of testing equipment and systems, interrelationship between tests, duration of tests and training periods. As construction progresses more detailed schedules are developed by the contractors.

.6 The commissioning schedule shall include the following milestones (as appropriate):

- .1 Introductory commissioning meeting chaired by the Commissioning Authority: 90 days after general contractor award of contract.
- .2 Inspection and Testing of ORs, ICUs, PACUs, Pharmacy and Special Service Areas
  - .1 Pre-finishing inspection of architectural features, caulking and sealing
  - .2 Pre-finishing room pressure test to determine the leakage rate of the room shell prior to closing in the room.
- .3 Start-up and Pre-Functional Checks
- .4 Building Clean – Ventilation Activation dates for all major functional areas
- .5 Testing and Balancing (TAB) of Air and Water Systems
- .6 BAS / BMS Checkout
- .7 Functional Performance Testing
- .8 Integration Testing
- .9 O&M Manual and As-Builts Submissions
- .10 Owner Training
- .11 Occupancy (Life Safety)
- .12 Substantial Completion
- .13 Start of Contractor Warranty Period
- .14 Deferred / Seasonal Testing

.7 The CA will monitor progress of commissioning against this schedule.

3.5 START-UP, PRE-FUNCTIONAL CHECKLISTS AND INITIAL CHECKOUT

.1 Application

.1 The following procedures apply to all equipment to be commissioned, according to *Paragraph 1.4, Systems to be Commissioned*. Some systems that are not comprised so much of actual dynamic machinery, e.g., architectural systems, electrical distribution panels, may have very simplified PCs and startup.

.2 General

.1 Pre-functional checklists are important to ensure that the equipment and systems are hooked up and operational. It ensures that functional performance testing (in-depth system checkout) may proceed without unnecessary delays. Each piece of equipment receives full pre-functional checkout. No sampling strategies are used. The pre-functional testing for a given system must be successfully completed prior to formal functional performance testing of equipment or subsystems of the given system.

.3 Pre-finishing inspection and testing of Critical Rooms (CSA Z8001 Annex J & K)

.1 The GC shall facilitate A/E and CA inspections of ORs, ICUs, PACUs, Pharmacy and Special Service Areas following drywall installation but prior to final finishes.

.2 GC shall provide all necessary equipment such as blower door assemblies, and pressure and airflow monitoring equipment required to obtain leakage rate of the room shells prior to closing in the rooms.

.3 Perform remedial actions to caulking and sealing as required to ensure that architectural features of the room that affect air seals and air flow are built in accordance with the room design such that the room will meet relative pressurization requirements of the design, CAN/CSA-Z317.2, The National Association of Pharmacy Regulatory Authorities (NAPRA) Model Standards (Sterile Preparations) and / or other accreditation guidelines and standards for the type of area being tested.

.4 Start-up and Initial Checkout Plan.

.1 The CA shall assist the commissioning team members responsible for startup of any equipment in developing detailed start-up plans for all equipment. The primary role of the CA in this process is to ensure that the contractor provides written documentation that each of the manufacturer-recommended procedures have been completed. Parties responsible for pre-functional checklists and startup are identified in the commissioning scoping meeting and in the checklist forms.

.2 The CA obtains manufacturer installation, startup and checkout data, including actual field checkout sheets used by the field technicians from the contractor (through an RFI) or shop drawings.

.3 The CA copies all pages with important instructional data and procedures from the startup and checkout manuals not covered in manufacturer field checkout sheets and adds a signature line in the column by each procedure.

.4 The copied pages, along with the pre-functional checklist provided by the CA and the manufacturer field checkout sheets become the “Startup and Checkout Plan.”

.5 For systems that may not have adequate manufacturer startup and checkout procedures, particularly for components being integrated with other equipment, the Sub should provide the added necessary detail and documenting format to the CA for approval, prior to execution.

.6 The CA transmits the full Startup Plan to the GC, who designates which trade or contractor is responsible to fill out each line item on the Pre-functional Checklist from the CA. The GC then transmits the full start-up plan to the Subs for their review and use. (This usually means that the Pre-functional Checklist, alone, will go to more than one Sub, while the full plan will go to the primary installing contractor.)

3.6 EXECUTION OF PRE-FUNCTIONAL CHECKLISTS AND STARTUP

.1 Four weeks prior to startup, the Subs and vendors schedule startup and checkout with the GC and CA. The performance of the Pre-functional checklists, startup and checkout are directed and executed by the Sub or vendor. When checking off Pre-functional checklists, signatures may be required of other Subs for verification of completion of their work.

.2 The Subs and vendors shall execute startup and provide the CA with a signed and dated copy of the completed start-up and Pre-functional tests and checklists. The CA may review pre-functional checklists in progress, as necessary.

.3 The site technician performing the line item task initials and dates on the Pre-functional and manufacturer field checkout sheets, as they are completed. Only individuals that have direct knowledge and witnessed that a line item task on the Pre-functional checklist was performed shall initial or check that item off. It is not acceptable for supervisors to fill out these forms unless they have directly witnessed the specific task.

3.7 DEFICIENCIES, NON-CONFORMANCE AND APPROVAL IN CHECKLISTS AND STARTUP

.1 The Subs shall clearly list any outstanding items of the initial start-up and Pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet.

.2 The procedures form and any outstanding deficiencies are provided to the CA within two days of test completion.

.3 The CA reviews the report and tracks issues and non-compliances in the Commissioning Issues Log, for follow-up by the Sub or GC. The CA shall work with the Subs and vendors to correct and retest deficiencies or uncompleted items. The CA will involve the GC and others as necessary. The installing Subs or vendors shall correct all areas that are deficient or incomplete in the checklists and tests in a timely manner, and shall notify the CA as soon as outstanding items have been corrected and resubmit an updated start-up report and response to the related Issues Log item. When satisfactorily completed, the CA recommends approval of the execution of the checklists and startup of each system to the Owner.

.4 Items left incomplete, which later cause deficiencies or delays during functional testing may result in back charges to the responsible party. Refer to Part 3.11 herein for details.

3.8 PHASED COMMISSIONING

.1 The project may require startup and initial checkout to be executed in phases. This phasing will be planned and scheduled in a coordination meeting of the CA, GC, Mechanical, Electrical, TAB and controls contactors. Results will be added to the master and commissioning schedule.

3.9 FUNCTIONAL PERFORMANCE TESTING

.1 This sub-section applies to all commissioning functional testing for all divisions.

.2 The general list of equipment to be commissioned is found in Paragraph 1.7. The specific equipment and modes to be tested are found in Sections 21 08 00, 22 08 00, *23 08 00* and *26 05 03*. If specific testing requirements were not included in the bid documents and original specifications, they should be developed for this project for each piece of commissioned equipment.

.3 The parties responsible to execute each test are listed with each test in Sections 21 08 00, 22 08 00, *23 08 00* and *26 05 03*.

.4 Objectives and Scope

.1 The objective of functional performance testing is to demonstrate that each system is operating according to the documented design intent and Contract Documents. Functional testing includes validation of completed systems in all modes of operation. Additionally, during the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

.2 In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze condition, low pressure, no flow, equipment failure, etc. shall also be tested. Specific modes required in this project are given in Sections 21 08 00, 22 08 00, *23 08 00* and *26 05 03*.

.3 The CA shall witness at a minimum, contractor functional testing for each piece of primary equipment, unless there are multiple units, in which case a sampling strategy may be used. In no case will the number of units witnessed be less than 20% of the total number of identical or very similar units. Sampling strategy is discussed further in section 3.8.3 below.

.5 Development of Test Procedures

.1 Before test procedures are written, the CA shall obtain all requested documentation and a current list of change orders affecting equipment or systems, including an updated points list, program code, control sequences and parameters. Using the testing parameters and requirements in *Sections* 21 08 00, 22 08 00, *23 08 00* and *26 05 03* the CA shall develop specific test procedures and forms to verify and document proper operation of each piece of equipment and system. CA obtains clarification, as needed, from contractors and the A/E regarding sequences and operation to develop these tests. Each Sub or vendor responsible to execute a test, shall aid the CA in developing the procedures (answering questions about equipment, operation, sequences, etc.). Prior to execution, the CA shall provide a copy of the primary equipment test procedures to the Subs (via the GC) who shall review the tests for feasibility, safety, equipment and warranty protection. The CA may submit the tests to the A/E for review, if requested.

.2 The CA shall review owner-contracted, factory testing or required owner acceptance tests which the CA is not responsible to oversee, including documentation format, and

shall determine what further testing or format changes may be required to comply with the *Specifications*. Redundancy of testing shall be minimized.

.3 The purpose of any given specific test is to verify and document compliance with the stated criteria of acceptance given on the test form.

.6 Test Methods.

.1 Functional performance testing and verification may be achieved by manual testing (persons manipulate the equipment and observe performance) or by monitoring the performance and analyzing the results using the control system's trend log capabilities or by stand-alone dataloggers. Sections 21 08 00, 22 08 00, *23 08 00* and 26 05 03 specify which methods shall be used for each test. The CA follows the Specifications when given and uses judgement where needed to determine which method is most appropriate. The CA may substitute specified methods or require an additional method to be executed, other than what was specified, with the approval of the Owner. This may require a change order and adjustment in charge to the Owner. The CA will determine which method is most appropriate for tests that do not have a method specified.

.1 Simulated Conditions: Simulating conditions (not by an overwritten value) shall be allowed, though timing the testing to experience actual conditions is encouraged wherever practical.

.2 Overwritten Values: Overwriting sensor values to simulate a condition, such as overwriting the outside air temperature reading in a control system to be something other than it really is, shall be allowed, but shall be used with caution and avoided when possible. Such testing methods often can only test a part of a system, as the interactions and responses of other systems will be erroneous or not applicable. Simulating a condition is preferable. e.g., for the above case, by heating the outside air sensor with a hair blower rather than overwriting the value, or by altering the appropriate setpoint to see the desired response. Before simulating conditions or overwriting values, sensors, transducers and devices shall have been calibrated.

.3 Simulated Signals: Using a signal generator which creates a simulated signal to test and calibrate transducers and DDC constants is generally recommended; over using the sensor to act as the signal generator via simulated conditions or overwritten values.

.4 Altering Setpoints: Rather than overwriting sensor values, and when simulating conditions is difficult, altering setpoints to test a sequence is acceptable. For example, to see the AC compressor lockout work at an outside air temperature below 12.78°C (55F), when the outside air temperature is above 12.78°C (55F), temporarily change the lockout setpoint to be approximately 1.2°C (2F) above the current outside air temperature.

.5 Indirect Indicators: Relying on indirect indicators for responses or performance shall be allowed only after visually and directly verifying and documenting, over the range of the tested parameters, that the indirect readings through the control system represent actual conditions and responses. Much of this verification is completed during Pre-functional testing.

.6 Setup: Each function and test shall be performed under conditions that simulate actual conditions as close as is practically possible. The Sub executing the test shall provide all necessary materials, system modifications, etc. to produce the necessary flows, pressures, temperatures, etc. necessary to execute the test according to the specified conditions. At completion of the test, the Sub shall return all affected building equipment and systems, due to these temporary modifications, to their pre-test condition.

.7 Sampling: Not all pieces of identical equipment receive in-depth testing; multiple identical pieces of non-life-safety or otherwise non-critical equipment may be functionally tested using a sampling strategy. Significant application differences and significant sequence of operation differences in otherwise identical equipment invalidates their common identity. A small size or capacity difference, alone, does not constitute a difference. It is noted that no sampling by Subs is allowed in Pre-functional checklist execution.

.1 A common sampling strategy referenced in the *Specifications* as the "xx% Sampling—yy% Failure Rule" is defined by the following example.

.1 xx = the percent of the group of identical equipment to be included in each sample.

.2 yy = the percent of the sample that if failing, will require another sample to be tested.

.2 The example below describes a 20% Sampling—10% Failure Rule.

.1 Randomly test at least 20% (xx) of each group of identical equipment. In no case test less than three units in each group. This 20%, or three, constitute the "first sample."

.2 If 10% (yy) of the units in the first sample fail the functional performance tests, test another 20% of the group (the second sample)

.3 If 10% of the units in the second sample fail, test all remaining units in the whole group.

.4 If at any point, frequent failures are occurring and testing is becoming more troubleshooting than verification, the CA may stop the testing and require the responsible Sub to perform and document a checkout of the remaining units, prior to continuing with functionally testing the remaining units.

3.10 EXECUTION OF FUNCTIONAL PERFORMANCE TESTS

.1 Coordination and Scheduling.

.1 The Subs shall provide sufficient notice to the CA regarding their completion schedule for the Pre-functional checklists and startup of all equipment and systems. The CA will schedule functional tests through the GC and affected Subs. The CA shall direct, witness and document the functional testing of all equipment and systems. The Subs shall execute the tests.

.2 In general, functional testing is conducted after Pre-functional testing and startup has been satisfactorily completed. For any given system, prior to performing functional testing, the CA waits until the Pre-functional checklist has been submitted with the necessary signatures, confirming that the system is ready for functional testing.

.3 The control system is sufficiently tested by the installing contractor before it is used for TAB or to verify performance of other components or systems. The air balancing and

water balancing is completed and debugged before functional testing of air-related or water-related equipment or systems. Testing proceeds from components to subsystems to systems. When the proper performance of all interacting individual systems has been achieved, the interfaces, integration and/or coordinated responses between systems is tested.

.2 Problem Solving

.1 The CA will recommend solutions to problems found, however the burden of responsibility to solve, correct and retest problems is with the contractors, Subs and A/E.

.3 Owner Engagement:

.1 The Owner's facilities operating staff are encouraged to attend and participate in the testing process. The CA will notify the Owner/PM, who will then notify the facility staff when the commissioning events will occur.

3.11 DOCUMENTATION, NON-CONFORMANCE AND APPROVAL OF TESTS

.1 Documentation

.1 The CA shall witness and document the results of all functional performance tests using the specific procedural forms developed for that purpose. Prior to testing, these forms are provided to the GC for review and approval and to the Subs for review. The CA will include the filled out forms in the System Manual.

.2 Non-Conformance

.1 The CA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted and reported to the GC on a standard non-compliance form.

.2 Corrections of minor deficiencies identified may be made during the tests at the discretion of the CA. In such cases the deficiency and resolution will be documented on the procedure form.

.3 Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures. However, the CA will not be pressured into overlooking deficient work or loosening acceptance criteria to satisfy scheduling or cost issues, unless there is an overriding reason to do so at the request of the GC.

.4 As tests progress and a deficiency is identified, the CA discusses the issue with the executing contractor.

.5 When there is no dispute on the deficiency and the Sub accepts responsibility to correct it:

.1 The CA documents the deficiency and the Sub's response and intentions; and then they go on to another test or sequence. After the day's work, the CA submits the non-compliance reports to the GC for signature, if required. A copy is provided to the Sub and CA. The Sub corrects the deficiency, signs the statement of correction at the bottom of the non-compliance form certifying that the equipment is ready to be retested and sends it back to the CA.

.2 The CA reschedules the test (through the GC) and the test is repeated.

.6 If there is a dispute about a deficiency, regarding whether it is a deficiency or who is responsible:

.1 The deficiency shall be documented on the non-compliance form with the Sub's response and a copy given to the GC and to the Sub representative assumed to be responsible

.2 Resolutions are made at the lowest management level possible (preferably between CA or GC and the Sub). Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.

.3 The CA documents the resolution process.

.4 Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency, signs the statement of correction on the non-compliance form and provides it to the CA. The CA reschedules the test and the test is repeated until satisfactory performance is achieved

.7 Cost of Retesting

.1 The cost for the Sub to retest a Pre-functional or functional test, if they are responsible for the deficiency, shall be theirs. If they are not responsible, any cost recovery for retesting costs shall be negotiated with the GC.

.8 For a deficiency identified, not related to any Pre-functional checklist or start-up fault, the following shall apply:

.1 The CA and GC will direct the retesting of the equipment once at no "charge" to the contractors for their time. However, the CA's and GC's time for a second retest will be charged to the contractors, who may choose to recover costs from the responsible Sub.

.2 Refer to the Sampling Section for requirements for testing and retesting identical equipment.

.9 The Contractor shall respond in writing to the CA and GC at least as often as commissioning meetings are being scheduled concerning the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.

.10 The CA retains the original non-conformance forms until the end of the project.

.11 Any required retesting by any contractor shall not be considered a justified reason for a claim of delay or for a time extension by the prime contractor.

.12 Failure Due to Manufacturer Defect:

.1 If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable by the GC or PM. In such case, the Contractor shall provide the Owner with the following:

.1 Within one week of notification from the GC or PM, the Contractor or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided to the GC or PM within two weeks of the original notice.

.2 Within two weeks of the original notification, the Contractor or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly exceed the specification requirements of the original installation.

.3 The GC or PM will determine whether a replacement of all identical units or a repair is acceptable.

.4 Two examples of the proposed solution will be installed by the Contractor and the GC will be allowed to test the installations for up to one week, upon which the GC or PM will decide whether to accept the solution.

.5 Upon acceptance, the Contractor and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty had begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

.3 Approval

.1 The CA notes each satisfactorily demonstrated function on the test form. Formal approval of the functional test is made later after review by the CA and by the Owner, if necessary. The CA recommends acceptance of each test to the Owner using a standard form.

3.12 OPERATION AND MAINTENANCE (O&M) DOCUMENTATION

.1 Standard O&M Manuals:

.1 Specific content and format requirements for the standard O&M manuals are detailed in Sections *01 33 00, 21 05 00, 22 05 00, 23 05 00* and *26 05 00*. Special requirements for the controls contractor and TAB contractor are found Section *23 08 00*.

.2 CA Review and Approval:

.1 Prior to substantial completion, the CA shall review the O&M manuals to verify compliance with the Specifications. The CA will communicate deficiencies in the manuals to the GC, PM or A/E, as requested. Upon a successful review of the corrections, the CA recommends approval and acceptance of these sections of the O&M manuals to the GC, PM or A/E.

.3 Warranty:

.1 A complete inventory of warranty items shall be provided by the Contractor. The CA also reviews each equipment warranty and verifies that all requirements to keep the warranty valid are clearly stated. This work does not supersede the A/E’s review of the O&M manuals according to the A/E’s contract.

.4 "As-built" Drawings and Specifications:

.1 These are generally produced by the consultant from the project record documents maintained on the site and kept up-to-date with all changes as they occur and marked thereon by the Contractor. Accuracy will be verified by the Consultant before preparation of the "As-builts" and by the Commissioning Authority after submission by the Consultant. They shall be completed in time to be used for owner’s training and demonstration sessions. For specific information regarding As-Builts refer to

specification sections Architectural Section 01 33 00, Mechanical Section 23 05 00, Electrical Section 26 05 00.

.5 Commissioning Records in O&M Manuals:

.1 Contractors shall include copies of all test reports and completed checklists in the O&M Manuals.

.2 The CA will compile a final Commissioning Report summarizing the results of the overall commissioning process under a separate cover. Refer to the Commissioning Plan for details.

3.13 DEMONSTRATION AND TRAINING OF OWNER PERSONNEL

.1 Detailed information regarding contents, duration and instructors for any particular building system is included in Specification *Section 01 91 15 – Commissioning –Training*.

.2 The Training Plans are produced conjointly by the Contractor and the Commissioning Authority to meet project-specific requirements and they include details provided by the Facility Property Manager relating to numbers and prerequisite qualifications and skills of trainees, type of training (i.e. observation, hands-on, classroom), etc.

.3 The CA coordinates and schedules, with the GC, the overall training for the commissioned systems. The CA develops criteria for determining that the training was satisfactorily completed, including attending some of the training, etc. The CA advises the OW on the adequacy of the training provided based on these pre-determined success criteria.

.4 Sample Training Agenda is included in Specification *Section 01 91 15 – Commissioning – Training*.

.5 The Commissioning Schedule shall indicate proposed training dates for specific systems.

3.14 ACTIVITIES DURING THE WARRANTY PERIOD

.1 While all Functional Performance Testing must be completed before Substantial Completion, it is anticipated that certain commissioning activities will be necessary during the Warranty Period.

.2 The CA shall remain at the service of the owner to address any commissioning related issues throughout the first year of operation. This may include coordination of deferred testing, deficiency resolution/follow-up, and addressing specific occupant or owner concerns. Near the end of the warranty period, the CA shall perform a commissioning review of commissioning related issues and their resolution during the first year of operation.

.3 Occupant concerns (Including temperature, thermal comfort, IAQ, and others) for the project shall be communicated through the building operation and maintenance department via the appropriate channels. These concerns shall then be relayed directly by the PM to the project team, including the CA, Contractor, Subs, and consultants. An investigation process to address concerns shall be led by the CA and responsible contractors. Subsequent action may include additional testing, deficiency resolution, and tuning of the systems with the contractor team and equipment manufacturers, under supervision and direction of CA. Upon resolution of the issue, the occupants are informed through the appropriate channels.

3.15 DEFERRED TESTING

.1 Unforeseen Deferred Tests.

.1 If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the PM. These tests will be conducted in the same manner as the seasonal tests as soon as possible. Services of necessary parties will be negotiated.

.2 Seasonal Testing:

.1 During the warranty period, seasonal testing (tests delayed until weather conditions are closer to the system's design) shall be completed as part of this contract. The CA shall coordinate this activity. Tests will be executed, documented and deficiencies corrected by the appropriate Subs, with facilities staff and the CA witnessing. Any final adjustments to the O&M manuals and as-builts due to the testing will be made.

3.16 WRITTEN WORK PRODUCTS

.1 The commissioning process generates a number of written work products described in various parts of the specifications. The following lists all the formal written work products and describes who is responsible to create them. In summary, the written products are:

Product		Developed By
.1	Commissioning Plan	CA
.2	Meeting Minutes	CA
.3	Commissioning Schedules	CA with GC and Subs
.4	Equipment documentation submittals	Subs
.5	Sequence clarifications	Subs and A/E as needed
.6	Pre-functional Checklists	CA and Subs
.7	Startup and initial checkout plan	Subs and CA
.8	TAB Plan	TAB
.9	Field Reviews	CA
.10	Room Leakage Test Reports	GC
.11	Pre-functional Checklists filled out	Subs
.12	Final TAB Report	TAB
.13	Issues Log (deficiencies)	CA
.14	Commissioning Progress Reports	CA
.15	Functional Test forms	CA
.16	Filled out Functional Tests	CA
.17	O&M Manuals	Subs
.18	Overall training plan	CA and GC
.19	Final Commissioning Report	CA

END OF SECTION

1.0 PART 1 – GENERAL

1.1 SUMMARY

.1 Refer to the Commissioning Plan prepared by the CA will be issued during submittals stage of the project to outline to the project specific commissioning program including draft checklists and test plans.

.2 The Commissioning Plan provides guidance in the execution of the commissioning process. Just after the initial commissioning scoping meeting the CA will update the plan which is then considered the “final” plan, though it will continue to evolve and expand as the project progresses. The Specifications will take precedence over the Commissioning Plan.

.3 Contractors shall be familiar with all parts of the Commissioning Plan, as well as associated Sections 01 91 13 Commissioning – General Requirements, 01 91 15 Commissioning – Training and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

2.0 PART 2 – PRODUCTS

.1 Not used.

3.0 PART 3 – EXECUTION

.1 Not used.

END OF SECTION

1.0 PART 1 – GENERAL

1.1 DESCRIPTION

.1 The building systems demonstration and training for Owners Operating Personnel shall be coordinated by the Commissioning Authority. The demonstration and training shall include all components as identified in this section and elsewhere in the specifications.

.2 Training Objectives: Training shall be in sufficient detail and of sufficient duration to meet the following objectives:

.1 Safe, reliable and energy-efficient operation of all systems in all normal, all emergency and catastrophic (internal and external) modes and under all conditions.

.2 Effective ongoing inspection and measurement of system performance.

.3 Proper preventive maintenance, diagnosis and troubleshooting.

.4 Service and repair of all systems, equipment and components.

.5 Ability to update documentation and input on future building modifications.

.6 Ability to operate equipment and systems under emergency conditions without assistance or until appropriate qualified assistance arrives.

.3 For training of O & M personnel to be effective, it is to be implemented during the later stages of construction, to allow for familiarization with the facility and the installed systems.

.4 Co-ordination and Monitoring:

.1 Contractors shall co-ordinate and implement all training

.2 The Owner shall co-ordinate all participants to attend training

.3 The Commissioning Authority shall track successful completion of all training to ensure that it has been delivered to the Owner's satisfaction.

.5 Long Term Ongoing Training: "Long-term" ongoing training is not included in commissioning activities. However, training courses and training materials must be designed to permit long term ongoing training well into the future.

1.2 RESPONSIBILITIES

.1 The Commissioning Authority shall:

.1 In conjunction with the Owner ensure all designated O & M personnel will be available for training during later stages of construction for purposes of familiarization with the facility and all installed systems,

.2 Review the quality of the Contractor's training and training materials meets all requirements of the project.

.2 The Contractor shall:

.1 Have overall responsibility to provide, coordinate, document, and record all training, and shall provide all training materials, training and classroom times. Note that the owner reserves the right to video record training sessions.

.2 Contractor's personnel, professional trainers, manufacturer's resources for training purposes and be responsible for:

.1 Direction of all training

.2 Implementation of all training activities

.3 Coordination among instructors

.4 Quality of training and training materials.

.3 Trainees shall include O & M personnel selected for operating and maintaining the project, the Facility Manager, building operators, maintenance staff, security staff, service contractors, and technical specialists (as applicable).

1.3 INSTRUCTORS

.1 Instructors shall include the following:

.1 Design Consultant:

.1 To provide instruction on the Design Philosophy, Design Criteria, Design Intent, and Description of all Systems.

.2 Contractor:

.1 To provide instruction on the operation of specific systems, equipment or components, including start up, operation, shut down, features of controls, such as reasons for, results of, implications on associated systems of, adjustment of set points of control and limit safety devices.

.3 Factory trained and certified manufacturer's maintenance specialist personnel:

.1 to provide instruction on start-up, operation, care, maintenance, shut down of equipment for which they have certified installation, started up and carried out PV tests.

.4 Professional trainers:

.1 Where the Contractor is not deemed to be able to deliver the quality or level or training required.

1.4 ORGANIZATION

.1 Training of O & M personnel shall consist of three main parts:

.1 Classroom sessions: shall be provided as necessary, with instruction regarding functional requirements, system philosophy, system operation and use of the Building Management Manual and all other commissioning documentation.

.2 Familiarization sessions organized for all systems during construction and installation stage and equipment commissioning. This may include review of installation, layout of equipment, systems and components, start-up and testing of the work, access to approved shop drawings, equipment operating and maintenance data. On- site observations may include still-photo records as deemed necessary by the O&M personnel – particularly of concealed elements.

.3 Hands on training: shall be provided on all systems, components and equipment and explanations of all commissioning procedures shall be provided.

1.5 CONTENT

.1 Training requirements for building systems are included in table format in this appendix and in the relevant commissioning specifications of various divisions.

.2 Training shall include:

.1 Review of the facility

.2 Functional requirements

.3 System philosophy – Design Criteria, design Intents, why the system was designed in this way, why certain settings are important and should not be changed without proper authority, limitations of each system, including emergency procedures

.4 Review of system layout and equipment, components and controls

.5 Use the printed installation, operation and maintenance instruction material included in the O&M manuals

.6 Discussion of warranties and guarantees.

.7 System operating sequences, including interaction between systems forming part of integrated systems, step by step directions for starting up and shutting down all systems, closing and opening valves, dampers and switches, adjusting control settings, turning motors on and off, and emergency procedures

.8 Features of controls, monitoring, and procedures for performance verification

.9 Reasons for, results of and implications on associated systems of adjustment of setpoints of control, limit and safety devices; interaction among systems during integrated operation

.10 Maintenance and servicing of systems, equipment and components

.11 Troubleshooting diagnosis – symptoms, signs, causes and corrective measures. For some equipment, this need only be a general knowledge, but should be enough to allow the operator to describe the problem adequately and to take emergency measures until qualified help arrives

.12 Review of O & M documentation

.3 Instructional Materials: All instructional material shall be produced in a digital electronic form that will permit future training for replacement O & M personnel to the same degree of detail and depth as supplied by initial training.

.4 Training materials shall include at least the following:

.1 “As Built” Contract Documents

.2 Operation and Maintenance (O&M) Manual – Copies of the O&M Manual shall be made available to O & M personnel prior to the familiarization sessions for retention throughout the training period for purposes of self-study.

.3 TAB, Commissioning Reports

.5 Instructional material shall be supplemented as necessary by:

.1 Manufacturers training videos. These should be screened by the Commissioning Authority and reviewed by the Consultant at least six months prior to pre start up inspections before being included as part of the training material.

.2 Equipment models

.6 Instructors shall be responsible for the content and quality of training materials for all training sessions under their jurisdiction.

1.6 TRAINING PLANS

.1 A training Plan developed by the Contractor for each discipline based upon project requirements..

.2 Submit the training Plan to the Commissioning Authority for review and comment at least 12 weeks prior to the proposed training dates. Update and resubmit as required.

.3 Include an agenda and a course outline summarizing the content and duration of training.

.4 Co-ordinate the date(s) of the training session (s) with the Owner. Owner to provide the lists of participants.

.5 Contractor to organize the location and circulate calendar invites for each session.

.6 Prepare a summary of the training sessions. Indicate dates, subject matter, and all personnel present for training. After training, submit the training summary to the Commissioning Authority.

.7 Record the time, date and subject matter of training sessions as they occur. Indicate all those who are present at each training session.

1.7 DELIVERY OF TRAINING

.1 Training shall normally be provided during regular working hours prior to take over of the project.

.2 Adequate time for training is to be included in Construction and Completion Schedule.

.3 Each training session should not be longer than three hours and provided between the hours of 08:30 – 11:30 and 13:00 – 16:00.

.4 Training is to be hands on, on site, classroom, oral, written and audio/visual.

.5 All training is to be completed prior to acceptance of facility.

.6 Training should include demonstrations by the trained O & M personnel so as to show confidence in, and depth of understanding of, all systems and equipment, and to demonstrate completeness of training.

.7 Upon completion of these demonstrations, the contractors responsible for all training shall provide a written report signed by Instructors and witnessed by Consultant and/or Commissioning Authority. This report shall be submitted to the Commissioning Authority.

.8 The owner reserves the right to video record any or all training sessions. Video recording services will be professional quality and include copies of the session to be handed over to the owner for future use. Procurement of video production to be as directed by the owner (carried by the owner or other).

1.8 TRAINING ACTIVITIES:

.1 See the following typical training agenda provided as an appendix to this section.

.2 This is a broad scope outline summary for the Contractors information and incorporation into the project training plan.

1.9 TRAINING DURATIONS

.1 At a minimum, the training shall be provided as follows:

System	Duration
Mechanical System Design	2 hours (by consultant)
Fire Suppression Systems	4 hours (min 30 mins per department) + 30 mins for plant services
Plumbing Systems	8 hours (min one hour per department) + one hour for plant services
Mechanical Systems	16 hours (min 2 hours for each department (due to phasing) and 2 hours min for plant changes
BAS Controls	4 hours – initial training 3 x 4 hours – follow up sessions
Venturi Valves and Critical Pressure Controls	8 hours (Compounding Pharmacy and Scope Processing)
Electrical and Communication System Design	2 hours (by consultant)
Electrical Distribution	4 hours
Communication Systems	8 hours
Fire Alarm System	8 hours
Lighting and Control System	4 hours – initial training 2 x 4 hours – follow up sessions

2.0 TRAINING AGENDA - TYPICAL

SYSTEM XX				
Systems and Goals	**Instructor**	**Content (approximately 30% Theory, 70% practical)**	**Duration**	**Instruction Materials and Tools**
Design Philosophy 1. General overview of design concepts 2. Awareness of interaction of mechanical systems	Engineer and/or Commissioning Authority (CA)	1. Explanation of mechanical and related electrical systems, their interaction 2. Site visit in early stages of project 3. Classroom sessions during commissioning stage	X hours	1. Schematic of layouts & controls 2. Installed system, equipment 3. Design Criteria, Design Intents
System A 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions	X hours	1. " As built" drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration
System B 1. To learn details of all systems installed 2. To develop in depth knowledge of the operation of each system	Installing Contractor, Equipment Manufacturer, CA	1. Explanation of operational concepts of systems and components 2. Review of O & M Manuals 3. Equipment operation, setpoints, and adjustment 4. Preventive maintenance requirements 5. Warranty 6. Equipment troubleshooting 7. Observation during construction 8. Site visits, classroom sessions	X hours	1. " As built" drawings 2. Systems Operations Manual 3. Maintenance Manual 4. Installed systems, equipment 5. Controls Schematics and Reports 6. Demonstration

Part 1 General

1.1 SECTION INCLUDES

.1 Alteration project procedures.

.2 Removal of designated building equipment and fixtures.

.3 Removal of designated construction.

.4 Disposal of materials.

.5 Storage of designated materials.

.6 Identification of existing building services.

1.2 RELATED SECTIONS

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 13 – Special Project Procedures.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 Comply with Northern Health Infection Control Policies.

.3 Canada Communicable Disease Report: Construction-related nosocomial infections in patients in health care facilities.

.4 APIC: Infection control tool kit series: construction and renovation.

.5 CSA Standard: CAN/CSA Z317.13-17, "Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities".

1.4 ALTERATION PROJECT PROCEDURES

.1 Materials: As specified in Product sections; match existing Products and work for patching and extending work.

.2 Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

.3 Remove, cut, and patch Work in a manner to minimize damage and to provide means of restoring Products and finishes to original condition.

.4 Refinish existing visible surfaces to remain in renovated rooms and spaces, to specified condition for each material, with a neat transition to adjacent finishes.

.5 Where new Work abuts or aligns with existing, provide a smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

.6 When finished surfaces are cut so that a smooth transition with new Work is not possible, terminate existing surface along a straight line at a natural line of division and submit recommendation to Consultant for review.

.7 Where a change of plane of 6 mm or more occurs, submit recommendation for providing a smooth transition; to Consultant for review.

.8 Patch or replace portions of existing surfaces which are damaged, lifted, discoloured, or showing other imperfections.

.9 Finish surfaces as specified in individual Product sections.

1.5 SUBMITTALS FOR CLOSEOUT

.1 Project Record Documents: Accurately record actual locations of capped utilities and subsurface obstructions.

1.6 REGULATORY REQUIREMENTS

.1 Conform to applicable code for demolition work, dust control, products requiring electrical disconnection and re-connection.

.2 Obtain required permits from authorities.

.3 Do not close or obstruct egress width to any building or site exit.

.4 Do not disable or disrupt building fire or life safety systems without 3 days prior written notice to Owner.

.5 Conform to procedures applicable when hazardous or contaminated materials are discovered.

1.7 SEQUENCING

.1 Sequence activities in the order determined by the Contractor.

1.8 SCHEDULING

.1 Schedule Work to coincide with new construction.

.2 Describe demolition removal procedures and schedule.

1.9 PROJECT CONDITIONS

.1 Conduct demolition to minimize interference with adjacent and occupied building areas.

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

Part 2 Products

2.1 NOT USED

.1 Not used.

Part 3 Execution

3.1 PREPARATION

.1 Comply with Northern Health Infection Control Policies.

.2 Provide, erect, and maintain temporary barriers at locations indicated.

.3 Erect and maintain weatherproof closures for exterior openings.

.4 Erect and maintain temporary partitions to prevent spread of dust, odours, and noise to permit continued Owner occupancy.

.5 Protect existing materials, furnishings, and equipment which are not to be demolished.

.6 Prevent movement of structure; provide bracing and shoring.

.7 Notify affected utility companies before starting work and comply with their requirements.

.8 Mark location and termination of utilities.

.9 Provide appropriate temporary signage including signage for exit or building egress.

3.2 DEMOLITION

.1 Comply with Interior Health Infection Control Policies.

.2 Disconnect remove and identify designated utilities within demolition areas.

.3 Demolish in an orderly and careful manner. Protect existing supporting structural members.

.4 Remove demolished materials from site except where specifically noted otherwise. Do not burn or bury materials on site.

.5 Remove materials as Work progresses. Upon completion of Work, leave areas in clean condition.

.6 Remove temporary Work.

END OF SECTION

Part 1 – General

1.1 DOCUMENTS

.1 This section of the specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SECTION INCLUDES

.1 Removal, clean up, transport and disposal of all asbestos containing materials and other hazardous materials identified in way of the work in accordance with applicable regulatory requirements.

1.3 RELATED SECTIONS OR REPORTS

.1 Section 01 35 13 Special Project Procedures

1.4 PERMITS

.1 Ensure that through the requirements for renovations or demolition, all electrical disconnection, capping or isolation of the appropriate services and utilities is complete should these services be affected by the removal.

1.5 STANDARDS

.1 Conform to and perform work in accordance with the B.C. Worker's Compensation Board.

.2 Conform to and perform work in accordance with M.S.D.S. sheets for all regulated products in use on the project.

.3 Conform to and perform work in accordance with CSA Z-190 standard for respirator fit testing.

.4 Conform to and perform work in accordance with WCB WHMIS core manual.

.5 Conform to and perform work in accordance with current WCB Occupational Health & Safety Regulations.

.6 Conform to and perform work in accordance with current WCB publication regarding work with asbestos.

.7 Conform to and perform work in accordance with Latest edition of the BC Building Code.

.8 Conform to and perform work in accordance with all applicable electrical codes.

.9 Conform to and perform work in accordance with WCB manual of First Aid requirements.

.10 Conform to and perform work in accordance with WCB Notice of Project.

.11 Conform to and perform work in accordance with WCB publication - "Confined Space Entry - A Manual of Standard Practice" (Latest Edition).

.12 Conform to CSA Z 317.17 -12 Infection Control during the Construction, Renovation and Maintenance of Health Care Facilities

.13 Conform to and perform work in accordance with CSA S350-M1980, Code of Practice for Safety in Demolition of Structures

1.6 PROCEDURES AND REQUIREMENTS

.1 The Hazardous Materials (hazmat) Contractor will be a subcontractor to the Prime Contractor for the purposes of this Specification unless otherwise determined in contract documents.

.2 Asbestos removal for this project will be conducted under moderate risk work conditions as defined by the Work Safe B.C. publication "Safe Work Practices for Handling Asbestos".

.3 The HazMat Contractor and the Prime Contractor must submit, upon award, a copy of his exposure control plans and site-specific written work procedures including methods of hazardous materials removal or procedures to work on or around hazardous materials specifically as they relate to this project.

Part 2 – Description of Work

2.1 ASBESTOS ABATEMENT GENERAL

1 The work specified herein shall be the removal of known hazardous materials by competent persons trained, knowledgeable and qualified in the handling, transport and disposal of the hazardous materials using moderate and high-risk work procedures. Any worker deemed by the Industrial Hygiene Consultant to be inadequately trained to perform these duties will be removed from the project.

.2 Any scaffolds and/or platforms used to access and/or support asbestos workers and to remove the asbestos-containing materials shall be constructed or used in accordance with Occupational Health & Safety regulations.

.3 All necessary documentation shall be the responsibility of the HazMat and Prime Contractors.

.4 The health and safety of all contract employees in the areas affected during hazmat removal shall be the responsibility of the HazMat Contractor and the Prime Contractor and should the HazMat Contractor require the assistance of any other trade during the hazmat work, he will provide all necessary equipment, labour and training required to affect the work.

.5 The HazMat Contractor will assume total responsibility for the erection, maintenance, signs and integrity of all enclosures and barriers related to the hazmat work.

.6 The HazMat Contractor will provide all necessary labour, materials, insurance, permits and equipment necessary to carry out the work in accordance with all applicable regulations and this documentation.

.7 The HazMat Contractor will provide all necessary labour to secure the required utilities for all asbestos work.

2.2 SCOPE OF WORK

.1 The scope of work covers the complete removal, cleanup, transport and disposal at a licensed landfill of all asbestos, lead and PCB containing materials and equipment in way of the work as defined in the project Architectural, Mechanical, Structural and Electrical Specifications and Drawings.

.2 HazMat removal for this project will be conducted under Moderate work conditions as defined by the Work Safe B.C. for Asbestos, Lead, Silica and PCBs.

.3 Conditions of Work:

1. All work at Prince George Hospital site must conform to CSA Z317.17-12 Standards and

WorkSafeBC Occupational Health and Safety Regulations and Guidelines.

2. Viewing Windows must be installed within each enclosure to provide unrestricted access for use by the Fire Department, Night Watchman, Supervisors and Consultants. The viewing window will be a minimum of two feet by two feet in size.
3. The waste bins will be in the loading dock or other approved location.

Part 3 – Waste Handling and Disposal

.1 Disposal of all hazardous wastes will be conducted in accordance with the B.C. Ministry of Environment regulations pertaining to hazardous waste.

.2 The contractor will have a Transportation or Dangerous Goods certified person prepare a waste manifest form prior to the disposal of any asbestos-containing waste materials from the site.

.3 All waste bins used for material transportation will be lockable. The contractor will ensure that the waste bin is always locked when there is no employee watching the bin. Hazardous wastes will be moved only after 07:00 p.m. or as agreed to by the owner.

.4 The waste level in the bins is not to go above one foot from the top of the bin before transport.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Furnishing of all labour, materials, services and equipment necessary for:

.1 Finishing slabs-on-grade and monolithic suspended floor slabs.

.2 Concrete topping, sealers, patching and levelling compounds.

.3 Floor finishing and tolerances.

1.2 RELATED SECTIONS

.1 Section 01 74 00 – Cleaning and Waste Processing

.2 Section 07 92 00 - Joint Sealants.

.3 Section 09 91 00 - Painting.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 CAN/CSA A23.1/A23.2, Concrete Materials and Methods of Concrete Construction / Methods of Test for Concrete.

.3 CAN/CGSB-25.20, Surface Sealers for Floors.

.4 ACI 302.1R, Guide for Concrete Floor and Slab Construction.

.5 ASTM E1155M, Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers.

1.4 SUBMITTALS

.1 Section 01 33 00: Submittal procedures.

.2 Product Data: Provide data on concrete hardener, sealer, and slip resistant finish compatibilities, and limitations.

1.5 MAINTENANCE DATA

.1 Section 01 33 00: Submittal procedures.

.2 Maintenance Data: Provide data on maintenance renewal of applied coatings.

1.6 QUALITY ASSURANCE

.1 Perform Work in accordance with CAN/CSA A23.1/A23.2.

1.7 DELIVERY, STORAGE, AND HANDLING

.1 Deliver materials in manufacturer's packaging including application instructions.

1.8 COORDINATION

.1 Coordinate floor finishing with concrete floor placement and concrete floor curing.

.2 Coordinate exposed architectural concrete finishing with concrete formwork and concrete placement.

1.9 WASTE MANGEMENT AND DISPOSAL

.1 Comply with Section 01 74 00 - Cleaning and Waste Processing

Part 2 Products

2.1 CONCRETE TOPPING

.1 Portland cement based, self-leveling, self-drying topping.

.2 Acceptable materials;

.1 Sika EmeriCrete Topping

.2 Target Bonded Topping Mix

.3 Ardex K 301 Self-Leveling Concrete Topping; Ardex K 500 self leveling cementitious topping; or Ardex SD-T fast track self leveling, self drying concrete topping.

.4 Or approved substitution.

2.2 BONDING AGENTS

.1 Portland cement/ epoxy-based bonding agent: Formulated for bonding new concrete to cured concrete.

.2 Acceptable materials;

.1 Ardex Bonding and Anti-corrosion agent

.2 Grace Daraweld C

.3 Target Polymer Bonding Agent

.4 Sternson Surfacrete Concentrate Bond Agent

.5 Steels Multipurpose Acrylic

.6 Or approved substitution.

2.3 LEVELING COMPOUND:

.1 Self-drying, cement-based, polymer modified, trowel-grade underlayment.

.2 Acceptable materials:

.1 Mapei Plani/Patch

.2 Ardex Feather Finish, Ardex Fortifinish high strength, Ardex SD-P trowelabe and rampable.

.3 Starpatch Super Fine Skim Coat Mortar

.4 Or approved substitution.

2.4 SURFACE SEALER

.1 Surface sealer: acrylic polymer water emulsion type, clear, to CAN/CGSB-25.20, Type 2 or ASTM-C309, Type 1.

.1 Acceptable material:

.1 CPD Acrylic Floor Sealer (Water Emulsion)

.2 W.R. Meadows Sealtight Vocomp-20

.3 Sika Florseal WB 25.

.4 Sonneborne Kure-N-Seal WB

2.5 FLOOR HARDENER

.1 Non-metallic hardener (plain): premixed, dry shake surface hardener.
- .1 Acceptable material: Sternson Diamag 7; Target Non-Metallic; CPD Floor Hardener Pre-Mix (Standard); Master Builders Mastercron; Sonneborn Harcol Redi-Mix.

.2 Non-metallic hardener (coloured): premixed, dry shake surface hardener, colour selected by Consultant.
- .1 Acceptable material: Sternson Colorplete; Master Builders Colorcron; Sonneborn Harcol Redi-Mix.

2.6 MIXING

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

2.7 SUBSTITUTIONS

.1 Specified manufacturer's products stated herein establish minimum acceptable standards for work of this Section.

.2 Other manufacturers offering products meeting or exceeding specified products and requirements may be considered.

.3 Requests for substitutions will be considered.

Part 3 Execution

3.1 EXAMINATION

.1 Section 01 71 00: Verify site conditions.

.2 Verify that floor surfaces are acceptable to receive the work of this section.

3.2 PREPARATION

.1 Prior to finishing concrete floors, confirm with the manufacturers of all finished flooring to be used on the project, the specific floor finish, (rough or smooth) required for the application of the finished flooring.

.2 Prior to application of levelling compounds and curing compounds, confirm compatibility of products with finished flooring manufacturers.

.3 Examine surfaces to receive curing compounds, patching and levelling compounds and report any defects which may affect the performance of the work of this section.

.4 Beginning of installation means acceptance of existing conditions.

.5 Prepare and clean substrates in accordance with manufacturer's directions for application of curing compounds, patching and levelling compounds.

.6 Concrete surfaces shall have been cured for time periods stipulated by manufacturers for installation of their products.

3.3 FLOOR SLAB FINISHING

.1 Finish concrete floor surfaces in accordance with CSA-23.1, Section 22 - Treatment of Unformed Surfaces, for Class 'A' floor finish.

.2 Steel Trowel Finish: In accordance with CSA-23.1, Section 22 and as follows:

.1 Thoroughly float surface with disc power floating machine until compacted. Continue floating until sufficient mortar rises to surface and fills all voids.

.2 When floor surface has hardened sufficiently and no fines are brought to the surface, trowel floor with steel trowel to smooth surface free from pinholes and imperfections.

.3 Ensure trowel disc lines are removed and provide a smooth hard burnished finish.

.4 Schedule:

.1 Concrete floors to receive resilient flooring.

.3 Tool all control joints and construction joints. Coordinate tooling with concrete finishing. Re-tool joints at completion of finishing as required to give full size joint and provide sound substrate suitable for sealant application.

3.4 FLOOR TOLERANCES

.1 Concrete tolerance for horizontal surfaces in accordance with CSA-A23.1/A23.2. Use F-number method to verify flatness within 48 hours after slab installation.

.2 Finish concrete to achieve the following tolerances:

.1 Under Resilient Finishes: F_F 32 and F_L 25.

.3 Correct the slab surface if the actual F_F or F_L number for the floor installation measures less than required.

.4 Correct defects in the defined traffic floor by grinding or removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.5 CORRECTION OF FLOOR TOLERANCES

.1 Where floor tolerances are not within the specified limits, grind or fill the floor to bring the surface to within the requirements.

.2 Where grinding is required, grind floors as soon as possible, preferably within three days but not until the concrete is sufficiently strong to prevent dislodging coarse aggregate particles.

.3 Where filling is required, the concrete surface shall be prepared by mechanical roughening or hydromilling to remove all surface film and laitence.

.4 Apply levelling compound as specified in accordance with manufacturer's printed instructions.

3.6 LEVELLING COMPOUND AND FLOOR DRAINS

.1 Apply levelling compound in accordance with manufacturer's instructions, where required to bring floor tolerances to within limits specified. Grind down subfloor ridges and bumps.

.2 Clean floor and apply filler to leave smooth, flat, hard surface in conformance with manufacturer's written recommendations. Prohibit traffic until fully cured.

.3 Unless otherwise detailed or specified, at junctions of flooring with differing finish levels provide a smooth transition using levelling compound as specified applied in accordance with manufacturer's printed instructions. Feather out levelling compound for a distance of 3 m (10 ft.).

.4 Flood test concrete floor surfaces incorporating floor drains to ensure that positive drainage has been provided in the floor area.

3.7 APPLICATION: CURING COMPOUND

.1 Apply curing and sealing compound in accordance with the manufacturer's instructions to all areas not scheduled to receive further floor finish. Apply at the rate of not less than 10 m2/litre for smooth steel troweled surfaces and 5 to 7.5 m2/litre for float or broom finished surfaces.

.2 Do not apply concrete curing compound to floors designated to receive resilient flooring, liquid applied finishes or ceramic tile.

3.8 APPLICATION: SURFACE SEALERS

.1 Ensure compatibility of floor treatment materials with adhesives of finished flooring materials and other bonded toppings or coatings prior to application.

.2 Apply floor treatment in accordance with manufacturer's written instructions.

.3 Clean overspray. Clean sealant from adjacent surfaces.

3.9 APPLICATION: FLOOR HARDENERS

.1 Apply hardener in accordance with manufacturer's written instructions.

.2 Apply floor hardener aggregate at rate of 0.75 - 1.0 lbs/ft² 3.66 - 4.88 kg/m² for a "light duty" hardened surface.

.3 Apply floor hardener aggregate at rate of 1.0 - 1.25 lbs/ft² 4.88 - 6.1 kg/m² for a "medium duty" hardened surface.

.4 Protect finished installation until floor treatment has cured.

3.10 BONDING AGENT

.1 Apply bonding agent to all concrete when new concrete will be applied against it under the following conditions:

.1 Patching

.2 At construction joints.

3.11 DEFECTIVE CONCRETE

.1 Repair honeycombing, rock pockets, chips, spalls and stains in exposed concrete surfaces. Remove fins and other protrusions in concrete surfaces by chipping, not grinding.

.2 Patch honeycombing, rock pockets, chips and spalls to match surrounding sound concrete surfaces, textures and colour.

.3 Remove stains from concrete surfaces.

3.12 PROTECTION

.1 At all times during the work protect architectural members as required with polyethylene sheets or the like from staining or becoming coated with leakage, due to continuing concreting operations. Protect concrete from staining due to rusting of reinforcing steel.

3.13 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 As work proceeds and on completion deposit all recyclable packing materials and containers in appropriate recycling containers.

.3 Rubbish and debris resulting from work of this section shall be collected regularly, and removed from the project site and disposed of in accordance with Section 01 74 00 - Cleaning and Waste Processing.

.4 Repair, remove and clean all drips or smears resulting from the work of this section on exposed, finished surfaces or surfaces to be subsequently finished.

.5 Clean adjacent soiled surfaces.

3.14 SCHEDULES

.1 Refer to Room Finish Schedule for Areas with resilient flooring and seamless flooring.

.2 Infill trenches where new underslab piping is intalled for new shower drains.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Furnishing of all labour, materials, services and equipment necessary for the design, supply and installation of shop fabricated miscellaneous metal items.

1.2 RELATED SECTIONS

.1 Section 06 41 11 - Architectural Cabinetwork.

.2 Section 09 91 10 - Painting.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM A53/A53M - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

.3 ASTM A153/A153 - Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

.4 ASTM A307 - Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.5 ASTM A500 - Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

.6 ASTM A501 - Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.

.7 CAN/CGSB-1.181 - Ready-Mixed, Organic Zinc-Rich Coating.

.8 CAN/CSA-G40.20-04/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.9 CAN/CSA-G164 - Hot Dip Galvanizing of Irregularly Shaped Articles.

.10 CSA/CAN-B44 - Safety Code for Elevators: Elevator access ladders.

.11 CSA W48 - Filler Metals and Allied Materials for Metal Arc Welding

.12 CSA W59 - Welded Steel Construction (Metal Arc Welding).

.13 SSPC (The Society for Protective Coatings) (formerly SSPC - Steel Structures Painting Council) - Steel Structures Painting Manual.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

.3 Indicate welded connections using standard welding symbols. Indicate net weld lengths.

1.5 QUALITY ASSURANCE

.1 Prepare Shop Drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the Province of British Columbia.

.2 Welded Steel Construction: CSA W59.

.3 Structural Design and Inspection:

.1 Provide and pay for the services of professional engineer registered in the Province of British Columbia who specializes in the restraint of building elements to:

.1 design the components of the work of this Section requiring structural performance,

.2 be responsible for determining sizes, joint spacing to allow for thermal and seismic movement and loading of components in accordance with all applicable codes and regulations,

.3 be responsible for production and review of shop drawings,

.4 inspect the work of this Section during fabrication and erection,

.5 stamp and sign each shop drawing,

.6 provide site administration and inspection of this part of the Work.

Part 2 Products

2.1 MATERIALS - STEEL

.1 Steel Sections and Plates: CAN/CSA-G40.20/G40.21.

.2 Steel Pipe: ASTM A53/A53M, Grade A Schedule 40, standard weight, black finish.

.3 Steel Tubing: ASTM A500, Grade B, black finish.

.4 Bolts, Nuts, and Washers: ASTM A307, galvanized to CSA G164 for galvanized components.

.5 Welding Materials: Type required for materials being welded.

.6 Welding Filler Material: CSA W48.

.7 Shop and Touch-Up Primer: SPCC 15 Type I red oxide.

2.2 MATERIALS - ALUMINUM

.1 Extruded Aluminum: ASTM B221/B221M alloy, 6063, Temper T5.

.2 Sheet Aluminum: ASTM B209/B209M, Alloy 6063, Temper T5.

.3 Aluminum-Alloy Drawn Seamless Tubes: ASTM B210, Alloy 6063, Temper T6.

.4 Aluminum-Alloy Bars: ASTM B211, Alloy 6063, Temper T6.

.5 Bolts, Nuts, and Washers: Stainless steel.

.6 Welding Materials: Type required for materials being welded.

2.3 FABRICATION

.1 Fit and shop assemble items in largest practical sections, for delivery to site.

.2 Fabricate items with joints tightly fitted and secured.

.3 Continuously seal joined members by continuous welds.

.4 Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

.5 Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

.6 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATION TOLERANCES

.1 Squareness: 3 mm maximum difference in diagonal measurements.

.2 Maximum Offset Between Faces: 1.5 mm.

.3 Maximum Misalignment of Adjacent Members: 1.5 mm.

.4 Maximum Bow: 3 mm in 1.2 m.

.5 Maximum Deviation from Plane: 1.5 mm in 1.2 m.

2.5 FINISHES - STEEL

.1 Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

.2 Exterior Exposed Steel: prepare to SSPC-SP-6, Commercial Blast. All other steel to be prepared to SSPC-SP3, Power Tool Cleaning.

.3 Do not prime surfaces in direct contact with concrete or where field welding is required.

.4 Prime paint items with one coat.

2.6 FINISHES - ALUMINUM

.1 Finish coatings to conform to AAMA 603 AAMA 605.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that field conditions are acceptable and are ready to receive work.

.3 Verify dimensions, tolerances, and method of attachment with other work.

3.2 SITE PREPARATION

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

.2 Supply steel items required to be cast into concrete or embedded in masonry with setting templates to appropriate sections.

3.3 INSTALLATION

.1 Install items plumb and level, accurately fitted, free from distortion or defects.

.2 Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

.3 Field weld components indicated on shop drawings.

.4 Perform field welding to CSA requirements.

.5 Obtain approval prior to site cutting or making adjustments not scheduled.

.6 After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

.7 Install ceiling grid equipment support system in accordance with manufacturer's written instructions.

.1 Rails shall be true, plumb and level to the tolerances indicated when maximum loading conditions are applied due to equipment operation.

3.4 ERECTION TOLERANCES

.1 Maximum Variation from Plumb: 6 mm per story, non-cumulative.

.2 Maximum Offset from True Alignment: 6 mm.

.3 Maximum Out-of-Position: 6 mm.

3.5 COATINGS/DISSIMILAR METALS

.1 Aluminum surfaces to be placed in contact with masonry or concrete shall, before shipment from the fabricating plant, be given a heavy coat of an alkali resistant bituminous paint. The paint shall be applied without the addition of any thinner in strict accordance with the paint manufacturer's instructions.

.2 Where aluminum work is fastened to steel supporting members or other dissimilar metal parts, the aluminum shall be kept from direct contact with such parts by a heavy shop coat of alkali resistant bituminous paint. The paint shall be applied without the addition of any thinner, in strict accordance with the paint manufacturer's instructions. Such paint shall be allowed to dry before assembly of parts.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Concealed blocking for support of toilet and bath accessories, wall cabinets, equipment, and other wall mounted apparatus.

.2 Telephone and electrical panel back boards.

.3 Roof curbs for mechanical equipment as per RCABC design guidelines.

1.2 RELATED SECTIONS

.1 Section 06 41 11 – Architectural Cabinetwork.

.2 Section 07 52 11 – SBS Modified Bitumen Membrane Roofing (Patch Work)

.3 Section 09 21 16 – Non-Structural Metal Stud Framing.

.4 Section 07 62 00 - Sheet Metal Flashing and Trim

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 CSA B111 - Wire Nails, Spikes and Staples.

.3 CSA O141 - Softwood Lumber.

.4 CSA O151 - Canadian Softwood Plywood.

.5 CSA O80 Series-97 - CSA Standards for Wood Preservation.

.6 National Lumber Grades Authority (NLGA) - Standard Grading Rules for Canadian Lumber.

Part 2 Products

2.1 FRAMING AND STRUCTURAL MEMBERS

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% (S-dry) or less to following standards:

.1 CAN/CSA-O141 - Softwood Lumber.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Glued end-jointed (finger-jointed) lumber is not acceptable.

.3 Structural Composite Lumber (SCL): to ASTM D5456.

.4 Framing and board lumber: to National Building Code (NBC), except as follows:

.1 Framing and board lumber: S-P-F species, NLGA No.2 grade or better.

.5 Furring, blocking, nailing strips, grounds, rough bucks, curbs, fascia backing and sleepers:

.1 Board sizes: SPF species, “Standard” or better grade.

.2 Dimension sizes: SPF species, “Standard” light framing or better grade.

.6 Do not use products containing added urea formaldehyde in the Facility.

2.2 ACCESSORIES

.1 Fasteners and Anchors:

.1 Fasteners: Hot dipped galvanized steel for high humidity and treated wood locations, unfinished steel elsewhere.

.2 Anchors: Toggle bolt type for anchorage to hollow masonry. Expansion shield and lag bolt type for anchorage to solid masonry or concrete. Bolt or ballistic fastener for anchorages to steel.

2.3 FASTENER FINISHES

.1 Galvanizing: to CSA G164, use galvanized finished fasteners for exterior work and pressure-preservative treated lumber.

2.4 PRESSURE PRESERVATIVE TREATED WOOD

.1 Sustainable requirements: only wood materials located outside of building air barrier assembly may be pressure preservative treated.

.2 Provide lumber and plywood materials pressure preservative treated for following:

.1 Roof curbs, fascia backing, sleepers.

.2 Furring, blocking on exterior of building.

.3 Other materials indicated on Drawings.

.3 Preservative: to CSA O80 Series, water-borne, alkaline copper quaternary (ACQ).

.4 Treat material to CSA O80 Series using ACQ preservative to obtain minimum net retention for exposures as follows:

.1 UC3.2 - material above grade.

.2 UC4.1 - material below grade or in contact with ground.

.5 Identify each piece of treated material with a tag or ink mark bearing Canadian Wood Preservers' Bureau quality mark.

.6 Following water-borne preservative treatment, dry material to maximum moisture content of 19% (S-dry)% or less.

.7 Field treatment: comply with AWPA M4 and revisions specified in CSA O80 Series, Supplementary Requirements to AWPA M2. Apply surface applied wood preservative to heartwood exposed from trimming, cutting, or boring.

.8 Remove chemical deposits on treated wood to receive applied finish.

Part 3 Execution

3.1 INSTALLATION

.1 Comply with requirements of BCBC, supplemented by following paragraphs.

.2 Refer to Structural Drawings for additional requirements.

.3 Install members true to line, levels, and elevations. Space uniformly.

.4 Construct continuous members from pieces of longest practical length.

.5 Install spanning members with "crown-edge" up.

.6 Select exposed framing for appearance. Install lumber and panel materials so that grade-marks and other defacing marks are concealed or are removed by sanding where

materials are left exposed. Sanding is acceptable only in locations where defacement will not be evident after finishing.

.7 Install blocking at locations indicated to support washroom accessories. For landscape work, obtain the Design Consultant's acceptance of rough grades prior to construction.

.8 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, electrical equipment mounting boards, and other work as required.

.9 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.10 Use dust collectors and high quality respirator masks when cutting or sanding wood panels.

3.2 Erection

.1 Frame, anchor, fasten, tie, and brace members to provide necessary strength and rigidity.

.2 Countersink bolts where necessary to provide clearance for other work.

.3 Use nailing disks for soft sheathing as recommended by sheathing manufacturer.

.4 Use fastenings of following types, except where specific type is indicated or specified:

.1 To hollow masonry, plaster, and panel surfaces use toggle bolt.

.2 To solid masonry and concrete use expansion shield with lag screw, lead plug with wood screw.

.3 To structural steel use bolts through drilled holes, welded stud-bolts, power driven self-drilling screws, welded stud-bolts, or explosive actuated stud-bolts.

.5 Furring and blocking:

.1 Install furring and blocking as required to space-out and support casework, cabinets, surface applied fixtures and equipment, wall and ceiling finishes, and other work as indicated.

.2 Align and plumb faces of furring and blocking to tolerance of 1:600.

.6 Nailing strips, grounds and rough bucks:

.1 Install rough bucks, nailers, and linings to rough openings as required to provide backing for frames and other work.

.2 Except where indicated otherwise, use material at least 38 mm thick.

.7 Curbs, Nailers:

.1 Install curbs, and other wood supports as required and secure using galvanized fasteners.

.2 Secure roof curbs, nailers with 10 mm diameter galvanized bolts where indicated, galvanized nails elsewhere. Space bolts within 300 mm from ends of members and uniformly spaces at maximum 1 200 mm on centre between. Countersink bolts where necessary to provide clearance for other work.

.3 On roof deck provide strips of roofing vapour barrier sheet under curbs, nailers, and sleepers installed directly onto roof deck. Extend vapour barrier sheet minimum 300 mm onto roof deck both sides of curbs or sleeper to allow for overlap and sealing to roofing vapour barrier. Apply as continuous strips, with 200 mm overlap at joints, and seal joints with mastic. Use same material used for roofing vapour barrier. Coordinate with roofing Subcontractor.

.8 Electrical equipment backboards: Install 19 mm fire rated fir plywood boards. On all walls in telephone and data rooms receiving wiring and equipment; minimum 1220 mm x 2440 mm panels on periphery walls over 300 mm wide, mounted 300 mm off of finished floor.

3.3 HANDLING AND USE OF TREATED TIMBER

.1 Handle and use treated material in a manner which will avoid damage or field fabrication, causing alteration in original treatment.

.2 Treat in field, cuts and damages to surface of treated material with an appropriate, clear preservative as described in CSA O80. Ensure that damaged areas such as abrasions nail and spike holes, are thoroughly saturated with field treatment solutions in accordance with CSA O80.

3.4 WORKMANSHIP

.1 Construct all work to details, using adequate fastening methods to ensure solid durable finished work suitable for purpose intended.

.2 Do all nailing and fastening neatly, evenly, and thoroughly.

.3 Install all members true to line, levels, and elevations. Set plumb and space uniformly.

.4 Use timbers of longest possible length to minimize joints.

3.5 SCHEDULE

.1 Install solid wood backing for support of all millwork cabinets.

.2 Install wood curbs and blocking to equipment curbs.

.3 Install concealed 19mm plywood backing for all wall mounted accessories.

END OF SECTION

1 General

1.1 SECTION INCLUDES

.1 Work of this Section shall include, but shall not be necessarily limited to the following:
  .1 Installation of prefabricated casework.
.2 Include also the following in this Section:
  .1 Installation of all solid core wood doors and installation of all finish hardware to pressed steel frames.
  .2 Receiving, unloading, storage and protection of metal doors and pressed steel door frames.
.3 Receiving, unloading and storage of finish hardware for installation.
.4 Washroom accessories installation.
.5 Installation of all trims and miscellaneous finishes as required.

1.2 RELATED SECTIONS

.1 Section 01 74 00 – Cleaning & Waste Processing
.2 Section 06 41 11 - Architectural Cabinetwork
.3 Section 08 11 13 – Standard Metal Doors and Frames
.4 Section 08 14 16 – Flush Wood Doors
.5 Section 08 71 00 - Door Hardware
.7 Section 09 91 10 - Painting

1.3 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 plumbing and electrical rough-in, installation of associated and adjacent components and equipment.

1.4 SUBMITTALS

.1 Section 01 33 00: Submission procedures.
.2 Product Data: Provide data on fire retardant treatment materials and application instructions.
.3 Shop Drawings:
  .1 Indicate site dimensions, materials, component profiles, fastening methods, jointing details, and accessories to a minimum scale of 1:10.
  .2 Provide instructions for attachment hardware, finish hardware, and specialties.
.4 If requested by Consultant submit following samples:
  .1 Three samples of finish plywood, 300 x 300 mm in size illustrating wood grain and specified finish.
  .2 Three samples of wood trim 300 mm long.

1.5 QUALITY ASSURANCE

.1 Section 01 40 00: Quality Control.
.2 Perform work in accordance with AWS Manual Custom quality.
.3 Work of this Section shall be manufactured and/or installed to specified AWS Manual requirements.
.4 Work that does not meet AWS Manual Quality Standards, as specified, shall be replaced, reworked, and/or refinished by the Finish Carpentry subcontractor, with no additional cost

to the project.

1.6 REGULATORY REQUIREMENTS

.1 Conform to the current BC Building Code for fire retardant requirements.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 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 Protect work from moisture damage.

2 Products

2.1 LUMBER MATERIALS

.1 Softwood lumber: AWS Lumber Grade 1, plain sawn, S4S, moisture content 4 - 9% (S-dry) or less in accordance with following standards: CAN/CSA-O141, NLGA, AWS.
.2 Hardwood Lumber: AWS Lumber Grade 1, select American Black Walnut, quarter sawn, moisture content 4 - 9 % or less in accordance with following standards; NHLA, AWS Manual.
.3 Glued end-jointed (finger-jointed) lumber is not acceptable.

2.2 SHEET MATERIALS

.1 Canadian softwood plywood (CSP) to CSA-O121, standard construction.
  .1 Urea-formaldehyde free.
.2 Hardwood Plywood:
  .1 Core: Fire-rated medium density fibreboard (MDF).
    .1 Acceptable Product: McKillican Flakeboard Vesta FR, no-added urea-formaldehyde, or approved alternate.
  .2 Face: Minimum 0.5 mm thick, in accordance with HVPA HP-1 AWI/AWMAC Grade AA, Select White Maple on all exposed faces to match control sample, quarter cut, book match, balance and center match, selected for architectural quality with respect to cutting lengths, uniformity of colour, figure grain and character; having a high standard of finished appearance, free of mineral streaks, discolouration, grain ruptures, loose texture, and shakes.
  .3 Urea-formaldehyde free.
.3 Medium Density Fibreboard (MDF): ANSI A208.2 Industrial grade, 54lb/ft^3 density, moisture resistant; composed of recycled and/or recovered wood particles reduced to fibres, wheat straw fibre or agrifibre, made with high waterproof resin binders; of grade to suit application; sanded faces, no added formaldehyde. Minimum 94% total recycled content, at least 10% of which shall be post-consumer recycled content.
.4 Particleboard: industrial grade, 47lb/ft^3 density, manufactured from recycled and/or recovered wood, no added urea-formaldehyde.
  .1 Acceptable Product:
    .1 Flakeboard Vesta FR, no-added urea-formaldehyde.
    .2 Medex SDF.
    .3 Or approved substitution.
.5 Hardboard: CAN/CGSB 11.3; pressed wood fibre with resin binder, tempered grade, 6 mm thick, smooth one side, no added formaldehyde.

2.3 ADHESIVE

.1 Adhesive: ANSI/WDMA I.S.-1 Series, Type recommended by AWS Manual to suit application.
.2 Total Volatile Organic Carbon (TVOC) emissive content: 20 gr/litre.

2.4 FASTENERS

.1 Fasteners: Of size and type to suit application; chromed steel finish in concealed locations and stainless steel finish in exposed locations.
.2 Concealed Joint Fasteners: Threaded steel.

2.5 ACCESSORIES

.1 Lumber for Shimming, Blocking: Softwood lumber of SPF species.
.2 Edge Trim: Solid PVC 3 mm, hot melt type.
.3 Glass: 4 mm tempered, specified in Section 08 80 50.
.4 Primer: Latex type, low VOC emitting.
.5 Wood Filler: Oil base, tinted to match surface finish colour.

2.6 SITE FINISHING

.1 Seal surfaces in contact with cementitious materials.

3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.
.2 Verify that field measurements are as indicated on reviewed shop drawings.
.3 Verify adequacy of backing and support framing.
.4 Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.
.5 Examine doors and frames and verify proper preparation for hardware.

3.2 INSTALLATION

.1 Install work in accordance with AWI/AWMAC Custom Quality Standard, except where indicated otherwise..
.2 Set and secure materials and components in place, plumb and level.
.3 Carefully scribe work abutting other components, abutting walls, and surfaces, fit properly into recesses and to accommodate piping, columns, fixtures, outlets, or other projecting, intersecting or penetrating objects, with maximum gaps of 1 mm. Do not use additional overlay trim to conceal larger gaps.
.4 Form joints to conceal shrinkage.

3.3 CONSTRUCTION

.1 Fastening:
  .1 Position items of finished carpentry work accurately, level, plumb, true and fasten or anchor securely.

.2 Design and select fasteners to suit size and nature of components being joined. Use proprietary devices as recommended by manufacturer.
.3 Set finishing nails to receive filler.
.4 Where screws are used to secure members:
.1 Concealed installation: countersink screw in round cleanly cut hole and plug with wood plug to match material being secured.
.2 Exposed installation, where specified: use flat headed screws with finishing washers.
.5 Replace items of finish carpentry with damage to wood surfaces including hammer and other bruises.
.6 Use fasteners compatible with material through which they pass.
.7 Use heavy-duty fasteners for securing wall hung items.

.2 Shelving.
.1 Install shelving on shelf brackets.

3.4 PREPARATION FOR SITE FINISHING

.1 Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.
.2 Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.5 ERECTION TOLERANCES

.1 Maximum Variation from True Position: 1.5 mm.
.2 Maximum Offset from True Alignment with Abutting Materials: 0.7 mm.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Furnish all labour, material, services and equipment necessary for the supply, fabrication, finishing, delivery and installation of all Casework, wood panels, wood frames, wood trim and plastic laminate-faced components as indicated on the drawings, as scheduled and as specified herein.

.2 Work shall include, but not necessarily be limited to the following:

.1 Casework including countertops, backsplashes, box cabinets, wall cabinets and shelving, closet rods and shelving.

.2 All plastic laminate work on wood substrates.

.3 All solid surface work on wood substrates.

.4 Supply and installation of all cabinet hardware.

.5 All accessories required for binding millwork together and securing in place.

.6 Supply and installation of fabricated steel casework support brackets as detailed in drawings.

.7 All sealants required between joints between counters and backsplashes and between casework and walls.

.8 Cutting and drilling to accommodate fixtures, services and all other work of other contractors that is required to be part of or pass through finished casework assembly.

.9 Supervision of later work to be installed by other contracting forces within the work produced by this Section.

.10 Stainless steel counters.

1.2 RELATED SECTIONS

.1 Section 06 10 13 – Wood Blocking and Curbs.

.2 Section 06 61 16 – Solid Surfacing Fabrication.

.3 Section 09 09 06 – Interior Finishes List

.4 Section 09 21 16 – Non-Structural Metal Stud Framing.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ANSI A208.2 - Medium Density Fibreboard (MDF) for Interior Applications.

.3 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

.4 AWMAC (Architectural Woodwork Manufacturers Association of Canada) – North American Architectural Woodwork Standards

.5 BHMA A156.9: Cabinet Hardware.

.6 CAN/CGSB-11.3 - Hardboard.

.7 CSA O80 Series - CSA Standards for Wood Preservation.

.8 CHPVA (Canadian Hardwood Plywood and Veneer Association) - Official Grading Rules for Canadian Hardwood Plywood.

.9 NEMA (National Electrical Manufacturers Association) LD3 - High-Pressure Decorative Laminates.

.10 NHLA (National Hardwood Lumber Association).

.11 NLGA (National Lumber Grades Authority) - Standard Grading Rules for Canadian Lumber, 2005.

1.4 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Shop Drawings:

.1 Notations prior to commencement of work under this section.

.2 Drawing Scale: Minimum metric scale of 1:10

.3 hardware location and schedule of finishes.

.4 Indicate component sections for oversized units

.3 Product Data: Provide data for hardware accessories.

.4 Samples:

.1 Submit two (2), 300 x 300 mm size samples, illustrating cabinet finish. One to the consultant and one to the field office.

.2 Submit two (2), 300 x 300 mm size samples, illustrating countertop finish and edge. One to the consultant and one to the field office.

.5 Submit shop drawings to the AWMAC Chapter office for review before work commences. Work that does not meet AWMAC's architectural woodwork standards, as specified, shall be replaced, reworked and/or refinished by the architectural woodwork contractor, to AWMAC's approval, at no additional cost to the owner.

1.5 QUALITY ASSURANCE

.1 Section 01 45 00: Quality Control.

.2 Products of This Section: Manufactured to ISO 9000 certification requirements.

.3 Perform work in accordance with AWMAC Custom quality.

.4 Fabricator Qualifications: Company specializing in fabricating Products specified in this section with minimum five (5) years experience.

.5 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years documented experience.

.6 Manufacture and install architectural woodwork to AWMAC's architectural woodwork standards in effect at time of bidding. Architectural woodwork shall be subject to an inspection at the manufacturing facility and/or site by an appointed AWMAC Certified Inspector. Inspection costs shall be included in the bid price for this project.

.7 If the architectural woodwork contractor is an AWMAC MSQ Qualified Manufacturer Member in good standing, a two (2) year AWMAC Guarantee Certificate shall be issued. The AWMAC Guarantee shall cover replacing, reworking and/or refinishing defective architectural woodwork due to faulty workmanship or defective materials supplied and/or installed by the architectural woodwork contractor that may appear during the two (2) year period following the date of certificate issuance. If the architectural woodwork contractor is ***not*** an AWMAC MSQ Qualified Manufacturer Member, they shall provide

the owner with a two (2) year maintenance bond in lieu of the AWMAC Guarantee Certificate to the full value of the architectural woodwork contract.

1.6 PRE-INSTALLATION MEETING

.1 Convene two (2) weeks before starting work of this section if requested by the consultant.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Transport, handle, and store Products in accordance with AWMAC guidelines.

.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 Protect units from moisture damage as specified in AWMAC Section 2.

.5 Protect surfaces with recyclable wrapping.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 During and after installation of work of this section, maintain the same temperature and humidity conditions in building spaces as will occur after occupancy.

Part 2 Products

2.1 LUMBER MATERIALS

.1 Hardwood Lumber: AWMAC Custom Grade; maple species, plain sawn, maximum moisture content of 10 percent; with vertical grain, of quality suitable for transparent finish. FSC Certified.

.2 Softwood Lumber: AWMAC Custom Grade; SPF species, plain sawn, maximum moisture content of 10 percent. FSC Certified.

2.2 SHEET MATERIALS

.1 Hardwood Plywood: CHPVA A; MDF core; maple face species, FSC Certified, plain sliced; of quality suitable for transparent finish.

.2 Medium Density Fibreboard (MDF): ANSI A208.2 moisture resistant; composed of wood particles reduced to fibres, FSC Certified, made with high waterproof resin binders; of grade to suit application; sanded faces, no added formaldehyde. Minimum 94% total recycled content, at least 10% of which shall be post-consumer recycled content.

.3 Hardboard: CAN/CGSB 11.3; pressed wood fibre with resin binder, FSC Certified, tempered grade, 6 mm thick, smooth one side, no added formaldehyde.

.4 Fibreboard: Fibreboard shall made from wheat straw fibre and formaldehyde-free, moisture resistant polyurethane resin.

2.3 MANUFACTURERS - HIGH PRESSURE LAMINATE

.1 Refer to Interior Finishes List.

.2 Other manufacturers offering products meeting or exceeding specified products, colours, patterns, and requirements may be considered. Proposed substitutions are to closely match scheduled colours and patterns and be reviewed and approved by the Consultant or they may be rejected.

2.4 LAMINATE MATERIALS

.1 High Pressure Laminate: NEMA LD3, high pressure laminate, refer to Interior Finishes List.

.2 Fibre Reinforced Laminate: NEMA 3.13; UL-723; ASTM E 84, class A, fibre reinforced laminate.

.3 Laminate Backing Sheet: NEMA LD3, BKL, same thickness and colour as face laminate.

2.5 ACCESSORIES

.1 Adhesive: ANSI/WDMA I.S.-1 Series, Type I. Total Volatile Organic Carbon (TVOC) emissive content: 20 gr/litre.

.2 Edge Trim:

.1 Edging at Millwork Components: Solid 2mm PVC heat applied matching wood grain and/or colour as exposed finish.

.2 Backsplash Edging: Plastic laminate when installed against a wall.

.3 Glass: minimum 6mm tempered, as specified in Section 08 80 50.

.4 Fasteners: Size and type to suit application.

.5 Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; bright zinc finish in exposed locations.

.6 Concealed Joint Fasteners: Threaded steel.

.7 Tape: Aluminum foil, insulating and heat dissipating tape.

.8 Primer: Latex type, low VOC emitting.

.9 Fabricated steel casework support brackets

.10 Adhesive for Countertop Edging: Titebond GREENchoice Heavy Duty Construction Adhesive.

2.6 HARDWARE

.1 Cabinet Hardware: To ANSI/BHMA A156.9 – 2003

.2 All hardware to conform to Section 10 of Architectural Woodwork Manufacturers of Canada, Edition 3.1 July 2017.

.1 Cabinet Hinges: All hinges to be of metal construction meeting or exceeding the ANSI/BHMA Grade 1 “performance” and “permanent set” test requirements 110° opening all metal hinge with “softclose” feature.

.1 Blum

.2 Grass

.3 Mepla.

.2 Drawer Glides: Drawer glides are the nominal length of 550 mm, full extension concealed all metal ball bearing glide with “softclose” feature, Load Capacity: 75 lbs (34 kg) at general purpose drawers, 100 lbs (45.4 kg) at file drawers, 150 lbs (68 kg) at lateral file drawers wider than 610 mm and less than 762 mm, 200 lbs (91 kg) at lateral file drawers wider than 762 mm.

.1 Accuride

.2 Blum

.3 Grass.

.3 Cabinet Pulls:

.1 Regular: Standard stainless “D” pull – Richelieu 33205170.

.2 Anti-ligature – Accurate Lock & Hardware CP-CAB, 630 satin stainless steel finish (for all patient accessible areas).

.4 Countertop Grommets:

.1 56 dia. – Stainless Steel finish – Richelieu – 20692170.

.5 Adjustable table leg:

.1 Stainless finish – Richelieu – 1020 mm – 620120170.

.6 Adjustable Shelf Hardware:

.1 5 mm Dia. Pins with seismic feature – Richelieu MP5849N30 White.

.7 Cabinet Locks:

.1 5 pin, removable core, master keyed, provide 2 keys per lock, finish to match door pulls – Schlage CL 100 or CL 200 Series

.8 Counter top support brackets Richelieu, Extra-Heavy-Duty Countertop Bracket, EH1824P/EH1818P, sized to suite counter, white primer or approved alternate. Prefinished powder coat finish, 3 mm thick steel, sizes; as selected from manufacturer's standard range to suit application, colour; as selected by Consultant. Use fabricated casework brackets where noted.

2.7 PLASTIC LAMINATE COUNTERTOPS

.1 Comply with AWMAC Quality Standards, custom grade requirements for counter construction supplemented as follows:

.2 High Pressure Laminate: NEMA LD3, high pressure laminate, Grade HGS; Refer to Interior Finishes List for pattern and colour.

.1 Edge Treatment: Extruded T&G PVC refer to 2.6 Accessories.

.2 Core Material: Medium density fiberboard at dry locations. Marine grade plywood required at countertops with plumbing cut-outs, high humidity areas and all food service areas.

2.8 SOLID SURFACE COUNTERTOPS

.1 Solid Polymer Surfacing: refer to Interior Finishes List, and Section 06 61 16.

.1 Edge Treatment: Straight square edge profile.

.2 Backsplash and side splash: Applied.

2.9 FABRICATION

.1 Fabricate to AWMAC - Custom grade.

.2 Shop prepare and identify components for matching during site assembly.

.3 Shop assemble casework for delivery to site in units easily handled and to permit passage through building openings.

.4 When necessary to cut and fit on site, provide materials with ample allowance for site cutting and scribing.

.5 Cabinet style: Flush overlay.

.6 Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 600 mm from sink cut-outs.

.7 Refer to drawings for wood grain directions where applicable.

.8 Shop apply laminate backing sheet to reverse side of plastic laminate finished surfaces.

.9 Fabricate metal countertop surfaces pressure glued to plywood core backing with welded joints.

.10 Mechanically fasten back splash to countertops with steel brackets at 400 mm on centre.

.11 Provide cut-outs for plumbing fixtures, inserts, fixtures and fittings. Verify locations of cut-outs from on-site dimensions. Seal cut edges.

.12 Shop glaze glass materials using the Interior Dry method specified in Section 08 80 50.

.13 Edge Trim:

.1 Secure T&G edging with specified heavy duty construction adhesive at plastic laminate finished countertops.

.2 Secure solid PVC edging using heat-applied method at other millwork components.

.3 Secure laminate self-edging using contact adhesive to backsplashes against walls.

2.10 TRIM FABRICATION

.1 Make custom miters and intersections with welded corners.

2.11 WOOD FINISHES

.1 Factory Finishing:

.1 Finishing System: AWMAC custom finish system.

.2 Sheen: As scheduled.

.2 Site Finishing: Seal with paint or varnish all semi-concealed wood and plywood surfaces. Brush apply only.

2.12 FACTORY FINISHING

.1 Sand work smooth and set exposed nails and screws.

.2 Apply wood filler in exposed nail and screw indentations.

.3 On items to receive transparent finishes, use wood filler which matches surrounding surfaces and of types recommended for applied finishes.

.4 Seal with paint or varnish exposed to view surfaces where indicated. Brush apply only.

.5 Shop apply plastic laminate finishes to exposed surfaces as indicated.

.6 Seal with paint or varnish all semi-concealed wood and plywood surfaces. Brush apply only.

.7 Seal surfaces in contact with cementitious materials.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify adequacy of backing and support framing.

.3 Verify location and sizes of utility rough-in associated with work of this section.

3.2 INSTALLATION

.1 Install Work in accordance with AWMAC Custom Grade.

.2 Set and secure casework in place; rigid, plumb, and level.

.3 Use fixture attachments in concealed locations for wall mounted components.

.4 Use concealed joint fasteners to align and secure adjoining cabinet units.

.5 Carefully scribe casework abutting other components, with maximum gaps of 1 mm. Do not use additional overlay trim for this purpose.

.6 Secure cabinet to floor using appropriate angles and anchorages.

.7 Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

.8 Apply plastic laminate finishes where indicated.

.1 Reinforce all vertical corners of millwork.

.2 Apply laminate backing sheet on reverse side of plastic laminate finished surfaces.

.9 All doors and drawers will be lockable.

3.3 TRIM INSTALLATION

.1 Install Millwork trims and accessories in accordance with manufacturer’s product data.

3.4 ADJUSTING

.1 Test installed work for rigidity and ability to support loads.

.2 Adjust moving or operating parts to function smoothly and correctly.

3.5 CLEANING

.1 Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

Part 1 General

1.1 SUMMARY OF WORK

.1 Supply and install solid surface counters as shown on drawings.

1.2 RELATED WORK

.1 Section 06 41 11 – Architectural Cabinetwork.

.2 Section 22 40 00 – Plumbing Fixtures and Trim – sinks.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the B C Building Code, current edition at the time of the application for Building Permit; if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM E 228 – Standard Test Method for Linear Thermal Expansion of Solid Materials With a Vitreous Silica Dilatometer.

.3 ASTM D 790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

.4 ASTM D 2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.

.5 ASTM G 21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

.6 ASTM G 22 – Standard Practice for Determining Resistance of Plastics to Bacteria.

.7 NEMA LD 3 – High Pressure Decorative Laminates.

.8 ISSFA-2 – International Solid Surface Fabricators Association – Classification and Standards for Solid Surfacing Material

.9 ANSI Z124.3 and Z124.6 – Plastic Lavatories and Sinks.

1.4 SUBMITTALS

.1 Shop drawings: Refer to Section 01 33 00 – Submittal Procedures. Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.

.2 Samples: Submit minimum 50 mm x 50 mm samples. Indicate full range of color and pattern variation. Approved samples will be retained as standards for work. Provide one sample to consultant and one sample to field office.

.3 Product data: Indicate product description, fabrication information and compliance with specified performance requirements.

.4 Maintenance data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

1.5 QUALITY ASSURANCE

.1 Allowable tolerances:

.1 Variation in component size: $\pm$ 3 mm.

.2 Location of openings: $\pm$ 3 mm from indicated location.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Store components indoors prior to installation.

.2 Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent physical damage or staining following installation for duration of project.

Part 2 Products

2.1 MATERIALS

.1 Solid surfacing (SD#): Homogenous non-porous sheet material composed of reacted monomers, acrylic resins, fire-retardant fill materials, and coloring agents. Free from conspicuous internal strengthening fibers.

.2 Nominal sheet thickness: 13 mm.

.3 Edge treatment: double eased with 38 mm profile, straight square profile.

2.2 SHAPED COMPONENTS

.1 Dimensions herein are interior dimensions unless indicated otherwise.

2.3 MANUFACTURERS

.1 Acceptable products: Refer to Interior Finishes List.

.2 Other manufacturers offering products meeting or exceeding specified products and requirements may be considered.

2.4 SOLID POLYMER FABRICATIONS

.1 Performance properties:

Performance Properties of Solid Surface*	All Types	Test Method
Fungal Resistance*	No Growth	ASTM G 21
Bacterial Resistance*	No Growth	ASTM G 22
Consistency of Color*	Pass	ISSFA SST 2.1.00
Cleanability/Stain Resistance*	$\leq$ 52	ISSFA SST 3.1.00
Visual Defects*	Pass	ISSFA SST 5.1.00
Light Resistance*	No Effect	ISSFA SST 7.1.00
Boiling Water Resistance*	No Effect	ISSFA SST 8.1.00
High Temperature Resistance **	No Effect	ISSFA SST 9.1.00

*To be tested without substrate
**Veneer grade to be tested with substrate

.2 Engineering Properties:

Engineering Properties	Standard Type	Test Method
Radiant Heat Resistance	600+ Second	NEMA LD 3-3.10
Linear Thermal Expansion mm./mm./°C	$\leq$ 5.40 x 10^{-5} mm./mm./ °C (3.00 x 10^{-5} in./in. °F)	ASTM E 228°'m -30 to 60 °C (-22 to 140 °F)
Flexural Strength	$\geq$27.58 Mpa (4000 psi)	ASTM D 790
Flexural Modulus	$\geq$ 6895 Mpa (1.00 Mpsi)	ASTM D 790
Hardness Barcol	50 – 70	ASTM D 2583

Flatness of Sheets	≤ 1.6 mm (0.063 in.)	ISSFA SST 4.1.00
Impact Resistance	Pass at 1525 mm. (60 in.)	ISSFA SST 6.1.00

2.5 ACCESSORIES

.1 Joint adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.

.2 Sink/bowl mounting hardware: Bowl clips, brass inserts and fasteners for attachment of under mount sinks/bowls, of type recommended by manufacturer.

.3 Silicone Sealant: Mildew resistant, recommended by manufacturer.

2.6 FABRICATION

.1 Fabricator/installer shall be approved by solid polymer manufacturer.

.2 Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and solid polymer manufacturer requirements.

.3 Form joints between components using manufacturer's standard joint adhesive for hard seam. Joints shall be inconspicuous in appearance and without voids. Attach 102 mm wide reinforcing strip of solid polymer material under each joint.

.4 Provide holes and cut-outs for penetrations as indicated.

.5 Rout and finish component edges to a smooth, uniform finish. Rout all cut-outs, then sand all edges smooth. Defective or inaccurate work will be rejected.

.6 Finish: All surfaces shall have uniform finish of satin or semi-gloss.

.7 Thermoforming: Comply with forming data from manufacturer.

.1 Construct matching molds of plywood to form component shape.

.2 Form pieces to shape prior to seaming and joining.

.3 Cut pieces larger than finished dimensions. Sand edges. Remove all nicks and scratches.

.4 Heat entire component uniformly prior to forming.

.5 Prevent blistering, whitening and cracking of solid polymer material during forming.

Part 3 Execution

3.1 INSTALLATION

.1 Install components plumb and level, in accordance with approved shop drawings and product installation details.

.2 Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work. Keep components and hands clean when making joints.

.3 Provide backsplashes and endsplashes as indicated on the drawings. Adhere to countertops and other components using manufacturer's standard color-matched silicone sealant.

.4 Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Components shall be clean on Date of Substantial Completion.

.5 Adhere under mount sinks/bowls to countertop using manufacturers recommended joint adhesive.

.6 Coordinate plumbing installation with plumbing contractor. Make plumbing connections to sinks in accordance with Division 22 - Plumbing.

.7 Protect surfaces from damage until Date of Substantial Completion

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Plastic laminate finishing for architectural millwork.

1.2 RELATED SECTIONS

.1 Section 06 40 00 - Architectural Woodwork.

1.3 QUALITY ASSURANCE

.1 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

.2 Fabricator Qualification: Engage a fabricator experienced in successfully fabricating components similar to those indicated in these documents, as well as production capacity to meet the schedule requirements of this Contract.

.3 Installer Qualifications: Engage an experienced installer who has successfully completed work similar in material, design, and extent of that indicated in these documents.

.4 Mockups: Construct mockups to demonstrate quality of execution. Construct mockup of each type of laminate application as directed by the Consultant. Approved mockups may remain as part of the final installation.

.5 Pre-installation Conference: Attend pre-installation conference to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements. Include fabricator and installer.

1.4 REFERENCES

.1 Canadian General Standards Board (CGSB): CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.

.2 Canadian Standards Association (CSA International): CSA O112-M1977(R2001), Standards for Wood Adhesives.

.3 Environmental Choice Program (ECP): CCD-044-95, Adhesives.

.4 National Electrical Manufacturers Association (NEMA): NEMA LD3-2000, High Pressure Decorative Laminates.

1.5 SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's for adhesives, solvents and cleaners.

.2 Samples:

.1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit duplicate samples of joints, edging, cutouts and square edge profiles.

.3 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.4 Closeout Submittals:

.1 Provide maintenance data for laminate work for incorporation into manual.

1.6 DELIVERY, STORAGE, AND HANDLING

.1 Storage and Protection:

.1 Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00 – Product Requirements.

.2 Maintain relative humidity between 25% and 60% at 22^{O} C during storage and installation.

Part 2 Products

2.1 LAMINATE MATERIALS

.1 Laminated plastic for flatwork: to NEMA LD 3.

.1 Manufacturers: Wilsonart, Arborite, Formica, Nevamar, Pionite, or equal.

.2 Type: General purpose.

.3 Grade: HGS for horizontal surfaces, VGS for vertical surfaces, square edge at tops.

.4 Size: 1.27 mm (0.05”) thick for horizontal surfaces and 1.0 mm (0.039”) thick for vertical surfaces, square edge at tops.

.5 Colour: Refer to Interior Finishes List.

.6 Pattern: Refer to Interior Finishes List.

.7 Texture Finish: Refer to Interior Finishes List.

.8 Use maximum length sheets of 3050mm (10’-0”) as required to cover vertical surfaces without horizontal seams.

.2 Laminated plastic for backing sheet: to NEMA LD 3.

.1 Type: Backer.

.2 Grade: BKH for horizontal surfaces, and BKV for vertical surfaces.

.3 Size: not less then 1.2 mm thick for horizontal surfaces and not less than 1.0 mm thick for vertical surfaces.

.4 Colour: Same colour as face laminate.

.3 Laminated plastic for liner: to NEMA LD 3.

.1 Type: Cabinet Liner.

.2 Grade: CLS.

.3 Size: 1.0 mm (0.039”) thick

.4 Colour: As selected by Consultant.

.4 Laminate: High pressure laminate (HPL) panels.

.1 Manufacturer: ABET Laminate

.2 Product: Stratifato HPL

.3 Compliance:

- EN 438: 2005 - Part 4

.4 Density: To meet ISO 1183

.5 Colour: As selected by consultant

.6 Note: Refer to drawing for location

.5 Sealants: One component mildew resistant sealant conforming to ASTM 920-00; colour to match laminate.

.1 Sustainability Requirements: Adhesives and sealants must meet the VOC requirements of the South Coast Air Quality Management District (SCAQMD) Rule #1168.

.6 Draw bolts and splines: as recommended by fabricator.

2.2 FABRICATION

.1 Comply with NEMA LD 3, Annex A.

.2 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.

.3 Ensure adjacent parts of continuous laminate work match in colour and pattern.

.4 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cutouts.

.5 Use straight self-edging laminate strip for flatwork to cover exposed edge of core material. Chamfer exposed edges uniformly at approximately 20 degrees. Do not miter laminate edges.

.6 Apply laminate backing sheet to reverse side of core of plastic laminate work.

.7 Apply laminated plastic liner sheet to interior of cabinetry to the back side of all exposed surfaces receiving plastic laminate finish.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

.1 Install work plumb, true and square, neatly scribed to adjoining surfaces.

.2 Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction.

.3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm on centre, 75 mm from edge. Make flush hairline joints.

.4 Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamfer edges and seal exposed core.

.5 At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant.

3.3 PROTECTION

.1 Cover finished laminated plastic veneered surfaces with heavy kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means. Do not remove until immediately before final inspection.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Perform care and cleaning with NEMA LD 3, Annex B.

.3 Remove traces of primer, caulking, epoxy and filler materials, clean doors and frames.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Blanket insulation for filling shim spaces and crevices in interior and exterior walls.

.2 Acoustic insulation for interior partitions, door frames and ceilings.

1.2 RELATED SECTIONS

.1 Section 07 84 00 - Firestopping.

.2 Section 09 21 16 - Gypsum Board Assemblies

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM C665 - Mineral-Fibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.3 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

.4 CAN/ULC-S102 - Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.5 CAN/ULC-S702 - Thermal Insulation, Mineral Fibre, for Buildings.

1.4 SYSTEM DESCRIPTION

.1 Materials of This Section: Provide continuity of thermal barrier at building enclosure elements. in conjunction with thermal insulating materials in other Sections.

.2 Materials of This Section: Provide thermal protection to air seal materials at building enclosure elements in conjunction with air barrier materials in Section 07 27 00.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 30 00 - Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with Section 07 26 00 for installation of vapour retarder and Section 07 27 00 for air seal materials.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials/Products:

.1 Fire Batts: Roxul RockBoard Insulation. (High Density Mineral Wool).

.2 Thermal Batts: Certainteed Fibre Glass Building Insulation, Owens Corning Thermal Batt Insulation, Johns Manville unfaced batt insulation.

.3 Acoustic Batts: Owens Corning Sound Attenuation Batts, unfaced glass fibre acoustic insulation, Johns Manville Sound Control Batts.

.2 Other manufacturers offering products meeting or exceeding specified requirements may be considered.

2.2 INSULATION

.1 Batt and blanket mineral fibre: to ASTM C553.

.1 Type: 1.

.2 Thickness: as indicated on drawings and to match stud thickness.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that substrate, adjacent materials, and insulation are dry and ready to receive insulation.

3.2 INSTALLATION

.1 Install in walls spaces without gaps or voids. Do not compress insulation.

.2 Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

.3 Fit insulation tight in spaces and tight to exterior side of mechanical and electrical services within the plane of insulation. Split batts around services within the wall.

.4 Retain insulation in place with wire mesh or fasteners secured to framing members.

.5 Coordinate work of this section with construction of air barrier seal specified in Section 07 27 00.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Fire-stopping and fire-safing materials and accessories.

.2 Only tested firestop systems shall be used in specific locations as follows:

.1 Penetrations for the passage of duct, cable, cable tray, conduit, piping, electrical busways and raceways through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions.

.2 Safing slot gaps between edge of floor slabs and curtain walls.

.3 Openings between structurally separate sections of wall or floors.

.4 Gaps between the top of walls and ceilings or roof assemblies.

.5 Expansion joints in walls and floors.

.6 Openings and penetrations in fire-rated partitions or walls containing fire doors.

.7 Openings around structural members which penetrate floors or walls.

.8 Alternative Solutions containing the manufacturer's firestop custom detail shall be used when no listed firestop system is available for an application in specific locations including, but not limited to the following:

.3 Perimeter joints between rated concrete floor and non-rated curtain wall system.

1.2 RELATED SECTIONS

.1 Section 09 21 16 - Gypsum Board Assemblies

.2 Section 23 33 00 – Air Duct Accessories

.3 Section 26 05 21 – Wiring and Cables

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

.3 ASTM E119 - Method for Fire Tests of Building Construction and Materials.

.4 ASTM E814 - Test Method of Fire Tests of Through-Penetration Fire Stops.

.5 ASTM E1966 - Test Method for Fire-Resistive Joint Systems

.6 CAN/ULC S101 - Fire Endurance Tests of Building Construction and Materials.

.7 CAN/ULC S102 - Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.8 CAN/ULC S115 - Fire Tests of Firestop Systems.

.9 British Columbia Building Code.

.10 NFPA - Life Safety Code.

.11 Canadian Electrical Code.

1.4 DEFINITIONS

.1 Firestopping (Firesafing): Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke and hot gases through penetrations in, or construction joints between, fire-rated wall and floor assemblies.

.2 Listed Firestop System: A specific construction consisting of materials, any penetrating items and their means of support, that has met the requirements of an F, FT, FH and/or FTH rating when tested in accordance with CAN/ULC-S115 - Standard Method of Fire Tests of Firestop Systems.

1.5 SYSTEM DESCRIPTION

.1 Listed Firestop System to achieve a fire rating as noted on Drawings.

.2 Surface Burning: CAN/ULC S102 with a flame spread/smoke developed rating of 5/40.

.3 Firestop all interruptions to fire rated assemblies, materials, and components.

1.6 SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of listed firestop systems to be used and manufacturer's installation instructions.

.3 Alternative Solutions: Manufacturer's firestop custom details for each custom application including both project name and subcontractor's name who will install the firestop solution as described in the detail drawing. This alternative solution must be reviewed by a professional Engineer registered in British Columbia who shall take responsibility for the design under seal.

.4 Submit material safety data sheets provided with product delivered to job-site.

.5 VOC Content Limitations: For firestop system products, submit documentation in accordance with Article 1.12.

.6 Shop Drawings: Provide shop drawings for products cast in concrete.

1.7 INSTALLER QUALIFICATIONS

.1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having the necessary experience, staff, and training to install manufacture's products per specified requirements.

1.8 QUALITY ASSURANCE

.1 A manufacturer's direct representative (not distributor or agent) to be on-site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures. This will be done per manufacturer's written recommendations published in their literature and drawing details. Single Source Responsibility: Obtain firestop systems for each type of penetration and construction situation from a single primary firestop systems manufacturer.

.2 Listed Firestop System installation must meet requirements of CAN/ULC-S115 tested assemblies that provide an F rating or FT rating as shown in 2.3.15 below.

.3 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.

.4 Listed Firestop Systems do not re-establish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.

.5 Alternative Solutions described in 1.6 - Submittals, Paragraph .3 shall be submitted to local authorities having jurisdiction for their review and approval prior to installation. Firestop custom details must follow current requirements set forth by the International Firestop Council.

1.9 REGULATORY REQUIREMENTS

.1 Conform to ULC for fire resistance ratings and surface burning characteristics.

1.10 COORDINATION MEETING

.1 All subtrades penetrating rated fire separations or providing joints between rated fire separations (regardless if firestopping or not) shall meet with firestop manufacturer prior to firestop installation to coordinate construction practices to best meet the requirements of the proposed listed firestop systems.

1.11 PROJECT CONDITIONS

.1 Do not use materials that contain flammable solvents.

.2 Scheduling:

.1 Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.

.2 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

.3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.

.4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.

.5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

Part 2 Products

2.1 FIRESTOPPING, GENERAL

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

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

.3 Firestopping Materials are either “cast-in-place” (integral with concrete placement) or “post installed.” Provide cast-in-place firestop devices prior to concrete placement.

2.2 MANUFACTURERS

.1 Acceptable Products/Materials: Subject to compliance with through penetration firestop systems and joint systems tested in accordance with CAN/ULC-S115, provide products of the following manufacturers as identified below:

.1 Hilti (Canada) Corporation, Mississauga, Ontario,1-800-363-4458 www.ca.hilti.com, or approved alternate.

.2 Acceptable Materials/Products are listed in article 2.3 - Materials are based on products manufactured by Hilti (Canada) Corporation. Alternate manufacturers and products may be accepted.

.3 Other manufacturers offering products meeting or exceeding specified products and requirements may be considered.

.4 3M is an approved manufacturer.

.2 Substitutions: Refer to Section 01 62 50.

2.3 MATERIALS

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

.1 Fire stop system rating: 1 hour and 2 hours.

.2 Service penetration assemblies: systems tested to CAN-ULC-S115.

.3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.

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

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

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

.9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify openings are ready to receive the work of this section.

3.2 PREPARATION

.1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

.1 Verify penetrations are properly sized and in suitable condition for application of materials.

.2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.

.3 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

.4 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.

.5 Do not proceed until unsatisfactory conditions have been corrected.

3.3 COORDINATION

.1 Coordinate location and proper selection of cast-in-place Firestop Devices with trade responsible for the work. Ensure device is installed before placement of concrete.

.2 Responsible trade is to provide adequate spacing of field run pipes to allow for installation of cast-in-place firestop devices without interference.

3.4 INSTALLATION

.1 Install firestop materials in accordance with Directory affiliated with listed firestop system.

.2 Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.

.3 Consult with Mechanical Consultant, Contractor, and damper manufacturer prior to installation of any firestop solutions that might hamper the performance of fire dampers as it pertains to ductwork.

.4 Protect materials from damage on surfaces subjected to traffic.

3.5 FIELD QUALITY CONTROL

.1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.

.2 Keep areas of work accessible until inspection by applicable code authorities.

.3 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

.4 Install a warning card that is clearly visible adjacent to all large and medium openings that may be re-penetrated. This card should contain the following information:

.1 Warning that the opening has being fire stop protected

.2 Indicate the fire stop system used

.3 F rating or FT rating

.4 Fire stop product(s) used

.5 Person to contact and phone number in case of modification or new penetration of fire stop system.

.5 Manufacturer's Field Service: During initial installation, firestop manufacture shall be present to assure proper installation of products.

3.6 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Remove equipment, materials and debris, leaving area in undamaged, clean condition.

.3 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

3.7 PROTECTION OF FINISHED WORK

.1 Protect adjacent surfaces from damage by material installation.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Preparing substrate surfaces.

.2 Sealant and joint backing.

1.2 RELATED SECTIONS

.1 Section 07 52 11 - SBS Modified Bitumen Membrane Roofing (Patch Work)

.2 Section 08 11 13 - Standard Metal Doors and Frames

.3 Section 09 21 16 - Gypsum Board Assemblies

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM C834 - Latex Sealants.

.3 ASTM C919 - Use of Sealants in Acoustical Applications.

.4 ASTM C920 - Elastomeric Joint Sealants.

.5 ASTM C1184 - Structural Silicone Sealants.

.6 ASTM C1193 - Guide for Use of Joint Sealants.

.7 ASTM C1311 - Solvent Release Sealants.

.8 ASTM C1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.

.9 ASTM C1401-14 - Standard Guide for Structural Sealant Glazing.

.10 ASTM E330/E330M-14 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

1.4 PERFORMANCE REQUIREMENTS

.1 Sealant Design: Design structural sealant to withstand specified loads without breakage, loss, failure of seals, product deterioration, and other defects.

.2 Design installed sealant to withstand:

.1 Dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall as calculated in accordance with BC Building Code. as measured in accordance with ASTM E330.

.2 Movement from ambient temperature range of 49 degrees C.

.3 Movement and deflection of structural support framing.

.4 Water and air penetration.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 30 00 - Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with all sections referencing this section.

1.6 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data indicating sealant chemical characteristics, performance criteria, substrate preparation, limitations, colour availability and

.3 Samples: Submit two samples illustrating sealant colours for selection.

1.7 QUALITY ASSURANCE

.1 Perform work in accordance with sealant and EIFS manufacturer's requirements for preparation of surfaces and material installation instructions.

.2 Perform sealant application work in accordance with ASTM C1193 and ASTM C1481.

.3 Perform structural sealant application work in accordance with ASTM C1401.

.4 Perform acoustical sealant application work in accordance with ASTM C919.

.5 Applicator Qualifications: Company specializing in performing the work of this section with minimum 3 years experience.

1.8 MOCK-UP

.1 Section 01 43 00: Requirements for mock-up.

.2 Provide mock-up to include sealant joints in conjunction with window, curtain wall, wall, air barrier system, and door frames.

.3 Construct mock-up with specified sealant types and with other components noted.

.4 Locate where directed.

.5 Approved mock-up may remain as part of the Work.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

Part 2 Products

2.1 SEALANT MATERIALS

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas which offgas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize offgas time.

.3 Where sealants are qualified with primers use only these primers.

.4 Accessories:

.1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.

.2 Joint Backing: Polyethylene, Urethane, Neoprene or Vinyl Foam.

.1 Extruded open cell foam backer rod.

.2 Size: oversize 30 to 50 %.

.3 Tensile strength: 20 to 30psi.

.4 Acceptable material: Tremco Sof-Rod or approved equal to ASTM D1056; round, closed cell, polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

.3 Bond Breaker: Pressure sensitive tape which will not bond to sealant recommended by sealant manufacturer to suit application.

2.2 SEALANT MATERIAL DESIGNATIONS

.1 Butyl Sealant (Type A): ASTM C1311, single component, solvent release, non-skinning, non-sagging, black colour.

.2 Acoustic Sealant (Type B): ASTM C920, Acoustic grade, single component, non-skinning, non-hardening; Grey colour.

.3 Polyurethane Sealant (Type C): ASTM C920, Grade NS, single component, chemical curing, non-staining, non-bleeding, non-sagging self-leveling type; colour as selected.

.4 Polyurethane Sealant (Type D): ASTM C920, multi-component, non-sagging type; colour as selected.

.5 Silicone Sealant (Type E): ASTM C920, single component; colour as selected.

.6 Security Sealants – Interior and Exterior applications:

.1 One component, non-sag, moisture cured polyurethane adhesive/sealant, specially designed for use in interior and exterior security areas.

.2 Acceptable Product: MasterSeal CR 195, or approved equivalent.

.7 Structural silicone glazing sealant (Type S) ASTM C920 Grade NS Class 50, use NT, G and A.

2.3 JOINT CLEANER

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.

.2 Primer: as recommended by manufacturer.

2.4 ACCESSORIES

.1 Primer: Non-staining type, recommended by sealant manufacturer to suit application.

.2 Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.

.3 Joint Backing: ASTM C1330; round, closed cell polyethylene foam rod; oversized 30 to 50 percent larger than joint width.

.4 Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

.5 Masking tape: Non-staining, non-absorbent type compatible with sealant and adjacent surfaces.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that substrate surfaces are clean, dry, and free of frost and ready to receive work.

.3 Verify that joint backing and release tapes are compatible with sealant and EIFS materials.

3.2 PREPARATION

.1 Remove loose materials and foreign matter which might impair adhesion of sealant.

.2 Clean and prime joints in accordance with sealant manufacturer's written instructions.

.3 Perform preparation in accordance with ASTM C1193 for solvent release and latex base sealants, ASTM C1481 for EIFS systems.

.4 Protect elements surrounding the work of this section from damage or disfiguration.

3.3 INSTALLATION

.1 Perform installation in accordance with ASTM C1193 for solvent release and latex base sealants, ASTM C919 for acoustical sealants.

.2 Measure joint dimensions and size materials to achieve required 2:1 width/depth ratios.

.3 Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width.

.4 Install bond breaker where joint backing is not used.

.5 Install sealant free of air pockets, foreign embedded matter, ridges, and sags.

.6 Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.

.7 Tool joints concave.

3.4 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Clean adjacent soiled surfaces.

3.5 PROTECTION OF FINISHED WORK

.1 Remove masking tape and excess sealant.

.2 Protect sealants until cured.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Non-rated and fire rated steel frames.

.2 Interior steel doors.

1.2 RELATED SECTIONS

.1 Section 08 14 16 – Flush Wood Doors

.2 Section 08 71 00 - Door Hardware.

.3 Section 09 91 00 – Painting.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.3 AAMA/WDMA/CSA 101/I.S.2/A440, North American Fenestration Standard/Specification for Windows, Doors, and Unit Skylights.

.4 AAMA/WDMA/CSA/101/I.S.2/A440S1, Canadian Supplement to Standard/Specification for Windows, Doors, and Unit Skylights.

.5 ASTM A653/A653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.6 ASTM B29-03 - Refined Lead.

.7 ASTM B749-03(2009) - Lead and Lead Alloy Strip, Sheet and Plate Products.

.8 ASTM C578 - Rigid, Cellular Polystyrene Thermal Insulation.

.9 ASTM C665 - Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.10 ASTM C1289 - Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.11 ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.

.12 ASTM E413 - Classification for Rating Sound Insulation

.13 CAN4-S104 - Fire Tests of Door Assemblies.

.14 CAN4-S105 - Fire Door Frames Meeting the Performance Required by CAN4-S104.

.15 CAN/ULC-S701 - Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.16 CAN/ULC-S702 - Thermal Insulation, Mineral Fibre, for Buildings.

.17 CAN/ULC-S704 - Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.18 CGSB 41-GP-19Ma - Rigid Vinyl Extrusions for Windows and Doors.

.19 CSA G40.20-04/G40.21 - General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.20 CSA W59 - Welded Steel Construction (Metal Arc Welding).

.21 Canadian Steel Door Manufacturers Association (CSDMA), Recommended Dimensional Standards for Commercial Steel Doors and Frames,

.22 Canadian Steel Door Manufacturers Association (CSDMA), Selection and Usage Guide for Steel Doors and Frames,

.23 DHI - Door Hardware Institute: The Installation of Commercial Steel Doors and Steel Frames, Insulated Steel Doors in Wood Frames and Builder's Hardware.

.24 NFPA 80- Standard for Fire Doors and Fire Windows.

.25 NFPA 252 - Standard Methods of Fire Tests of Door Assemblies.

1.4 SUBMITTALS FOR REVIEW

.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, louvres, and finish.

1.5 QUALITY ASSURANCE

.1 Conform to requirements of CSDMA.

.2 Exterior doors to conform to AAMA/WDMA/CSA 101/I.S.2/A440-08 - NAFS - North American Fenestration Standard / Specification for Windows, Doors, and Skylights and AAMA/WDMA/CSA/101/I.S.2/A440S1, Canadian Supplement to Standard/ Specification for Windows, Doors, and Unit Skylights.

1.6 REGULATORY REQUIREMENTS

.1 Fire Rated Door and Frame Construction: Labelled and listed to CAN/ULC S104M, Fire Tests of Door Assemblies.

.2 Fire Rated Door Construction: Rate of rise of 250 C degrees across door thickness.

.3 Installed Door and Frame Assembly: Conform to NFPA 80 for fire rated class as scheduled.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Section 01 61 00: Deliver, store, protect and handle products to site.

.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.

1.8 COORDINATION

.1 Coordinate the work with frame opening construction, door, and hardware installation.

.2 Sequence installation to ensure wire connections are achieved in an orderly and expeditious manner.

Part 2 Products

2.1 MATERIALS

.1 Sheet Steel - Standard Frames: Hot dipped galvanized steel to ASTM A653/A653M, commercial grade (CS), Type B, minimum base steel thickness in accordance with CSDMA.

.1 Interior Frames: coating designation ZF75 (A25).

.2 Minimum base steel thickness (gauge) in accordance with CSDFMA Table 1, except as follows:

.1 Frames: 1.6 mm (16 gauge).
.2 Astragals: 1.9 mm (14 gauge).
.3 Floor anchors: 1.6 mm (16 gauge).
.4 Jamb anchors:
.1 "T" strap type: 1.6 mm (16 gauge).
.2 "L" type: 1.2 mm (18 gauge).
.3 Stirrup-strap type: 15 x 250 x 1.6 mm (5/8" x 10" x 16 gauge).
.4 Stud type: 1.2 mm (18 gauge).
.5 Wire type: 4.0 mm (9 gauge).
.5 Reinforcing steel:
.1 Locks, strikes: 1.6 mm (16 gauge).
.2 Butts, hinges: 3.4 mm (10 gauge).
.3 Surface mounted hardware: 2.7 mm (12 gauge).
.6 Flush bolts: 3.4 mm (10 gauge).
.7 Glazing stops: 0.9 mm (20 gauge). ULC approved for fire rated doors and frames.
.8 Channel reinforcement for glazed and louvre openings: 0.9 mm (20 gauge).
.9 Mortar guard boxes: 0.8 mm (22 gauge).
.10 Jamb spreaders: 1.2 mm (18 gauge).

.3 **Lead Lining**: ASTM B29 ASTM B749, cast or rolled pure lead, minimum thickness as indicated on Drawings and **as per the Shielding Assessment for the project**.

.1 Balance of core materials used in conjunction with lead to manufacturer's proprietary design.

.2 Top and Bottom Channels: Recessed, welded steel channels (lead-lined if scheduled) and flush steel top and bottom caps.

.3 Lead-Lined Frames: 1.6 mm thick base metal thickness, with lead lining secured to inside of frame profile, on door side of frame only.

.4 Ensure integrity of lead-lining between interior of frame and adjacent wall assembly.

2.2 PRIMERS

.1 Rust inhibitive touch-up only.

2.3 ACCESSORIES

.1 Primer: to CAN/CGSB-1.181.Door Silencers: Single stud rubber/neoprene.

.2 Fire labels: metal riveted or embossed labels.

.3 Isolation Coating: Alkali resistant bituminous paint.

.4 Metallic paste filler: to manufacturer's standard.

.5 Weather-stripping: Specified in Section 08 71 00.

.6 Glass: In accordance with Section 08 80 50.

2.4 SYSTEM DESCRIPTION

.1 Design Requirements:
- .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa (25 lbs/ft²) not to exceed 1/175th of span.

.2 Regulatory Requirements:
- .1 Steel fire rated frames: labeled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104, for ratings indicated.
- .2 Provide fire labeled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104 and listed by nationally recognized agency having factory inspection services.
- .3 Provide fire labeled doors and frames for those openings requiring fire protection ratings. Test products in conformance with CAN4-S104 and listed by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

2.5 FABRICATION - FRAMES

.1 Interior Frames:
- .1 Door Frames and Window Assemblies: Welded type construction. Knock down frames are not permitted.
- .2 Transom Frames: Welded type construction.
- .3 Sidelight Assemblies: Welded type construction.

.2 Mullions for Double Doors: Fixed type, of same profiles as jambs.

.3 Transom Bars for Glazed Lights: Fixed type, of same profiles as jamb and head.

.4 Mortised, blanked, reinforced, drilled and tapped for templated hardware, in accordance with templates provided by hardware supplier.

.5 Protect mortised cut-outs with steel guard boxes for frames installed in masonry and concrete walls.

.6 Reinforce head of frames wider than 1219 mm.

.7 Prepare frames for silencers. Provide three single silencers for single doors on strike side. Provide single silencers on frame head at double doors without mullions.

.8 Attach fire rated label to each fire rated door unit.

.9 Fabricate frames with integral junction boxes for electrically wired hinge, door position switch, and future consideration of electric strike for selected doors as scheduled.

.10 Manufacturer's nameplates on frames and screens are not permitted.

.11 Conceal fastenings except where exposed fastenings are indicated.

2.6 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and one additional anchor for each additional 760 mm of height or fraction thereof.

.4 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.

.5 Where frames are installed in prepared openings, countersink frame at screw anchor location.

2.7 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Corner joints to have contact edges closed tight with faces mitred and stops either mitred or butted. Faces and soffits shall be continuously welded and the faces finished smooth. The use of gussets or splice plates as a substitute for welding will not be accepted.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Securely attach floor anchors to inside of each jamb profile.

.5 Fabrication frame assemblies in largest sections possible. Where field splices are required provide welded joints, ground smooth. Make field splices and joints inconspicuous after assembly. Exposed fasteners not permitted.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.8 SHOP PRIMING

.1 Provide touch-up primer at areas where zinc coating has been removed during fabrication or installation.

.2 For frames fabricated of steel sheet with Z275 (G90) designation galvanized coating apply in factory one coat of zinc-rich primer CAN/CGSB-1.181 to all exposed surfaces. Properly pre-treat and prepare surfaces before application of primer to ensure good primer adhesion.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 EXAMINATION

.1 Section 01 70 00: 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.

3.3 INSTALLATION

.1 Install doors and frames to CSDMA.

.2 Install fire-rated doors and frames in accordance with NFPA 80, and local authority having jurisdiction.

.3 Coordinate with wall construction for anchor placement.

.4 Coordinate installation of glass and glazing.

.5 Coordinate installation of frames with installation of hardware specified in Section 08 71 00.

.6 Frames:

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Install roll formed steel reinforcement channels between two abutting frames. Anchor to structure and floor.

.6 Coordinate installation with Electrical Subcontractor for installation of junction boxes and conduit for electric hardware, wiring, and controls for electronic hardware.

.7 Insulate frame cavities when in a wall containing acoustic batt insulation or at exterior wall conditions.

3.4 REMEDIAL WORK

.1 Refer to all drawings, schedules, and work of other trades that may affect work of this section.

.2 Remove existing doors and frames and reinstall in new locations where indicated.

.3 Modify doors and frames for new finish hardware where indicated.

.4 Reuse existing hardware where indicated.

3.5 CAULKING AND SEALING

.1 For both interior frames seal joint between frames and adjacent construction with sealant (caulking). Apply sealant around full perimeter of frames, on both sides of opening.

.2 Install continuous bead of sealant where door frames abut floors.

.3 Apply sealants in accordance with Section 07 92 00 - Joint Sealing. Provide smooth, neat bead, tooled to slight concave profile.

3.6 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish. Apply primer on sanded surfaces.

3.7 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 Interior aluminum frames.

.2 Perimeter sealant.

.3 Installation of Aluminum Door Hardware. Hardware for aluminum entrance doors to be supplied under Section 08 71 00 and installed under this section.

1.2 RELATED SECTIONS

.1 Section 07 92 00 - Joint Sealants.

.2 Section 08 71 00 - Door Hardware.

.3 Section 08 80 50 - Glass and Glazing.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 AAMA 611 - Voluntary Specifications for Anodized Finishes Architectural Aluminum.

.3 ASTM B 211- Standard Specification for Aluminum and Aluminum-Alloy Bar, Rod, and Wire.

.4 ASTM A 311/A 311M - Standard Specification for Cold-Drawn, Stress-Relieved Carbon Steel Bars Subject to Mechanical Property Requirements

.5 ASTM E283 - Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.6 ASTM E330 - Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

.7 ASTM B 783 Standard Specification for Materials for Ferrous Powder Metallurgy (P/M) Structural Parts.

.8 BC Energy Efficiency Regulations for Windows, Glazing, Doors, Skylights, Curtain Walls.

1.4 SYSTEM DESCRIPTION

.1 Aluminum entrances and storefront system includes tubular aluminum sections, shop fabricated, factory finished, glazing units, related anchorage and attachment devices.

.2 System Assembly: Site assembled.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate with other work having a direct bearing on work of this section.

.1 Coordinate the Work with installation of components or materials affecting work of this Section.

.2 Pre-Installation Meeting: Convene one (1) week before starting work of this section if requested by consultant.

1.6 SUBMITTALS FOR REVIEW

.1 Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill.

.2 Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work and expansion and contraction joint location and details.

.3 Submit a report, issued by a certified materials testing laboratory, attesting that the entrance system has been tested and conforms with CAN/CSA-A440-M90 performance requirements specified herein.

.4 Submit two samples of aluminum finish. One to consultant and one to field office.

1.7 CLOSEOUT SUBMITTALS

.1 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.8 QUALITY ASSURANCE

.1 Perform Work in accordance with AAMA SFM-1

.2 Conform to requirements of BC Building Code for accessibility.

.3 Manufacturer and Installer: Company specializing in manufacturing aluminum glazing systems with minimum three years documented experience.

1.9 DELIVERY, STORAGE, AND PROTECTION

.1 Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings which bond when exposed to sunlight or weather.

1.10 WARRANTY

.1 Products supplied shall be free from material defects, in material and workmanship, including oil-canning and delamination of brake shapes, for a period of two (2) years from the date of substantial completion of the project.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials/Products:

- .1 Kawneer:
  - .1 Interior frames: Trifab VersaGlaze 450.
  - .2 Interior Frames with insulating glass units with integrated blinds: Trifab VersaGlaze 451
  - .3 Doors: 350 Medium Stile Entrances.
- .2 CRL US Aluminum
  - .1 Interior frames: Series 450
  - .2 Interior Frames with insulating glass units: Series 451
  - .3 Doors: Series 400
- .3 Alumicor
  - .1 Interior frames: Series 1800

.2 Interior Frames with insulating glass units: Series 1800

.3 Doors: Series 400

.4 Metro Aluminum

.1 Interior frames: Series 1750

.2 Interior Frames with insulating glass units: Series 2000

.3 Doors: Series 350

.5 Other manufacturers offering products meeting or exceeding specified products and requirements may be considered.

.6 Substitutions: Refer to Section 01 62 00.

2.2 MATERIALS

.1 Extruded Aluminum: ASTM B221.

.2 Fasteners: Stainless steel.

2.3 COMPONENTS

.1 Interior Frames: 51 x 114 mm nominal dimension as indicated on Drawings; applied glazing stops.

.2 Doors: 43 mm thick, 150 mm wide top rail, 150 mm wide vertical stiles, 150 mm wide bottom rail; square glazing stops.

2.4 GLASS AND GLAZING MATERIALS

.1 Glass and Glazing Materials: As specified in Section 08 80 50

2.5 SEALANT MATERIALS

.1 Sealant and Backing Materials:

.1 Perimeter Sealant: Type E or D as specified in Section 07 92 00.

2.6 HARDWARE

.1 See Section 08 71 00.

2.7 FABRICATION

.1 Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

.2 Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.

.3 Prepare components to receive anchor devices. Fabricate anchors.

.4 Arrange fasteners and attachments to conceal from view.

.5 Reinforce interior horizontal head rail to receive drapery track brackets and attachments.

.6 Prepare components with internal reinforcement for door hardware.

.7 Reinforce framing members for imposed loads.

2.8 FINISHES

.1 Finish Coatings: Conform to AAMA 611.

.2 Interior Exposed Aluminum Surfaces: AAMA-M12C22A41 anodized to clear colour.

Part 3 Execution

3.1 EXAMINATION

.1 Verify dimensions, tolerances, and method of attachment with other work.

.2 Verify wall openings and adjoining air and vapour seal materials are ready to receive work of this Section.

3.2 INSTALLATION

.1 Install wall system to manufacturer instructions.

.2 Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

.3 Provide alignment attachments and shims to permanently fasten system to building structure.

.4 Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

.5 Install hardware using templates provided. Refer to Section 08 71 00 for installation requirements.

.6 Install glass in accordance with Section 08 80 50, to glazing method required to achieve performance criteria.

.7 Install perimeter sealant Type, backing materials, and installation criteria in accordance with Section 07 92 00.

3.3 ERECTION TOLERANCES

.1 Maximum Variation from Plumb: 1.5 mm/m non-cumulative.

.2 Maximum Misalignment of Two Adjoining Members Abutting in Plane: 0.8 mm.

3.4 ADJUSTING

.1 Adjust operating hardware for smooth operation.

3.5 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Remove protective material from pre-finished aluminum surfaces.

.3 Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.

.4 Remove excess sealant by method acceptable to sealant manufacturer.

3.6 PROTECTION OF FINISHED WORK

.1 Protect finished Work from damage.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Complete intensive care/critical care aluminum door systems, trackless ICU/CCU sliding door systems including ICU/CCU entrances rated as a barrier for passage of smoke.

.1 Interior, single slide, manual sliding ICU/CCU entrances without track.

1.2 RELATED SECTIONS

.1 Section 08 71 00 - Door Hardware - Common Requirements

.2 Section 08 80 50 - Glass and Glazing: Glass

.3 Electrical Specifications: Electrical connections including conduit and wiring for ground of ICU/CCU entrances.

1.3 REFERENCES

.1 BC Building Code.
.2 ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
.3 ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
.4 NFPA 105 - Standard for the Installation of Smoke Door Assemblies.
.5 UL 1784 - Air Leakage Tests for Door Assemblies.
.6 NAAMM - Metal Finishes Manual for Architectural and Metal Products.
.7 AAMA 607.1 - Clear Anodic Finishes for Architectural Aluminum.
.8 AAMA 611 Voluntary Specification for Anodized Architectural Aluminum.
.9 AAMA 701 Voluntary Specification for Pile Weatherstripping and Replaceable Fenestration Weatherseals.
.10 AAMA 101: Appendix Dissimilar Materials.
.11 ANSI Z97.1: Safety Glazing Materials Used in Buildings - Methods of Test.

1.4 PERFORMANCE REQUIREMENTS

.1 Provide ICU/CCU entrances capable of withstanding structural loads and thermal movements based on testing manufacturer's standard units in assemblies similar to those indicated for this Project.

.2 Thermal Movements: Provide ICU/CCU entrances that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

.1 Temperature Change (Range): 67 deg C, ambient; 100 deg C, material surfaces.

.3 Operating Range: Minus 34 deg C to 54 deg C.

.4 Opening-Force Requirements for Egress Doors: Not more than 222 N required to manually set door in motion if power fails, and not more than 67 N required to open door to minimum required width.

1.5 SUBMITTALS

.1 Product Data: Submit manufacturer's complete product and installation data, and certified test data from and accepted third party testing agency that products have been tested in accordance with UL 1784 and meet or exceed maximum air infiltration ratings specified herein.

.2 Shop Drawings: Include plans, elevations, sections, details, profiles, product components including anchorage, accessories, hardware mounting heights, finish and glazing details, and attachments to other work.

.3 Quality Assurance and Closeout Submittals: Submit the following:

.1 Maintenance Manual including Manufacturer's Operation and Maintenance Data.

.2 Warranty document as specified herein.

1.6 QUALITY ASSURANCE

.1 Installer Qualifications: Manufacturer's authorized representative who is trained for installation and maintenance of units required for this Project.

.2 Manufacturer Qualifications: Manufacturer to have minimum (5) five years successful experience in the fabrication of intensive care doors of the type required for this project. Manufacturer capable of providing field service representation during installation, approving acceptable installer and approving application method.

.3 Source Limitations: Obtain ICU/CCU entrances through one source from a single manufacturer.

.4 Product Options: Drawings indicate sizes, profiles, and dimensional requirements of ICU/CCU entrances and are based on the specific system indicated.

.5 Emergency-Exit Door Requirements: Comply with requirements of authorities having jurisdiction for ICU/CCU entrances serving as a required means of egress.

1.7 PROJECT CONDITIONS

.1 Section 01 70 50 - Field Measurements: Verify actual dimensions/openings by field measurements before fabrication and record on shop drawings. Coordinate with fabrication and construction schedule to avoid construction delays.

.2 Mounting Surfaces: Verify all surfaces to be plumb, straight and secure; substrates to be of proper dimension and material.

.3 Floor Surfaces: For entrances scheduled to be rated as a barrier for passage of smoke verify that floor surface is level and in accordance with manufacturer's tolerance requirements to achieve required rating.

.4 Advise Contractor of any inadequate conditions or equipment.

1.8 COORDINATION

.1 Templates: Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing ICU/CCU entrances to comply with indicated requirements.

.2 Electrical System Roughing-in: Coordinate layout and installation of ICU/CCU entrances with connections to facility grounding system.

1.9 WARRANTIES

.1 Refer to Section 01 11 00: Warranty. Warranty Period for all supplied materials, equipment and installation is two (2) years from the date of Service Commencement.

.2 Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

.3 Distributor's Warranty: Two year warranty: Labour and transportation charges for defective parts replacement.

.4 During the warranty period perform and affect repairs by a factory-trained technician.

A safety inspection shall be performed after each adjustment or repair and a completed inspection form shall be submitted to the Building Operator.

.5 During the warranty period all warranty work, including but not limited to emergency service, shall be performed during normal working hours.

1.10 DELIVERY, STORAGE AND HANDLING

.1 Ordering and Delivery: Comply with factory's ordering instructions and lead time requirements. Delivery shall be in factory's original, unopened, undamaged containers with identification labels intact.

.2 Storage and Protection: Provide protection from exposure to harmful weather conditions and vandalism.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials/Products:

.1 Type 1: Nabco Gyrotech: GT2100 Series manual Trackless Sliding Doors.

.2 Alternative Manufacturers / systems: Other manufacturers may bid the work in this section provided they submit certified tested data in accordance with Article 1.5 Submittals, clause 1.5.1 attesting that their proposed products meet or exceed the Air Infiltration Rating requirements specified herein shall meet or exceed these specifications and other applicable requirements of Contract Documents and are pre-approved by the Consultant. Modify products if necessary to ensure compliance with all requirements of Contract Documents.

2.2 MATERIALS

.1 Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.

.1 Headers, stiles, rails, and frames 6063-T5 or equivalent.

.2 Extruded Bars, Rods, Profiles, and Tubes: ASTM B 221.

.3 Sheet and Plate: ASTM B 209.

.4 Structural Header Sections: Minimum 5 mm thickness.

.5 Structural Frame Sections: Minimum 3 mm thickness.

.6 Structural Panel Sections: Commercial grade.

.2 Sealants and Joint Fillers: Performed under Section 07 92 00 - Joint Sealants.

2.3 ICU/CCU ENTRANCE ASSEMBLIES

.1 General: Provide manufacturer's standard ICU/CCU entrance assemblies including doors, sidelights, framing, headers, carrier assemblies, roller tracks, pivots, and accessories required for a complete installation.

.2 ICU/CCU Entrances:

.1 Single Slide Entrances:

.1 Configuration: One sliding leaf and one sidelight.

.2 Traffic Pattern: Two-way.

.3 Breakaway Capability: Sliding leaves and sidelights.

.4 Mounting: Between jambs.

.5 Track: None, trackless.

.3 Minimum clear door opening 1067 mm (3'-6"), or as indicated on the door schedule.

2.4 PRODUCT COMPONENTS

.1 Aluminum doors, swing panels and frame assembly:

.1 Door panel(s) and Swing panel(s) shall be factory assembled with 10 mm threaded tie rods spanning full length of top and bottom rails. Snap in glass stop with integral extruded vinyl standoff to accommodate glass flexing. A horizontal muntin bar to provide glass protection. Configurations shall include a 2 panel (single) version and 4 panel (bi-part) version.

.2 Vertical Jambs shall be 44.5 mm x 114.3 mm and Horizontal Header shall be 127.0 mm x 114.3 mm aluminum extrusions. Header shall be accessible by a hinged cover that locks in the open position for ease of service.

.3 All major extrusions to be minimum 3.2 mm wall thickness.

.2 Rollers - Support and Guide:

.1 Sliding door suspension provided by two, nylon roller assemblies, and two anti-rise rollers, rated at 90.72 kg. each. Each roller assembly shall have 11 mm of vertical adjustment. Each swing panel shall include one spring-loaded bottom guide assembly, incorporating a rubber outer shell and lubricated sealed ball bearing. Guide rollers shall be attached to the swing panel with a 4.76 mm thick formed guide bracket. All steel brackets and fittings shall be plated for corrosion resistance.

.3 Door carrier assembly, swing panel pivots, breakaway latches, limiting arms, pull handles, static arrester, and weathering seal.

.1 Entrance systems shall have door panels attached to a door carrier hanger assembly by means of an adjustable support rod pivot assembly and corrosion resistant adjustable breakaway release latch holding the door panel in the closed position under normal manual operation. Breakaway pressure shall be field adjustable (2.268-22.68 kg) to meet local building code requirements but will be factory set at 22.68 kg. maximum. The support rod pivot assembly allows door to swing freely in panic mode without sagging. The system shall have breakaway swing panels held in place by means of a top pivot and floor pivot plate secured to the floor and a flush bolt lock into the header.

.2 All panels shall have a limiting arm to control the panels as they swing in the direction of egress.

.3 Positive Latch with lever handle is provided on each side of the door.

.4 An electrical grounding system on each door grounds entrance package from static electricity.

.5 23.8 mm wide vinyl strip positioned between the door(s) and lead stile(s) of the swing panel(s).

2.6 HARDWARE

.1 General: Provide units in sizes and types recommended by ICU/CCU entrance and hardware manufacturers for entrances and uses indicated.

.2 Breakaway Feature: Provide release hardware that allows panel(s) to swing out in direction of egress to full 90 degrees. Maximum force to open panel shall be 50 lbf (222 N) with panel retaining bolts released.

.3. Positive Latch: Manufacturer's standard non-keyed, spring loaded, latch that can secure sliding door panels to adjacent panels or jambs. Latch shall engage by closing action of door.

.4 Pulls: Provide manufacturer's standard flush cup pulls.

2.7 FABRICATION

.1 Factory fabricate ICU/CCU entrance components to designs, sizes, and thickness indicated and to comply with indicated standards.

.1 Form aluminum shapes before finishing.

.2 Use concealed fasteners to greatest extent possible.

.1 Where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration, use self-locking devices.

.2 Reinforce members as required to receive fastener threads.

.2 Framing: Provide ICU/CCU entrances as prefabricated assemblies.

.1 Fabricate tubular and channel frame assemblies with manufacturer's standard mechanical or welded joints. Provide sub-frames and reinforcement as required for a complete system to support required loads.

.2 Perform fabrication operations in manner that prevents damage to exposed finish surfaces.

.3 Form profiles that are sharp, straight, and free of defects or deformations.

.4 Prepare components to receive concealed fasteners and anchor and connection devices.

.5 Fabricate components with accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.

.3 Doors: Factory fabricated and assembled in profiles indicated. Reinforce as required to support imposed loads and for installing hardware.

.4 Weatherstripping material captured in extruded aluminum door panel. Door nosing weatherstrip to be spring-loaded adjustable astragal type. Surface applied self-adhesive weatherstripping not acceptable.

.5 Glazing: Fabricate framing with minimum glazing edge clearances for thickness and type of glazing indicated.

.6 Hardware: Factory install hardware to the greatest extent possible; remove only as required for final finishing operation and for delivery to and installation at Project site.

2.8 FINISHES

.1 Class II, Clear Anodic Finish: AA-M10C22A31 Mechanical Finish: as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.40 mils minimum complying with AAMA 611-98 and AAMA 607.1.

Part 3 Execution

3.1 EXAMINATION

.1 Examine conditions for compliance with manufacturer's requirements for installation tolerances, header support, and other conditions affecting performance of ICU/CCU entrances.

.2 Notify Contractor in writing of conditions detrimental to the proper and timely completion of work.

.3 Proceed with installation only after unsatisfactory conditions have been corrected.

.4 Beginning of installation means acceptance of existing surfaces and substrates.

3.2 INSTALLATION

.1 General: Door equipment shall be installed by manufacturer-approved, factory-trained installers in compliance with manufacturer's recommendations and reviewed shop drawings. Do not install damaged components. Fit frame joints to produce joints free of burrs and distortion. Rigidly secure non-movement joints.

.2 Entrances: Install ICU/CCU entrances plumb and true in alignment with established lines and grades without warp or rack of framing members and doors. Anchor securely in place.

.1 Install surface-mounted hardware using concealed fasteners to greatest extent possible.

.2 Set headers, carrier assemblies, tracks, operating brackets, and guides level and true to location with anchorage for permanent support.

.3 Install door units plumb, level and true to line, without warp or rack of frames or sash with manufacturer's prescribed tolerances. Provide support and anchor in place.

.3 Dissimilar Materials: Comply with AAMA 101, Appendix Dissimilar Materials by separating aluminum materials and other corrodible surfaces from sources of corrosion or electrolytic action contact points.

.4 Grounding: Connect ICU/CCU entrances to building grounding system as specified in Division 16 Sections.

.5 Glazing: Performed under Section 08 80 50 - Glass and Glazing in accordance with ICU/CCU entrance manufacturer’s instructions.

.6 Sealants: Comply with requirements specified in Section 07 92 00 - Joint Sealants to provide weather tight installation.

3.3 FIELD QUALITY CONTROL

.1 Testing Services: Factory Trained Installer shall test and inspect each ICU/CCU entrance to determine compliance of installed systems with applicable standards.

3.4 ADJUSTING

.1 Adjust ICU/CCU entrances, and hardware for smooth and safe operation.

.2 Repair or replace damaged installed products.

3.5 CLEANING AND PROTECTION

.1 As work proceeds and on completion deposit all recyclable packing materials and containers in appropriate recycling containers.

.2 As work proceeds and on completion remove and recycle excess materials as required.

.3 Final cleaning shall be as described in Section 01 74 00 - Cleaning and Waste Processing.

.4 After installation, installer to take following steps:

.1 Remove temporary coverings and protection of adjacent work areas.

.2 Remove construction debris from construction site and legally dispose of debris.

.3 Clean product surfaces and lubricate operating equipment for optimum condition and safety.

.4 Clean glass and aluminum surfaces promptly after installation. Remove excess glazing and sealant compounds, dirt, and other substances. Repair damaged finish to match original finish. Comply with requirements in Section 08 80 50 - Glass and Glazing for cleaning and maintaining glass.

.5 Advise Contractor: Of precautions required through the remainder of the construction period, to ensure that doors will be without damage or deterioration (other than normal weathering) at the time of acceptance.

3.6 SCHEDULE

.1 Refer to Door Schedule for location.

.2 Refer to Section 08 71 00.1 - Door Hardware Sets

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Hardware for wood doors.

.2 Seals, and door gaskets.

1.2 RELATED SECTIONS

.1 Section 01 74 00 – Cleaning and Waste Processing

.2 Section 08 11 13 – Standard Metal Doors and Frames.

.3 Section 08 14 16 - Flush Wood Doors

.4 Section 08 31 13 – Access Doors and Frames

.5 Section 08 42 43 – ICU Critical Care Unit Entrance

.6 Division 26: Power supply to electric hardware devices.

.7 Section 28 13 00 - Access Control: Card access equipment.

.8 Section 28 16 00 - Security Equipment.

.9 Section 28 31 03 - Fire Alarm and Voice Communication: Electrical connection to release magnetic holders.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 CAN/ULC-S104-10 - Standard Method for Fire Tests of Door Assemblies.

.3 CAN/ULC-S132-07 - Standard for Emergency Exit and Emergency Fire Exit Hardware.

.4 CSDMA (Canadian Steel Door Manufacturers Association).

.5 DHI (Door and Hardware Institute Canada) - AHC and EHC certification programs.

.6 DHI (Door Hardware Institute) - A115 series.

.7 DHI - Recommended Locations for Architectural Hardware for Flush Wood Doors (1993).

.8 BHMA (Builders Hardware Manufacturers Association) - A156 Series Standards.

.9 NFPA 80 - Standard for Fire Doors and Other Opening Protectives, 2013 Edition.

.10 NFPA 252 - Fire Tests of Door Assemblies, 2012 Edition.

.11 UL 10B-2008 - Fire Tests of Door Assemblies (10th Edition).

.12 UL 305-2012 - Standard for Panic Hardware (6th Edition).

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 30 00 - 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.

.2 Sequencing: Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.5 PERFORMANCE REQUIREMENTS

.1 Finish hardware shall be heavy duty commercial quality hardware. Locksets and latch sets shall be fully mortised type with lever handles of solid material.

1.6 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Submit contract hardware list.

.3 Submit detailed hardware schedule showing each separate type of item including design, finish, catalogue identification, and reference identification to specified standards.

.4 Submit complete set of schematic drawings illustrating function and wiring for electronic hardware at each door opening.

.5 Submit samples if requested by the Consultant.

.6 Provide templates of approved hardware to door and frame manufacturers for accurate shop fabrication.

.7 Labeled hardware (for use in labeled or rated doors) must have appropriate ULC label permanently affixed to each item of hardware.

1.7 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

.2 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

.3 Warranty Documentation: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.8 MAINTENANCE MATERIAL SUBMITTALS

1. Tools:
2. Provide special wrenches and tools applicable to each different or special hardware component.
3. Provide maintenance tools and accessories supplied by hardware component manufacturer.

1.9 QUALITY ASSURANCE

.1 Perform Work in accordance with the following requirements:

1. BHMA A156 series.
2. CSDMA.
3. NFPA 80.
4. NFPA 252.
5. UL 10B.

6. UL 305.
7. ULC S132.
8. CAN4-S104.

.2 Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

.3 Hardware Supplier Personnel: Employ an Electrified Hardware Consultant (EHC) to assist in the electronics and controls work of this section.

1.10 REGULATORY REQUIREMENTS

.1 Conform to applicable code for Products requiring electrical connection. Listed and classified by ULC, as suitable for the purpose specified and indicated.

1.11 DELIVERY, STORAGE, AND PROTECTION

.1 Package hardware items individually; label and identify each package with door opening code to match hardware schedule.

1.12 WARRANTIES.

.1 Provide two (2) year warranty on finish hardware items.

.2 Refer to Section 08 71 00.01 - Door Hardware - Specific Requirements issued with the Hardware Schedules for guarantee requirements.

Part 2 Products

2.1 DOOR HARDWARE

.1 Material - General

1. General products of the following manufacturers are approved equals for the type of hardware listed. Product numbers of the first-named manufacturers are the ones generally used in the finish hardware schedule.

.2 Mortise Locks

1. Non-electric locksets:

.1 L9000 Series: ANSI/BHMA Certified, A156.3 – 2012, Series 1000, Grade 1 Operational, Grade 1 Security, UL listed, 25 mm throw, stainless steel. Exceeds 1,000,000 ANSI cycles.

.2 No substitution

.3 Levers, Rose, Occupied Indicator, Trim:

1. Lever: Schlage 06.
2. Rose: Schlage B, 65 mm diameter.
3. Occupied Indicator, Thumb Turn: Schlage L9496 with ADA thumb turn L583-363.
4. No substitution

.4 Butt Hinges, Heavy Weight:

1. IVES 5BB1HW, five knuckle, ball bearing, heavy weight, full mortise hinge.
2. Comply with ANSI/BHMA A156.1. Size in accordance with DH1 and ANSI/BHMA standards.
3. NRP – non-removable pin on secure openings and exterior locations.

4. Approved equal.

.5 Power Transfer Devices:

1. Electrified hinge: IVES electrified hinge. UL listed, comply with ANSI/BHMA A156.1, through wire, TW4 and TW8 with MON-monitor. 50V AC/DC at 3.5 amp continuous and 16 amp pulse up to 400 milliseconds.
2. Electric Power Transfer: Von Duprin EPT10.
3. Approved equal.

.6 Continuous Hinges:

1. Gear type full mortise for aluminum swing door: IVES 112HD.
2. Gear type edge wrap full mortise stainless steel for aluminum swing doors: IVES 224HD.
3. Concealed bearing swing clear hinges: IVES 711.
4. Approved equal.

.7 Electric Strikes:

1. Von Duprin 6211.
2. Comply with ANSI/BHMA A156.31, Grade 1, 680 kg. static strength.
3. Approved equal.

.8 Closers:

1. Surface Closer: LCN 4040 XP Series, LCN 1460 Series
2. approved equal.

.9 Protection Plate (kick plate/mop plate/armor plate)

1. Door protection plates, 0.05” thick stainless steel
2. Bevel edge, stainless steel screws
3. 300mm high for kick plate
4. 900mm high for armor plate
5. IVES 8400 series protection plates
6. Approved equal

.10 Door Edge Protection

1. Door edge protection, 0.05” thick stainless steel
2. Bevel edge, stainless steel screws
3. 900mm high
4. Mortised to door
5. Gallery GHS 48N series
6. Approved equal

.11 Door Frame Protection (Half/Full Wrap)

1. Door frame protection, 0.04” thick stainless steel
2. Bevel edge, stainless steel screws
3. 900mm high
4. Gallery GHS 50N series
5. Approved equal

.12 Perimeter/Smoke Seal

1. Self adhesive
2. Anti-ligature in areas with higher safety risk category (anti-ligature) in behavioral and mental health application
3. Compliant to:
    - .1 UL1784 smoke test, Category H listed up to 180 min
    - .2 UL10C fire test, Category G listed up to 20 min
- .2 Black silicone material
- .3 Zero 188 self adhesive door seal series
- .4 Approved equal

.13 Perimeter/smoke seal

1. Anti-ligature in areas with higher safety risk category (anti-ligature) in behavioral and mental health application
    - .1 Mortised split astragal to door edges
    - .2 Compliant to:
        - .1 UL1784 smoke test
        - .2 UL10C fire test, positive pressure
        - .3 Air infiltration test
    - .3 Pemko 369_PK Split Astragal, mill finish aluminum with PemkoPrene insert
    - .4 Approved equal

.14 Operable door bottom

1. Recessed mounted
2. Compliant to:
    - .1 UL1784 smoke test
    - .2 UL10C fire test
    - .3 Closed cell sponge neoprene insert smoke infiltration tested in accordance with NFPA 80 and NFPA 101
- .2 Zero International automatic door bottoms
- .3 Pemko automatic door bottoms
- .4 Approved equal

.15 Ensure that the hardware installed on the **lead lined doors** meet all regulations.

2.2 UNDERWITER'S REQUIREMENTS

.1 All latch bolts on labeled doors to have 12mm throw.

.2 On pairs of labeled doors latch bolts and bolts on vertical rods of panic sets shall have 19mm throw.

.3 Labeled doors shall have labeled hardware items and seals whether scheduled or not.

.4 All pairs of labeled doors with astragal to have labeled coordinating device.

2.3 CYLINDERS

.1 Manufacturer and Product:

1. Scheduled Manufacturer and Product: Facility standard Schlage C123 series

.2 Requirements: Provide cylinders/cores complying with the following requirements.

1. Cylinders/cores compliant with ANSI/BHMA A156.5; latest revision, Section 12, Grade 1; permanent cylinders; cylinder face finished to match lockset, manufacturer's series as indicated.

.3 Non-Interchangeable Core Standard Cylinder(s), distributed throughout the Project as indicated.

.4 Nickel silver bottom pins.

.5 Project Cylinder/Core Distribution: Provide cylinders/cores complying with the following requirements in Project locations as indicated.

.6 Construction changes keys

1. All cylinders to be keyed alike.
2. Contractor shall allow for a total of 25 keys for the project.
3. All keys shall be handed over to the Owner at handover.

2.4 KEYING

.1 Keys for installed cylinders: Standard keys for all cylinders installed (keyed alike) and to be provided by the contractor. All keys shall be turned over to the Owner at handover.

.2 Keying System: Standard keys (Schlage C123 Cylinders) for every cylinder installed (Keyed Alike)

.3 Master Keying Requirements –The Owner shall be responsible for final keying.

.4 Keys

1. Material: Nickel silver; minimum thickness of .107-inch (2.3mm)
2. Quantity: The Owner will determine the final quantity of key per cylinder installed and will be arranged between the Owner and their keying vendor.

2.5 FINISHES

.1 All hardware finishes shall match throughout the project, generally satin chrome, stainless steel or aluminum, or as noted in the finish hardware schedule.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that doors and frames are ready to receive work and dimensions are as indicated on reviewed shop drawings.

.2 Verify that electric power is available to power operated devices and is of the correct characteristics.

3.2 INSTALLATION

.1 Install hardware to manufacturer instructions.

.2 Use templates provided by hardware item manufacturer.

.3 Mounting heights for hardware from finished floor to centre line of hardware item:

1. Locksets: 1024 mm.
2. Push/Pulls: 1067 mm.
3. Dead Locks: 1525 mm.
4. Exit Devices: 965 mm.

3.3 FIELD QUALITY CONTROL

.1 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 OF FINISHED WORK

.1 Do not permit adjacent work to damage hardware or finish.

3.6 MANUFACTURER'S ABREVIATION

Legend:
↯Electrified Opening

Door#	HwSet#
E343↯	001
E389↯	001A
E1508↯	001A
N232↯	002
N233	003
N234	003
N235	004
N235/1	005
N236	003
N237↯	006
N238↯	007
N239	003
N240	003
N250	008
N315	009
N316	009
N317	009
N318	009
N319↯	010
N321↯	011
N322↯	012
N326	013
N327↯	002A
N329↯	014
N330	003
N331	003
N333	015
N334↯	006
N335	016
N337	003
N338	003
N340	003
N341	003
N342	017
N347↯	018
N349↯	015A
N350↯	019
N350/1↯	019

3.7 DOOR HARDWARE SCHEDULE

Legend:
Link to catalog cut sheet
Electrified Opening

Hardware Group No. 001 - CARD READER, AUTO OPERATOR

For use on Door #(s):
E343

Provide each UEP door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	AUTO OPERATOR	DITEC DAB105			AL	
2	EA	ACTUATOR, TOUCH	8310-836T			630	LCN
2	EA	ARMOR PLATE	8402 915MM X 40MM LDW B-CS			630	IVE
1		CARD READER	WORK OF DIVISION 28				
1	EA		REUSE BALANCE OF EXISTING HARDWARE				

Hardware Group No. 001A - AUTO OPERATOR

For use on Door #(s):
E389 E1508

Provide each UEP door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	AUTO OPERATOR	DITEC DAB105			AL	
2	EA	ACTUATOR, TOUCH	8310-836T			630	LCN
2	EA	ARMOR PLATE	8402 915MM X 40MM LDW B-CS			630	IVE
1	EA		REUSE BALANCE OF EXISTING HARDWARE				

Hardware Group No. 002 - CARD READER, STC

For use on Door #(s):
N232

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 114X114MM			652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO			626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE DS CON 12/16/24/28 VAC/VDC			630	VON
1	EA	OH STOP	100S			630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630 MOUNT ON PULL SIDE			689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ SRT			689	LCN
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS			630	IVE
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-CS			630	IVE
1	EA	SOUND CONTROL	870AA X 1/DW X 2/DH			AL	ZER
1	EA	DOOR BOTTOM	367AA X DW			AA	ZER
1	EA	WIRE HARNESS	CON-6W				SCH
1	EA	WIRE HARNESS	CON____(SIZE TO SUIT)				SCH
1	EA	DOOR CONTACT	679-05HM			BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC			WHT	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC			LGR	SCE
1		CARD READER	WORK OF DIVISION 28				

VALID CREDENTIALS WILL MOMENTARILY SHUNT THE DOOR CONTACT AND UNLOCK THE ELECTRIC STRIKE.
FREE EXITING BY INSIDE LEVER.

Hardware Group No. 002A - CARD READER, DOOR VIEWER

For use on Door #(s):
N327

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 114X114MM			652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO			626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE DS CON 12/16/24/28 VAC/VDC			630	VON
1	EA	OH STOP	100S			630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630 MOUNT ON PULL SIDE			689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ SRT			689	LCN
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS			630	IVE
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-NH-A			630	IVE
1	EA	VIEWER	698			B26D	IVE
1	EA	WIRE HARNESS	CON-6W				SCH
1	EA	WIRE HARNESS	CON____(SIZE TO SUIT)				SCH
1	EA	DOOR CONTACT	679-05HM			BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC			WHT	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC			LGR	SCE
1		CARD READER	WORK OF DIVISION 28				

Hardware Group No. 003

For use on Door #(s):

N233	N234	N236	N239	N240	N330
N331	N337	N338	N340	N341	

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 127X114MM		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS		630	IVE
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-CS		630	IVE

Hardware Group No. 004 - 45 MIN.

For use on Door #(s):
N235

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1HW 127X114MM		652	IVE
1	EA	ENTRANCE LOCK	ND53P6D RHO EV29 S		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	SURFACE CLOSER	4040XP EDA		689	LCN
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS		630	IVE
1	EA	ARMOR PLATE	8402 915MM X 40MM LDW B-CS		630	IVE
1	SET	SEAL	188S X 1/DW X 2/DH		WHT	ZER

Hardware Group No. 005

For use on Door #(s):
N235/1

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 127X114MM		652	IVE
1	EA	PASSAGE SET	ND10S RHO		626	SCH
1	EA	OH STOP	100S		630	GLY
1	EA	ARMOR PLATE	8400 915MM X 40MM LDW B-CS		630	IVE
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS		630	IVE

Hardware Group No. 006 - CARD READER

For use on Door #(s):
N237 N334

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 114X114MM			652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO			626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE DS CON 12/16/24/28 VAC/VDC			630	VON
1	EA	SURFACE CLOSER	4040XP RW/PA			689	LCN
1	EA	WALL STOP	WS401/402CVX			626	IVE
1	EA	VIEWER	698			B26D	IVE
1	EA	WIRE HARNESS	CON-6W				SCH
1	EA	WIRE HARNESS	CON____(SIZE TO SUIT)				SCH
1	EA	DOOR CONTACT	679-05HM			BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC			WHT	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC			LGR	SCE
1		CARD READER	WORK OF DIVISION 28				

VALID CREDENTIALS WILL MOMENTARILY SHUNT THE DOOR CONTACT AND UNLOCK THE ELECTRIC STRIKE.
FREE EXITING BY INSIDE LEVER.

Hardware Group No. 007 - CARD READER, SLIDING DOOR

For use on Door #(s):
N238

Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
1	EA	MANUAL SLIDING DOOR C/W SELF CLOSING OPTION	STANLEY PROCARE 8300				
1	EA	HOOK BOLT MORTISE LOCK	MS1850SN-450 X LC			628	ADA
1	EA	MORTISE CYLINDER	20-013 118			626	SCH
1	EA	ELECTRIC STRIKE	1006R			630	HES
1	EA	LONG DOOR PULL	9264F 24" X 9264F 24" B/B MTG.			630-316	IVE
1	EA	DOOR CONTACT	679-05HM			BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC			WHT	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC			LGR	SCE
1		CARD READER	WORK OF DIVISION 28				

VALID CREDENTIALS WILL MOMENTARILY SHUNT THE DOOR CONTACT AND UNLOCK THE ELCTRIC STRIK ALLOWING THE DOOR TO BE PULLED OPEN

Hardware Group No. 008

For use on Door #(s):
N250

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
3	EA	HINGE	5BB1 114X114MM		652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO		626	SCH
1	EA	SURFACE CLOSER	4040XP RW/PA		689	LCN
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-CS		630	IVE
1	EA	WALL STOP	WS401/402CVX		626	IVE

Hardware Group No. 009

For use on Door #(s):
N315 N316 N317 N318

Provide each SL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER	FINISH	MFR
1	EA	MANUAL SLIDING DOOR PACKAGE	STANLEY PROCARE 8300 C/W BREAKAWAY PANEL		

Hardware Group No. 010 - CARD READER, DOOR VIEWER

For use on Door #(s):
N319

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 127X114MM			652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO			626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE DS CON 12/16/24/28 VAC/VDC		✓	630	VON
1	EA	OH STOP	100S			630	GLY
1	EA	SURFACE CLOSER	4040XP RW/PA			689	LCN
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS			630	IVE
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-CS			630	IVE
1	EA	VIEWER	698			B26D	IVE
1	EA	WIRE HARNESS	CON-6W		✓		SCH
1	EA	WIRE HARNESS	CON____(SIZE TO SUIT)		✓		SCH
1	EA	DOOR CONTACT	679-05HM		✓	BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC		✓	WHT	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC		✓	LGR	SCE
1		CARD READER	WORK OF DIVISION 28				

VALID CREDENTIALS WILL MOMENTARILY SHUNT THE DOOR CONTACT AND UNLOCK THE ELECTRIC STRIKE.
FREE EXITING BY INSIDE LEVER.

Hardware Group No. 011 - AUTO OPERATOR

For use on Door #(s):
N321

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 127X114MM			652	IVE
1	EA	PUSH PLATE	8200 100X405MM			630	IVE
1	EA	PULL PLATE	8303 255MM 100X405MM			630	IVE
1	EA	OH STOP	100S			630	GLY
1	EA	AUTO OPERATOR	DITEC DAB105		✓	AL	
2	EA	TOUCHLESS & PUSH ACTUATOR	CM-7536VR/4		✓	630	CAM
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS			630	IVE
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-CS			630	IVE

Hardware Group No. 012 - CARD READER

For use on Door #(s):
N322

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 114X114MM			652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO			626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE DS CON 12/16/24/28 VAC/VDC		✓	630	VON
1	EA	SURFACE CLOSER	4040XP RW/PA			689	LCN
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS			630	IVE
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-CS			630	IVE
1	EA	WALL STOP	WS401/402CVX			626	IVE
1	EA	WIRE HARNESS	CON-6W		✓		SCH
1	EA	WIRE HARNESS	CON____(SIZE TO SUIT)		✓		SCH
1	EA	DOOR CONTACT	679-05HM		✓	BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC		✓	WHT	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC		✓	LGR	SCE
1		CARD READER	WORK OF DIVISION 28				

VALID CREDENTIALS WILL MOMENTARILY SHUNT THE DOOR CONTACT AND UNLOCK THE ELECTRIC STRIKE.
FREE EXITING BY INSIDE LEVER.

Hardware Group No. 013

For use on Door #(s):
N326

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1HW 127X114MM			652	IVE
1	EA	PASSAGE SET	ND10S RHO			626	SCH
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS			630	IVE
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-CS			630	IVE
1	EA	WALL STOP	WS401/402CVX			626	IVE

Hardware Group No. 014 - CARD READER

For use on Door #(s):
N329

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 114X114MM			652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO			626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE DS CON 12/16/24/28 VAC/VDC			630	VON
1	EA	OH STOP	100S			630	GLY
1	EA	SURFACE CLOSER	4040XP ST-1630 MOUNT ON PULL SIDE			689	LCN
1	EA	TOP JAMB MTG PLATE	4040XP-18TJ SRT			689	LCN
1	EA	ARMOR PLATE	8400 915MM X 40MM LDW B-CS			630	IVE
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS			630	IVE
1	EA	WIRE HARNESS	CON-6W				SCH
1	EA	WIRE HARNESS	CON____(SIZE TO SUIT)				SCH
1	EA	DOOR CONTACT	679-05HM			BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC			WHT	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC			LGR	SCE
1		CARD READER	WORK OF DIVISION 28				

VALID CREDENTIALS WILL MOMENTARILY SHUNT THE DOOR CONTACT AND UNLOCK THE ELECTRIC STRIKE.
FREE EXITING BY INSIDE LEVER.

Hardware Group No. 015 - AUTO OPERATOR

For use on Door #(s):
N333

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 114X114MM			652	IVE
1	EA	CORRIDOR LOCK W/ OUTSIDE INDICATOR W/ INSIDE INDICATOR	L9456P6 06B 630 626 L583-363 OS-OCC IS-LOC			630/626	SCH
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS			630	IVE
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-CS			630	IVE
1	EA	WALL STOP	WS401/402CVX			626	IVE

Hardware Group No. 015A - AUTO OPERATOR

For use on Door #(s):
N349

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 114X114MM			652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO			626	SCH
1	EA	ELECTRIC STRIKE	6211 FS DS CON 12/16/24/28 VAC/VDC		✓	630	VON
1	EA	AUTO OPERATOR	DITEC DAB105		✓	AL	
1	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS			630	IVE
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-CS			630	IVE
1	EA	WALL STOP	WS401/402CVX			626	IVE
1	EA	SWITCH RESTROOMS CONTROL KITS	CX-WC17VR-PS		✓		CAM
	EA	EMERGENCY CALL KIT	CX-WEC10K2				CAM

THE STRIKE IS UNLOCKED, ALLOWING ENTRY INTO WASHROOM BY PULLING OR PUSHING THE DOOR. OPERATING THE WALL MOUNT EXTERIOR ACTUATOR WILL ACTIVATE THE AUTOMATIC DOOR OPERATOR.
PRESSING "PUSH TO LOCK BUTTON" IN WASHROOM WILL ENERGIZE THE ELECTRIC STRIKE TO LOCK, DE-ACTIVATE THE OUTSIDE ACTUATOR WHICH WILL TURN FROM GREEN TO RED, INDICATING THAT THE WASHROOM IS OCCUPIED.
EXITING BY INSIDE LEVER BY PUSHING OR PULLING THE DOOR OPEN OR PRESSING THE INSIDE ACTUATOR WILL UNLOCK THE STRIKE AND ACTIVATE THE AUTOMATIC DOOR OPERATOR.
AFTER EXITING, THE MAGNETIC CONTACT SWITCH WILL RESET THE SYSTEM.
THE CX-WC17VR-PS KIT COMES WITH THE CX-33PS POWER SUPPLY CABINET, (2) CM-7536VR/4-36" COLUMN "WHEELCHAIR" SYMBOL AND "PUSH TO OPEN" GRAPHICS, CM-7536VR/8B-36" COLUMN "LOCK" SYMBOL AND "PUSH TO LOCK" GRAPHIC SYMBOL, & CX-MDA MAGNETIC CONTACT.

Hardware Group No. 016 - LEAD LINED

For use on Door #(s):
N335

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
1	SET	PIVOT	L147		626	RIX
1	EA	INTERMEDIATE PIVOT	ML19		626	RIX
1	EA	PASSAGE SET	ND10S RHO XN12-307		626	SCH
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-NH-A		630	IVE
1	EA	FLOOR STOP	S115		626	SMH

Hardware Group No. 017

For use on Door #(s):
N342

Provide each UEP door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER		FINISH	MFR
6	EA	HINGE	5BB1 127X114MM		652	IVE
1	EA	MANUAL FLUSH BOLT	FB458 305MM INSTALL AT TOP OF DOOR		626	IVE
1	EA	CLASSROOM LOCK	ND70P6D RHO		626	SCH
2	EA	OH STOP	100S		630	GLY
2	EA	ARMOR PLATE	8400 915MM X 40MM LDW B-CS		630	IVE
2	EA	MOP PLATE	8400 150MM X 25MM LDW B-CS		630	IVE

Hardware Group No. 018 - CARD READER, 45 MIN.

For use on Door #(s):
N347

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1 114X114MM			652	IVE
1	EA	STOREROOM LOCK	ND80P6D RHO			626	SCH
1	EA	ELECTRIC STRIKE	6211 FSE DS CON 12/16/24/28 VAC/VDC			630	VON
1	EA	SURFACE CLOSER	4040XP RW/PA			689	LCN
1	EA	KICK PLATE	8400 205MM X 40MM LDW B-CS			630	IVE
1	EA	WALL STOP	WS401/402CVX			626	IVE
1	SET	SEAL	188S X 1/DW X 2/DH			WHT	ZER
1	EA	WIRE HARNESS	CON-6W				SCH
1	EA	WIRE HARNESS	CON____(SIZE TO SUIT)				SCH
1	EA	DOOR CONTACT	679-05HM			BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC			WHT	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC			LGR	SCE
1		CARD READER	WORK OF DIVISION 28				

VALID CREDENTIALS WILL MOMENTARILY SHUNT THE DOOR CONTACT AND UNLOCK THE ELECTRIC STRIKE.
FREE EXITING BY INSIDE LEVER.

Hardware Group No. 019 - CARD READEWR

For use on Door #(s):
N350/1 N350

Provide each SGL door(s) with the following:

QTY		DESCRIPTION	CATALOG NUMBER			FINISH	MFR
3	EA	HINGE	5BB1HW 114X114MM			652	IVE
1	EA	MORTISE LOCK	4900 x L/C			628	ADA
1	EA	MORTISE CYLINDER	20-013 118			626	SCH
1	EA	ELECTRIC STRIKE	6211AL FSE DS CON 12/16/24/28 VAC/VDC			613	VON
1	EA	PULL PADDLE	4591-XX-00			626	ADA
1	EA	PUSH/PULL BAR	9190EZHD-305MM-NS			630-316	IVE
1	EA	SURFACE CLOSER	4040XP PULL SIDE MOUNT			689	LCN
1	EA	MOUNTING PLATE	4040XP-18 SRT			689	LCN
1	EA	WALL STOP	WS401/402CVX			626	IVE
1	EA	WIRE HARNESS	CON-6W				SCH
1	EA	WIRE HARNESS	CON____(SIZE TO SUIT)				SCH
1	EA	DOOR CONTACT	679-05HM			BLK	SCE
1	EA	MOTION SENSOR	SCANII 12/24 VDC			WHT	SCE
1	EA	POWER SUPPLY	PS902 BBK 900-2RS KL900 120/240 VAC			LGR	SCE
1		CARD READER	WORK OF DIVISION 28				

VALID CREDENTIALS WILL MOMENTARILY SHUNT THE DOOR CONTACT AND UNLOCK THE ELECTRIC STRIKE.
FREE EXITING BY INSIDE PULL PADDLE.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Glass and glazing for sections referencing this section for products and installation.

.2 Mirrors

1.2 RELATED SECTIONS

.1 Section 06 41 11 - Architectural Cabinetwork

.2 Section 07 92 00 - Joint Sealants.

.3 Section 08 11 13 - Standard Metal Doors and Frames.

.4 Section 08 14 16 - Flush Wood Doors.

.5 Section 08 42 43 - Intensive Care Unit/Critical Care Unit Entrances

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ANSI Z97.1 - Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test.

.3 ASTM C542 - Specification for Lock-Strip Gaskets.

.4 ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

.5 ASTM C920 - Elastomeric Joint Sealants.

.6 ASTM C1036 - Flat Glass.

.7 ASTM C1048 - Heat-Treated Flat Glass - Kind HS, Kind FT Coated and Uncoated Glass.

.8 ASTM C1193 - Use of Joint Sealants.

.9 ASTM C1503 - Silvered Flat Glass Mirror.

.10 ASTM D412 -Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers - Tension.

.11 ASTM D1149 - Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber.

.12 ASTM D2240 - Test Method for Rubber Property - Durometer Hardness.

.13 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

.14 ASTM E283 - Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen.

.15 ASTM E773 - Test Method for Accelerated Weathering of Sealed Insulating Glass Units.

.16 CAN/CGSB 12.1 - Tempered or Laminated Safety Glass.

.17 CAN/CGSB 12.3 - Flat, Clear Float Glass.

.18 CAN/CGSB 12.4 - Heat Absorbing Glass.

.19 CAN/CGSB 12.20 – Structural Design of Glass for Buildings.

.20 GANA (Glass Association of North America)

.1 GANA Glazing Manual.

.2 GANA Laminated Glass Reference Manual.

.3 GANA Sealant Manual.

.21 FGMA Sealant Manual.

.22 IGMAC Insulating Glass Manufacturers Association of Canada.

.23 Glazing Contractors Association of BC

.24 GCA - Glazing Systems Specifications Manual

1.4 PERFORMANCE REQUIREMENTS

.1 Interior windows and sidelights shall be constructed of tempered glass, except where indicated in the schedule below.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.

.3 Samples: Submit two (2) samples 300 x 300mm in size, exampling glass, colouration and design for each type upon consultant request.

1.6 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Manufacturer's Certificate: Certify that sealed insulated glass, meets or exceeds specified requirements.

1.7 QUALITY ASSURANCE

.1 Perform Work in accordance with GANA Glazing Manual, for glazing installation methods.

1.8 ENVIRONMENTAL REQUIREMENTS

.1 Do not install glazing when ambient temperature is less than 10 degrees C.

.2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.9 EXTENDED WARRANTY

.1 Refer to Section 01 11 00: Warranty. Warranty Period for all supplied materials, equipment and installation is two (2) years from the date of Service Commencement.

Part 2 Products

2.1 MANUFACTURERS

.1 Basis of Design products are named in this Section; additional manufacturers offering similar setting systems may be incorporated into the work provided they meet the performance requirements established by the named products.

.2 Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

.1 Vision Glass:

.1 AGC Flat Glass North America (formerly AFG or AFGD)
.2 AHC Glass (formerly Visteon)
.3 Cardinal Glass Industries Inc
.4 Garibaldi Glass Industries Inc
.5 Guardian Glass
.6 Pilkington Glass of Canada
.7 Vitro Architectural Glass (formerly PPG Industries)
.8 Viracon Inc.

2.2 MATERIALS

.1 Clear Float Glass: to CAN/CGSB-12.3, glazing quality, 6 mm minimum thickness.

.2 Safety glass: to CAN/CGSB-12.1, transparent, 6 mm minimum thickness.

2.3 INTERIOR GLAZING

.1 Type INT-1, windows, sidelights and doors in low risk areas:

.1 12mm clear tempered laminated glass

.1 6mm clear tempered
.2 1.5mm PVB interlayer
.3 6mm clear tempered.

.2 Interior steel doors and frames – non fire rated:

.1 Glass: 6 mm thick safety glass tempered.
.2 Glazing method: interior dry method.
.3 See door schedule for locations

2.4 SPANDREL GLASS

.1 Type SPA-1: 6mm clear heat strengthened, Opacifying coating: ICD OPACI-COAT, 0.17mm thick, colour as selected.

2.5 GLAZING COMPOUNDS

.1 Silicone Sealant: CAN/CGSB 19.13 single component; chemical curing; capable of water immersion without loss of properties; non-bleeding, non-staining, cured Shore A hardness of 15 to 25.

2.6 MANUFACTURERS - GLAZING ACCESSORIES

.1 Setting Blocks: ASTM C864, Silicone, 80 to 90 Shore A durometer hardness tested to ASTM D2240, length of 25 mm for each square metre 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.

.2 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.

.3 Glazing Tape: Preformed butyl compound; 10 to 15 Shore A durometer hardness tested to ASTM D2240; coiled on release paper; black colour.

Part 3 Execution

3.1 EXAMINATION

.1 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.

.5 Site confirm all glass sizes prior to fabrication and installation.

3.3 INSTALLATION

.1 Install as per glazing manufacturer installation guidelines.

.2 Caulk all around frames

.3 Insure to protect all glass from damage prior to installation.

3.4 CLEANING

.1 Section 01 74 00: Cleaning installed work.

.2 Remove glazing materials from finish surfaces.

.3 Remove labels after Work is complete.

.4 Clean glass and adjacent surfaces.

3.5 PROTECTION OF FINISHED WORK

.1 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 and joint treatment.

.2 Gypsum interior sheathing.

.3 Acoustic insulation.

.4 Light gauge metal stud wall framing.

.5 Metal channel ceiling framing.

1.2 RELATED SECTIONS

.1 Section 06 10 13 - Wood Blocking and Curbing

.2 Section 07 21 16 - Blanket Insulation

.3 Section 07 84 00 - Firestopping

.4 Section 09 21 40 - Gypsum Board

.5 Section 09 22 16 – Non-Structural Metal Stud Framing

.6 Section 10 28 14 - Toilet and Bath Accessories

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ANSI A118.9 - Specifications for Cementitious Backer Units.

.3 ASTM C475/C475M - Joint Compound and Joint Tape for Finishing Gypsum Board.

.4 ASTM C645 - Non-Structural Steel Framing Members.

.5 ASTM C665 - Mineral-Fibre Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.6 ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board.

.7 ASTM C1002 - Steel Self-Piercing, Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.8 ASTM C1047 - Accessories for Gypsum Wallboard and Gypsum Veneer Base.

.9 ASTM C1278/C1278M - Fiber-Reinforced Gypsum Panel.

.10 ASTM C1396/C1396M - Gypsum Board.

.11 ASTM E90 - Test Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions and Elements.

.12 CAN/ULC S101 - Methods of Fire Endurance Tests of Building Construction and Materials.

.13 CAN/ULC S102 - Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.14 GA-214 (Gypsum Association) - Recommended Levels of Gypsum Board Finish.

.15 GA-216 (Gypsum Association) - Application and Finishing of Gypsum Panel Products.

.16 GA-254 - Fire-Resistant Gypsum Sheathing.

.17 GA-600 (Gypsum Association) - Fire Resistance Design Manual.

.18 GA-801 (Gypsum Association) - Handling and Storage of Gypsum Panel Products: A Guide for Distributors, Retailers, and Contractors.

.19 ULC - Fire Resistance Directory.

.20 CSA Z317 Infection Control During Construction or Renovation of Health Care Facilities, April 2003.

1.4 SYSTEM DESCRIPTION

.1 Acoustic Attenuation for Identified Interior Partitions: Provide STC ratings as indicated in accordance with ASTM E90.

1.5 SUBMITTALS

.1 Section 01 33 00: Submission procedures.

.2 Product Data:

.1 Provide data on metal framing, gypsum board, cementitious backer board, joint tape, and joint compound.

.2 Provide MSDS on all products within the wall assembly.

.3 Provide a letter of certification from the Gypsum manufacturer indicating that the products supplied for this project do not contain hydrogen sulphide, sulphur dioxide, sulphur or any sulphur by-products.

1.6 QUALITY ASSURANCE

.1 Perform Work in accordance with GA-214, GA-216, and GA-600.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years experience.

.3 Handling Gypsum Board: Comply with GA-801.

.4 Gypsum Board materials supplied for use on this project shall not contain hydrogen sulphide, sulphur dioxide, sulphur or any sulphur by-products.

1.7 REGULATORY REQUIREMENTS

.1 Conform to applicable code for fire rated assemblies in conjunction with Section 05 41 00 and 09 22 16 as follows:

.1 Fire Rated Partitions: Listed assembly by ULC listed Design Assembly and as detailed.

.2 Fire Rated Ceilings: Listed assembly by ULC listed Design Assembly and as detailed.

.3 Fire Rated Structural Column Framing: Listed assembly by ULC listed Design Assembly as scheduled or detailed.

1.8 ACOUSTICAL PERFORMANCE REQUIREMENTS

.1 The following healthcare spaces shall be designed with increased sound proofing to fall into the confidential privacy rating.

.2 Typical sound transmission class (STC) rating requirements and space adjacencies:

Part 2 Products

2.1 ACCEPTABLE MANUFACTURERS

.1 The following Manufacturers of gypsum drywall are deemed to be acceptable for the supply of gypsum drywall for this project:

- .1 Canadian Gypsum Company (US Gypsum)
- .2 Certainteed Gypsum Canada Inc.
- .3 Georgia Pacific.
- .4 Westroc Inc.
- .5 Winroc.

2.2 FRAMING MATERIALS

.1 Studs and Tracks: Specified in Section 09 22 16.

.2 Furring, Framing, and Accessories: Specified in Section 09 22 16.

.3 Fasteners: ASTM C1002.

.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.

2.3 CEILING SUSPENSION SYSTEM

.1 Main Runner Channels:

- .1 Cold formed steel channels with rust inhibitive coating.
- .2 Size: 38 x 12 mm.
- .3 Gauge: 1.22 mm

.2 Hanger Rods and Tie Wires:

- .1 Wire: 3.6 mm galvanized wire.
- .2 Rods: 4.8 mm diameter zinc coated or cadmium plated steel rods with rust inhibitive coating.
- .3 Inserts: develop full strength of hangers they support.
- .4 Tie wires: Minimum 1.22 mm, soft annealed galvanized wire, two strands for attaching furring to main runners.

2.4 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 Regular core, 13 mm and 16 mm thick.
- .2 Fire rated core, 13 mm and 16 mm thick.

.2 Gypsum Ceiling Board ASTM C1396/C1396M, paper-faced, regular core, 13 mm thick; 1220 mm wide, maximum available length in place; tapered edges, ends square cut.

.3 Flexible Gypsum Board: ASTM C1396/C1396M, paper-faced, regular core, 6 mm thick, 1220 mm wide, maximum available length in place; ends square cut, tapered edges.

.4 Moisture Resistant Gypsum Board: MMRGWB ASTM C1658/C1658M, moisture and mould resistant core and fibreglass facers, maximum available length in place; tapered edges, ends square cut. Mould resistance:to ASTM D3273, Standard Test Method for Resistance to Growth of Mould on the Surface of Interior Coatings in an Environmental Chamber, score 10.

.1 Regular core, 16 mm thick.

.2 Fire rated core, 16 mm thick.

.5 Water Resistant Gypsum Board: ASTM C1278/C1278M, glass fibre-reinforced, paperless face; maximum available length in place; tapered edges, ends square cut.

.1 Regular core, 16 mm thick.

.2 Fire rated core, 16 mm thick.

.6 Gypsum Tile Backer Board: ASTM C1278/C1278M, paperless, water-resistant gypsum/cellulose-fibre reinforced composition, 13 mm thick, 915 mm wide; maximum available length in place; square edges, ends square cut.

.7 Lead Radiation Shielding: Refer to the Shielding Assessment for the project and provide lead shielding as required.

2.5 ACOUSTIC ACCESSORIES

.1 Acoustic Insulation: As specified under Section 07 21 16 - Blanket Insulation.

.2 Acoustic Sealant: As specified under Section 07 92 00 - Joint Sealants.

2.6 ACCESSORIES

.1 Corner Beads: GA-216; Metal corner bead.

.2 Edge Trim: GA-216; Type J or U casing bead.

.3 Joint Materials: GA-216

.1 Joint Tape: ASTM C475 and ASTM C840, 50.8 mm spark perforated paper tape, made from 100% recycled paper, of type recommended by manufacturer of gypsum board products. Fiber glass tape is not acceptable.

.2 Joint compound: ASTM C475 and ASTM C840, asbestos-free, all-purpose, premixed: Low-VOC, free of antifreeze, vinyl adhesives, preservatives, biocides, and other slow-releasing compounds, casein, latex base; slow setting; bedding and finishing compounds of type recommended by manufacturer of gypsum board. Standard of acceptance: CGC "Durabond" Setting Compound; Georgia-Pacific "Ready Mix" Sandable 20, 45, 90 Setting Compound; BPB Canada "ProFin" Joint Compounds or equivalent.

.1 For areas receiving High Build Epoxy Coatings specified under Section 09 96 59, provide Durabond 90 joint compound or equivalent.

.3 Mould resistant joint compound: to ASTM C475, asbestos free, mould resistant. Acceptable product: DensArmor Cote all-purpose, ready-mix joint compound, and DensArmor sandable setting compounds.

.4 Wall smoothing coating: sandable, high solid content, flat latex base coat designed to minimize surface texture differences between gypsum board face paper and joint compound.

.5 Corner and casing beads, edge trim: To ASTM C1047, Minimum 0.455 mm metal core thickness (26 gauge) galvanized sheet steel with Z275 zinc finish to

ASTM A525M-86, type with perforated flanges, or metal/paper flange combination of type to be finished with joint compound.

.6 Coved Corner Beads: Pre-formed metal/paper profile, 19 mm inside corner radius or pre-formed metal/paper profile 38 mm outside corner. Acceptable materials: Beadex SLIC and Danish Profiles.

.7 Control/Expansion Joints: To ASTM C1047, Control joint #093, 3 m lengths, roll-formed zinc with a tape protected 6 mm opening, 11 mm deep.

.8 Gypsum Board and Sheathing Fasteners: ASTM C1002, Type S12 and GA-216.

.9 Cementitious Board Fasteners: Board manufacturer's purpose made screws, corrosion resistant steel, self-drilling points, counter-sink heads to prevent strip-out, for steel substrate.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that site conditions are ready to receive work and opening dimensions are as indicated on reviewed shop drawings.

3.2 FURRING FOR FIRE RATINGS

.1 Install furring as required for fire resistance ratings indicated and to GA-600 requirements.

3.3 CEILING FRAMING INSTALLATION

.1 Install in accordance with GA-216.

.2 Coordinate location of hangers with other work.

.3 Install ceiling framing independent of walls, columns, and above ceiling work.

.4 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.

.5 Laterally brace entire suspension system.

3.4 ACOUSTIC ACCESSORIES INSTALLATION

.1 Comply with manufacturer's instructions for particular conditions of installation in each case.

.2 Batts may be friction-fit in place until the interior finish is applied. Install batts to fill entire stud cavity. If stud cavity is less than 2400 mm in height, cut lengths to friction-fit against floor and ceiling tracks.

.3 Walls with penetrations require that insulation be carefully cut to fit around outlets, junction boxes and other irregularities. 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.

.4 Where walls are not finished on both sides or insulation does not fill the cavity depth, supplementary support must be provided to hold product in place.

.5 Where insulation must extend higher than 2400 mm, temporary support shall be provided to hold product in place until the finish material is applied.

.6 Install acoustic sealant at gypsum board perimeter at:

.1 Base Layer.

.2 Face Layer.

.3 Caulk all penetrations of partitions by conduit, pipe, duct work, and rough-in boxes.

3.5 GYPSUM BOARD INSTALLATION

.1 Install gypsum board in accordance with GA-216 and GA-600.

.2 Erect single layer board with ends and edges occurring over firm bearing.

.3 Erect single layer fire rated gypsum board, with edges and ends occurring over firm bearing.

.4 Set the bottom edge of wallboard a minimum of 12 mm above finished floor level. Apply sealant in gap.,

.5 Use screws when fastening gypsum board to metal furring or framing.

.6 Double Layer Applications: Secure second layer to first with fasteners.

.7 Place second layer parallel to first layer. Offset joints of second layer from joints of first layer.

.8 Treat cut edges and holes in moisture resistant gypsum board with sealant.

.9 Place control joints consistent with lines of building spaces.

.10 Place corner beads at external corners. Use longest practical length. Place edge trim where gypsum board abuts dissimilar materials.

.11 Install backing board over metal studs in accordance with manufacturer's written instructions.

.12 Install J or U casing bead where gypsum board butts to dissimilar materials.

.13 Install moisture resistant drywall from floor to 1220mm above floor for the entire room. Install moisture resistant drywall to the following locations:

- All washrooms,
- Janitor room,

.14 In addition to areas noted above, install moisture resistant gypsum board at all plumbing fixture rough-in locations where plumbing penetrates wall assembly, to both sides of wall assembly and a minimum of 1200 mm each side of the penetration.

3.6 JOINT TREATMENT

.1 Finish in accordance with GA-214 Level 1, 3, or 4 as scheduled.

.2 Feather coats on to adjoining surfaces so that camber is maximum 0.8 mm.

.3 Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.

.4 Fill and finish joints and corners of cementitious backing board.

3.7 TOLERANCES

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

3.8 SCHEDULES

.1 Level of finish for final decoration for walls and ceilings:

- .1 Level 1: Above finished ceilings concealed from view.
- .2 Level 4: Walls and partitions exposed to view.
- .3 Level 4: Ceilings exposed to view.
- .4 Level 5: Walls, partitions and ceilings exposed to view and scheduled to receive semi-gloss or gloss paint finish, or high build epoxy coatings.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Formed metal framing of studs and furring, at interior locations.

.2 Framing accessories.

.3 Concealed blocking for support of toilet and bath accessories, wall cabinets and door frames.

.4 Installation of metal door frames.

1.2 RELATED SECTIONS

.1 Section 06 10 13 – Wood Blocking and Curbing

.2 Section 07 21 16 - Blanket Insulation

.3 Section 08 31 13 - Access Doors and Frames

.4 Section 09 21 16 - Gypsum Board Assemblies

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM A123/A123M - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.4 ASTM C645 - Non-Structural Steel Framing Members.

.5 ASTM C754 - Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.6 ASTM C1002 - Steel Self-Piercing, Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.7 CAN/CGSB-1.181 - Ready-Mixed, Organic Zinc-Rich Coating.

1.4 SYSTEM DESCRIPTION

.1 Interior Walls: Metal stud framing assembly with batt type acoustic insulation specified in Section 07 21 16, interior gypsum board specified in Section 09 21 16.

.2 Size components to withstand an assumed average lateral pressure of 240 Pa.

.3 Maximum Allowable Deflection: 1:180 of span.

.4 Maximum Total Allowable Deflection: 25 mm.

.5 Wall Assembly:

.1 Design assembly to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.

1.5 DESIGN REQUIREMENTS

.1 The work of this Section shall be designed by a qualified professional engineer registered or licensed in Province of B.C.

.2 Design framing for wall, partition, and suspended ceilings assemblies to resist safely and effectively all loads and effects of seismic loads in accordance with British Columbia Building Code, latest Edition.

.3 Design framing for walls and partitions for Acoustical Performance Requirements as indicated in Wall Type Schedule.

1.6 QUALITY ASSURANCE

.1 Perform Work in accordance with ASTM C754.

1.7 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Provide shop drawings prepared under supervision of professional engineer registered in the Province of British Columbia.

.1 Shop drawings for seismic restraint of partitions shall be sealed by a professional engineer registered in the Province of British Columbia.

.2 Indicate prefabricated work, component details, stud layout, and accessories or items required of other related work.

.3 Describe method for securing studs to tracks, and for blocking and reinforcement to framing connections.

.4 Provide calculations for loadings and stresses of specially fabricated framing, under the Professional Structural Engineer's seal.

.3 Letters of Assurance:

.1 The Engineer sealing the shop drawings shall submit to the Consultant, as required by the BC Building Code, the following:

.1 Schedule B-1 Assurance of Professional Design and Commitment for Field Review.

.2 Schedule B-2 Summary of Design and Field Review Requirements.

.3 Schedule C-B Assurance of Professional Field Review and Compliance.

.4 The Engineer sealing the shop drawings shall provide field reviews of the installation and shall provide sufficient reviews in order to provide letters of professional assurance. Written inspection reports shall be submitted to the Consultant promptly as field reviews occur.

1.8 ADMINISTRATIVE REQUIREMENTS

.1 Section 01 30 00 - Coordination:

.1 Coordinate with other work having a direct bearing on work of this section.

Part 2 Products

2.1 RECYCLED CONTENT

.1 Steel stud, furring, and suspension materials: Minimum 25% post-consumer, 50% post-industrial, 75% total recycled content.

2.2 STUD FRAMING MATERIALS

.1 Framing Assembly Components: ASTM C645.

.1 Typical walls: Bailey B18 Hardboard steel studs or approved alternate.

.2 Walls supporting wall-hung millwork or similar elements: minimum 0.9 mm (20 ga.) steel studs, unless otherwise determined by metal stud framing design Engineer.

.3 Walls supporting heavy loads (i.e. sinks and equipment): minimum 1.2 mm (18 ga.) steel studs.

.4 Walls in offices and similar areas not requiring extensive services: as per 2.2.1.1.

.5 Provide thicker gauge studs where required by engineering design.

.6 Acoustic (STC-rated) walls: as per 2.2.1.1.

.1 Acoustic Walls supporting wall-hung elements: Provide additional support framing designed by the metal stud framing design Engineer to be independent of wall studs to support wall-hung loads. Additional support framing shall be designed to not degrade the acoustical properties of the wall assembly.

.2 Tracks and Headers: Same material and thickness as studs, bent leg retainer notched to receive studs.

.3 Deflection Tracks: 50 mm high "U" shaped tracks or nested tracks.

.4 Furring Channels and Bracing Members: "Hat" shaped. Size: 70 mm wide x 22 mm deep; 35 mm face width. Thickness to suit purpose. Channels to have knurled face and hemmed legs.

.5 Fasteners: ASTM C1002, self-drilling, self-tapping screws.

.6 Sheet Metal Backing: 1.2 mm thick galvanized steel plate To ASTM A924, galvanized to ASTM A853, Z180 coating.

.7 Acoustic Sealant: As specified in Section 09 21 16.

.8 Touch-Up Primer for Galvanized Surfaces: CAN/CGSB 1.181.

2.3 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.

2.4 FINISHES

.1 Studs:

.1 Galvanize to minimum Z180 (G60) coating class.

.2 Tracks and Headers: Same finish as studs.

.3 Accessories: Same finish as framing members.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that rough-in utilities are in proper location.

3.2 ERECTION

.1 Align and secure top and bottom runners at 600 mm on centre.

.2 Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

.3 Install studs vertically as scheduled.

.4 Align stud web openings horizontally.

.5 Secure studs to tracks. Do not weld.

.6 Stud splicing: Not permissible.

.7 Fabricate corners using a minimum of three studs.

.8 Double stud at wall openings, door and window jambs, not more than 50 mm from each side of openings.

.9 Install pressed steel door frames and pressed steel glazed light frames.

.10 Brace stud framing assembly rigid.

.11 Coordinate erection of studs with requirements of door frames, window frames, and access panels; install supports and attachments.

.12 Sheet Metal Backing:

.1 Coordinate sizes and locations of sheet metal backing with reviewed shop drawings of the supported items, including NHA-Supplied Equipment.

.2 Secure sheet metal backing to studs. Install backing for support of all wall-mounted items including, but not limited to, wall-mounted equipment, plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, opening frames, slat wall panels, and NHA-Supplied Equipment.

.13 Wood blocking:

.1 Install wood blocking specified in Section 06 10 13 to steel stud cavities at all millwork locations.

.14 Unless indicated otherwise construct partitions full-height extending through the ceiling to the structure above. Refer to Drawings for indication of partitions extending to finished ceiling only. Maintain clearance under structural building members to avoid deflection transfer to studs. Provide extended leg ceiling runners.

.15 Coordinate placement of insulation in stud spaces after stud frame erection.

3.3 ERECTION TOLERANCES

.1 Section 01 73 00: Tolerances.

.2 Maximum Variation from True Position: 3 mm in 3 m.

.3 Maximum Variation from Plumb: 3 mm in 3 m.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Suspended metal grid ceiling system and perimeter trim.

.2 Acoustic ceiling tile panels including back loaded ceiling as noted on drawings.

1.2 RELATED SECTIONS

.1 Section 01 78 30 – Spare Parts Maintenance Materials

.2 Section 07 21 16 - Blanket Insulation

.3 Section 21 10 00 - Fire Suppression Sprinkler Systems

.4 Section 23 37 00 - Air Outlets.

.5 Section 26 50 00: Light fixtures in ceiling system.

.6 Division 27: Speakers, cameras, microphones, DAS Antennas, WIFI access points, and other telecommunication and multimedia equipment in ceiling system.

.7 Section 28 31 00 - Fire Alarm and Voice Communication.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.1 ASTM C635 - Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

.2 ASTM C636/C636M - Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.

.3 ASTM E580/E580M - Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Moderate Seismic Restraint.

.4 ASTM E1264 - Classification of Acoustical Ceiling Products.

.5 CAN/ULC-S702-14 - Standard for Mineral Fibre Thermal Insulation for Buildings.

.6 AWCCBC (Association of Wall and Ceiling Contractors of British Columbia).

.7 UL - Fire Resistance Directory.

.8 ULC-FR-14 - Fire Resistance Directory (2014 Edition).

1.4 SYSTEM DESCRIPTION

.1 Suspension System: Rigidly secure acoustic ceiling system including integral mechanical and electrical components with maximum deflection of 1:240.

1.5 ADMINISTRATIVE REQUIREMENTS

.1 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 DESIGN REQUIREMENTS

.1 Suspension systems for acoustic tile shall be designed by a Professional Engineer registered in British Columbia to conform to the seismic restraint requirements of ASTM E580 Standard Practice for Application of Ceiling Suspension Systems for Acoustical Tile and Lay in Panels. Seismic requirements shall be in accordance with the B.C. Building Code.

1.7 SUBMITTALS FOR REVIEW

.1 Product Data: Provide data on metal grid system components, acoustic units and moldings.

.2 Samples: Submit two (2) samples full size illustrating material and finish of acoustic units. Provide one sample to consultant and one to field office.

.3 Samples: Submit two (2) samples each, 300 mm long, of each suspension system type main runner, cross runner and perimeter moldings. Provide one sample to consultant and one to field office.

.4 Provide shop drawings prepared under supervision of professional engineer registered in the Province of British Columbia. Indicate grid layout and related dimensioning, junctions with other work or ceiling finishes, seismic bracing, interrelation of mechanical and electrical items related to system.

1.8 QUALITY ASSURANCE

.1 Conform to AWCCBC requirements.

1.9 LETTERS OF ASSURANCE

.1 Have the Engineer responsible for sealing the engineered shop drawings submit to the Consultant, British Columbia Building Code Schedule B-1 Assurance of Professional Design and Commitment for Field Review and Schedule B-2 Summary of Design and Field Review Requirements with the shop drawings.

.2 Engineer to provide field review of the installation and submit to the Consultant British Columbia Building Code Schedule C-B Assurance of Professional Field Review and Compliance upon completion of the work.

1.10 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Refer to Section 01 78 30.

1.11 ENVIRONMENTAL REQUIREMENTS

.1 Maintain uniform temperature of minimum 16 degrees C, and maximum humidity of 40 percent prior to, during, and after acoustic unit installation.

Part 2 Products

2.1 MANUFACTURERS - SUSPENSION SYSTEM

.1 Acceptable Materials/Products:

.1 Refer to Interiors Finishes List for specified finishes and locations.

.2 Alternates may be considered.

.2 Other manufacturers offering products meeting or exceeding specified products, colours, patterns, and requirements may be considered. Proposed substitutions shall closely match scheduled colours and patterns or they may be rejected by the Consultant.

2.2 MATERIALS - SUSPENSION SYSTEM

.1 Non-fire Rated Grid:

.1 ASTM C635, intermediate duty; exposed T; components die cut and interlocking.

.2 Provide ASTM C635, heavy duty exposed T grid system for wood ceiling panels where required by wood ceiling panel manufacturer.

.2 Grid Materials: Commercial quality cold rolled steel with galvanized coating.

.3 Grid Finish: Steel: Colour as scheduled by Consultant.

.4 Exposed Grid Surface Width: 24 mm (15/16 inch) and 14 mm (9/16). Refer to Interiors Finishes List for product reference and Drawings for locations.

.5 Use Aluminum grid and all componets.for wet areas.

.6 Accessories: perimeter moldings: Manufacturer's standard angle molding, and perimeter molding.

.7 Refer to Interiors Finishes List for specified finishes and Drawings for locations.

.8 Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.

.9 Hold Down Clips: Purpose made steel clips to hold down ceiling tile.

.10 Seismic Accessories: Accessories, mouldings, braces and clips to provide seismic restraint.

.11 Gasketed Grid as noted on drawing.

2.3 MANUFACTURERS - ACOUSTIC UNITS

.1 Acceptable Materials/Products:

.1 Refer to drawings for locations

.2 Materials noted in item 2.4. below.

.2 Other manufacturers offering products meeting or exceeding specified products, colours, patterns and requirements may be considered. Proposed substitutions shall closely match scheduled colours and patterns, or they may be rejected by the Consultant.

2.4 MATERIALS – ACOUSTICAL UNITS

.1 Acoustical Ceiling Tiles – ACT-1:

.2 Acoustical Ceiling Tiles – ACT-2: Wet Areas

.3 Acoustical Ceiling Tiles – ACT-3: (Back loaded with Acoustic batt insulation.)

Refer to drawings and Interiors Finishes list for material selections and placement.

2.5 DESIGN CRITERIA

.1 Maximum deflection of L/360 of span to ASTM C635 deflection test

.2 Finished ceiling suspension systems shall be square with adjoining walls and level within 1:1000

.3 Complete suspension systems shall support all superimposed loads, such as lighting fixtures, diffusers grilles and speakers; curtain tracks, IV tracks. Provide additional hangers as necessary. Coordinate with work of other Subcontractors.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that layout of hangers will not interfere with other work.

3.2 INSTALLATION - LAY-IN GRID SUSPENSION SYSTEM

.1 Install suspension system to manufacturer instructions and ASTM C636, and as supplemented in this section.

.2 Install system capable of supporting imposed loads to a deflection of 1/240 maximum.

.3 Locate system on room axis according to reflected plan.

.4 Install after major above ceiling work is complete. Coordinate the location of hangers with other work.

.5 Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.

.6 Coordinate ceiling installation with light fixtures. Perimeter cove light fixtures will need to be installed prior to grid installation.

.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 and related carrying channels 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.
- .2 Use longest practical lengths.
- .3 Mitre corners.
- .4 Provide at junctions with other interruptions.

3.3 INSTALLATION - ACOUSTIC UNITS

.1 Fit acoustic units in place, free from damaged edges or other defects detrimental to appearance and function.

.2 Lay directional patterned units one way with pattern parallel to longest room axis. Fit border trim neatly against abutting surfaces.

.3 Install units after above ceiling work is complete.

.4 Install acoustic units level, in uniform plane, and free from twist, warp, and dents.

.5 Cutting Acoustic Units:

.1 Cut to fit irregular grid and perimeter edge trim.

.2 Cut square reveal edges to field cut units.

.3 Double cut and field paint exposed edges of tegular units. All field cut edges exposed to view to be coloured to match factory finish.

.6 Lay acoustic insulation atop of (AT-3) acoustic tile where indicated on drawings.

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 SCHEDULE

.1 Refer to Interior Finishes List for materials and to Drawings for locations.

END OF SECTION

Part 1 General

1.1 SUMMARY OF WORK

.1 Supply and install resilient sheet flooring and non-slip resilient sheet flooring.

.2 Resilient flash-cove base.

.3 The floor slab surface in the renovation area requires significant patching, repair and resurfacing.

1.2 RELATED SECTIONS

.1 Section 01 78 30 – Spare Parts Maintenance Materials

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

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

.3 ASTM F1861- Resilient Wall Base.

.4 ASTM F1913 - Vinyl Sheet Floor Covering Without Backing.

.5 CAN/ULC S102 - Test for Surface Burning Characteristics of Building Materials and Assemblies.

.6 ASTM F1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing

.7 ASTM F 1066 - Standard Specification for Vinyl Composition Floor Tile

.8 United States Environmental Protection Agency (EPA) Standards for acceptable VOC concentration and emission rates.

.9 National Floor Covering Association (NFCA) Specification Standards Manual. US Federal Specification RR-T-650d.

.10 ASTM F710 - 19 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring

1.4 SUBMITTALS FOR REVIEW

.1 Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colours available.

.2 Samples:

.1 Submit two (2) samples, 300 x 300 mm in size illustrating colour and pattern for each floor material for each colour specified. Provide one sample to consultant and one to field office.

.2 Submit two (2) 300 mm long samples of base material for each colour specified. Provide one sample to consultant and one to field office.

1.5 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

1.6 MAINTENANCE MATERIAL SUBMITTALS

.1 Extra Stock Materials: Refer to Section 01 78 30.

1.7 DELIVERY, STORAGE, AND PROTECTION

.1 Protect roll materials from damage by storing on end.

.2 Store all materials within the manufacturer's product data sheet temperature range.

1.8 SITE CONDITIONS

.1 Store materials for three (3) days in area of installation to achieve temperature stability.

.2 Maintain ambient temperature required by adhesive manufacture three (3) days prior to, during and forty-eight (48) hours after installation of materials.

1.9 QUALITY ASSURANCE

.1 Installer qualifications: engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project. Installers must be certified and in good standing with the flooring manufacturer to install any specified products.

.2 All preparation, materials, and workmanship will be in strict accordance with NFCA requirements and material manufacturer's written recommendations and detail requirements for conditions of work that apply, and guarantee / Warranty Periods noted herein. Comply with the NFCA Specification Standards Manual.

Part 2 Products

2.1 MATERIALS – RESILIENT SHEET FLOORING

.1 Resilient Sheet Flooring:

.1 **RSF-1**: Refer to Interior Finishes List for manufacturer, product, and colour.

.2 **RSF-2**: Refer to Interior Finishes List for manufacturer, product, and colour.

.2 Non-slip resilient sheet Flooring:

.1 **(NSVF-1):** Refer to Interior Finishes List for manufacturer, product, and colour.

.3 Or approved alternate.

2.2 MATERIALS – FLASH-COVE (INTEGRAL BASE)

.1 Resilient Sheet Flash Cove – Colour as per 2.1.1. above. Pattern as per finishes plan.

.2 Form flash coved bases 150 mm high, straight cut, with cove former, finished with metal J-cap and apply silicone caulking to any gaps to address infection control requirements.

.3 Pre-Fabricated Cove Base: fabricated from same materials and dye lots as resilient flooring, in maximum practical lengths, with 38 mm x 38 mm formed aluminum reinforcing bonded to back of base material.

.1 Acceptable Manufacturers:

.1 FlashCove Prefabricated Bases Inc., Telephone: 905-475-0915

2.3 ACCESSORIES

.1 Subfloor filler and leveller: trowelable non-shrink, water resistant, cementitious underlayment. Minimum compressive strength 4200 P.S.I. (29 Mpa) after 28 days cure.

.1 Acceptable material: Elsro Ardex K-55, Mapei Plani/Patch, EP Para-Patch System.

.2 Gypsum based products are not permitted.

.2 Caulking: Refer to manufacturers approved products and specification section 07 92 00 – Joint Sealants.

.3 Transitions Strips: at resilient flooring to connecting floor material: Resilient flooring to be flush with adjacent material. Prepare floor for flooring installation by feathering back minimum of 2'-0" from connection, or as required. Acceptable material: Schluter, Schiene, brushed stainless steel.

.4 Edge strips, reducers, thresholds: rubber or vinyl, manufacturer's standard, colours selected from full range by Consultant.

.5 Heat Welding Rods: by same manufacturer as sheet flooring. Colours to match manufacturer's recommended weld rod. Allow for multiple colour selection.

.6 Cove Former: type recommended by resilient flooring material manufacturer and sized to suit.

.7 Primers: Waterproof, low-VOC emitting; types recommended by flooring manufacturer.

.8 Adhesives: Solvent based, water soluble, low-VOC emitting; types recommended by flooring manufacturer.

.10 Waterproof Membrane: WP-900 is a one-component, flexible, load bearing waterproofing latex compound applied by paint roller or quality paintbrush to form a seamless waterproof membrane under concrete topping in the shower base installations. WP-900 also acts as a crack isolation membrane for these same types of applications.

.1 Acceptable material: WP-900 Hydro-Bloc System by Flextile Products.

Part 3 Execution

3.1 EXAMINATION

.1 Verify concrete floors are dry to a maximum moisture content of 7 percent and alkalinity limit of pH 9, and exhibit negative carbonization, or dusting. Refer to manufacturer's guidelines for environmental requirements.

.2 Verify floor and lower wall surfaces are free of substances that may impair adhesion of new adhesive and finish materials.

3.2 PREPARATION

.1 The floor slab surface in the renovation area will require significant floor leveling.

.2 Prep subfloor as per ASTM F710-19.

.3 Float entire floor with self leveling compound to meet ASTM F710-19.

.4 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.

.5 Prohibit traffic until filler is cured.

.6 Vacuum clean substrate.

.7 Refrain from using indelible ink on subfloor for marking or measurements.

.8 Provide seaming diagrams for review by consultant.

.9 Provide flooring mock-up consisting of the following for consult review:

.1 Flash cove inside corner.

.2 Flash cove outside corner.

.3 Field welds.

.4 Door transitions.

.5 Floor border.

.6 Approved mock-up can be part of finished work.

3.3 INSTALLATION - SHEET FLOORING

.1 Install sheet flooring to manufacturer 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 parallel to building lines to produce minimum number of seams.

.5 Install sheet flooring parallel to length of room. Provide minimum of 1/3 full roll width. Double cut sheet; provide continuously heat welded seal.

.6 Terminate flooring at centreline of door openings where adjacent floor finish is dissimilar.

.7 Install edge strips at unprotected or exposed edges, and where flooring terminates

.8 Scribe flooring to floor outlets, etc. to produce tight joints.

.9 Install flooring in pan type floor access covers. Maintain floor pattern.

.10 Install feature strips, edge strips, where indicated. Fit joints tightly.

.11 Heat-Welded Seams: Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces in accordance with the flooring manufacturer's printed instructions and ASTM F 1516.

.12 Heat weld new flooring to existing floor product where applicable.

3.4 INSTALLATION – INTEGRAL BASE

.1 Install integral (flash) cove, of dimension shown on the Drawings, constructed in accordance with manufacturer's printed instructions. Support floor covering at horizontal and vertical junction with cove strip. On masonry and other irregular surfaces, fill voids behind base with filler/wall patch. Butterfly interior and exterior corners. Provide stainless steel cap at top edges of base unless detailed otherwise.

3.5 CLEANING

.1 Remove access adhesive from floor, base, and wall surfaces without damage.

.2 Clean, seal, and wax floor and base surfaces in accordance with manufacturer's product data instructions.

.3 Finish flooring with high speed buffing as per manufacturer’s specification. **DO NOT** apply sealer or wax.

3.6 PROTECTION OF FINISHED WORK

.1 Prohibit traffic after installation of flooring in accordance with manufacturer's product data and installation sheets.

3.7 SCHEDULES

.1 Refer to Interior Finishes List for product selection.

.2 Refer to Floor Finishes Plans for product locations, layout, and details.

END OF SECTION

1 General

1.1 SUMMARY

1.1.1 This Section includes requirements for supply and installation of interior Tile Carpeting to areas located on Drawings.

1.2 REFERENCE STANDARDS

1.2.1 American Association of Textile Chemists and Colorists (AATCC):

1.3.1.1 AATCC 16E – Colorfastness to Light
1.3.1.2 AATCC 107 – Colorfastness to Water
1.3.1.3 AATCC 134 – Electrostatic Propensity of Carpets
1.3.1.4 AATCC 165 – Colorfastness to Crocking: Textile Floor Coverings Crockmeter Method

1.3.2 American Society for Testing and Materials (ASTM):

1.3.2.1 ASTM D 1335 – Standard Test Method for Tuft Bind of Pile Yarn Floor Coverings
1.3.2.2 ASTM D 2859 – Standard Test Method for Ignition Characteristics of Finished Textile Floor Coverings (Pill Test)
1.3.2.3 ASTM D 3936 – Standard Test Method for Resistance to Delamination of the Secondary Backing of Pile Yarn Floor Coverings
1.3.2.4 ASTM D 5252 – Standard Practice for the Operation of the Hexapod Tumble Drum Tester
1.3.2.5 ASTM E 492 – Standard Test Method for Laboratory Measurement of lmpact Sound Transmission through Floor-Ceiling Assemblies Using the Tapping Machine
1.3.2.6 ASTM E 648 – Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
1.3.2.7 ASTM E 662 – Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
1.3.2.8 ASTM E 989 – Standard Classification for Determination of lmpact lnsulation Class (llC)
1.3.2.9 ASTM E 1745 – Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
1.3.2.10 ASTM F 141 – Standard Terminology Relating to Resilient Floor Coverings
1.3.2.11 ASTM F 710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
1.3.2.12 ASTM F 1482 – Standard Practice for Installation and Preparation of Panel Type Underlayments to Receive Resilient Flooring
1.3.2.13 ASTM F 1861 – Standard Specification for Resilient Wall Base
1.3.2.14 ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride
1.3.2.15 ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes

1.3.2.16 ASTM F 2419 – Standard Practice for Installation of Thick Poured Gypsum Concrete Underlayments and Preparation of the Surface to Receive Resilient Flooring

1.3.2.17 ASTM F 2471 – Standard Practice for Installation of Thick Poured Lightweight Cellular Concrete Underlayments and Preparation of the Surface to Receive Resilient Flooring

1.3.2.18 ASTM F 2659 – Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and other Floor Slabs and Screeds Using a Non- Destructive Electronic Moisture Meter

1.3.2.19 ASTM F 2678 – Standard Practice for Preparing Panel Underlayments, Thick Poured Gypsum Concrete Underlayments, Thick Poured Lightweight Cellular Concrete Underlayments, and Concrete Subfloors with Underlayment Patching Compounds to Receive Resilient Flooring

1.3.2.20 ASTM F 3191 – Standard Practice for Field Determination of Substrate Water Absorption (Porosity) for Substrates to Receive Resilient Flooring

1.3.3 Canadian Carpet Institute/Canadian Rug Institute (CCI/CRI)

1.3.4 National Fire Protection Association (NFPA):

1.3.4.1 NFPA 253 – Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source

1.3.4.2 NFPA 258 – Test Method for Specific Optical Density of Smoke Generated by Solid Materials

1.3.5 Underwriters Laboratories Canada (ULC):

1.3.5.1 CAN/ULC S102.2-10, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings and Miscellaneous Materials and Assemblies.

1.4 ADMINISTRATIVE REQUIREMENTS

1.4.1 Coordination: Close spaces to traffic during flooring installation and until time period after installation recommended in writing by manufacturer; install flooring and accessories after other finishing operations, including painting and ceiling construction have been completed and as follows:

1.4.1.1 Coordinate floor flatness and levelling requirements of this section; work of this Section includes floor levelling and patching required to meet resilient flooring manufacturer's installation requirements; notify Consultant where differences occur between specified tolerances and actual conditions.

1.4.1.2 Install flooring before demountable partitions and other surface mounted fixtures are installed.

1.4.1.3 Coordinate existing floor condition for locations flooring is to be removed and installed with new flooring.

1.4.2 Post installation Conference: Conduct conference at Project site. Review methods and procedures related to floor care including, but not limited to, the following:

1.4.2.1 Review maintenance manual, equipment, methods, materials, and warranty requirements

1.4.2.2 Document proceedings, including required corrective measures.

1.5 SUBMITTALS

1.5.1 Provide required information in accordance with Division 01 – Submittal Procedures.

1.5.2 Action Submittals: Provide the following submittals before starting any work of this Section:

1.5.2.1 Product Data: Submit manufacturer's standard product data indicating requirements for installation.

1.5.2.2 Samples for Verification:

1.5.2.2.1 Submit samples of each different specified product for verification of colour and pattern in manufacturer's standard size, but not less than 150 mm x 200 mm in size for tile

1.6 QUALITY ASSURANCE

1.6.1 Regulatory Requirements: Use only carpeting materials that have been tested and accepted for labelling under ULC S102.2 and meeting requirements of the Authority Having Jurisdiction.

1.6.2 Qualifications: Provide proof of qualifications when requested by Consultant:

1.6.2.1 The Subcontractor must be verified and approved by Flooring Manufacturer as possessing the necessary technical competencies to ensure the successful installation of the flooring product specified.

1.6.2.1.1 Flooring Manufacturer shall provide a list of pre-qualified Floorcovering Contractors approved to acquire specified flooring materials and accessories.

1.6.3 Subcontractor to provide Quality Assurance Plan to Design Builder for review.

1.7 MOCK-UP

1.7.1 Provide required Mock-up in accordance with Division 01 – Quality Control.

1.8 DELIVERY, STORAGE, AND HANDLING

1.8.1 Delivery and Acceptance Requirements: Deliver flooring and installation accessories to site in manufacturer's original, unopened cartons and containers, bearing names of product and manufacturer, project identification, and shipping and handling instructions.

1.8.2 Storage and Handling Requirements: Store products in dry spaces protected from the weather, with ambient conditions maintained between manufacturer's recommended temperature range, and as follows:

1.8.2.1 Do not stack tile goods over four cartons high, and distribute cartons evenly over floor area to prevent overloading of structure.

1.8.2.2 Keep water based adhesives from freezing

1.9 WARRANTY

1.9.1 Installer shall provide a warranty stating that they agree to repair or replace tile carpeting that do not comply with performance and other requirements specified in this Section for a period of two (2) years from Substantial Completion for the Project.

2 Products

2.1 MANUFACTURERS

2.1.1 Materials Manufacturers:

2.1.1.1 Forbo

2.1.1.2 J &J Flooring Group

2.1.1.3 Or equivalent

2.2 PERFORMANCE REQUIREMENTS

2.2.1 Modular tile carpeting performance requirements are based on acceptable minimums published by the Carpet and Rug Institute as follows, and as otherwise modified by actual materials specified.

2.2.1.1 Electrostatic Propensity: 1.6Kv in accordance with AATCC 134.

2.2.1.2 Flammability: Tested in accordance with ASTM D2859 and ASTM E662, and as follows:

2.2.1.2.1 Smoke Density: ≤450 Corrected Optical Density

2.2.1.3 VOC Emission: In accordance with Low-Emitting Materials, and CCI/CRI for VOC emission rate of less than 0.6 mg/m2/ h4.

2.3 MATERIALS

2.3.1 Tile Carpeting: Flocked high performance carpet tile with a 100% nylon type 6.6 wear layer with an intermediate fiberglass layer and a recycled vinyl cushioned backing as indicated on Drawings.

2.4 ACCESSORIES

2.4.1 Adhesives: Solvent free, water resistant primer and adhesive as recommended by flooring manufacturer to suit resilient products specified and substrate materials and conditions meeting requirements.

2.4.2 Trowellable Levelling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation.

2.4.3 Resilient Accessories: Transition strips, and rubber base as specified of types indicated on drawings and as required to protect exposed edge of carpet; maximum lengths to minimize running joints.

3 Execution

3.1 EXAMINATION

3.1.1 Compliance: Comply with manufacturer's product technical data, including most current product technical bulletins, installation recommendations and floor care recommendations.

3.1.2 Testing and Inspections: Relative Humidity in Concrete Slabs: As tested results in accordance with the latest version of ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs using in situ Probes and Moisture Vapor Emitted: as tested with a calcium chloride test kit, per results in accordance with the latest version of ASTM F1869 – 16 Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride, and as follows:

3.1.2.1 Provide 72 hours of notice to the Consultant of commencement of the Work

3.1.2.2 Include cost for an independent testing firm for conducting of testing and submitting test results as a part of the price for work of this section.

3.1.2.2.1 Report the following information for ASTM F2170 to Consultant:

- Name and address of the structure.
- Date and time measurements were made. Name, title, and affiliation of worker performing the measurements.

- Locations and depths of probe holes within the structure.
- Relative humidity in each probe hole, to the nearest percent relative humidity.
- Temperature in each probe hole, to the nearest degree Celsius.
- Ambient air temperature, to the nearest degree Celsius and relative humidity (to the nearest percent relative humidity) above each probe hole.
- Make, model, and last calibration date of the instrument used to make the measurements.
- Report any observations that might affect the interpretation of individual measurements such as standing water on the slab, wet coring operations, weather, or ventilating system operations.

3.1.2.2.2 Report the following information for ASTM F1869 to Consultant:

- Name and address of the structure.
- Date and time measurements were made. Name, title, and affiliation of worker performing the measurements.
- Diagram of the area showing the locations of tests within the structure.
- Results of each test conducted
- Report any observations that might affect the interpretation of individual measurements such as standing water on the slab, wet coring operations, weather, or ventilating system operations.

3.1.2.3 Do not install flooring over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive, as determined by flooring manufacturer's recommended bond and moisture test, and as follows:

3.1.2.3.1 Confirm with Resilient flooring manufacturer’s published Technical Data Sheets in effect on the date of original purchase for recommended rH and emission rate before starting testing.

3.1.2.3.2 Moisture tests must be conducted on all concrete slabs regardless of age and is especially critical where low VOC or water based adhesives are specified

3.1.2.3.3 Carefully monitor test conditions to ensure that tampering or disturbance of the test packs does not affect the results.

3.1.2.3.4 Maintain a minimum temperature of 13□C for substrates during testing operations.

3.1.3 Examine substrates, areas, and conditions affecting work are in accordance with manufacturer's requirements, and as follows:

3.1.3.1 Verify that floor surfaces are smooth and flat to plus or minus tolerance required by flooring manufacturer; notify Consultant in writing where floor tolerances are not within acceptable values.

3.1.3.2 Verify that concrete slabs comply with ASTM F710 and the following:

3.1.3.2.1 Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond.

3.2 PREPARATION

Prepare floors requiring vapour emission control floor sealer by shot blasting to sealer manufacturer's written instructions.

3.2.1 Comply with resilient flooring manufacturer's written installation instructions for preparing substrates indicated to receive flooring.

3.2.2 Manufacturer's Field Services: Upon request of the Province, Design Builder or Consultant, and with at least 72 hours' notice, provide manufacturer's field service consisting of product use recommendations and periodic site visit for inspection of product installation in accordance with manufacturer's recommendations.

3.3 INSTALLATION

3.3.1 Install in accordance with manufacturer's printed instructions using material from same dye lot; mix materials to obtain consistent colour, pattern and texture match within any one visual area.

3.3.2 Use adhesive applied to the substrate in compliance with the flooring manufacturer's recommendations, including those for proper spreading of the adhesive, adhesive missing and adhesive open and working times

3.3.3 Layout tile carpeting as with joints as indicated on Drawings to produce a symmetrical tile pattern so that perimeter tile width is minimum 1/2 full size.

3.3.4 Fit neatly around architectural, mechanical, electrical and telephone outlets, and furniture fitments, around perimeter of rooms into recesses and around projections:

3.3.4.1 Cut tile carpeting to fit accurately around perimeter of rooms into all recesses and around fixtures.

3.3.4.2 Make cut outs for floor mounted service boxes, receptacles, switches, hardware where they occur on tile carpeting.

3.3.4.3 Cut holes as close as possible to allow services to pass through and that trim will completely hide hole when installed.

3.3.4.4 Cooperate and coordinate with electrical trade to ensure correct location of outlets is obtained.

3.3.4.5 Cooperate and coordinate with mechanical trade for diffusers in the floor.

3.3.5 Install edging strips at all openings or doorways and where tile carpeting abuts other floor covering.

3.4 PROTECTION

3.4.1 Protection: Do not allow heavy traffic or rolling loads for at least 72 hours following the installation. Additional time may be necessary if the installation is over a non-porous substrate. Protect installed product and finish surfaces from damage during construction. Remove and legally dispose of protective covering when directed by Design Builder.

END OF SECTION

Part 1 General

1.1 SUMMARY

1. Provide PVC panel protective wall coverings to designated areas indicated in Drawings and as specified. It must consider all aspects of the installation process i.e., mechanical ventilation requirements, gypsum wallboard preparation etc.

1.2 RELATED WORK

1. Section 09 21 16 Gypsum Board
2. Section 09 51 13 Acoustic Ceilings
3. Section 09 65 10 Resilient Flooring
4. Section 09 91 00 Painting

1.3 SUBMITTALS

1. Provide submittals in accordance with Section 01 33 00.
2. Product Data:
   - .1 Submit manufacturer's current printed product literature, specifications, installation instructions, and field reports in accordance with Section 01330 - Submittal Procedures.
   - .2 Submit one (1) copy of Material Safety Data Sheets (MSDS) prior to commencement of work for review and for posting at job site as required.
3. Submit Shop drawings indicating by large scale details, materials, finishes, dimensions of area to be covered, anchorage and assembly.
4. Samples: Submit duplicate 300 mm long samples of profiles and colours for both corner and wall joint areas.
5. Operation and Maintenance Data:
   - .1 Submit one (1) hard copy and one electronic PDF copy on thumb drive of Maintenance Manuals at completion of Project on application for Certificate of Substantial Performance,
   - .2 Manual to include copy of final approved shop drawing issued for Project of which have been recorded changes made during fabrication and installation caused by unforeseen conditions, extended warranties and Project Data Book.
   - .3 Include separate booklet of maintenance requirements for staff reference located in kitchen including maintaining products and precautions against cleaning materials and methods detrimental to finishes and performance.
6. Submit copy of Manufacturer's Warranty for Owner's review, prior to installation

1.4 QUALITY ASSURANCE

1. Installer Qualifications:

.1 Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.

.2 Training: Installer who has attended an ALTRO Whiterock installation training clinic.

.3 Source Quality: Obtain wall products from a single manufacturer.

2. Mock-up:

.1 Install site mock-up using one (1) 4 ft x 9 ft panel of accepted products and manufacturer approved installation methods. Obtain Owner's and Consultant's acceptance of finish color, texture and pattern, and workmanship standards.

.2 Maintain mock-up during construction for workmanship comparison.

.3 Mock-up may be incorporated into final construction upon Owner's approval.

3. Pre-installation Meeting: Conduct pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE & HANDLING

1. Coordinate manufacturer's ordering instructions and lead time requirements to avoid construction delays.
2. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
3. Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.
4. Store panels in temperature-controlled environments. Leave protective film on panel until ready to use.

1.6 WASTE MANAGEMENT AND DISPOSAL

1. Deposit of packaging materials in appropriate container on site for recycling or reuse.
2. Avoid using landfill waste disposal procedures when recycling facilities are available.
3. Keep discarded packaging away from children.

1.7 PROJECT CONDITIONS

1. Temperature Requirements: If storage temperature is below 65deg F (18deg C), the ALTRO Whiterock wall panel must be moved to a warmer place and allowed to reach this temperature before installation. For further information, refer to current Installation Guide
2. Maintain air temperature and structural base temperature at installation area between 65deg F (18deg C) and 80deg F (26deg C) for 48 hours before, during and 24 hours after installation.

1.8 WARRANTY

1. Submit fully executed Manufacturer's Warranty authorized by company official for Owner's

acceptance. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

2. Warranty Period to be for twenty (20) years commencing on Date of Substantial Completion.

1.9 EXTRA MATERIALS

1. Provide extra materials of product and adhesives in accordance with Section 01 78 00- Closeout Procedures.
2. Provide one (1) full 4 ft x 9 ft panel of same type material required for project for maintenance use in manufacturer's original, unopened, undamaged containers

Part 2 Products

2.1 MATERIALS

1. Wall Protection Systems:

.1 Prefabricated components manufactured designed to absorb shock and resist map and abrasions under impact. Smooth, low maintenance PVC panels with matching and caps returns and accessories designed for mechanical attachment directly to continuous aluminum retainer.

.2 Fire rating: ULC classified for flame spread and smoke requirements for a Class 1 rating. Acceptable Material for components listed.

.3 Accepted Product:

.1 **SRP**: ALTRO Whiterock White Hygienic Wall System, maintenance free, impact resistant, extruded semi-rigid PVCu polymer for operating temperatures upto 60deg\ C.

.1 Thickness: 2.5mm (0.10")

.2 Sheet Size: 4' x 9' – 1220 x 3050

.3 Colour: See Interior Finishes List Section 09 09 06.

.4 Impact Strength in accordance with ASTMF476.

.5 Chemical and Stain Resistance in accordance with ASTM D-1308.

2.2 ACCESSORIES

1. Vinyl welding rod: Acceptable material:

.1 ALTRO weld rod – WSR01, Colour to match panels,

2. Double sided foam tape and tape adhesion promoter Altro W39.
3. Acrylic Adhesive: For dry, climate-controlled areas, use ALTROFix W157, a one-part, water-based, acrylic adhesive as recommended by manufacturer.
4. Polyurethane Adhesive: The default adhesive for most installations, suitable for wet area, non-climate-controlled areas, and non-absorbent surfaces, use ALTROFix W39, atwo-part resin-based polyurethane adhesive as recommended by manufacturer.

5. Caulking and Sanitary Sealant Compounds and Tools:
   .1 ALTRO Sanitary Sealant – A802 White, 10.5 oz Tube.
6. Vertical trims 2- Part start and edge trims with gaskets as indicated.
7. Any wall graphic images to be provided by consultant. Files will be.ai and .psd or jpegs.
8. Alto Whiterock Recessed Shelf A900. Standard White color.

Part 3 Execution

3.1 EXAMINATION

1. Comply with manufacturer's product data, including product technical bulletins, product catalog, installation instructions and product label instructions for installation.
2. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

3.2 SUBSTRATE PREPARATION

1. Walls should be smooth and level. High points must be removed and low points filled with Filler intended for the substrate and environmental conditions.
2. Surfaces must be permanently dry and free from all substances that may contribute to adhesive bond failure.
3. Remove loose paint and conduct an adhesive bond test with paint.
4. Exterior walls must be adequately damp-proofed and insulated.
5. Dry wall substrates should be paint ready.

3.3 PREPARATION

1. All surfaces must be free from dust and cleaned prior to Altro Whiterock installation. The working environment must also be dust free. Failure to comply with these conditions will reduce the bond strength between the adhesive and substrate, and may cause the Altro Whiterock panels to debond.
2. Very absorbent / porous substrates (particularly plaster finishes and unprimed sheetrock) must have a proprietary sealer e.g. PVA primer or similar, applied to the surface a minimum of 12 hours prior to the installation.
3. All electrical switches, power points etc., should be in a first fix / installation state. All electrical equipment should only be moved or altered by a qualified electrician.
4. All plumbing should have pipe-work removed to a first fix or installation state and "tails" left protruding from the substrate. Altro Whiterock panels can then be drilled and slid over the pipe tails. All holes should be drilled 1/8" (3mm) oversize to allow for expansion, then sealed with Altro Sanitary Sealant. Plumbing should always be done by a qualified plumber.
5. Hot pipes and steam pipes should be insulated and a 1/8" to 1/4" (3-6mm) expansion gap should be created when installing panels around these pipes, then sealed with Altro Sanitary Sealant.

6. All pipes, fixing bolts, etc. extending through the Altro Whiterock panels should have a minimum 1/8" (3mm) expansion gap and be sealed using Altro Sanitary Sealant.
7. If fitting to doorframes, these must be in place prior to installation of Altro Whiterock.
8. Prior to installation, it is advisable to complete any painting which comes in contact with Altro Whiterock, as sealant used at junctions is non-paintable.
9. First, check the room using a 6' (2 m) level to ensure all walls are flat, paying particular attention to the corners, window reveals, and door entrances. These need to be inspected to ensure they are free of any debris or irregularities, which could prevent the panels laying flat to the substrate after the adhesive has been applied and the panel installed.

3.4 INSTALLATION

1. Hygienic Wall Installation: Install Altro Whiterock in accordance with the current published Altro Installation Guide. All panels should be joined via heat welding to ensure a hygienic seal by approved methods as detailed in the installation guide. Failure. to install Altro Whiterock in accordance with recommended procedures will void the Altro Limited Product Warranty.
2. Internal and external pencil radius corners shall be made on site with Altro Thermoformer following the methods detailed in the Altro Whiterock Installation Guide.
3. Install components plumb, true and square, scribed neatly to adjoining surfacesin accordance with Manufacturer's instructions.
4. Keep hands and tools clean during installation. Remove adhesives, sealants, and other stains. Install corner guard on steel stud continuous solid backing and erect with materials and components straight, tight and in alignment.
5. Adhere panel wall protection to substrate at locations and heights as indicated continuous between abutments. Scribe to tight butt joint between door frames and projections.
6. Coordinate with Section 09 65 00 and install wall panels after floor is installed. After wall finish is completed finish edge and seal any remaining gaps with manufacturers matching colour urethane mastic. Wall panels to overlap the floor base by 75mm, seal bottom edge of wall panel with a sanitary sealant.
7. At White Rock in rooms that require wet wall systems all seams to be heat welded.
8. At White Rock locations behind hand hygiene stations which butt against Acrovyn or at standalone locations, utilize the vertical 2-part start and edge trims. Apply Altro Sanitary sealants to the front edge.
9. Install recessed shower shelfs where indicated. The factory formed insert to be heat welded directly into the wall panels for a water tight installation. Provide solid plywood backing behind the recessed shelf. Refer to manufacturer's installation guide.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Surface preparation and field application of paints and coatings.

.2 Scope: Finish all interior and exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including but not limited to the following:

- .1 Interior walls, ceilings, and bulkheads.
- .2 Doors frames.
- .3 Other new items as shown.

.3 Do Not Paint or Finish the Following Items:

- .1 Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
- .2 Data cables
- .3 Cable trays.
- .4 Device boxes
- .5 Items indicated to receive other finishes.
- .6 Items indicated to remain unfinished.
- .7 Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
- .8 Floors, unless specifically so indicated.
- .9 Glass.
- .10 Concealed pipes, ducts, and conduits.
- .11 Existing exposed ducts, pipes, and hangers.
- .12 Concealed ceiling spaces and walls above drywall and t-bar ceilings.
- .13 Any new mechanical ductwork or piping with insulation.
- .14 Surfaces scheduled as having “No Finish” in Room Finish Schedules.

1.2 RELATED SECTIONS

.1 Section 01 78 30 – Spare Parts Maintenance Materials

.2 Section 05 50 00 - Metal Fabrications

.3 Section 08 11 13 – Standard Metal Doors and Frames.

.4 Section 09 21 16 – Gypsum Board Assemblies

1.3 REFERENCES

.1 AWWA (American Water Works Association) - C218 - Standard for Coating the Exterior of Aboveground Steel Water Pipelines & Fittings.

.2 AWWA (American Water Works Association) - D102 - Coating Steel Water Storage Tanks.

.3 NACE (National Association of Corrosion Engineers) - Industrial Maintenance Painting.

.4 MPI (Master Painters Institute) - Specifications Manual.

.5 SSPC (The Society for Protective Coatings) (formerly SSPC - Steel Structures Painting Council) - Steel Structures Painting Manual.

.6 MPI (Master Painters Institute) Architectural Painting Specification Manual and Maintenance Repainting Manual.

1.4 SUBMITTALS FOR REVIEW

.1 Samples:

.1 Submit the following samples in the sizes indicated:

.1 Draw Down Cards: Submit two (2) sets of 'draw down cards' for each colour a minimum of 30 calendar days prior to commencement of painting. Provide one set to consultant and one set to field office.

.1 Draw Down Cards are to be provided upon completion of the work for their inclusion in the Operation and Maintenance Manuals.

.2 Product List:

.1 Submit a Schedule of Finishes listing manufacturer's product name and colour for each paint system.

.3 Product Data:

.1 Provide data on all finishing products.

1.5 SUBMITTALS FOR INFORMATION

.1 Section 01 33 00: Submission procedures.

.2 Installation Data: Manufacturer's special installation requirements indicating special surface preparation procedures, substrate conditions requiring special attention.

1.6 QUALITY ASSURANCE

.1 Applicator Qualifications:

.1 Provide the work of this Section, executed by a competent installer having:

.1 Minimum of five (5) years experience in the application of products, systems and assemblies specified.

.2 All materials, preparation and workmanship shall conform to requirements of the latest edition of the Architectural Painting Specification Manual by the Master Painters Institute (MPI) (hereafter referred to as the MPI Painting Manual) as issued by the local MPI Accredited Quality Assurance Association having jurisdiction.

.3 All paint manufacturers and products used shall be as listed under the Approved Product List section of the MPI Painting Manual. Paint materials will be rated under Environmental Notation System (ENS) with acceptable VOC ranges as listed in the MPI Approved Product List under “E” ranges.

1.7 REGULATORY REQUIREMENTS

.1 Conform to applicable code for flame and smoke rating requirements for finishes.

1.8 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

.2 Container label to include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, colour designation, and written instructions for mixing and reducing.

.3 Store paint materials at minimum ambient temperature of 7 degrees C and a maximum of 32 degrees C, in ventilated area, and as required by manufacturer's written instructions.

1.9 ENVIRONMENTAL REQUIREMENTS

.1 Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

.2 Do not apply exterior coatings during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

.3 Minimum Application Temperatures for Latex Paints: 7 degrees C for interiors; 10 degrees C for exterior; unless required otherwise by manufacturer's written instructions.

.4 Minimum Application Temperature for Varnish and Finishes: 18 degrees C for interior or exterior, unless required otherwise by manufacturer's written instructions.

.5 Provide lighting level of 860 lx measured mid-height at substrate surface.

Part 2 Products

2.1 ACCEPTABLE MATERIALS

.1 Except as specified herein, paint, varnish, stain, enamel, lacquer, and fillers shall be of a type and brand listed under "Product Listings" as covered in the MPI Manual, latest edition, for specific uses.

.2 Only materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, etc.) listed in the latest edition of the MPI Approved Product List (APL) and for interior systems, listed as Institutional Low-odor, Low-VOC or High Performance Architectural Latex systems are acceptable for use on this project. All such material shall be from a single manufacturer for each system used.

.3 Indoor Air Quality - Interior applications: Use only materials having a minimum MPI "Environmentally Friendly" E2 or E3 rating based on VOC (EPA Method 24) content levels and within VOC limits described in 1.12.

.4 Paint materials such as linseed, oil, shellac, turpentine, and any of the above materials not specifically mentioned herein but required for work with the finish specified shall be highest quality product of an approved manufacturer.

.5 Paints and materials to be lead and mercury free and shall have a low VOC content where possible or where required by authorities having jurisdiction.

.6 Where required, paints and coatings shall meet the flame spread requirements of local authorities having jurisdiction.

.7 No recycled content paints and primers will be allowed on interior applications.

2.2 EXTERIOR FINISH SYSTEMS - (Not all systems listed my be used for this project)

.1 Steel:

.1 For exterior areas protected from the elements (covered): EXT 5.1B W.B. Light Industrial Coating, Gloss Level 5 (over inorganic zinc primer).

.2 For exposed exterior areas: EXT 5.1F: Epoxy Gloss Level 6 (over inorganic zinc primer).

.2 Galvanized Metal (Premium Grade) Factory Primed:

.1 EXT. 5.3B Alkyd Gloss Level 5 Finish.

.2 Finish to be used for all exterior galvanized steel, including but not limited to pressed steel frames and hollow metal doors; roof top ducts, vents and piping; and other exterior galvanized metal.

2.3 INTERIOR FINISH SYSTEMS – (Not all systems listed my be used for this project)

.1 Structural Steel and Metal Fabrications:

.1 INT 5.1S Institutional Low odor/Low VOC, semi gloss, or

.2 INT 5.1B W.B. Light Industrial Coating, semi gloss.

.2 Galvanized Metal High Contact/High Traffic Areas (Doors, Frames, Railings, Pipes, etc.):

.1 INT 5.3M Institutional Low odor/Low VOC, semi gloss.

.3 Dressed Lumber including painted doors and trim:

.1 INT 6.3V High Performance Acrylic Low odor/Low VOC, semi gloss.

.4 Dressed Lumber - clear finish (including trim, and mouldings):

.1 MPI INT 6.3Q: W. B. Varnish, Clear.

.5 Wood Paneling (plywood backboards, etc.):

.1 INT 6.3V Institutional Low odor/Low VOC eggshell finish.

.6 Gypsum Board: All areas except for areas specified below:

.1 INT 9.2M Institutional Latex, Low odor/Low VOC. Acceptable substitution: 9.2L WB Light Industrial Coating (MPI #151).

.1 Walls: Topcoat sheen locations:

.1 All rooms to be eggshell unless otherwise indicated.

.2 The following rooms are to be semi-gloss

.1 Washrooms

.2 Storage Rooms

.3 Housekeeping Rooms

.2 Ceilings and bulkheads: Eggshell.

.3 Note: Provide vapour barrier primer/sealer paint where indicated, MPI#61.

.7 Gypsum Board: Epoxy Finished Surfaces for areas subject to cleaning with alcohol and harsh cleaning products:

.1 INT 9.2E Water-based Epoxy (tile-like) finish, Gloss Level 5.

.8 Gypsum Board: Fire retardant surfaces for Comm. Rooms:

.1 INT9.2H – Pigmented fire retardant coating (UOC rated).

.9 Paint – Fire Resistant: noted PFR in Finish Schedule: Flame Control Coatings No. 20-20 class A flat latex fire retardant paint, two coats, sand between coats.

.10 Allow for 2 walls per room for accent colour, to be selected by Owner from the finishes list.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that surfaces are ready to receive work as instructed by the product manufacturer.

.3 Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

.4 Test shop applied primer for compatibility with subsequent cover materials.

.5 Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces is below the following maximums:

.1 Plaster and Gypsum Wallboard: 12 percent.

.2 Masonry, Concrete, and Concrete Unit Masonry: 12 percent.

.3 Interior Wood: 15 percent, measured in accordance with ASTM D2016.

.4 Exterior Wood: 15 percent, measured in accordance with ASTM D2016.

.5 Concrete Floors: 8 percent.

3.2 PREPARATION

.1 Remove or mask electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.

.2 Correct defects and clean surfaces which affect work of this section. Remove existing coatings that exhibit loose surface defects.

.3 Seal with shellac and seal marks which may bleed through surface finishes.

.4 Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

.5 Aluminum Surfaces Scheduled for Paint Finish: Remove surface contamination by steam or high-pressure water. Remove oxidation with acid etch and solvent washing. Apply etching primer immediately following cleaning.

.6 Asphalt, Creosote, or Bituminous Surfaces Scheduled for Paint Finish: Remove foreign particles to permit adhesion of finishing materials. Apply latex based sealer or primer.

.7 Insulated Coverings: Remove dirt, grease, and oil from canvas and cotton.

.8 Concrete Floors: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

.9 Copper Surfaces Scheduled for a Paint Finish: Remove contamination by steam, high pressure water, or solvent washing. Apply vinyl etch primer immediately following cleaning.

.10 Copper Surfaces Scheduled for a Natural Oxidized Finish: Remove contamination by applying oxidizing solution of copper acetate and ammonium chloride in acetic acid. Rub on repeatedly for required effect. Once attained, rinse surfaces with clear water and allow to dry.

.11 Gypsum Board Surfaces: Fill minor defects with filler compound. Spot prime defects after repair.

.12 Galvanized Surfaces: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.

.13 Plaster Surfaces: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

.14 Uncoated Steel and Iron Surfaces: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by hand wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Spot prime paint after repairs.

.15 Shop Primed Steel Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Prime metal items including shop primed items.

.16 Interior Wood Items Scheduled to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats.

.17 Wood Doors Scheduled for Painting: Seal top and bottom edges with primer.

3.3 APPLICATION

.1 Apply products to manufacturer instructions.

.2 Do not apply finishes to surfaces that are not dry.

.3 Apply each coat to uniform finish.

.4 Apply each coat of paint slightly darker than preceding coat unless otherwise approved.

.5 Sand wood lightly between coats to achieve required finish.

.6 Vacuum clean surfaces free of loose particles. Use tack cloth just prior to applying next coat.

.7 Allow applied coat to dry before next coat is applied.

.8 Where clear finishes are required, tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.

.9 Prime concealed surfaces of interior woodwork with primer paint.

.10 Prime concealed surfaces of interior woodwork scheduled to receive stain or varnish finish with gloss varnish reduced 25 percent with mineral spirits.

3.4 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

.1 Refer to Section 23 05 53 and Section 26 05 53 for schedule of colour coding and identification banding of equipment, duct work, piping, and conduit.

.2 Paint shop primed equipment. Paint shop prefinished items occurring at interior areas.

.3 Remove unfinished louvres, grilles, covers, and access panels on mechanical and electrical components and paint separately.

.4 Prime and paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, except where items are prefinished.

.5 Paint interior surfaces of air ducts, and convector and baseboard heating cabinets that are visible through grilles and louvres with one coat of flat black paint, to visible surfaces. Paint dampers exposed behind louvres, grilles, and convector and baseboard cabinets to match face panels.

.6 Paint exposed conduit and electrical equipment occurring in finished areas.

.7 Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

.8 Colour code equipment, piping, conduit, and exposed duct work in accordance with requirements indicated. Colour band and identify with flow arrows

.9 Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.5 CLEANING

.1 Collect waste material which may constitute a fire hazard, place in closed metal containers and remove daily from site.

3.6 SCHEDULE

.1 Use eggshell for all walls unless noted otherwise.

.2 Use semi-gloss for all patient areas.

.3 Use semi-gloss for all door frames and metal doors.

.4 Use clear coat interior rub varnish for all wood finish doors.

.5 Use eggshell for all ceilings and bulkheads.

3.7 SCHEDULE - COLOURS

.1 Colours: Refer to Interior Finishes List.

.2 Locations: Refer to drawings.

3.8 MAINTENANCE MATERIALS

.1 The following paint is to be provided as maintenance material.

.1 Refer to Section 01 78 30.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Surfaced metal marker boards.

.2 Tack boards.

.3 Perimeter trim, chalk rails, and accessories.

1.2 RELATED SECTIONS

.1 Section 09 21 16 - Gypsum Board Assemblies: Preparation of substrate and adjacent work to receive work of this section.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ANSI A135.4 - Basic Hardboard.

.3 ANSI A208.1 - Particleboard.

.4 APA (American Plywood Association) - Construction and Industrial Plywood.

.5 ASTM A424 - Steel, Sheet, for Porcelain Enamelling.

.6 ASTM A653/A653M - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.7 ASTM B209M - Aluminum and Aluminum-Alloy Sheet and Plate.

.8 ASTM B221M - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

.9 ASTM C208 - Cellulosic Fibre Insulating Board.

.10 ASTM C1396/C1396M - Gypsum Wallboard.

.11 ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.

.12 CAN/CGSB 11.3 - Hardboard.

.13 CANPLY (Canadian Plywood Association) - Canadian Plywood Handbook.

.14 CAN/ULC S706 - Wood Fibre Thermal Insulation for Buildings.

.15 CHPVA (Canadian Hardwood Plywood and Veneer Association) - Official Grading Rules for Canadian Hardwood Plywood.

.16 HPMA (Hardwood Plywood Manufacturers Association) Hardwood and Decorative Plywood.

.17 PEI (Porcelain Enamel Institute) - Specifications for Porcelain Enamel Marker Boards and Chalkboards.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the Work with installation of wall outlets and switches that are within the wall space for Work of this section.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data on marker boards, tack boards, tack board coverings, trim and accessories.

.3 Shop Drawings: Indicate wall elevations, dimensions, joint locations, special anchor details.

.4 Samples: Submit two (2) samples 150 x 150 mm in size illustrating materials and finish, colour and texture of tack board surfacing.

1.6 CLOSEOUT SUBMITTALS

.1 Operation and Maintenance Data: Include data on regular maintenance cleaning and stain removal.

1.7 REGULATORY REQUIREMENTS

.1 Conform to applicable code for flame/smoke rating of for vinyl fabric covered tack boards to ASTM E84. The complete laminated panel consisting of the vinyl fabric surface, adhesive and fibreboard backing shall have a vinyl surface flame spread rating of Class II (26-75), when tested in accordance with ASTM E84.

1.8 QUALITY ASSURANCE

.1 Provide whiteboards produced by a single manufacturer, including necessary mounting accessories, fittings, and fastenings.

.2 Whiteboard writing surface shall be scratch and stain resistant.

1.9 DELIVERY, STORAGE, AND PROTECTION

.1 Protect pre-finished surfaces with wrapping.

1.10 WARRANTY

.1 Warranty Period for all supplied materials, equipment and installation is two (2) years from the date of service commencement.

.2 Warranty: Include coverage to correct defective work and for failure to meet specified requirements.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials/Products:

.1 Magnetic White Boards:

.1 Alliance Porcelain Enamel Steel Whiteboards as manufactured by Shanahan's Ltd.

.2 LCS Porcelain Enamel Steel Whiteboards as distributed by Panel Products/Richelieu.

.3 Or approved alternate.

.2 Other manufacturers offering products meeting or exceeding specified products and requirements may be considered.

2.2 MARKER BOARD MATERIALS

.1 Sheet Steel: ASTM A653/A653M, galvanized to G90 designation.

2.3 CORE AND FRAME MATERIALS

.1 Fibre Board: CAN/ULC S706, cellulosic, dry type having an ASTM E84 Class III flame spread index.

.2 Foil Backing: Aluminum foil sheet, 0.40 mm thick.

.3 Frame and Chalk Rail: Aluminum extrusions, ASTM B221, 6063 alloy, T5 temper.

2.4 ACCESSORIES

.1 Adhesives: Non-toxic water based, Low-VOC emitting, type.

.2 Marker tray: full length, extruded anodized aluminum, alloy 6063-T5, ends rounded.

.3 Map rail: 25 mm wide extruded anodized aluminum with 6 mm cork insert.

.4 Map Supports: Formed aluminum sliding hooks, to fit map rail, 1 per 600mm of rail, minimum of two per rail.

.5 Temporary Protective Cover: Sheet polyethylene, 0.2 mm thick.

.6 Cleaning Instruction Plate: Provide written instructions for marker board cleaning on a metal plate fastened to perimeter frame near chalk rail.

2.5 FABRICATION - MARKER BOARDS

.1 Outer Face Sheet: Steel, 0.4 mm thick.

.2 Core: Particle board, 9 mm thick.

.3 Backing Surface: Steel, 0.4 mm thick.

.4 Splice Joint: Concealed spline of sheet steel.

2.6 FABRICATION - FRAME AND TRIM

.1 Aluminum Frame: Manufacturer's standard U-shaped profile; concealed fasteners, map rail with cork insert over marker board and tack board surfaces.

.2 Aluminum Marker Tray: Manufacturer's standard profile, one piece full length of marker board, moulded ends; concealed fasteners.

2.7 FINISHES

.1 Porcelain Enamel: Fired vitreous porcelain enamel, 2 coats enamel 0.102 mm minimum thickness, base metal 0.61 mm. Colour: white.

.2 Aluminum Frame, marker tray and accessories: Anodized to clear finish.

.3 Concealed Steel Items: Galvanized in accordance with ASTM A123 to 610 g/sq m.

.4 Apply one coat of bituminous paint to concealed metal surfaces in contact with cementitious or dissimilar materials.

Part 3 Execution

3.1 EXAMINATION

.1 Verify dimensions, tolerances, and method of attachment with other work.

.2 Verify that internal wall blocking is ready to receive work and positioning dimensions are as indicated on reviewed shop drawings.

3.2 INSTALLATION

.1 Install marker boards to manufacturer's instructions.

.2 Establish top of marker tray at 915 mm above finished floor unless otherwise indicated.

.3 Secure units level and plumb.

.4 Marker Boards:

.1 Butt panels tight with concealed spline to hairline joint.

.5 Carefully cut holes in marker boards for thermostats where required.

3.3 CLEANING

.1 Remove protective material from surfaces.

.2 Clean marker board surfaces in accordance with manufacturer's written instructions, then cover marker board surfaces with protective cover, taped to frame.

.3 Remove temporary protective cover at date of Service Commencement.

3.4 PROTECTION OF FINISHED WORK

.1 Protect finished Work from damage.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Curtain track and accessories.

.2 Cubicle curtains.

.3 I.V. tracks and supports.

1.2 RELATED SECTIONS

.1 Section 06 10 00 – Wood Blocking

.2 Section 09 51 13 - Acoustical Panel Ceilings: acoustical tile ceilings.

.3 Section 09 21 16 - Gypsum Board Assemblies: gypsum board ceilings.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

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

.2 Shop drawings:
- .1 Tracks: indicate manufacturer, model number, accessories, track sizes and dimensions, layout of each track system, mounting heights and installation details, requirements for related work.
- .2 Curtains: include information regarding cleaning and washing instructions, properties of stain resistance, maintenance procedures, and recommended procedures for stain removal.

1.4 CLOSEOUT SUBMITTALS

.1 Maintenance data: provide maintenance data for incorporation into manual.
- .1 Track and hardware: include manufactures product data, installation instructions, and parts list.
- .2 Curtains: provide 2 additional curtains of each size, style, fabric, colour and pattern installed on project.

.2 Spare parts and extra materials:
- .1 Track and hardware: provide 2 full size tracks of each size and configuration used on project, including hardware and accessories.
- .2 Curtains: provide 200% additional privacy curtains of each size, style, fabric, colour and pattern installed on project.

1.5 WARRANTY

.1 Warranty Period for all supplied materials, equipment and installation is two (2) years from the date of Service Commencement.

.2 Warranty to include replacing and refinishing due to defects or faulty workmanship.

Part 2 Products

2.1 CUBICLE TRACKS AND HARDWARE

.1 Acceptable material:
- .1 Quality Stage Drapery Series 2000.
- .2 IPC Optitrac.
- .3 Urban Edge Model 6170.
- .4 AR Nelson 1200CT

.2 Tracks: extruded aluminum with structures to form raceway for slider, recessed mounted, white finish.

.3 Curtain carriers: breakaway, hookless.

.4 Complete with mounting brackets, splice connectors, end sleeves, stops, and suspension tubes.

.5 Provide track switches as required to suit layouts indicated.

2.2 CURTAINS

.1 Curtain fabric: refer to Interiors Finish List.

.2 Curtain mesh: 12 mm holes, white.

.3 Curtains will comply with CAN/CBSB-4.162-M, “Hospital Textiles - Flammability Performance Requirements”.

.4 Curtains will be hookless curtain/track type system. Provide open mesh at along the top of curtain as required for sprinkler protection. Height of curtains and tracks will ensure complete privacy without compromising clinical and operational functionality for Staff and of other equipment, including ceiling lift tracks and ceiling lifts.

.5 Provide curtain grabber bar tools for simple removal and installation of each curtain by Staff without the use of ladders. Provide 3 in total.

2.3 FABRICATION: TRACKS

.1 Fabricate tracks to shapes and dimension indicated. Bend to radii indicated with minimum radius 203 mm.

.2 Fabricate in single length where track length does not exceed 7300 mm, including bends.

2.4 FABRICATION: CURTAINS

.1 Verify curtain sizes prior to fabrication.

.2 Curtain sizes: Execution

.1 Width: full length of track plus 10% allowance for fullness, but not less than 305 mm added fullness.

.2 Length: to be equal to floor-to-ceiling height minus 762 mm from finished ceiling at top, and minus distance above the finished floor at bottom 381 mm.

.3 Mesh to extend 712 mm to top hem and to have a 1-1/4 inch 100% flame resistant polyester tape double lock stitched into top hem.

.4 Top hem: 37 mm wide, triple thickness and double locked stitch.

.5 Sew mesh in between double row of stitching at bottom edge of top hem.

.6 Bottom hem 37 mm wide, double fold and double locked stitch. Side hems 18 mm wide, double fold and double locked stitch. Remove selvage edge.

.7 Where curtains require joining provide vertical seam, double locked stitched. Serge exposed edge, fold over, and flat stitch a second time.

.8 Stitch length 8-10 stitches per 25 mm.

2.5 I.V. TRACKS AND SUSPENSION UNITS

.1 Track: For IV tracks, use extruded aluminum, anodized finish and entirely enclosed except for slot in bottom. Provide IV carriers consisting of plated steel block supported from four

nonconductive nylon ball-bearing wheels and equipped with 180-degree twist lock with nylon washer.

.2 I.V. suspension Units: "Karapita" I.V. suspension unit; stainless steel construction, infinite height adjustability, one hand control, c/w built-in overload protection.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

.1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 SITE VERIFICATION

.1 Verify site conditions prior to commencing installation. Ensure supplementary anchorage, if required, is in place.

.2 Do not commence curtain installation until ceilings are complete.

.3 Do not commence installation until painting and finishing in installation areas is complete. Do not install tracks in unpainted gypsum board ceilings.

.4 Coordinate track height with ceiling height and owner supplied lift. Provide suspension rods and track as required.

3.3 INSTALLATION

.1 Install tracks and hardware in accordance with reviewed shop drawings and manufacturer's instructions.

.2 Securely anchor to ceilings with proper fasteners and anchors for substrate. Space fasteners/brackets at approximately 600 mm on center and as close as possible to ends.

.1 Suspended gypsum board ceilings: secure tracks to furring or blocking above ceilings using screws into solid backing.

.2 Curtain and IV tracks will be structurally supported.

.3 Provide required furring or framing above suspended or furred ceilings. Ensure fasteners are secured to solid backing.

.4 Where track is located on radiant heating panels do not fasten to panels without instructions from panel manufacturer. Coordinate with mechanical Subcontractor.

.5 Recessed ceiling tracks shall run continuously between walls.

.6 Fill all joints between sections of track with tamper resistant sealant to reduce opportunities for ligature.

.7 Install curtains on curtain tracks.

.8 Install I.V. tracks in 'oval' shapes to locations noted on the drawings. Install suspension units; adjust as required for smooth operation.

3.4 ADJUSTING

.1 Test tracks, components, and accessories for smooth, trouble free operation. Make necessary adjustments.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Wall protection

.2 Corner guards

.3 Bumper rails

.4 Corridor handrails

.5 Exposed Backing Boards

1.2 RELATED SECTIONS

.1 Section 01 78 30 – Spare Parts Maintenance Materials

.2 Section 05 50 00 - Metal Fabrications: Concealed in wall plates for attachment of work of this section.

.3 Section 06 10 13 – Wood blocking and curbing.

.4 Section 09 21 16 - Gypsum Board Assemblies: Installation of blocking and backing plates in wall assemblies, preparation of substrate and adjacent work to receive work of this section.

.5 Section 09 72 16 - Rigid Sheet PVC Wall Covering

1.3 PERFORMANCE REQUIREMENTS

.1 Installed Wall Rail Component Assembly: Support vertical live load of 1 400 N/m with deflection not to exceed 1/50 of span between supports.

.2 Installed Component Assembly: Resist lateral force of 333 N at any point without damage or permanent set.

.3 Corner Guards: Resist lateral impact force of 445 N at any point without damage or permanent set.

1.4 ADMINISTRATIVE REQUIREMENTS

.1 Coordinate with other work having a direct bearing on work of this section.

.2 Coordinate the work with wall or partition sections for installation of concealed blocking or anchor devices.

1.5 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

.3 Samples: Submit two (2) sections of bumper rail, corridor handrail, corner guards, 600 mm long, illustrating component design, configuration, colour and finish. Submit one sample to consultant and one to field office.

1.6 QUALITY ASSURANCE

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

.2 Perform Work in accordance with BC Building Code accessibility requirements.

.3 Installer qualifications: engage an installer who has no less than 3 years experience in installation of systems similar in complexity to those required for this project.

.4 Manufacturer's qualifications: not less than 5 years experience in the production of specified products and a record of successful in-service performance.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Deliver materials to the project site in unopened original factory packaging clearly labeled to shown manufacturer.

.2 Store materials in original, undamaged packaging in a cool, dry place out of direct sunlight and exposure to the elementals. A minimum room temperature of 5° C and a maximum of 38° C should be maintained.

1.8 PROJECT CONDITIONS

.1 Materials must be acclimated in an environment of 18° - 24° C for at least 24 hours prior to beginning the installation.

.2 Installation areas must be enclosed and weatherproofed before installation commences.

Part 2 Products

2.1 MATERIALS

.1 Layouts and subsets of wall protection can be found on drawings.

.2 Wall Protection – Rigid Vinyl (**WP-1** – 1220mm high, **WP-2** – 1830mm high)

.1 Refer to the drawings for location and Interior Finishes list for material and colour.

.2 Refer to Section 09 72 16 - Rigid Sheet PVC Wall Covering

.3 Corner Guards: - (**CG-1**)

.1 Manufacturer: C/S Group or approved alternate

.2 Product: CO-8 (Corner Guard)

.3 Material: 304 Stainless Steel

.4 Finish: #4 Satin

.5 Size: 89mm (3 ½") legs 1220mm (4'-0") long adjust length to suit conditions. 90 deg and custom angles required.

.6 Method of attachment: Adhesive

.4 Corner Guards: - (**CG-2**)

.1 Manufacturer: C/S Group or approved alternate

.2 Product: CO-8 (Corner Guard)

.3 Material: 304 Stainless Steel

.4 Finish: #4 Satin

.5 Size: 89mm (3 ½") legs 2438mm (8'-0") long adjust length to suit conditions. 90 deg and custom angles required.

.6 Method of attachment: Adhesive

.5 Handrails - (**HR-1**): C/S Group HRBW-10C to match existing.

.6 Bumper Rail – (**BR-1**): C/S Group SCR-64 to match existing.

.7 Exposed Backing Boards

.1 HDPE 12.5 board c/w rounded corners and smooth edges as indicated on drawings and color as selected by Architect.

.2 Available from Red Wood Plastics, Prince George BC, tel 1-833-381-1195

.3 Provide sample for review.

.8 Door Kickplates: Refer to 08 71 00 - Door Hardware

2.2 MANUFACTURER

.1 **Acceptable products:** Refer to Interior Finishes List 09 09 06.

Part 3 Execution

3.1 EXAMINATION

.1 Verify that field measurements are as indicated on Drawings.

.2 Verify that rough-in for components are correctly sized and located.

.3 Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion. Do not proceed until unsatisfactory conditions have been corrected.

.4 Prior to installation clean substrate to remove dirt, debris and loose particles. Perform additional preparation procedures as require by manufacturer’s instructions.

3.2 INSTALLATION

.1 Install components to manufacturer's instructions.

.2 Install components level and plumb, secured rigidly in position to wall framing members only.

.3 Position top of bumper rail as detailed.

.4 Position top of corridor hand rail as detailed.

.5 Position corner guard 150 mm above finished floor to heights as detailed.

.6 Terminate rails short of door openings, intersecting walls and other appetences as detailed.

.7 Return rails to wall.

.8 Temperature at the time of installation must be between 65º -75ºF (18º-24ºC) and be maintained for at least 48 hours after the installation.

.9 Relative humidity shall not exceed 80%.

.10 Adjust installed end caps as necessary to ensure tight seams

.11 Where splices occur in horizontal runs, splice retainer and rails at different locations along the run.

.12 Do not expose wall protection to direct sunlight during or after installation. This will cause the surface temperature to rise, which in turn will cause bubbles and delamination.

.13 Coordinate top of wall protection with medical device outlets and cover plates. Adjust wall protection to suit elevations of installed outlets. Device covers are not to be in conflict with top edge of wall protection.

.14 Adjust rail returns at walls to ensure reveal is per manufacturers details. Provide colour matched caulking at rail/wall termination.

.15 Install plywood backing for all handrails and wall bumper guards.

3.3 INSTALLATION TOLERANCES - HORIZONTAL RAILS

.1 Maximum Variation from Required Height: 3 mm.

.2 Maximum Variation from Level or Plane for Visible Length: 3 mm.

3.4 CLEANING

.1 Immediately upon completion of installation, clean rails, wall protection and accessories in accordance with manufacturer's recommended cleaning method.

.2 Remove surplus materials, rubbish and debris resulting from installation as work progresses and upon completion of work.

3.5 PROTECTION

.1 Protect installed materials to prevent damage by other trades. Use material that may be easily removed without leaving residue or permanent stains.

3.6 SCHEDULES

.1 Refer to drawings for layout and locations.

.2 Refer to Interior Finish List for product details and colour.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Toilet, and washroom accessories including mirrors.

.2 Grab bars.

.3 Miscellaneous equipment as per Owner's equipment list.

.4 Attachment hardware.

1.2 RELATED SECTIONS

.1 Section 06 10 13 – Wood Blocking and Curding

.2 Section 09 21 16 - Gypsum Board Assemblies: Preparation of substrate and adjacent work to receive work of this section.

1.3 REFERENCES

.1 The versions of the standards referenced in this section are those listed in the BC Building Code, current edition at the time of the application for Building Permit; or if they are not referenced in the specified code, they are the latest version of the standard in effect at the time of the application for Building Permit.

.2 ASTM A123/A123M - Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.3 ASTM A167 - Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.

.4 ASTM A269 - Seamless and Welded Austenitic Stainless-Steel Tubing for General Service.

.5 ASTM A1008/A1008M - Steel, Sheet, Cold-Rolled Carbon, Structural, High-Strength Low Alloy and High Strength Low Alloy with Improved Formability.

.6 ASTM B456 - Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

.7 NEMA LD3 - High - Pressure Decorative Laminates.

1.4 ADMINISTRATIVE REQUIREMENTS

.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 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide data and manufacturer's cut sheets on accessories describing size, finish, details of function.

1.6 REGULATORY REQUIREMENTS

.1 Conform to the B.C. Building Code, Section 3.8 - Building Requirements for Persons with Disabilities.

1.7 PERFORMANCE REQUIREMENTS

.1 Accessories shall be commercial / institutional grade.

.2 Washroom accessory installation shall facilitate regular routine maintenance and cleaning of walls and adjacent areas.

.3 All accessories shall be mounted and installed using concealed fasteners and fixings and to appropriate backing and reinforcement.

Part 2 Products

2.1 MATERIALS

.1 Sheet Steel: ASTM A1008/A1008M.

.2 Stainless Steel Sheet: ASTM A167, Type 304.

.3 Tubing: ASTM A269, stainless steel.

.4 Fasteners, Screws, and Bolts: Stainless steel, tamper-proof.

.5 Expansion Shields: Fibre, lead, or rubber as recommended by accessory manufacturer for component and substrate.

2.2 PRODUCTS

.1 Refer to schedule at end of this section.

2.3 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 Fabricate grab bars of tubing, free of visible joints, return to wall with end attachment flanges. Form bar with 38 mm clear of wall surface. Knurl grip surfaces.

.4 Shop assemble components and package complete with anchors and fittings.

.5 Provide steel anchor plates, adapters, and anchor components for installation.

2.4 KEYING

.1 Supply three (3) keys for each accessory to Owner.

.2 Master key all accessories to Owner requirements.

2.5 FINISHES

.1 Galvanizing: ASTM A123/A123M, to 380g/sq m. 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 coat primer and minimum two coats epoxy baked enamel.

.4 Chrome/Nickel Plating: ASTM B456, Type SC 2 finish.

.5 Stainless Steel: No. 4 satin luster finish.

.6 Back paint components where contact is made with building finishes to prevent electrolysis.

Part 3 Execution

3.1 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Verify that field measurements are as indicated on product data.

.3 Verify that site conditions are ready to receive work and dimensions are as indicated on shop reviewed drawings and manufacturer's instructions.

.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 manufacturer instructions.

.2 Install plumb and level, securely and rigidly anchored to substrate.

3.4 ACCESSORIES SCHEDULE

.1 Refer to attached Toilet and Bath Accessories Schedule

END OF SECTION

Part 1 General

1.1 RELATED DOCUMENTS

.1 Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SECTION INCLUDES

.1 Miscellaneous products for interior and exterior applications.

1.3 SUBMITTALS

.1 See Section 01 33 00 - for Submittal Procedures.

.2 Product Data: Provide data for each miscellaneous specialties describing size, finish, details and attachment methods. Include installation instructions.

.3 Warranties:

.1 Submit manufacturer's written warranty that products supplied are free from defects in materials and workmanship for a period of 1 year beginning from the date of Substantial Completion.

Part 2 Products

2.3 STAINLESS STEEL TABLES AND WORK SURFACES

.1 Manufacturer: Mott Manufacturing - 442 Hardy Road, Brantford, ON, Canada N3T 5L7 T: (519) 752-7825 Website: Mott.ca

.2 Products:

All welded table frames.

- Table frame TDA2248 no lower shelf – 2 required

Work surfaces with 102mm (4") back splash

- 1270mm W x 762mm D x 970mm H (50" W x 30" D x 38" H) – 2 required

.3 Options: Work surface to have marine edge.

.4 Finish: Stainless Steel

.5 Construction: 50mm (2") square tubular legs with leveling feet. Table frame to be height adjustable in 25mm (1") increments.

2.6 WALLPAPER

.1 Wall Covering: Wall covering materials meeting requirements of ASTM F793 or CGSB 41 GP 30M, 1370 mm finished width, ULC labelled, Type 2 - medium duty weight meeting the following minimum requirements:

.1 Fabric weight: 68 g/m2

.2 Vinyl weight: 424 g/ m2

.3 Flame spread: 15.

.4 Fuel contributed: 0.

.5 Smoke developed: 15

.6 Basis-of-Design: as indicated on Drawings and graphic/ image selected by Architect.

.2 Substrate Primer/Sealer: White pigmented low VOC acrylic base primer/sealer specifically formulated for use with vinyl wall coverings.

.3 Adhesive: Mildew resistant, low VOC as recommended by the wallcovering manufacturer and as required to minimize flame spread rating of vinyl wall covering material.

2.7 WALL MOUNTED PEG STYLE LEAD APRON RACKS

1. Provide heavy gauge steel for durability, Electro-magnetic power coated in the color White, Pegs tilt upward at the ends to prevent aprons from sliding. Pegs are 4.3" Long x 0.44" Diameter, designed to mount securely on walls, racks shall hold 1 to 9 lead aprons. Mounted to wall studs; provide a plywood backing to studded wall when mounting.

    a. SKU 7156-80

    b. Number of Pegs 4

    c. Lead Apron Capacity 2

    d. Rack Dimensions 3" H x 12" W

    e. Rack Weight 4.2 lbs

    f. Rack Capacity 24 lbs

2.8 PORTABLE AND ACOUSTIC PARTITION

2. Partitions constructed with 2” wide, sound-dampening panels and 4-sided anodized aluminum posts, 6’ High match existing. Submit samples for approval.

3. Aluminum extrusions: Aluminum Association alloy AA6063 T54 or 6061-T6 and meeting the requirements of ASTM B429.

4. Acoustical Insulation: fibreglass insulation as recommended by partition manufacturer to achieve STC rating specified.

5. Steel Components: to ASTM A653M with Z180 zinc coating.

    a. Dimensions 6’ high, match existing office partitions, Hush Panel or equivalent.

    b. Attach up to four panels to one post.

    c. All post kits include a foot.

    d. For stability provide Wall-Mount Brackets.

6. Compatibility: Partition system shall accommodate the following:

    a. Concealed electrical wiring.

    b. Electrical Outlets: base mounted.

    c. Concealed voice and data communication wiring.

    d. Voice and Data Communications Outlets: base mounted.

    e. Wall mounted thermostats.

7. Partition System Dimensions:

    a. Panel Module: as indicated on Drawings.

    b. Height: as indicated on Drawings.

    c. Thickness: manufacturer’s standard

8. Finish: As selected by Architect.

Part 3 Execution

3.1 PREPARATION

.1 Deliver inserts and rough-in frames to site for timely installation.

3.2 INSTALLATION

.1 Install accessories in accordance with manufacturers' instructions.

.2 Install plumb and level, securely and rigidly anchored to substrate.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Horizontal solar window roller shades, manual, chain-operated, where indicated.

.2 Horizontal solar window roller shades, motorized, where indicated.

.3 All shades systems specified in this section shall be provided by one manufacturer who shall take full responsibility for the total project.

1.2 RELATED SECTIONS

.1 Section 09 21 16 - Gypsum Board Assemblies.

.2 Section 09 22 16 - Non-Structural Metal Stud Framing.

1.3 REFERENCES

.1 ASHRAE Standard 74073 - shading coefficient

.2 ASTM G21 - fungal resistance

1.4 SYSTEM DESCRIPTION - MANUAL WINDOW ROLLER SOLAR SHADES

.1 Roller shade system shall be a smooth operating chain and sprocket roller shade system.

.2 All shades systems specified in this section shall be provided by one manufacturer who shall take full responsibility for the total project.

.3 Operation: Easy-Lift (Chain operated) Action with infinite positioning. Left or right hand operation to suit installation.

.1 Motorized where indicated on plans.

.4 Noise reduction seals for sound isolation and absorption of mechanism noise.

.5 Shade Orientation: Shade cloth to roll at window side of roller.

.6 Degree of Openness: 1%.

.7 Provide for smooth and quiet operation.

.8 All chains to be concealed in chain guards to meet regulation SOR/2019-97.

1.5 SYSTEM DESCRIPTION - DUAL MANUAL SOLAR AND BLACKOUT ROLLER SHADES

.1 Teleshade system shall be a smooth operating chain and sprocket roller shade system.

.2 Operation: Easy-Lift (Chain operated) Action with infinite positioning. Left or right-hand operation to suit installation.

.3 Noise reduction seals for sound isolation and absorption of mechanism noise.

.4 Solar Shade Orientation: On interior side of dual system, shade cloth to roll at window side of roller.

.5 Blackout Shade Orientation: Closest to window glazing, blackout fabric to roll at window side of roller.

.6 Provide for smooth and quiet operation.

.7 All chains to be concealed in chain guards to meet regulation SOR/2019-97.

.1 Motorized where indicated on plans.

1.6 SUBMITTALS FOR REVIEW

.1 Section 01 33 00: Submission procedures.

.2 Product Data: Provide manufacturer's data sheets describing components, accessories, dimensions, tolerances for window openings required, colours and textures.

.3 Shop Drawings: Indicate dimensions in relation to window jambs, operator details, top rail, conditions between adjacent shades, corner conditions, anchorage details, hardware and accessories details, connections and required clearances.

.4 Samples: Submit two (2) sets of 300 mm long samples of each visible-to-view component, indicating colour, surface texture and sheen.

Part 2 Products

2.1 MANUFACTURERS

.1 Acceptable Materials/Products: This specification is based on following products manufactured by Solarfective Products Ltd. Contact: Mark Bromley, Cascadia Design Products - 604.739.0966.:

.1 Manual Window Roller Shades: Model - Manual Teleshade.

.2 Dual Solar and Blackout Window Roller Shades: Model - Dual manual solar / manual blackout.

.2 Other manufacturers offering products offering functionally and aesthetically equivalent products and meeting or exceeding specified products and requirements may be considered.

.1 Approved alternate: Fraser Shading Systems Inc.

.3 Provide fully factory assembled shade unit consisting of 2 end brackets, shade tube, extruded aluminium fascia, hembar and fabric specified. Chain operated action with infinite positioning. Left or right-hand operation to suit installation.

.1 Mounting type: Wall.

.2 Removal must not require the disassembly of the shade unit.

.4 End Bracket: the 77 x 96 mm end bracket shall be a two piece moulded ABS construction with a 64 mm diameter nylon drive sprocket. Brackets colour shall co-ordinate with the fascia colour.

.5 Shade Tube: the extruded aluminium shade tube shall be 1.52 mm thick with three internal continuous fins 4.82 mm high, for strength and drive capabilities when attached to the nylon sprocket. The fins shall be spaced 120 degrees apart.

.6 Fascia, where blinds are not recessed: extruded aluminium fascia shall be 1.7 mm thick, complete with three continuous screw flute, anodized.

.7 Drive Assembly: Shall be factory set for size and travel of shades.

.8 Capable of being field adjusted from the exterior of the shade unit without having to disassemble the hardware.

.9 Provided with a built-in shock absorber system to prevent chain breakage, under normal usage conditions.

.10 Drive Chain: No. 10 stainless steel bead chain formed in a continuous loop. The chain shall have a 90 # test. Provide chain guide for each chain, coordinate length of chain on

site with windows. All chains to be concealed in chain guards to meet regulation SOR/2019-97.

.11 Exterior Hembar: 12.7 mm extruded aluminium with plastic end finials. Finish: Anodized: clear.

2.2 COMPONENTS - DUAL MANUAL SOLAR AND BLACKOUT ROLLER SHADES

.1 Provide fully factory assembled shade unit consisting of two end brackets, shade tube, extruded aluminum fascia, blackout side and sill channels, and hembar. Mounting Type: Wall mounted bracket. Removal must not require the disassembly of the shade unit.

.2 End Bracket: Brackets color shall co-ordinate with the fascia color. Brackets shall have cross-over channels for chain to clear blackout channel.

.3 Shade Tube: the extruded aluminum shade tube shall be 1.52 mm thick with three internal continuous fins 4.82 mm high, for strength and drive capabilities when attached to the nylon sprocket. The fins shall be spaced 120 degrees apart.

.4 Fascia: the extruded aluminum fascia shall be 1.7 mm thick, complete with three continuous flutes, clear anodized or Solarfective standard color.

.5 Drive Assembly:

.1 Shall be factory set for size and travel of shades.

.2 Capable of being field adjusted from the exterior of the shade unit without having to disassemble the hardware.

.3 Provided with a built-in shock absorber system to prevent chain breakage, under normal usage conditions.

.6 Drive Chain: Shall be No. 10 stainless steel bead chain formed in a continuous loop. The chain shall have a 90 # test. Provide chain guide for each chain, coordinate length of chain on site with windows. All chains to be concealed in chain guards to meet regulation SOR/2019-97.

.7 Exterior Hembar: extruded aluminum with plastic end finials. Finish: Clear anodized.

2.3 SOLAR SHADING FABRICS

.1 Solarfective Solargreen Aura, PVC free.

.1 Vinyl-coated polyester yarns: 24% polyester, 76% vinyl on polyester.

.2 Flame Retardance: Certified by Independent Laboratory to pass CAN/ULC S109-M-98 Small Scale Vertical Burn Requirements test and NFPA 701 small scale.

.3 Bacteria and Fungal Resistance: ASTM-G21 and ASTM-G22.

.4 Mesh Weight: 627 gr/m2.

.5 Fabric thickness: 0.91 mm.

.6 Openness Factor: 1% openness.

.7 Breaking Strength: (lb./in.): 400 warp, 120 fill.

.8 Stretch: 1.0% warp, 3.0% fill.

.9 UV Blockage: 99%.

.10 Colour: roller shade fabric to be selected upon submittal.

.11 Approved alternate: SolarVeil 2300

.12 Refer to drawings for location.

.2 Performance - As a "shade cloth" the fabric shall hang flat, without buckling or distortion. The edge, when trimmed, shall hang straight without raveling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than 3 mm in either direction due to warp distortion, or weave design.

2.4 BLACKOUT FABRICS

.1 Solarfective, Phifer SheerWeave 7100 Style.

.1 Laminated black-out fabric. PVC-coated fiberglass fabric laminated with a 2-ply 100% PVC blackout film.

.2 Flame Retardance: Certified by Independent Laboratory to pass CAN/ULC S109-M-98 Small Scale Vertical Burn Requirements test and NFPA 701 small scale.

.3 Bacteria and Fungal Resistance: ASTM-G21 and ASTM-G22.

.4 Mesh Weight: 671 gr/m2.

.5 Fabric Thickness: 0.58 mm.

.6 Openness Factor: Opaque.

.7 Breaking Strength: (lb./in.): 253 warp, 263 fill.

.8 Elongation to Breaking Point: 3.8% warp, 5.8% fill.

.9 Colour: as selected by Architect.

.10 Referral to drawings for location.

.2 Performance - As a "shade cloth" the fabric shall hang flat, without buckling or distortion. The edge, when trimmed, shall hang straight without raveling. An unguided roller shade cloth shall roll true and straight, without shifting sideways more than 3 mm in either direction due to warp distortion, or weave design.

.3 Room Darkening Shade - 100% opaque material shall be 3 ply (4 mil thickness) vinyl laminated to both sides of 100% fibreglass base 13 gauge thickness. If sewn, needle holes shall not permit light penetration. Washable with mild soap and water.

Part 3 Execution

3.1 PREPARATION

.1 Field verify that all backing and framing necessary to carry shade assembly hardware is a proper installation and secure.

.2 Notify Contractor in writing of any deficiencies in the work of other trades that would affect the window treatment system.

.3 Make accurate measurements at the site before fabrication. Check layout of glazing framing sections, spans, and loading capabilities.

.4 Coordinate requirements for backing, and structural supports to ensure adequate means for installation of window shades.

.5 Coordinate work of this section with other work that this section is dependent upon including windows, gypsum board assemblies and all other work related to or dependent upon the work of this section.

3.2 EXAMINATION

.1 Verify existing conditions before starting work.

.2 Examine substrate and conditions for installation.

.3 Beginning of installation means acceptance of substrate and project conditions.

3.3 INSTALLATION

.1 Install window shades at locations indicated on Drawings.

.2 Install motorized window shades at locations indicated on Drawings.

.3 Install work by manufacturer's skilled tradesmen and install in strict accordance with manufacturers written instructions and reviewed shop drawings.

.4 All items installed, plumbed, squared, rigidly coupled and adequately anchored, maintaining uniformed clearances, accurate alignment levels, and parallel with the window plane to provide smooth operation without binding.

.5 The solar screen fabric shall be pre-measured and manufactured off-site.

.6 Install units and their accessories to manufacturer's instructions.

.7 Securely screw end plugs to conceal exposed cut aluminum of exterior hem bar.

.8 Securely anchor units plumb and level, using hardware and accessories to provide smooth operation without binding.

3.4 INSTALLATION TOLERANCES

.1 Maximum variation of gap at window opening perimeter: 6 mm per 2.4 m (plus or minus 3 mm) of shade height.

.2 Maximum offset from level: 3 mm.

.3 Use manufacturer's edge clearance requirements for shades where the width-to-height ratio exceeds 1:3.

3.5 ADJUSTING AND CLEANING

.1 Operate shade through complete cycle of lowering, stopping, and raising to ensure proper operation. Adjust as required for smooth operation.

.2 Adjust shades and operating components as required to ensure smooth and trouble free operation without binding.

.3 Adjust shade and shade cloth to hang flat without buckling or distortion.

.4 Clean shades and exposed components.

.5 Touch up damaged finishes and repair minor damage in a manner to eliminate evidence of repair. Remove and replace work that cannot be satisfactorily repaired.

.6 Clean exposed surfaces and edges/ends, including metal and shade cloth, using non-abrasive materials and methods recommended by manufacturer.

.7 Remove and replace work which cannot be satisfactorily cleaned.

.8 Protect from damage from construction operations. If damage occurs, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

3.6 CLOSEOUT ACTIVITIES

.1 Demonstration: Demonstrate operation method and instruct Owner's designated personnel in the proper operation and maintenance of the window shade assembly.

3.7 SCHEDULE

.1 Refer to Interior Finishes List for materials and Drawings for locations. Refer to Drawings for locations.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 Custom metal cabinets.

.2 Custom counter tops, work surfaces and shelves.

.3 Casework hardware.

1.2 PERFORMANCE REQUIREMENTS

.1 Reinforce frame counters to safely support a load of 90 kg concentrated on 0.093 sq min any area with no indentation showing on surface and with permanent set not exceeding 0.127 mm.

1.3 ADMINISTRATIVE REQUIREMENTS

.1 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.

1.4 SUBMITTALS FOR REVIEW

.1 Product Data: Provide component dimensions, configurations, construction details, joint details, and attachments.

.2 Shop Drawings: Indicate casework locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required.

1.5 SUBMITTALS FOR INFORMATION

.1 Installation Data: Manufacturer's special installation requirements.

.2 Closeout Submittals: submit following items:

.1 CSA Certification: Provide documentation certifying sinks are manufactured in accordance with CAN/CSA-B45 series.

1.6 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.

1.7 WARRANTY

.1 Confirm by writing that all case goods and materials shall be guaranteed for a period of three (3) years from the date of Substantial Performance of the Work against all defects in design, material, fabrication and installation.

.2 Defects in materials and workmanship that may develop within this time are to be replaced without cost or expense to the Owner.

.3 Defects include, but are not limited to:

.1 Ruptured, cracked, or stained coating.

.2 Discoloration or lack of finish integrity.

.3 Cracking or peeling of finish.

.4 Slippage, shift, or failure of attachment to wall, floor, or ceiling.

.5 Weld or structural failure.

.6 Warping or unloaded deflection of components.

.7 Failure of hardware.

1.8 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for steel laboratory casework and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Indicate on drawings:

.1 Details of laboratory casework construction and related and dimensional position, with sections.

.2 Location of each casework unit.

.3 Location for roughing-in of plumbing and electrical services.

.3 Samples:

.1 Submit duplicate samples of:

.1 Countertop material, 300 x 300mm including external corner.

.2 Standard colour of cabinet finish on 300 x 300mm steel sheet.

.3 All cabinet hardware.

1.9 DELIVERY, STORAGE, AND PROTECTION

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials indoors in dry location and in accordance with manufacturer's

recommendations in clean, dry, well-ventilated area.

.2 Store and protect steel laboratory casework from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

PART 2 Products

2.1 MANUFACTURERS

.1 Acceptable Manufacturers:

.1 Goelst Medical Casework by Dwyer Products Corporation. Contact: Jonathan Fuller, Tel: 604-723-0227. email: jfullan@dwyerproducts.com.

.2 Mott Manufacturing, MottLab Stainless Steel Casework.

.3 Norlab Laboratory Systems.

.4 Bedcolab.

.5 H.H. Hawkins.

.6 Or approved substitution.

2.2 MATERIALS

.1 Sheet Steel: ASTM A653/A653M

.2 Stainless Steel: 316 alloy to ASTM A167.

.3 Safety Glass: CAN/CGSB-12.1, fully tempered 6 mm thick minimum; exposed edges ground, cut or drilled to receive hardware.

.4 Counter Tops, Back Splash and Side Splash: Stainless Steel.

.1 Countertop Core Material:

.1 Dry locations: Medium Density Fiberboard, 19 mm thick.

.2 Wet locations, high humidity areas and all food service areas: Marine grade veneer core plywood, sanded, 19 mm thick with Type II adhesive, required for the entire countertop including all returns.

.5 Casework Core: Sound Deadening Material, Inorganic, for sandwich panel fabrication.

.6 Sealant: sanitary type, specified in Section 07 92 00.

2.3 STAINLESS STEEL CASEWORK

.1 Stainless steel work shall conform to best practice and fabrication techniques. Corners shall be welded, ground, polished and crevice free. Joints and welds shall be polished to a uniform No. 4 satin finish. No fillers or solder shall be used. Straight lengths shall be one piece with all seams, including field joints, welded.

.2 Tops shall be sound deadened and reinforced with waterproof plywood core, bonded to tops with waterproof contact cement. Underside of top (plywood core) shall be made of the same Stainless Steel sheet as the counter top.

Splashbacks shall be formed as an integral part of the tops and shall be radiused construction where the splashback occurs in the top. All splashbacks shall be bonded to a core, bonded in same manner as the tops. Countertops, splashbacks and front aprons shall be fabricated from a single piece of stainless steel.

2.4 HARDWARE

.1 Hardware: BHMA A156.9.

.2 Hardware: Manufacturer's standard.

.3 Drawer and Door Pulls: 100 mm flush aluminum.

.4 Sliding Door Pulls: Recessed steel circular design.

.5 Cabinet Locks: Lock with 4 pin cylinder and 2 keys per lock.

.6 Catches: Nylon roller spring catch or dual self aligning, permanent magnet type.

Provide two catches on doors over 1200 mm high.

.7 Drawer Slides: Full extension arms, steel and ball bearing construction.

.8 Hinges: Institutional type, five knuckle, stainless steel. Provide one pair for doors less than 1200 mm high and 1-1/2 pair for doors over 1200 mm high.

.9 Sliding Door Track Assemblies: Nylon track with solid bearing followers.

.10 Drawer Stops: Designed to permit easy removal, and yet prevent inadvertent drawer removal. Provide on all drawers, located on the inside.

.11 Casters for the mobile units as noted.

2.5 CASEWORK FABRICATION

.1 Factory fabricate casework, assembled and welded to layout and configurations indicated.

.2 Fabricate corners and joints without gaps or inaccessible spaces or areas where dirt or moisture could accumulate.

.3 Fabricate components, doors, drawers, counters, shelves of die formed stainless steel.

Form each unit rigid, not dependent on building structure for rigidity.

.4 Form edges and seams smooth. Form material for counter tops, facings, shelves from continuous sheets.

.5 Turn down edges of shelves 25 mm on each side and return 16 mm front and back.

.6 Form front edge of shelves as indicated with a lip to prevent items from slipping off shelf.

.7 Electric spot weld casework; grind joints smooth and flush.

.8 Fabricate door and drawer fronts of sandwiched sheets of stainless steel welded together and reinforced for hardware. Fill with sound deadening core.

.9 Component Sizes:

.1 Gables, Front and Back Panels, Gusset Plates and Rails: 1.5 mm (16 Ga.).

.2 Drawers, Door Fronts, Cabinet Floors, Shelves, Filler Panels and Drawer Dividers: 1.2 mm (18 Ga.).

.3 Backing Sheet to Door and Door Fronts: 0.9 mm (20 Ga.).

.4 Counter tops, back splash: 1.5 mm (16 Ga.).

.10 Cut and drill countertops, backs, and other components for service outlets and fixtures.

.11 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 COUNTERTOP FABRICATION

.1 Fit and shop assemble items to layout and configurations indicated in largest practical sections, for delivery to site.

.2 Fabricate countertop surfaces with sound deadening stainless steel ribs welded to underside of countertops.

.3 Provide front and end overhang of 25 mm over base construction.

.4 Where possible fabricate units for installation without field-made joints. Weld, grind and polish exposed joints flush and smooth to render joints invisible.

.5 Edges: No-drip marine edge, 38 mm exposed face.

.6 Backsplash: Fabricate 100 mm high back and side splash unless otherwise indicated, integrally coved to horizontal surface with minimum 12 mm radius.

.7 Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

.8 Provide all necessary support brackets and solid gable ends as indicated to support the required design loads indicated.

2.7 FINISHES

.1 Stainless Steel: No. 4 satin finish.

.2 Shop finish all components.

.3 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 adequacy of support framing and anchors.

3.2 INSTALLATION

.1 Install casework, components and accessories to manufacturer instructions.

.2 Use anchoring devices to suit conditions and substrate materials encountered.

.3 Set casework items plumb and square, securely anchored to building structure.

.4 Insulate to prevent electrolysis between dissimilar metals.

.5 Scribe to abutting surfaces and align adjoining components. Apply matching filler pieces where casework abuts dissimilar construction.

.6 Field weld joints in stainless steel work, without open seams. Grind smooth and polish to match adjacent surfaces.

.7 Close ends of units, splash aprons, shelves and bases with sealant.

.8 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 Clean casework, counters, shelves, glass, legs, hardware, fittings and fixtures.

3.5 PROTECTION OF FINISHED WORK

.1 Protect installed work from damage due to successive work activities.

.2 Do not permit finished casework to be exposed to continued construction activity.

3.6 SCHEDULES

.1 Refer to drawings for locations and details.

END OF SECTION

DIVISION 21 TABLE OF CONTENTS

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 WORK INCLUDED

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 The Division 23 Common Work Results for HVAC shall govern the Division 21 Fire Suppression sections of the work (read in conjunction with Division 1). This section covers items common to Division 21 series sections and is intended only to supplement the requirements of Division 1 and 23.

.3 Fire Suppression drawings are diagrammatic and approximately to scale. They establish the scope of the work and the general location and orientation of the fire suppression systems. The systems shall be installed generally in the locations and generally along the routings shown, close to the building structure and coordinated with other services. Piping shall be concealed within walls, ceilings or other spaces and shall be routed to maximize head room and the intended use of the space through which they pass, unless specifically noted otherwise.

.4 Contractor to provide for multiple shutdowns and recharge to accomplish the isolation work including nighttime hours. Provide for fire watch during times with no fire protection system.

.5 Contractor shall be aware, and thereby allow accordingly, that they will be working in Hospital areas and departments that are designated to be continuously in a 24 hour operation by hospital staff. As such the hospital's operation and department function shall not be disrupted or compromised in any way. Particular attention shall be given to related work in Patient, Staff, and Visitor occupied areas. In these areas, the work is to be performed during night time hours as follows:

.6 Monday through Fridays daily: 22:00 to 06:00. (Contractor to confirm the dates and hours with the owner).

.7 Saturdays and Sundays daily: 06:00 to 06:00. (Contractor to confirm the dates and hours with the owner).

.8 Night-time and weekend work are required for all shutdowns. (Contractor to confirm the dates and hours with the owner).

1.2 DESCRIPTION OF WORK

.1 Install new sprinkler heads and wet sprinkler piping throughout the renovation area as noted on the drawings. The renovation area does not currently contain any sprinkler piping or heads and the previous sprinkler zone piping was removed and capped at the standpipe in the stairwell. Reconnect zone and provide new piping and sprinkler heads.

.2 The fire suppression contractor shall retain the services of a Professional Engineer registered in the Province of British Columbia to provide complete engineering design and field review services including signed and sealed CAD fire suppression drawings and hydraulic calculations. Refer to “Document Submittals” for additional information.

.3 The contractor’s Professional Engineer shall provide field reviews of the work on site as the work progresses and submit signed copies of the reports to Stantec Consulting Ltd.

.4 Provide hard copy and digital files (AutoCAD and pdf formats) of all “as-built” record drawings for inclusion in the maintenance manuals.

.5 Submit all documentation to the Authorities Having Jurisdiction, arrange for, pay for and obtain trade permits prior to commencing installation work on site.

.6 Arrange for, pay for and obtain static and residual water supply pressure information from the utility or municipality in writing and submit a copy of this information with the Shop

Drawings. If this information is not available, arrange for, pay for and perform a hydrant flow test.

.7 Provide all fire suppression systems throughout the buildings as noted on the drawings and including:

.1 Wet sprinkler systems

.2 Portable fire extinguishers

.3 Standpipe systems

.8 Refer to the Code Consultant's or equivalency reports, obtain copies through the Architect or Project Manager and provide all fire suppression systems outlined therein including water curtains, window and glazing sprinkler suppression systems.

.9 Connect to the combined fire suppression / potable water supply main or dedicated fire suppression water main located as shown on the drawings.

.10 Provide all Testing, Adjusting; Commissioning; Identification; Insulation; and Heat Tracing for all fire suppression systems as described in the associated specification Sections.

.11 Provide system shutdown and drain down of existing wet sprinkler system to connect new level 3 zone piping. Coordinate shut downs with Northern Health, FMO and local Fire Marshal.

1.3 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Where multiple versions of the same code are published, the most recent version shall be applied, unless noted otherwise by building codes and local by-laws.

.2 Installation, workmanship and testing shall conform to the following standards:

.1 Province of BC Building Code

.2 Local building by-Laws

.3 National Fire Protection Association NFPA 10 - Standard for Portable Fire Extinguishers.

.4 National Fire Protection Association NFPA 13 - Standard for the Installation of Sprinkler Systems.

.5 Fire Commissioner of Canada standards.

.6 Factory Mutual (FM) approval guides.

.7 Insurer's Advisory Organization (IAO) Interpretive Guides.

.3 Installation shall be subject to design approval, inspection and test of the Authority Having Jurisdiction.

.4 All system components shall be of one manufacturer. Normally, materials and devices listed by nationally recognized fire test laboratories will be acceptable.

1.4 DOCUMENT SUBMITTALS

.1 The fire suppression contractor shall retain the services of a Professional Engineer registered in the Province of British Columbia to provide complete engineering design and field review services including signed and sealed CAD fire suppression drawings and hydraulic calculations.

.2 The contractor's Registered Professional Engineer shall provide signed and sealed Province of BC Building Code Letters of Assurance Schedule B and Schedule C-B for the project.

.1 Some Cities or Municipalities may allow sprinkler contractors to perform limited amounts of sprinkler work (such as the relocation or addition of a limited number of sprinklers) under a Trade Permit, without the requirement of submitting Schedules B and C-B. Where this scenario is permitted by the City or Municipality, the sprinkler contractor may not, under the scope of this contract,

break down the work and take out multiple Trade Permits in order to alleviate submitting Schedules B and C-B.

.2 Where the project size is limited enough to consider the previous clause, Stantec still requires Schedules B & C-B from a Sprinkler Engineer as specified. If detailed calculations are not required for a project, then a signed and sealed letter from the Sprinkler Engineer confirming design approach (i.e. pipe schedule method) shall be submitted.

.3 Submit static and residual water supply pressure information.

.4 Submit CAD drawings of all fire suppression sprinkler systems, fire suppression standpipes, clean agent suppression systems, and other fire suppression or fire extinguishing systems, for both shop drawings and record drawings.

.1 Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval.

.5 Any drawings prepared by the Consultant are provided only to show the general features of the systems, and general concepts of the arrangement and locations of the sprinklers.

.6 Submit hydraulic calculations for all water-based fire suppression sprinkler and standpipe systems.

.7 Submit a "Contractor's Material and Test Certificate" for each Aboveground section of the work in accordance with the Authority Having Jurisdiction test procedure requirements, to the Consultant and to the local Authority Having Jurisdiction a minimum of 10 working days prior to Occupancy.

.8 Submit a signed letter from the fire stopping installation firm on their company letterhead certifying that all penetrations of fire suppression piping through vertical and horizontal rated separations have been fire stopped in accordance with CAN4-S115.

.9 Obtain from the Division 26/27 Electrical contractor and submit a copy of the Fire Alarm Verification Certificate.

.10 Submit maintenance data for all systems and arrange for inclusion in the project Mechanical Maintenance and Operations Manuals as outlined below.

.11 Submit signed and sealed copies of Record Drawings, Final Design Drawings and As-built Drawings as requested by the project Architect, Certified Professional (C.P.), Authority Having Jurisdiction and the Consultant.

.12 Submit shop drawings as noted below.

.13 Submit samples as noted below.

1.5 SHOP DRAWINGS

.1 Refer to Division 1 and Section 23 05 00 for additional requirements.

.2 Submit shop drawings for the following items where they are provided for the project:

.1 Piping materials.

.2 Valves, fittings and grooved joint couplings.

.3 Fire department connections.

.4 Fire hose valves and cabinets.

.5 Supervisory switches.

.6 Flow switches.

.7 Pressure switches.

.8 Sprinklers and escutcheon plates.

.9 Fire extinguishers and cabinets.

.10 Fire stopping component data sheets and ULC or Warnock Hersey listings.

1.6 RECORD DRAWINGS

.1 Provide project record drawings for all fire suppression systems as specified in Section 23 05 00 Common Work Results for HVAC.

.2 Submit hard copies of all “as-built” record drawings for inclusion in the paper maintenance manual.

.3 Provide digital files in pdf formats for inclusion in the digital format manuals.

.4 In addition to the requirements of the clause above, as a minimum, during the construction period, keep on site a clean set of drawings marked up, IN COLOUR, to reflect the 'As-Built' state, for examination by the Consultant on a regular basis. Include elevations, rough-in details and detailed locations of all hidden services, including locations of maintenance items and their associated identification code (ie. valves). All underground services and/or concealed piping shall be dimensionally located and noted (use gridlines or structure as the reference).

.5 At the time of 'Ready-For-Takeover' submit to the Consultant two complete full sized COLOUR Xerox copies of all As-Built state drawing information produced as per the above clause. Transfer the As-Built drawing mark-ups digitally using AutoCad onto, and by creating, Record As-Built Drawing “DWG” files. At the time of 'Ready-For-Takeover submit to the Consultant, on a USB drive, all produced Record As-Built drawings DWG files, including reference files (XRefs, fonts, shapes, line type, plot/print profiles… consider using the E-Transmit function), and one PDF file for each DWG file produced.

1.7 MAINTENANCE DATA

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

.2 Provide maintenance data for all fire suppression systems complete with a Table of Contents and coordinate with the plumbing and HVAC trades for incorporation into a designated section of the project Mechanical Operation and Maintenance Manual.

.3 Submit pdf format digital files of all equipment data sheets, approved shop drawings, and maintenance data for inclusion in the maintenance manual.

.4 Include a copy of National Fire Protection Association NFPA-25, Standard for the Inspection, Testing and Maintenance of Water-Based Fire Protection Systems.

.5 Detailed instructions for the normal maintenance of all installed equipment including operational procedures, frequency of operational checks, service instructions and troubleshooting instructions. Information provided must be suitable for incorporation into the local Fire Department's operation manual if so requested by the Authority Having Jurisdiction.

.6 Local source of supply for each item of equipment indicating the manufacturer’s and local supplier’s company names, addresses, phone numbers, faxes and e-mails.

.7 Labeling and identification schedules.

.8 Valve schedule including location, service type and normal position for all systems.

.9 Warranties, certificates and miscellaneous reports.

.10 Manufacturer's operating and maintenance brochures, including wiring diagrams.

.11 Comprehensive description of the operation of the system including the function of each item of equipment within the system.

.12 Operating electrical switchgear schedule indicating location of equipment.

.13 Lubrication schedule indicating the recommended lubricants and grades (grease or oil) for all lubricated equipment components.

.14 Shop drawings for all components as listed in the Shop Drawings clauses above.

.15 Documentation as listed in the Documentation Submittals clauses above.

1.8 OCCUPANCY DOCUMENTATION REQUIREMENTS

.1 Provide occupancy documentation for all fire suppression work as specified in Section 23 05 00 Common Work Results for HVAC.

.2 The contractor shall submit the following documentation to the Consultant a minimum of 5 working days prior to the project occupancy site walk-through or occupancy date, whichever is scheduled first. The dates will be established by the project architect, project manager or Certified Professional. It is the contractor's responsibility to provide all documentation to the Consultant in a timely manner. If all documentation is not received, the Consultant may not be able to issue their associated Schedule C-B in support of the building occupancy application and any associated consequences shall become the responsibility of the contractor.

.3 Fire Suppression system Letters of Assurance Schedules B Assurance of Professional Design and Commitment for Field Review; and Schedule C-B Assurance of Professional Field Review and Compliance from the contractor's fire suppression engineer.

.4 Seismic restraint system letters of assurance Schedules Band C-B from the fire suppression contractor's seismic restraint engineer.

.5 Letter confirming that all penetrations of rated assemblies have been firestopped in conformance with CAN4-S115, on the firestopping installing agencies letterhead.

.6 Fire Suppression system Contractor's Material and Test Certificates for Aboveground Piping systems per NFPA-13.

.7 A copy of the Fire Alarm Verification Certificate for components related to the fire suppression system devices.

.8 Copies of pressure test reports for all piping systems on contractor's letterhead.

.9 Maintenance manuals for fire suppression systems.

1.9 SWAY BRACES

.1 Supply and install sway-bracing hangers on fire suppression piping systems in accordance with NFPA 13 requirements. Generally, this shall apply to all crossmains 50 mm [2"] and larger, and shall apply to all feed mains including all standpipe risers. Horizontal piping shall be 2-way bracing and vertical piping shall include 4-way bracing at the tops of all risers. On floor loops, sway-braces are also required at the corners of all loops.

.2 Power actuated or drop-in fasteners shall not be used to resist tension forces for the support or restraint of the fire suppression systems or their components. All fasteners shall be reviewed and approved by the Supporting Professional Engineer for Seismic Restraints prior to installation.

1.10 SEISMIC RESTRAINTS

.1 Supply and install seismic restraints for all fire suppression piping systems in accordance with the Province of BC Building Code.

.2 Include the services of a Supporting Professional Engineer to design and certify the seismic restraints for all fire suppression piping systems in accordance with the Province of BC Building Code. Provide signed and sealed Letters of Assurance Schedule B and Schedule C-B for the project.

.3 Power actuated or drop-in fasteners shall not be used to resist tension forces for the support or restraint of the fire suppression systems or their components. All fasteners shall be reviewed and approved by the Supporting Professional Engineer for Seismic Restraints prior to installation.

1.11 PIPE, FITTINGS AND COUPLINGS

.1 The responsibility for including for all pipe, fittings, couplings, valves, nipples, drains, test connections and all accessory pipe work for a complete installation is to be included in this Section of the work within the base tender price.

.2 No extra cost will be considered based on failure of the contractor to allow for extra pipe, fittings and pipe work as required during construction to provide offsets to avoid structural components, and to coordinate with other piping services, ductwork, cable trays, conduits or other obstacles whether shown on the drawings or not.

.3 All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

.4 All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.12 SPRINKLERS

.1 The responsibility for allowing for all sprinklers for a complete installation is to be included in this Section of the work within the base tender price. The layout on the drawings shows the general intention of the work and sprinkler locations with respect to other ceiling elements such as ceiling tiles, lights and diffusers. However, the contractor shall provide all additional sprinklers as may be required.

.2 No extra cost will be considered based on failure of the contractor to allow for extra sprinklers as required during construction to conform to all NFPA requirements and the Authority Having Jurisdiction, whether shown on the drawings or not.

.3 Include sprinklers above and below suspended architectural ceiling panels.

.4 Include sprinklers in concealed spaces containing exposed combustible construction including exposed wood beams, exposed wood framing and exposed wood ceiling materials.

1.13 CLEAN UP

.1 Leave systems operating with work areas clean to satisfaction of the Consultant, Architect or the Owner’s representative.

1.14 SYSTEM DEMONSTRATIONS

.1 The fire suppression contractor’s Professional Engineer and their licensed journeyman sprinkler fitter shall attend all demonstrations of the fire suppression systems to the Municipal officials, the Fire Department and the consultant. This may require multiple site visits and multiple demonstrations depending on the scheduling and sequence of demonstrations as may be established by the Architect, Project Manager or General Contractor.

.2 The fire suppression contractor’s Professional Engineer and their licensed journeyman sprinkler fitter shall demonstrate all devices to the consultant. including all tamper switches, all flow switches, all test ‘n drain assemblies.

.3 Demonstrations to Municipal officials and / or the Fire Department shall not alleviate the requirement to provide an additional demonstration of all devices and components to the consultant partial demonstrations in lieu of full demonstrations shall be at the sole discretion of the consultant.

.4 The fire suppression contractor’s Professional Engineer and their licensed journeyman sprinkler fitter shall coordinate to have the electrical contractor and / or their fire alarm system contractor present and to provide all necessary walkie-talkies, ladders, smoke canisters etc. to provide complete system demonstrations.

.5 The fire suppression contractor's licensed journeyman sprinkler fitter shall rectify any deficiencies and subsequently drain all dry system piping, reset all devices and leave the systems in a fully operating condition.

Part 2 Products

2.1 GENERAL

.1 All materials shall be ULC Listed for the intended service and shall be supplied in original factory packaging.

2.2 HANGERS AND SUPPORTS

.1 All hangers and supports including seismic restraints shall be ULC Listed and shall conform to the BC Building Code and to the appropriate NFPA standards.

.2 Toggle hangers or strap hangers are unacceptable.

.3 All sprinklers, piping and related equipment in the MRI area shall be non-ferrous.

2.3 FIRE STOPPING

.1 Provide fire stopping materials listed in accordance with CAN4-S115 at all pipes penetrating horizontal and vertical fire rated separations.

2.4 MISCELLANEOUS METAL RELATED TO FIRE PROTECTION SYSTEM

.1 All miscellaneous metal related to the fire suppression systems including all metal back up plates, stands, brackets and supports for all roof, floor or wall supported equipment and piping systems is part of this Section of the work.

.2 Provide two coats of heavy red oxide primer to all steel components after fabrication, and touch up on site after installation.

2.5 ISOLATION VALVES:

.1 Install isolation valves whether shown on the drawings or not at the following locations:

.1 At the base of each standpipe riser.

.2 At each sprinkler zone.

.3 At all points as indicated on the drawings.

.4 At all points where required by the Building Codes, By-Laws or NFPA.

Part 3 Execution

3.1 PIPE ROUTING

.1 Install piping to maximize headroom in all areas, including areas without ceilings where the piping is exposed, without interfering with other systems.

.2 Do not route piping through electrical or communications rooms or closets, elevator machine rooms, or other similar locations without express permission from the electrical consultant. Limit the piping to branch lines that serve those specific rooms where such rooms are required to be sprinklered.

3.2 GRADING AND DRAINAGE OF PIPING

.1 Grade all fire suppression piping so that it can be drained through drain cocks.

.2 Pipe all sprinkler system drains to floor drains in mechanical service rooms.

3.3 BUILDING MOVEMENT

.1 Install all piping systems, including all take-offs installed within the building such that the piping and connected equipment will not be distorted by expansion, contraction or building settlement.

.2 Provide offsets and / or piping expansion components at all building expansion joints, all building seismic joints and all firewalls.

.3 Provide anchors where necessary to control pipe expansion and pipe movement.

3.4 PIPE SLEEVES AND ESCUTCHEONS

.1 The supply and installation of pipe sleeves and escutcheons for fire suppression system piping is included in this Section of the work.

.2 Do not cast piping into concrete walls, slabs or masonry walls.

.3 At exterior wall or slab penetrations, provide sleeves a minimum of 2 nominal pipe diameters larger than the pipe. (i.e. a 300 mm [12”] sleeve for a nominal 200 mm [8”] diameter pipe).

.4 Install pipe concentric within the sleeves.

.5 Remove plastic sleeves, where they are used, prior to installation of the pipe penetration. The resulting hole shall be then classified as the sleeve except in wet areas.

.6 Provide minimum Schedule 10 steel pipe sleeves where piping penetrates masonry walls.

.7 Extend sleeves 50 mm [2"] above floor slabs in wet areas. Wet areas include penthouse equipment rooms, janitor's rooms, utility rooms and washrooms.

.8 Seal all penetrations through aboveground exterior walls, and underground exterior walls and slabs including slabs on grade, where no hydrostatic pressure exists, with a flexible, non-hardening, weatherproof caulking compound. Seal around the exterior circumference of the sleeves as well as the annular space between the pipes and the sleeves.

.9 Seal all penetrations through underground exterior walls and slabs, including slabs on grade, where hydrostatic pressure exists, with mechanical seals such as Link Seal.

.10 Install chrome plated escutcheons on exposed piping passing through walls, floors and ceilings in finished areas.

.11 Risers for fire suppression systems with horizontal branch takeoffs passing through sleeves that are set rigidly in the structure adjacent to the risers shall be set to accommodate long term structural movement to avoid imposing stress on these systems.

3.5 FIRE STOPPING

.1 Provide fire stopping to CAN4-S115 at all pipes penetrating horizontal and vertical rated separations.

.2 Smooth the finished surface in a neat and workman like appearance.

3.6 CORE DRILLING

.1 The fire suppression contractor shall be on site and coordinate sleeves and block out requirements in accordance with the project construction schedule to minimize coring.

.2 Arrange and pay for all costs of all core drilling required for fire suppression systems in this Section of the Work.

.3 X-ray all concrete walls, partitions, shafts, slabs and other concrete or concrete block assemblies prior to coring. The cost of x-raying shall be included in the cost of the Work. Repairs to existing services damaged as a result of core drilling is included in this section of the Work.

.4 Verify the location of existing service runs and structural reinforcement within existing concrete floors and walls prior to core drilling and cutting. Core drilling and cutting of structural building components shall only take place upon the receipt of specific written approval of the structural consultant. Repairs that may be required to existing services damaged as a result of core drilling is included in this Section of the work.

.5 Penetrations up to 150 mm [6"] nominal pipe size in precast concrete may be cored on site per the fire suppression contractor. Larger penetrations shall be located and arranged for in precast work with the precast manufacturer prior to shipping to the construction site.

3.7 HANGERS AND SUPPORTS

.1 Provide all hangers and supports as outlined in NFPA including supports to adequately secure the piping to restrict movement upon activation of the fire suppression systems including the activation of fire pumps and charging of the systems through the fire department connections.

3.8 PRESSURE GAUGES

.1 Provide pressure gauges at the following locations and additional gauges as required by NFPA, the Authority Having Jurisdiction and the system configuration:

.1 At the top of all fire suppression standpipe and sprinkler risers.

3.9 SEISMIC RESTRAINTS

.1 Provide seismic restraints as outlined in NFPA and to the seismic zone listed in the applicable building code or bylaw.

.2 Anchorage and seismic restraints of the fire suppression systems as listed in the Letters of Assurance Schedules B and C-B is included in this Section of the work.

3.10 TESTS AND INSPECTION

.1 Furnish all labour, materials, equipment and instruments necessary for all required tests. All work shall be subject to review by the Consultant, Owner’s representative, and local Authority Having Jurisdiction.

.2 Provide at least one hundred and twenty (120) business hours’ notice for projects greater than 100 km [60 miles] of the Consultant’s office, in advance of making the required tests.

.3 Tests on fire suppression systems shall include pressure tests and shall conform to the standards of the Authority Having Jurisdiction. Fire department connections and fire pump test header lines shall also be hydrostatically tested.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 53 Mechanical Identification. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 53 provide identification on all fire suppression piping, valves and equipment including the following:

.1 Fire suppression wet sprinkler systems.

.3 Identification of all fire suppression systems must comply with the requirements of the applicable NFPA Standard where the requirements of that standard exceed these specifications.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 23 05 93 Testing, Adjusting & Balancing for HVAC. Comply with all requirements of that Section of work as related to General Requirements, Products and Execution.

.3 Also refer to Section 21 08 00 Commissioning of Fire Suppression.

1.2 SCOPE OF WORK

.1 In addition to the piping, equipment and systems listed in Section 23 05 93 provide testing, adjusting and balancing for all fire suppression piping, equipment and systems including the following:

.1 Fire suppression wet sprinkler systems.

.2 The fire suppression contractor shall provide testing, adjusting and balancing of the fire suppression and fire extinguishing systems.

.3 Provide completed copies of Contractor's Material and Test Certificates for Aboveground Piping, and for Underground Piping as per NFPA-13.

.4 The fire pump manufacturer's authorized representative shall provide testing, adjusting and balancing of the fire pump and jockey pump systems including submission of a report.

.5 The manufacturer's authorized representatives shall provide testing, adjusting and balancing of the pre-action, deluge, clean agent, foam-water and / or carbon dioxide fire suppression or fire extinguishing systems including submission of a report for each system.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Refer to Section 23 08 00 Commissioning of HVAC. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 08 00 provide commissioning of all fire suppression piping, equipment and systems including the following:

.1 Fire suppression wet sprinkler systems.

.2 Fire suppression standpipe systems.

.3 The fire suppression contractor shall provide commissioning of the fire suppression and fire extinguishing systems.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 DESCRIPTION OF WORK

.1 The following is a general description of the work involved:

.1 Provide new sprinklers throughout the renovated area as depicted on the mechanical drawings.

.2 Connect new wet sprinkler system to existing wet system capped zone valve piping within the stairwell.

.3 Pre-action sprinkler systems at designated areas.

1.3 QUALITY ASSURANCE

.1 Provide a wet sprinkler system throughout the building, in accordance with the listed codes, bylaws, standards and approvals including NFPA 13 and the Province of BC Building Code.

1.4 RELATED WORK

.1 Coordinate with Division 26 Electrical for connection of all supervised isolation valves to supervisory signals, flow switches to alarm signals, and supervisory switches to supervisory signals on the fire alarm system.

.2 Coordinate the work of this Section with the HVAC trades, plumbing trades, electrical trades and ceiling trades.

1.5 SUBMITTALS

.1 Submit CAD drawings of all fire suppression sprinkler systems, fire suppression standpipes, and other fire suppression or fire extinguishing systems, for both shop drawings and record drawings.

.1 Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval.

.2 Any drawings prepared by the Consultant are provided only to show the general features of the systems, and general concepts of the arrangement and locations of the sprinklers.

.3 The fire suppression subcontractor and their Registered Professional Engineer shall include for all sprinklers as required to fully comply with NFPA-13, local by-laws and the Province of BC Building Code, whether or not they are indicated on the Consultant's, Architect's or any other drawings.

.4 Indicate on the drawings all information required by the Authority Having Jurisdiction including features of the building construction, direction and size of beams, ceiling configurations, partition locations, as well as light fixtures (noting the depths of surface mounted light fixtures where these occur) and diffuser locations.

.5 Stipulate the positions and elevations of the sprinklers with respect to the floor elevations; the temperature rating all sprinklers; the spacing and types of hangers; drains and low point drains; test and flushing connections; types of sprinkler alarms; locations and types of sprinkler control valves; and all other essential features of the piping systems.

.6 Include with the submission detailed sprinkler plans and hydraulic calculations as described in NFPA 13.

.7 Sprinklers shall be referred to on drawings, submittals, and other documentation, by the sprinkler identification or model number as specifically published in the appropriate agency listing or approval.

.8 Only those shop drawings that have been reviewed, signed and sealed by the fire suppression subcontractor's Registered Professional Engineer shall be submitted to the Consultant for review.

.9 The contractor's Registered Professional Engineer shall provide signed and sealed Province of BC Building Code Letters of Assurance Schedule B and Schedule C-B for the project.

.1 Some Cities or Municipalities may allow sprinkler contractors to perform limited amounts of sprinkler work (such as the relocation or addition of a limited number of sprinklers) under a Trade Permit, without the requirement of submitting Schedules B and C-B. Where this scenario is permitted by the City or Municipality, the sprinkler contractor may not, under the scope of this contract, break down the work and take out multiple Trade Permits in order to alleviate submitting Schedules B and C-B.

.10 The contractor's Professional Engineer shall provide field reviews of the work on site as the work progresses and submit signed copies of the reports to Stantec Consulting Ltd.

.11 Submit to the Authority Having Jurisdiction for their review and/or approval, complete sets of shop drawings and hydraulic calculations for each area.

.12 Arrange for, pay for and obtain a fire suppression system / sprinkler permit prior to commencing the fire suppression system installation.

.13 In addition to the foregoing documentation, submit shop drawings for the following items:

.1 Pipe, valves, fittings and grooved joint couplings.

.2 Sprinklers including all sprinkler types.

.3 Pre-action valves, control panels and devices.

1.6 SYSTEM DEMONSTRATIONS

.1 Refer to Section 21 05 00 re system demonstration requirements.

Part 2 Products

2.1 SPRINKLER PIPING AND FITTINGS - ABOVE GROUND

.1 Piping:

.1 Steel pipe, black or hot dipped galvanized, standard weight or lightwall, material and IPS dimensions conforming to NFPA 13 and ASTM A53, ASTM A135 or ASTM A795.

.2 Ductile iron pipe or copper pipe for the portion of the combined potable water and fire suppression system upstream of a ULC listed backflow prevention device, as per Section 21 12 00.

.3 CPVC piping is not acceptable for this project.

.2 Fittings:

.1 Compatible with the piping material and suitable for the maximum pressures in the system but not less than 1210 kPa [175 psig] working pressure.

.2 Welded fittings shall conform to ANSI B16.5, B16.9, B16.11 and B16.25 and ASTM A234.

.3 Threaded fittings conforming to ANSI B16.1, B16.3 and B16.4 are acceptable on minimum Schedule 40 steel pipe up to 150 mm [6"] diameter and minimum Schedule 30 steel pipe for 200 mm [8"] diameter and larger and shall have a ULC corrosion resistance ratio of 1.00 or greater.

.4 Grooved end fittings shall be ductile iron conforming to ASTM A536, and shall provide full flow design, short pattern, with flow equal to standard pattern fittings. Fittings, couplings and gaskets shall be of one manufacturer and shall provide a rigid joint. Grooving tools shall be of the same manufacturer as the grooved components. Standard of Acceptance: Victaulic FireLock™.

.5 Branch connections may be provided by bolted mechanical branch connections complete with synthetic rubber gaskets approved for line service. Standard of Acceptance: Victaulic Style 920920N and 922.

.6 Victaulic 922 outlet tees shall have cast upper and lower housings and may be used for up to 25 mm [1”] branch outlets and individual sprinklers.

.7 Victaulic "Pressfit System" of pipe and cold drawn carbon steel fittings with integral synthetic O-ring is not acceptable for this project.

.8 Grooved joint couplings shall consist of two ductile iron housing segments conforming to ASTM A536, pressure responsive gasket to ASTM D2000, and zinc electroplated steel bolts and nuts.

.1 Rigid Type: Housings shall be cast with offsetting angle-pattern bolt pads to provide rigidity and system support and hanging in accordance with NFPA-13. Couplings shall be fully installed at visual pad-to-pad offset contact. (Tongue and recess type couplings, or any coupling that requires exact gapping of bolt pads on each side of the coupling at specified torque ratings, are not allowed.)

.1 32 mm [1-1/4”] through 100 mm [4”]: Installation-Ready, for direct stab installation without field disassembly.

.2 Standard of Acceptance: Victaulic Style 107, Victaulic FireLock™ Style 005H or Victaulic Zero-Flex Style 07

.2 Flexible Type: For use only in locations where vibration attenuation and stress relief are required, and for seismic applications.

.1 Standard of Acceptance: Victaulic Installation-Ready Style 177 and Style 75 / 77.

.3 For dry pipe systems, use a FlushSeal® coupling gasket in rigid and flexible couplings where required by NFPA 13.

.1 Standard of Acceptance: Victaulic Style 005 Firelock and Style 75

.9 Submit requests for consideration of other products or systems in accordance with the submittal procedures, prior to the closing of this subtrade tender.

.3 The Victaulic Vic-Flex multiple use flexible stainless steel drop system may be used to properly locate sprinkler heads. The drop system shall be supplied with required supporting members and bracing.

2.2 VALVES

.1 Gate - 1210 kPa [175 psig] - Underwriters' Laboratories Canada (ULC) listed:

.1 12 mm - 50 mm [1/2” - 2”]: Standard of Acceptance:Jenkins 305-U, Crane 459, Nibco T-104-0, Kennedy.

.2 65 mm [2 ½”] and larger: Standard of Acceptance: Jenkins 825, Crane 467, Nibco F-607-0TS and F-607-RW, Kennedy; Grooved end valves shall be Victaulic Series 771.

.2 Butterfly/Ball - 2065 kPa [300 psig] - ULC or UL listed, and FM approved, with handwheel and weatherproof actuator housing:

.1 12 mm - 50 mm [1/2" - 2"]: Standard of Acceptance: Victaulic 728 Firelock ball valve with supervisory switch, Milwaukee BB-SCS Butterball slow close butterfly valve with indicator and integral supervisory switch, Nibco KT-505-8.

.2 50 mm - 300 mm [2" - 12"]: Standard of Acceptance: Victaulic Style 705 grooved end FireLock™ complete with factory installed double throw / single pole supervisory switches, and pressure responsive seat. The valve stem shall be offset from the disc centerline to provide full 360-degree circumferential seating.

.3 100 mm - 300 mm [4" - 12"]: Standard of Acceptance: Demco Series NE-H with tapped lug end design, Grinnell, Nibco L-002-N6 complete with gear operator and indicator.

.3 Pressure regulating sprinkler zone control valve - 2750 kPa [400 psig] - ULC listed:

.1 64 mm [2 ½"]: cast brass, straight pattern valve, rough brass finish with red wheel handle, female threaded outlet, 2760 kPa [400 psig] rated. Capable of field adjustment of the pressure.

.2 Standard of Acceptance: NFE model A203NB

.4 Test and Drain Valves - 1210 kPa [175 psig] - ULC listed

.1 25 mm and 50 mm [1" through 2"]: Forged brass or cast bronze construction, tapped 6 mm [1/4"] gauge outlet, and integral sight glass.

.2 Standard of Acceptance: Victaulic TestMaster II or NFE model A61

.5 Check - 1725 kPa [250 psig] - ULC listed/FM approved:

.1 65 mm [2 ½"] and larger: Standard of Acceptance:Victaulic Style 717 (grooved end valves), Jenkins 477, Crane 375, Mission, Nibco F-908-W.

.2 Provide a spool piece to ensure full check valve opening where adjacent an alarm or gate valve.

.6 Alarm, Dry Pipe, Preaction:

.1 ULC listed for automatic fire suppression sprinkler systems.

.2 Standard of Acceptance: FireFlex, Grinnell, Victaulic NXT Series, Viking.

.7 All valves shall be ULC listed for fire suppression systems.

.8 Where working pressure exceeds 1035 kPa [150 psig] provide 2060 kPa [300 psig] valves.

.9 Required air pressure for dry valves shall be 90 kPa [13 psig].

.10 All grooved end valves shall be of one manufacturer. Acceptable products: Victaulic.

.11 Valves shall be externally resettable.

.12 Valve internal components shall be replaceable without removing the valve from the installed position.

.13 All drain valves shall be provided with hose end adaptors complete with caps and chains, and auxiliary drains shall be provided with a drum drip.

2.3 SPRINKLERS

.1 Sprinkler body shall be glass bulb type, with a die-cast body. The body shall be integrally cast with a hex-shaped wrench boss to reduce the risk of damage during installation.

.1 Wrenches shall be provided by the sprinkler manufacturer that directly engage the hex-shaped wrench boss in the sprinkler body.

.2 Sprinklers with rubber O-rings are not permitted,

.3 All sprinklers shall be ULC listed for use in the occupancies in which they are to be installed.

.4 All sprinklers shall be quick response unless stated otherwise.

.5 All sprinklers shall be for commercial applications unless stated otherwise. Residential sprinklers are only permitted in residential areas of residential buildings.

.6 Sprinkler Types:

.1 Concealed Pendant – concealed, quick response, chrome plated flat cover plate, at locations as noted on the drawings including main entrances, foyers, boardrooms, and other similar high-profile locations.

.2 Recessed Pendent – recessed, quick response, glass bulb, chrome plated finish on sprinklers and escutcheons in all finished areas with ceilings except noted below.

.3 Standard of Acceptance: Viking

.7 All sprinklers in exposed areas subject to viewing by the occupants of the building shall be in chrome plated finish with chrome plated escutcheons. All sprinklers in service spaces, mechanical and electrical rooms and other spaces subject to view by the maintenance staff of the building may be in natural plain brass finish.

.8 Escutcheon plates shall allow accessible (T-bar) ceilings to be removed without removing sprinklers. Construction consists of a cup and skirt, the cup being the portion retaining the sprinkler and the skirt being the removable portion around the exterior perimeter of the cup that covers the tile hole. The finished escutcheon installation shall not project more than 4 mm [1/4”] below the finish ceiling surface. Recessed two-piece escutcheons and single piece escutcheons that are specifically manufactured with sprinklers to permit escutcheon and ceiling tile removable without sprinkler removal are also considered to be acceptable. The escutcheons shall match the sprinkler finish, be of the same manufacturer as the sprinkler and shall coordinate with architectural features of the building.

.9 Provide wire sprinkler guards in areas such as mechanical rooms, service rooms, below lower level stair landings, etc. where sprinklers are susceptible to mechanical damage or vandalism.

.10 Escutcheons and guards shall be listed, supplied, and approved for use with the sprinkler by the sprinkler manufacturer.

2.4 SPARE SPRINKLERS

.1 Provide a red baked enamel steel cabinet containing a minimum of 2 spare sprinklers of each pattern, but in addition, not less than the following of all types:

Number of Sprinklers	Total Spares
up to 300	6 minimum
300 - 1000	12 minimum
over 1000	24 minimum

Part 3 Execution

3.1 FIRE SUPPRESSION SPRINKLER SYSTEMS

.1 Supply and install fire suppression sprinkler systems throughout the building, in accordance with the listed codes, bylaws, standards and approvals including NFPA - 13 and the Province of BC Building Code.

.2 Test sprinkler systems to listed requirements and furnish a certificate stating that such testing has been carried out and approved.

.3 Provide inspector's test valves and drains at all remote points in the system to NFPA - 13 requirements.

.4 Supply and install fire suppression sprinkler systems in accordance with the general piping configuration depicted on the drawings. The sprinkler contractor shall hydraulically calculate the sprinkler systems in accordance with the following provisions:

.1 Such calculations shall be the responsibility of, and shall be signed and sealed by, the fire protection subcontractor's Registered Professional Engineer.

.2 Submit signed and sealed Province of BC Building Code Letters of Assurance Schedule B for the project to the Consultant and to the local Authority Having Jurisdiction in accordance with the Province of BC Building Code.

.3 Such calculations shall be based on the general piping configuration depicted on the tender and/or contract drawings.

.4 The water supply hydraulic data shall be confirmed in writing by the contractor with the water utility or the municipal authority prior to the submission of shop drawings.

.5 Supply and installation of the sprinkler systems based on the hydraulic calculations shall be the responsibility of the fire suppression subcontractor and their Registered Professional Engineer.

.6 Install piping to maximize headroom in all areas, including areas without ceilings where the piping is exposed, without interfering with other systems.

.7 Locate sprinklers in general conformance with the locations shown on the sprinkler design drawings. For exact locations refer to the architectural reflected ceiling plans. In the absence of reflected ceiling plans sprinklers shall be installed at the centre point, quarter point and/or third point in the long dimension of ceiling tiles, and in the center point of the short dimension of ceiling tiles, and/or in line with other ceiling elements, light fixtures, diffusers, audio devices and other fittings, in a symmetrical and aesthetic pattern acceptable to the Architect. Coordinate the sprinkler layout with architectural, structural, electrical and mechanical HVAC ceiling elements.

.1 The Victaulic Vic-Flex multiple use flexible stainless steel drop system may be used to properly locate sprinkler heads. The drop system shall be supplied with required supporting members and bracing.

.8 Do not install sprinklers that have been dropped, damaged, or show a visible loss of fluid. Never install sprinklers with cracked bulbs.

.9 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.

.10 At Ready-For-Takeover, and a minimum of 10 working days prior to the scheduled Occupancy date, submit 'Schedule C-B: Assurance of Professional Field Review and Compliance' to the Consultant and to the local Authority Having Jurisdiction in accordance with the Province of BC Building Code.

.11 Submit to the Consultant a completed Contractor's Material and Test Certificate for all fire suppression systems, and a provide copy in the project Mechanical Operation and Maintenance Manuals. All sections of the forms must be filled in completely and accurately and signed by the applicable persons. In addition to their signatures, their names must be legibly printed on each form.

3.2 PIPE AND FITTINGS

.1 All welding shall be done in the shop using welding fittings. Field welding is not permitted.

.2 Flanged pattern fittings shall be used for piping 200 mm [8"] diameter and larger, and at valve stations and fire department connections.

.3 Provide ULC listed expansion joints or flexible joint fitting assemblies at building expansion joints, building earthquake joints, building firewalls and all other locations as necessary.

.4 All grooved end components including valves, fittings, gaskets and couplings shall be of one manufacturer and shall be installed in accordance with the manufacturer's instructions.

.5 The grooved coupling manufacturer's factory trained representative shall provide on-site training for the contractor's field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review that the contractor is following their recommended practices in grooved product installation. Roll and cut grooves shall be made in conformance with the fitting manufacturer's written Standard Groove Specifications and within the listed dimensional tolerances. The contractor shall measure the groove dimensions and adjust the grooving machine rollers and cutters on a regular basis to ensure all grooves are within the manufacturer's written dimensional tolerances.

.6 Tie rods shall only be used in conjunction with fittings possessing integral tie lugs.

.7 Tie rods complete with their associated nuts and bolts shall be coated with two coats of asphaltic paint after installation.

3.3 FLUSHING OF SPRINKLER SYSTEMS

.1 Flush piping with water until effluent is clear and free of debris.

.2 Rate of flushing flows shall be as indicated in NFPA-13.

.3 Provide proper drainage for this flushing operation.

3.4 ELECTRICAL EQUIPMENT PROTECTION FROM WATER

.1 Sprinkler piping and sprinklers are to be installed in various areas containing electrical equipment as shown on the drawings.

.2 Responsibility for water damage to electrical equipment in these areas from the sprinkler system installation whether due to testing or leakage prior to the Owner's acceptance of the building shall be the responsibility of this Section.

.3 Provide and install in this Section of the work minimum 20-gauge sheet metal protective hoods individually located over all electrical equipment susceptible to water damage upon release of sprinklers in electrical areas. Such electrical equipment shall include all transformers, all equipment with ventilation grilles and all other switchgear with openings that will allow water entry into the electrical equipment.

.1 Protective hoods shall be sloped to allow shedding of water and shall project horizontally beyond the equipment perimeter and shall not be integrally mounted on the equipment unless prior approval has been obtained from the electrical authorities.

.2 Holes through protective hoods that cannot be avoided as in the case of transversing electrical conduit shall be sealed with an appropriate waterproof sealing compound.

END OF SECTION

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1 GENERAL

1.01 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.02 REFERENCE STANDARDS

.1 Perform work in accordance with the recommendations and requirements of:
- .1 National Fire Protection Association, NFPA 10 - Standard for Portable Fire Extinguishers.
- .2 B.C. Building Code.

2 PRODUCTS

2.01 FIRE EXTINGUISHER FE-1 (RECESSED CABINET WITH 5 LB)

.1 Fully recessed cabinet with 2.3 kg [5 lb.] ABC multipurpose dry chemical fire extinguisher

.2 Cabinet:
- .1 203 mm [8”] wide x 432 mm [17”] high x 127 mm [5”] deep fully recessed cabinet with 6mm [1/4”] turnback frame for minimum 127 mm [5”] wall thickness
- .2 22-gauge steel tub, 16-gauge steel door and trim with 5 mm [3/16”] clear tempered glass.
- .3 Full length semi-concealed piano hinge for 180-degree swing and flush stainless-steel door latch with no exposed fasteners
- .4 Gray baked enamel finish that can be used for either prime coat for field painting, or final finish.

.3 Extinguisher: steel cylinder with bottom skirt, polyester powder cost finish, waterproof stainless-steel gauge, stainless steel or aluminum valve body, rivets and gauge, handles with polyester powder coat finish, steel pull pin, matching wall hook, hose strap, hose and nozzle.

3 EXECUTION

3.01 INSTALLATION

.1 Install fire extinguishers in cabinets at locations as indicated on the drawings.

.2 Coordinate locations of fire extinguisher cabinets with the framing trades in order to facilitate recessed and semi-recessed installations.

.3 Mount fire extinguishers and cabinets such that the top of the extinguisher is at 1220 mm [4 feet] above the floor.

.4 Install fire extinguisher cabinet doors, glazing panels and fire extinguishers in the cabinets prior to the project substantial completion review by the Consultant.

3.02 IDENTIFICATION

.1 Identify fire extinguishers in accordance with the recommendations of NFPA 10.

.2 Attach a tag or label to all fire extinguishers, indicating the month and year of installation, with space for recording subsequent service dates.

END OF SECTION

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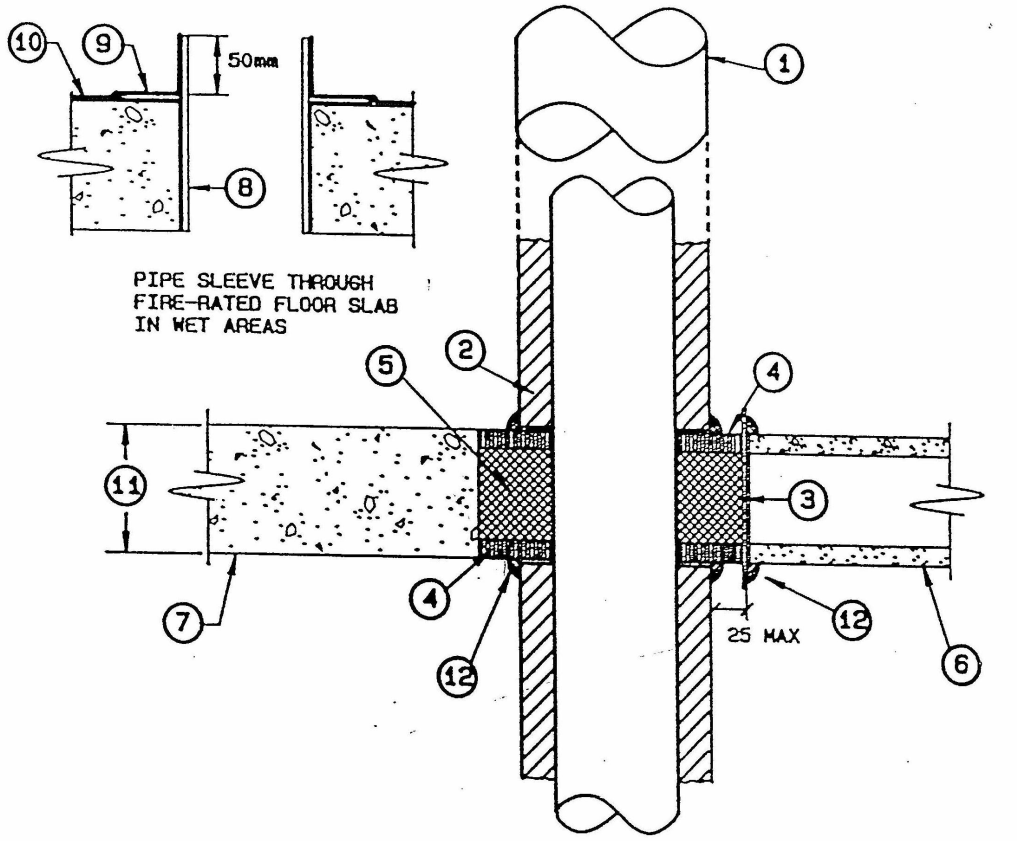
1.1 FIRE STOPPING



NOTES:

1 UNINSULATED PIPE.
2 INSULATION (AS SPECIFIED) TO BUTT UP TO FIRE STOP.
3 0.61mm (24 GA.) GALVANIZED STEEL SLEEVE (NOT REQ'D. FOR CORE DRILLED CONCRETE OPENINGS) (SEE NOTE 8 FOR WET AREAS).
4 MIN. 12mm (1/2") THICK - U.L.C. APPROVED FIRE STOP SEALANT. SEAL BOTH SIDES (TO MAINTAIN RATING ON GYPROC WALLS; TO RETAIN MINERAL WOOL INSULATION; TO SEAL VAPOUR BARRIER ON COLD PIPES).
5 MINERAL WOOL INSULATION - MANSON "CERAFIBER" OR CARBORUNDUM "FIBERFRAX" TIGHTLY PACKED.
6 FIRE RATED GYPROC WALL.
7 FIRE RATED CONCRETE FLOOR OR WALL.
8 PIPE SLEEVE (SCHED. 40).
9 FLANGE WELDED TO SLEEVE.
10 WATERPROOF MEMBRANE.
11 OVERALL THICKNESS OF MINERAL FIBER PACKING (5) AND FIRE STOP SEALANT (4) TO ENSURE REQUIRED FIRE - RESISTANCE RATING OF SEPARATION.
12 BEAD OF FIRE STOP SEALANT.
13 PIPE INSTALLATION TO ENSURE THAT NO PIPE EXPANSION OCCURS AT FIRESTOP.

DIVISION 22 TABLE OF CONTENTS

END OF SECTION

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Part 1 General

1.1 WORK INCLUDED

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 The Division 23 Common Work Results for HVAC shall govern the Division 22 Plumbing sections of the work (read in conjunction with Division 1). This section covers items common to Division 22 series sections and is intended only to supplement the requirements of Division 1 and 23.

.3 Refer to Section 23 99 60 Mechanical Forms and submit all documentation therein that is applicable to Division 22 Plumbing.

1.2 RELATED WORK

.1	Concrete	Division 3
.2	Electrical	Division 26

1.3 COORDINATION

.1 Systems indicated in Division 22 sections, located inside and/or on the roof of the building shall extend to a point 900 mm [36"] beyond the exterior face of the building.

.2 Plumbing drawings are diagrammatic and approximately to scale. They establish the scope of the work and the general location and orientation of the plumbing systems. The systems shall be installed generally in the locations and generally along the routings shown, close to the building structure and coordinated with other services. Piping shall be concealed within walls, ceilings or other spaces and shall be routed to maximize head room and the intended use of the space through which they pass, unless specifically noted otherwise.

1.4 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Where multiple versions of the same code are published, the most recent version shall be applied, unless noted otherwise by building codes and local by-laws.

.2 Installation, workmanship and testing shall conform to the following standards:

- .1 British Columbia Building Code
- .2 Local Building By-Laws
- .3 National Building Code of Canada
- .4 CSA Standard Z7396.1 Medical Gas Pipeline Systems
- .5 CSA Z317.1 Special requirements for plumbing installations in healthcare facilities

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 1 and Division 23.

.2 Shop drawings are required for all materials and equipment including, but not limited, to the following:

- .1 Cleanouts and access panels.
- .2 Floor drains.
- .3 Plumbing fixtures.
- .4 Trap primers.
- .5 Valves.
- .6 Water hammer arrestors.
- .7 Pipe, fittings and couplings.

.8 All medical gas equipment

.9 Fire stopping.

1.6 MAINTENANCE DATA

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

1.7 RECORD DRAWINGS

.1 Provide project record drawings for all plumbing systems as specified in Section 23 05 00 Common Work Results for HVAC.

.2 Submit hard copies of all “as-built” record drawings for inclusion in the paper maintenance manual.

.3 Provide digital files in pdf for inclusion in the digital format manuals.

.4 In addition to the requirements of the clause above, as a minimum, during the construction period, keep on site a clean set of drawings marked up, IN COLOUR, to reflect the 'As-Built' state, for examination by the Consultant on a regular basis. Include elevations, rough-in details and detailed locations of all hidden services, including locations of maintenance items and their associated identification code (ie. valves). All underground services and/or concealed piping shall be dimensionally located and noted (use gridlines or structure as the reference).

.5 At the time of 'Ready-For-Takeover' submit to the Consultant two complete full sized COLOUR Xerox copies of all As-Built state drawing information produced as per the above clause. Transfer the As-Built drawing mark-ups digitally using AutoCad onto, and by creating, Record As-Built Drawing “DWG” files. At the time of 'Ready-For-Takeover' submit to the Consultant, on a USB drive, all produced Record As-Built drawings DWG files, including reference files (XRefs, fonts, shapes, line type, plot/print profiles… consider using the E-Transmit function), and one PDF file for each DWG file produced.

1.8 OCCUPANCY DOCUMENTATION REQUIREMENTS

.1 Provide occupancy documentation for all plumbing work as specified in Section 23 05 00 Common Work Results for HVAC.

.2 The contractor shall submit the following documentation to the Consultant a minimum of 5 working days prior to the project occupancy site walk-through or occupancy date, whichever is scheduled first. The dates will be established by the project architect, project manager or Certified Professional. It is the contractor’s responsibility to provide all documentation to the Consultant in a timely manner. If all documentation is not received, the Consultant may not be able to issue their associated Schedule C-B in support of the building occupancy application and any associated consequences shall become the responsibility of the contractor.

.3 Seismic restraint system letters of assurance Schedules B and C-B from the plumbing contractor’s seismic restraint engineer.

.4 Letter confirming that all penetrations of rated assemblies have been firestopped in conformance with CAN4-S115, on the firestopping installing agencies letterhead.

.5 Copies of pressure test reports for all piping systems on contractor’s letterhead.

.6 Chlorination certificates for potable water systems.

.7 Balancing reports for domestic hot water recirculation systems.

.8 Plumbing inspector’s final certificate.

.9 Medical gas piping system test certificate.

.10 Medical gas system compliance certification.

.11 Maintenance manuals for plumbing systems.

1.9 TEMPORARY USAGE OF PLUMBING EQUIPMENT

.1 Plumbing equipment and systems shall not be used without the written permission of the Design Authority and in no circumstances shall be used prior to testing and inspection.

1.10 CHROMIUM PLATED PIPING

.1 Use strap wrenches only on chromium plated pipe or fittings. Surfaces damaged by wrench marks shall be replaced. Joints shall be threaded or slip joints.

1.11 EXISTING PIPING AND EQUIPMENT TO BE REMOVED

.1 All existing plumbing piping systems that become obsolete as a result of the work or depicted on the drawings for abandonment shall be removed, and/ or disposed of if the Owner declines to retain, in the following situations:

.1 Where specifically noted on the drawings for removal.

.2 Where plumbing piping systems are exposed.

.3 Where ceilings are opened-up for any reason that would permit such removal to be implemented. In such a case only those portions of the plumbing system that can be removed without taking down more ceiling shall be removed.

.2 All existing plumbing equipment that become obsolete as a result of the work or depicted on the drawings for removal shall be removed, and/ or disposed of if the Owner declines to retain.

.1 If the Owner is to keep the equipment, move to a location as identified by the Owner.

.3 Provide fire-stopping for all existing piping at fire separations.

1.12 ACOUSTICAL TREATMENT

.1 The insulation for wall, ceilings and pipe chases as outlined herein is to be provided and installed under another division of work. This section is responsible for ensuring that all special requirement for plumbing systems have been met before the wall or ceilings have been closed in.

.2 General Scope of Work

.1 All plumbing systems located in any walls or within 2 metres [6½'] in any direction of the enclosing walls of the following areas (or of similar areas not specifically named) shall be especially protected against noise transmission as defined herein:

.1 Conference rooms.

.2 Private offices.

.3 Quiet Rooms.

.3 Summary of Requirements

.1 Drain, Waste and Vent Stacks and Rainwater Leaders:

.1 Cast iron pipe and mechanical or neoprene compression gasket hub fittings shall be used. Plastic and copper piping are unacceptable. Waste piping over sound sensitive areas shall be insulated with pre-formed glass fiber insulation.

.2 Stubs from appliances in the kitchens or lounge areas may be copper, but a minimum length should be used.

.3 Waste connections from appliances and fixtures may be copper to the waste stack.

.4 All copper dry vent pipes in walls, chases and ceiling plenums shall be lagged with 25 mm [1"] preformed glass fiber pipe insulation, canvas

wrapped and sealed airtight and with one or more coats of heavy enamel paint.

.5 Rainwater leader chases shall be airtight and contain non-compressed RSI 2.11 [R-12] glass fibre insulation in the stud cavities.

.2 Domestic Water Operating Parameters:

.1 The maximum pressure at any faucet or outlet shall be 275 kPa [40 psi] with at least 10% of maximum rated flow through any pressure reducing valve in the system.

.3 Pipe Sizes:

.1 The minimum pipe size to faucets or mixing valves of each fixture shall be 12 mm [½"]. The use of 9 mm [⅜"] pipes is strictly prohibited.

.4 Plumbing Fixtures and Trim:

.1 Mixing Valves and Faucets: Quiet cartridge shall be used at mixing faucets and shower valves. Any which subsequently become noisy during the warranty period shall be replaced at no extra charge to the owner.

.2 Back-to-back Fixtures: Drain line and water supply lines shall be divided at the riser. Tee takeoffs serving back-to-back fixtures are not permitted.

.3 Quick Acting Valves: All solenoid operated, or other quick acting valves shall be equipped with water hammer arresters located as close to the valves as possible.

.5 Fastening to the structure:

.1 Piping shall not contact any framing stud or wall surface; or any other conduit, electrical or ventilation fixture that is connected to any wall or ceiling surface.

.2 Piping shall not be fastened to a partition which forms part of an adjacent room not served by the pipe in question. Do not secure piping to gypsum wallboard or its supporting frame.

.3 Riser clamps shall be isolated from the structure using an approved resilient material between the support collar and the floor structure (Vibro-Acoustics type SN, 30 durometer, 57.15 mm [2¼"] x 57.15 mm [2¼"] in size, or an approved equal). An alternate method is to wrap the pipe with neoprene prior to clamping.

.4 Pipe hangers shall be oversized to suit the insulation and shall have a protection shield between the insulation and the hanger.

.5 Pipe hangers shall contain 50 durometer, 3.2 mm [1/8"] thick neoprene pads inserted between the hanger saddle and pipe.

.6 Clearance Around Pipes:

.1 All pipe (bare or insulated) shall be clear of contact with studs or gypsum wallboard.

.2 Pipes in acoustically critical walls shall be wrapped with a minimum thickness of 6 mm [¼"] of Armaflex or Rubatex sleeving and secured by use of oversized clamps. This is not necessary where the piping is insulated if pipe clamps are mounted around the exterior of the insulation. Hard plastic pipe sleeves shall not be used.

.7 Wall and Slab Penetration by Pipes:

.1 Slab penetrating pipes shall be glass fiber wrapped prior to grouting. The grout shall not contact pipes.

.2 Gypsum wallboard or plaster wall pipe penetrations shall be 3 mm [⅛"] to 6 mm [¼"] oversized with the pipe centred in the hole and the gap caulked with silicone or other non-hardening sealant.

.3 Pipe expansion joints shall be for noise free operation.

.8 Ceiling, Wall and Other Plumbing Pipe Chases:

.1 The interior spaces shall be insulated with non-compressed RSI 2.11 [R-12] batt insulation in the following proportions:

.1 Ceiling plenum - 80% of area.

.2 Chases - 100% of all four vertical surfaces.

.3 Walls - 50% of space containing pipe, and 100% of adjacent stud space.

1.13 COLD WEATHER PROTECTION

.1 Roof Penetrations:

.1 All vent penetrations of roof structure shall be 100 mm [4"] minimum size.

1.14 SEISMIC PROTECTION

.1 Refer to Section 22 05 49 Seismic Restraint Systems for Plumbing Piping and Equipment.

1.15 BUILDING OPERATION DURING CONSTRUCTION

.1 In order to minimize operational difficulties for the building's staff, the Contractor must cooperate with the Owner throughout the entire construction period and particularly ensure that noise is minimized.

.2 Convenient access for the staff and public to the building must always be maintained . Minor inconvenience and interruption of services will be tolerated, provided advance notice is given, but the Contractor will be expected to coordinate his work, in consultation with the owner, so the operation of the facility can be maintained as nearly normal as possible.

.3 Contractor shall be aware, and thereby allow accordingly, that they will be working in Hospital areas and departments that are designated to be continuously in a 24 hour operation by hospital staff. As such the hospital's operation and department function shall not be disrupted or compromised in any way. Particular attention shall be given to related work in Patient, Staff, and Visitor occupied areas. In these areas, the work is to be performed during night time hours as follows:

.4 Monday through Fridays daily: 22:00 to 06:00. (Contractor to confirm the dates and hours with the owner).

.5 Saturdays and Sundays daily: 06:00 to 06:00. (Contractor to confirm the dates and hours with the owner).

.6 Night-time and weekend work are required for all shutdowns and connections into existing, and for the coordination (ie. planning) of such work. Allow for multiple shut-downs and re-charges, to accommodate the work. (Contractor to confirm the dates and hours with the owner).

.7 All work is to be performed within a protective environment. Provide and conform to Infection Control standards (see Section 01 15 10).

.8 The contractor shall ensure that on a daily basis, prior to turning work areas over for Hospital operation, the area is left clean and all systems are fully functioning. Allow for multiple shut-downs and re-starts/charges to accommodate the work/schedule and multiple phases.

.9 Contractor shall allow for, coordinate and arrange for all systems shut-downs and re-charges, as needed to realize the works, for multiple times, during night time hours as needed.

.10 In order to minimize disruptions to hospital operations, pipe freezing (by Nitro Pipe Freeze, http://www.nitropipefreeze.com/) may be required. To this end, include and provide and allow for 1 instance of pipe freezing (on domestic services at 2"ø pipe and 1"ø pipe diameter) plus 2 instance of pipe freezing (on domestic services at 1"ø pipe diameter) plus 2 instance of pipe freezing (on domestic services at 1 ¼" ø pipe diameter). Refer to drawings M201, M202 and M203. Disclose this cost value in the tendered bid as an included unit cost per instance, per pipe size. If pipe freezing is not required (ie. shut-downs can be accommodated by FMO by means of existing equipment/systems without negative impact on operations), then the total value amount(s) shall be returned to the Owner.

1.16 OTHER CONTRACTS ON THIS SITE

.1 Cooperation with respect to on-site coordination of all piping connections is an integral part of the responsibility of this section of the work all within the basic tender price. No extra cost will be allowed based on a failure to allow for scheduling of piping connections to produce a complete workable system whether shown on the drawings or not.

.2 Special coordination will need to be carried out with respect to capped off plumbing systems that are to be extended above slab within concealed architectural walls under a future contract. Dimensioned architectural drawings will be available to coordinate under slab piping installation with respect to future wall placement as an integral responsibility of this section of the work. These dimensioned architectural drawings shall be used for all wall dimension requirements where roughed-in plumbing is to be concealed in walls as shown on the drawings.

1.17 DIRECT DIGITAL CONTROL (DDC)

.1 The following equipment and systems shall include contacts and/or electronic relays as required as an integral part of the equipment supplied and installed in the Plumbing Section of the work to allow connection from such equipment to a DDC computer terminal in a location remote from each plumbing system location.

.2 The plumbing systems and each condition to be monitored and/or controlled within each plumbing system for remote readout on the DDC system is as follows:

.1 Domestic hot water recirc temperature

.2 Domestic hot water temperature

.3 Refer to Division 25 for further detail. Connection from plumbing systems equipment to DDC by Division 25.

1.18 EXISTING SERVICES

.1 Protect all existing services encountered. Every effort has been made to show the known existing services. However, the removal of concealing surfaces may reveal other existing services. Work with the Owner's staff to trace the originating source and points served. Obtain instructions from the Consultant when existing services require relocation or modifications, other than those already indicated in the Contract Documents.

.2 Arrange work to avoid shutdowns of existing services. Where shutdowns are unavoidable, obtain the Owner's approval of the timing, and work to minimize any interruptions.

.3 In order to maintain existing services in operation, temporary relocations and/or bypasses of piping may be required.

.4 Be responsible for any damages to existing system by this work.

.5 The Owner reserves the right to withhold permission for a reasonable period with respect to any shutdown, if shutting off a service will interfere with important operations.

Part 2 Products

2.1 PRODUCT CONSISTENCY

.1 All products utilized on the project shall be as per the shop drawing submissions.

.2 All products of a similar nature used in a similar system or application shall be of the same manufacturer throughout the project.

2.2 ACCESS DOORS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

2.3 CLEANOUTS

.1 Cleanouts shall be full size for pipe sizes up to 100 mm [4"] and not less than 100 mm [4"] on larger sizes. Cleanouts in inside finished areas shall all be of the same shape either round or square.

.2 Cleanouts passing through a waterproofed floor or a slab on grade subject to hydrostatic pressure shall possess a clamping collar which shall be clamped to the floor membrane or lead flashing.

.3 Pipe manufacturers' cleanouts are acceptable for vertical installation at the base of soil and waste stacks or rainwater leaders only.

.4 Make cleanouts with Barrett type fitting that has a bolted cover plate and gasket, fitting that has a threaded plug, or a cleanout ferrule that is installed in a wye or extended wye.

.5 Unfinished concrete area cleanouts shall be of heavy-duty construction and have a fully exposed scoriated cover. Standard of Acceptance: Zurn Z1400, Jay R. Smith 4229, Watts, Mifab

.6 Lino or lino tiled area cleanouts shall have the centre portion of cover recessed to receive a piece of tile that matches the adjoining tile. Standard of Acceptance: Zurn ZN 1400-X or ZN 1400-TX, Jay R. Smith 4140, Ancon, Mifab

.7 Terrazzo tile floor area cleanouts have the centre portion of cover recessed to receive terrazzo that matches the adjoining terrazzo finish. Standard of Acceptance: Zurn ZN 1400-Z, Jay R. Smith 4180, Ancon, Mifab

.8 Latex deck area cleanouts. Standard of Acceptance: Zurn ZN 1400-DX, Jay R. Smith DX4343/2646Y, Mifab

.9 Carpet area cleanouts shall be fully concealed with a small raised marker. Standard of Acceptance: Zurn ZN 1400-CM, Jay R. Smith 4020-Y, Ancon, Mifab

2.4 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

2.5 SERVICE PENETRATIONS IN NON-RATED FIRE SEPARATIONS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

2.6 FIRE STOPPING AND SMOKE SEAL MATERIALS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

2.7 MISCELLANEOUS METAL RELATED TO PLUMBING SYSTEMS

.1 Frames shall be of welded construction consisting of angle iron sections with 7.9 mm [5/16"] locating strips and anchoring lugs at a minimum of 900 mm [36"] centres.

.2 Cover plates shall be constructed of minimum 7.9 mm [5/16"] checker plate in sections not exceeding 0.93 square metres [10 ft^2] in size with lifting holes at each end of each section. Cover plates shall be provided complete with at least two lifting keys.

.3 Gasketing between frames and cover plates on sanitary systems shall be of rubber construction.

.4 Backing Plates shall be adequate to support the use intended and shall be a minimum 4.76 mm [3/16"] in thickness.

Part 3 Execution

3.1 PIPING INSTALLATION

.1 General:

.1 Install piping straight, parallel and close to walls and ceilings, with a fall of not less than 1:100 for gravity piping and with a slope to drain cocks, fixtures or equipment for all pressure piping unless otherwise indicated on drawings. Use standard fittings for direction changes. Provide drain cocks as required.

.2 Install groups of piping parallel to each other; spaced to permit application of insulation, identification, and service access, on trapeze hangers.

.3 Where pipe size differs from connection size to equipment, install reducing fitting close to equipment. Reducing bushings are not permitted.

.4 Brass and copper pipe and tubing shall be free from surface damage. Replace damaged pipe or tubing.

.5 Ream ends of pipe and tubes before installation.

.6 Lay copper pipe so that it is not in contact with dissimilar metal and will not be crimped or collapsed. All joints on cast or ductile iron pressure service piping shall be made electrically conductive.

.7 Install flanges or unions to permit removal of equipment without disturbing piping systems.

.8 Clean ends of pipes or tubing and recesses of fittings to be jointed. Assemble joints without binding.

.9 Install piping to connections at fixtures, equipment, outlets and all other appurtenances requiring service. Trap and vent waste connections to fixtures. Grade all vents to drain back to waste piping.

.10 Plug or cap pipe and fittings to keep out debris during construction.

.11 Jointing of pipe shall be compatible with type of pipe used.

.12 Non-corrosive lubricant or Teflon tape shall be applied to the male thread of threaded joints.

.13 Flush and clean out piping systems after testing.

.2 Equipment Drainage:

.1 Install drain valves at low points.

.2 Extend equipment drain piping to discharge into floor or hub drain.

.3 Expansion and Contraction and Building Seismic Joints:

.1 Support piping to prevent any stress or strain.

.4 Install pressure piping with loops and offsets which will permit expansion and contraction to occur without damaging the pressure piping system.

3.2 ACCESS DOORS

.1 Install access doors at all concealed cleanouts, traps, unions, expansion joints, valves, control valves, air vents, water hammer arrestors, special equipment, trap primers,

vacuum breakers and any other equipment for which subsequent periodic access will be required during the life of said equipment.

.2 Locate access doors so that all concealed items are readily accessible for adjustment, operation, maintenance and replacement.

.3 Do not locate access doors in feature walls or ceilings without the prior approval of the Consultant. Locate in service areas and storage rooms wherever possible.

3.3 CLEANOUTS

.1 Install cleanouts at the following locations:

.1 Building drain leaving building on the upstream side of exterior wall.

.2 Changes of direction of more than 45 degrees in drainage piping.

.3 Nominally horizontal branch or building drain at intervals of not more than 7.5 metres [25'] for pipe sizes 65 mm [2½"] and less, 15 metres [50'] for 75 mm [3"] and 100 mm [4"] pipe sizes, and 26 metres [85'] for pipe sizes larger than 100 mm [4"].

.4 Fixture drain of a sink, kitchen piping or grease waste piping at intervals not exceeding 7.5 metres [25'] for pipe all sizes.

.5 Base of soil or waste stacks and rainwater leaders.

.6 As called for by the applicable codes.

.2 Cleanouts which are located low on walls shall be located 75 mm [3"] minimum above the top of the baseboard or minimum 200 mm [8"] above finished floor level where there is no baseboard.

.3 Cleanouts shall be coordinated with all millwork and with all other obstructions, shall be placed in readily accessible locations and shall have enough clearance for rodding and cleaning.

.4 Extend cleanouts to the finished floor or wall unless exposed in a basement room, pipe tunnel or accessible crawlspace.

.5 Cleanouts in wet floor areas shall extend above the floor in walls or be provided with gasketed waterproofed tops.

.6 Cleanouts on outside drains shall be brought to grade and anchored in a concrete collar.

.7 Cleanouts serving hand hygiene sinks (HHS-1) shall be located a minimum of 150mm [6”] above the flood level trim of the fixture.

3.4 HANGERS AND SUPPORTS

.1 Refer to section 22 05 29 for Hangers and Supports for Plumbing Systems.

3.5 PIPE SLEEVES AND ESCUTCHEONS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

3.6 CUTTING, PATCHING, DIGGING, CANNING, AND CORING

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

3.7 MISCELLANEOUS METALS

.1 Refer to Section 23 05 00 Common Work Results for HVAC.

3.8 PIPING EXPANSION

.1 All piping systems, including all take-offs shall be so installed within the building that the piping and connected equipment will not be distorted by expansion, contraction or settling.

.2 If circumstances on the job require additional changes in direction from those shown on the drawings, the configuration shall be adjusted to suit at no extra cost.

.3 Anchors shall be installed where necessary to control expansion. Expansion joints or loops shall be installed on hot water piping where required.

3.9 TESTING AND INSPECTION

.1 Furnish all labour, materials, instruments, etc. necessary for all required tests. All work shall be subject to inspection by local plumbing inspector and review by the Consultant. At least forty-eight (48) business hours [2 business days] notice shall be given in advance of making the required tests for projects within 40 km of Stantec's Vancouver office.

.2 All leaks shall be corrected by remaking the joints. The systems shall be retested until no leaks are observed.

.3 No plumbing system or part thereof shall be covered until it has been inspected and approved by the Plumbing Inspector and UHNBC Facility Maintenance (FM). UHNBC FM should have an opportunity to inspect and approve the systems.

.4 If any plumbing system or part thereof is covered before being inspected or approved, it shall be uncovered upon the direction of the Plumbing Inspector or Consultant.

3.10 PROJECT PHOTOGRAPHS

.1 Contractor shall provide digital progress photographs in "jpeg" format to the Consultant. Submit the photographs via email in a regular, monthly basis (to review progress at the end of each month), in addition to as required for RFIs, and/or as requested by the Consultant.

.2 Provide additional digital photographs of the work as requested by the Consultant to assist in the resolution of RFIs, prior to covering the work.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Also refer to Section 22 05 48 Vibration Isolation for Plumbing Piping and Equipment, and Section 22 05 49 Seismic Restraint Systems for Plumbing Piping and Equipment.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 29 Hangers and Supports for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 The contractor is to arrange and pay for the services of a BC registered professional engineer to provide all required engineering services necessary for the complete design, sizing and detailing of all anchors and anchor supports to the structure required for the project. Submit details for approval.

.3 In addition to the piping, equipment and systems listed in Section 23 05 29 provide hangers and supports on all plumbing piping and equipment including:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Domestic tempered water and recirculation.
- .4 Sanitary waste and venting.
- .5 Storm drainage.
- .6 Medical gases and vacuum piping systems.

.4 Hangers, threaded rods, nuts and associated components for hanging of under-slab piping shall be stainless steel and shall be fixed to the foundation or structural slab.

.5 Spacing of hangers shall comply with B.C. Building Code.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Also refer to Section 22 07 19 Plumbing Piping Insulation.

.3 Also refer to Section 22 05 33 Heat Tracing for Plumbing Systems.

1.2 DESCRIPTION OF WORK

.1 Furnish and install a complete CSA Certified and FM Approved system of heating cables and components, listed specifically for maintaining domestic hot water temperatures at selected temperatures.

Part 2 Products

2.1 GENERAL

.1 Operating temperature range: 40°C [105°F] to 60°C [140°F] (red).

.2 Temperature shall be maintained by utilizing an electronic controller with straight runs of heating cable on the pipe.

.3 Standard of Acceptance:

.1 Raychem HWAT 140oF HWAT-R2 (red)

2.2 HEATING CABLES

.1 The self-regulating heating cable shall consist of two (2) 16 AWG nickel-coated radiation-crosslinked conductive polymer core. It shall be covered by a radiation-crosslinked, polyolefin dielectric jacket surrounded by polymer-coated aluminum wrap and enclosed in a tinned copper braid of 14 AWG equivalent wire size. The braid shall be covered with a (nominal) 40 mil polymer outer jacket, colour coded for easy identification.

.2 The cable shall have a minimum cut-through resistance of 100lb per the IEEE 515.1 and CSA 130-03 Resistance to Cutting Tests. The cable shall have a minimum impact resistance of 10 ft-lbs per the IEEE 515.1 and CSA 130-03Impact Tests. The cable shall have a minimum abrasion resistance of 2500 cycles per the IEEE 515.1 Abrasion Test. The cable shall withstand a crush resistance of 225 lbs per the IEEE 515.1. Deformation Test and withstand a crush resistance of 345 lbs per the CSA 130-03 Crush Resistance Test.

.3 The heater shall operate on a line voltage of 208 volts.

.4 All heating cable connection kits shall be CSA Certified and FM Approved for use as part of the system to maintain hot water temperature. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating cable core to expose the bus wires. Connection systems requiring the installing contractor strip the bus wires, or which use crimp or terminal blocks, shall not be acceptable. All connection kits except for the power connection shall be installed under the thermal insulation. The end seal shall use silicone gel.

2.3 CONTROLLER

.1 Provide a controller for each system designed specifically for use with hot water temperature maintenance systems.

.2 Standard of Acceptance:

.1 Raychem HWAT - ECO

.3 Installed system shall include at least one agency-approved electronic controller. The controller shall not be of line sensing over-limit design.

.4 The controller shall be capable of setting different pipe temperatures based on ambient and voltage with 24-hour, 7 day/week programmable options, energy savings, BMS interface capabilities and flexible wiring configurations to operate individually or control up to eight additional controllers.

2.4 FIBERGLASS TAPE

.1 Standard of Acceptance: Raychem GT-66

Part 3 Execution

3.1 INSTALLATION

.1 Install self-regulating heating cables and components on domestic hot water supply piping mains and risers as indicated on the plans and specifications after the piping has been pressure tested, but before the thermal insulation is applied. Secure the heating cable to the piping with fiberglass tape.

.2 Apply "electric heat traced" signs to the outside of the thermal insulation jacketing.

.3 Install the system in accordance with the drawings and the manufacturer's instructions. The installer shall be responsible for providing a functional system, installed in accordance with applicable local, Provincial and National requirements.

.4 Provide each electrical circuit with a appropriately sized ground-fault protection device.

3.2 PIPE INSULATION

.1 Note: On pipe 32 mm [1 ¼"] and smaller, provide insulation that is oversized by 6 mm [¼"] to allow room for properly installing the insulation over the heating cables. On pipes 75 mm [3"] and larger, the thickness of insulation may be equal to the pipe diameter with one heating cable or 1/3 the pipe diameter with two runs of heating cable.

.2 Pipe routed through unheated areas including parking garages are to have minimum 75 mm [3"] insulation thickness.

3.3 TESTS

.1 After installation and before and after installing the thermal insulation, test all heater cables using a 2500 VDC megger. The heater circuits shall be continuous and megger readings shall be at least 1000 megohm regardless of the heater length. Repair or replace circuits yielding unacceptable readings.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Also refer to Section 22 05 48 Vibration Isolation for Plumbing Piping and Equipment.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 49 Seismic Restraint Systems for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 49 provide seismic restraints on all plumbing piping and equipment including the following:

.1 Domestic cold water.

.2 Domestic hot water and recirculation.

.3 Domestic tempered water and recirculation.

.4 Sanitary waste and venting.

.5 Storm drainage.

.6 Medical gases and vacuum piping systems.

1.3 DOCUMENT SUBMITTALS

.1 Provide letters of assurance signed and sealed by the contractor’s specialist registered Professional Engineer.

.2 The contractor’s Professional Engineer shall provide field reviews of the work on site as the work progresses and submit signed copies of the reports to the Consultant.

.3 The contractor’s Registered Professional Engineer shall provide signed and sealed Province of BC Building Code Letters of Assurance Schedule B and Schedule C-B for the project.

.4 Submit Schedule B to the Consultant and to the local Authority Having Jurisdiction at the time of the shop drawing submission.

.5 Submit Schedule C-B to the Consultant and to the local Authority Having Jurisdiction a minimum of 10 working days prior to Occupancy.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Refer to Section 23 05 53 Identification for HVAC Piping and Equipment. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 05 53 provide identification on all plumbing piping, valves and equipment including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Domestic tempered water and recirculation.
- .4 Sanitary waste and venting.
- .5 Storm drainage.
- .6 Medical gases and vacuum piping systems.

.3 Identification of all medical gas systems must comply with the requirements of the applicable CSA Standard where the requirements of that standard exceed these specifications. Refer to Section 22 63 02.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 23 05 93 Testing, Adjusting & Balancing for HVAC. Comply with all requirements of that Section of work as related to General Requirements, Products and Execution.

.3 Also refer to Section 22 08 00 Commissioning of Plumbing Systems.

1.2 SCOPE OF WORK

.1 In addition to the piping, equipment and systems listed in Section 23 05 93 provide testing, adjusting and balancing for all plumbing piping, equipment and systems including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Domestic tempered water and recirculation.
- .4 Sanitary waste and venting.
- .5 Storm drainage.
- .6 Medical gases and vacuum piping systems.

.2 Balancing of the domestic hot water and tempered water recirculation systems by a recognized balancing agency and submission of a balancing report is mandatory.

.3 Pressure test all plumbing piping systems in accordance with the specific requirements of the specification sections that describe those systems.

.4 Medical gas systems are to be tested by a certified independent testing agency selected by the Owner and retained by the Owner.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Also refer to Section 22 07 16 Plumbing Equipment Insulation.

1.2 REGULATORY REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the B.C. Building Code and NFPA 90A. Generally, the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.2 Insulation thickness and insulating values shall be in accordance with NRC National Energy Code of Canada for Buildings (NECB).

1.3 SCOPE OF WORK

.1 Refer to Section 23 07 19 HVAC Piping Insulation. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping and systems listed in Section 23 07 19 provide piping insulation on all plumbing piping systems including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Service hot water and recirculation 82°C [180°F].
- .4 Domestic tempered water and recirculation.
- .5 Storm drainage piping for the full length of the systems located within the building and the underside of drain bodies.
- .6 Sanitary waste and p-traps, grey and black water systems in exterior and unheated areas.
- .7 All piping provided with heat tracing cable for freeze protection, domestic hot water temperature maintenance, or grease waste lines in unheated areas.
- .8 Offset waste piping, p-traps and supplies under all wheelchair accessible lavatories and sinks.
- .9 Sanitary vent stacks for the last 3 meters [10 feet] prior to penetrating the roof or penetrating a cold attic or similar space.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Refer to Section 23 08 00 Commissioning of HVAC. Comply with all requirements of that Section of work as related to general requirements, products and execution.

.2 In addition to the piping, equipment and systems listed in Section 23 08 00 provide commissioning of all plumbing piping, equipment and systems including the following:

- .1 Domestic cold water.
- .2 Domestic hot water and recirculation.
- .3 Domestic tempered water and recirculation.
- .4 Sanitary waste and venting.
- .5 Storm drainage.
- .6 Medical gases and vacuum piping systems.

.3 Commissioning related to plumbing systems shall include the start-up, set up, adjustment and recording of the operational data of at least all the following systems and components as related to the project:

- .1 Domestic water heater temperature set points.
- .2 Central and individual tempered water mixing valve set points.
- .3 Balancing of the domestic hot water recirculation systems.
- .4 Setting of temperature limit stops on all shower valves with maximum temperatures recorded for each fixture.
- .5 Operation of all plumbing fixtures including adjustments of all flush valves.
- .6 Verification of pump operation.
- .7 Set points for all control devices.
- .8 Testing and certification of all backflow preventers.

.4 Medical gas systems are to be commissioned by a certified independent commissioning agency selected by the Owner and retained by the Owner. Refer to Section 22 63 02.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Domestic water systems include domestic cold water, domestic hot water, domestic tempered water and domestic water re-circulation systems.

.2 Interior domestic water piping shall be provided as depicted on the drawings to all plumbing fixtures, appliances and equipment that require domestic water service.

.3 New interior domestic water piping shall be connected to receive domestic water supply from the existing domestic water piping as depicted on the drawings.

.4 Non-functioning existing interior domestic water piping shall be removed where access is readily available or capped off and abandoned in place as referenced on the drawings.

.5 Refer to Section 21 05 00 Common Work Results for Fire Suppression where domestic water supply and supply to fire suppression systems are combined in one common supply line.

1.3 CROSS CONNECTION CONTROL

.1 All installations shall be in accordance with the recommendations contained in the latest edition of the Cross-Connection Control Manual published by Pacific Northwest Section of the American Water Works Association.

.2 Double check valve assemblies and reduced pressure principle backflow prevention devices shall have approval from the Foundation for Cross Connection Control, University of Southern California.

.3 Vacuum breakers shall conform to the requirements of C.S.A. B64.5.

.4 Following installation, a test report completed by a certified tester shall be submitted to the Owner, indicating satisfactory operation of each device.

.5 Tests are to be conducted in the period 30 to 60 days prior to date of Ready-For-Takeover.

.6 Provide one repair kit for every cross-connection control device installed.

Part 2 Products

2.1 PIPE AND FITTINGS

.1 Above ground water pipe and fittings inside the building:

.1 Copper:

.1 Cold water:

.1 Type 'K' hard drawn seamless copper tubing to ASTM B88 or copper pipe to ASTM B42. All copper water tubing shall be certified by the Canadian Standards Association or Warnock Hersey Professional Services Ltd. to ASTM B88.

.2 Hot water:

.1 Type 'K' hard drawn seamless copper tubing to ASTM B88 or copper pipe to ASTM B42. All copper water tubing shall be certified by the Canadian Standards Association or Warnock Hersey Professional Services Ltd. to ASTM B88.

.3 Fittings

.1 Above ground copper water pipe fittings inside the building:

.2 Use of the 'T-Drill' system of joining copper piping is not acceptable.

.3 Cast brass or wrought copper solder joint pressure fittings with 95/5 Sn/Sb or Silvabrite 100 solder joints; or

.4 Cast bronze or wrought copper roll grooved pressure fittings with grooved mechanical pipe connector couplings with angle bolt pad and Victaulic style of 'flush seal' gaskets or Shurjoint ‘Gap Seal’ gaskets.

.5 Standard of Acceptance:

.1 Victaulic 'The Copper Connection System for Copper Tubing (CTS)' with 606 couplings, 600 Series fittings and 641 flange adaptors.

.6 Exception: Where compression fittings are required they shall be to ANSI B16.22

2.2 VALVES

.1 General

.2 Certified lead free and contaminant free, and NSF-61 compliant.

.1 Gate: (for shut-off and isolation)

.1 NPS 2 and smaller:

.1 Standard of Acceptance:

.1 Soldered. Kitz 807

.2 Threaded Kitz 808

.2 NPS 2½ and larger: flanged,

.2 Ball: (in lieu of gate valves or as specified)

.1 NPS 2 and smaller:

.1 Standard of Acceptance:

.1 Soldered.

.2 Threaded

.3 Butterfly: (in lieu of gate valves or as specified,)

.1 NPS 2½ and larger: flanged, full lug body,

.2 to MSS-SP-67, ANSI 150 temperature and pressure rating and suitable for working pressures up to 1720 kPa (250 psig) at 100°C (212°F)

.1 Factory tested to minimum of 2067 kPa (300 psig) at 37.8°C (100°F)

.4 Globe: (for throttling, bypass and make-up applications)

.1 NPS 2 and smaller:

.1 Standard of Acceptance:

.1 Soldered.

.2 Threaded

.2 NPS 2½ and larger: flanged,

.5 Swing Check Valves: (for horizontal installation only)

.1 NPS 2 and smaller:

.1 Standard of Acceptance:

.1 Soldered.

.2 Threaded

.2 NPS 2½ and larger: flanged,

.6 Balance: (for domestic hot water recirculation)

.1 Lead free, NSF/ ANSI 61 & 372 certified, automatic flow limiting valve specifically designed for domestic potable water applications, threaded ends..

.2 Standard of Acceptance:

.1 Nexus UltraMatic UMNL up to 25mm [1”]

.7 Pressure Reducing Valves

.8 Pressure reducing valve with integral low flow bypass:

.9 Vacuum relief: (for DHW tanks)

.10 Drain Valves:

.11 Solenoid Valves:

.12 Mixing Valves (tempered water):

.1 Refer to Section 22 40 00 Plumbing Fixtures.

.3 Vacuum Relief Valves: (for DHW tanks)

.1 860 kPa [125 psig] rating.

.1 Standard of Acceptance:

.1 Watts 36A, Cash Acme

.4 Pressure Reducing Valves:

.1 6 mm [¼"] to 9 mm [3/8"] ,860 kPa [125 psig] rating.

.1 Standard of Acceptance:

.1 Watts 215, Cash Acme, Singer.

.2 12 mm [½"] to 50 mm [2"], 860 kPa [125 psig] rating.

.1 Standard of Acceptance:

.1 Watts 223, Braukman, Conbraco, Cash Acme, Singer.

.3 65 mm [2½"] and larger, 860 kPa [125 psig] rating.

.1 Standard of Acceptance:

.1 BCA 317 PR, Clayton 90 or 90B, Singer 106PR.

.5 Pressure reducing valve with integral low flow bypass:

.1 40 mm [1½"] and larger, 860 kPa [125 psig] rating.

.1 Standard of Acceptance:

.1 Watts PV-10-06M, Clayton, Singer, Wilkins.

.6 Drain Valves:

.1 Ball type with outlet with hose threads, brass body, cap & chain and chrome plated brass ball.

.1 Standard of Acceptance:

.1 Kitz 58CC, Red & White / Toyo 5046, Dahl.

.7 Solenoid Valves:

.1 Slow-closing forged brass body, Buna "N" disc, stainless steel parts, enclosure to suit environmental conditions, UL and CSA approved, 120 volt.

.1 Standard of Acceptance:

.1 ASCO

.8 Mixing Valves (tempered water):

.1 Refer to Section 22 40 00 Plumbing Fixtures.

2.3 VACUUM BREAKERS

.1 Pressure type:

.1 CSA approved, mechanically independent spring-loaded poppet type check valve with a downstream spring loaded air inlet valve, with upstream and downstream isolation valves and test cocks.

.1 Standard of Acceptance:

.1 Cla-Val 27, Conbraco 40-500, Febco 765, Watts 800, Wilkins 720A

.2 Atmospheric type:

.1 CSA approved, bronze body, chrome plate finish where exposed.

.1 Standard of Acceptance:

.1 Conbraco 38-100; Febco 710 / 715A; Watts 288A, 288AC; Wilkins 30; Rainbird

.3 All vacuum breakers shall be sized in accordance with the following table:

Pipe Size mm [in.]	Pressure Type Size mm [in.]	Atmospheric Type Size
12 - 25 [½ - 1]	12 [½]	Full Pipe Size
30 - 40 [1¼ - 1½]	19 [3/4]	Full Pipe Size
50 - 75 [2 - 3]	25 [1]	Full Pipe Size

2.4 STRAINERS

.1 Sized on a 4 to 1 ratio of basket open area to connecting pipe cross-sectional area, 'Y' pattern, 304 stainless steel screen.

.1 50 mm [2"] and smaller: threaded ends, bronze body, 1034 kPa [150 psig] rating.

.1 Standard of Acceptance:

.1 Red & White / Toyo 380, Crane 988-1/2, Armstrong, Muessco, RP&C 59, Sarco (Canada), Kitz 15.

.2 65 mm [2½"] and larger, flanged ends, cast iron body, 860 kPa rating.

.1 Standard of Acceptance:

.1 Red & White / Toyo 381A, RP&C 531, Crane 989-1/2, Armstrong, Muessco, Sarco (Canada), Kitz 80.

2.5 WATER HAMMER ARRESTORS

.1 Bellows or piston manufactured style with stainless steel casing and welded stainless steel nesting bellows if of the bellows style. Air chambers are unacceptable.

.1 Standard of Acceptance:

.1 Zurn Z-1700 Series bellows style, Jay R. Smith, Ancon, Amtrol, Watts; Precision Plumbing Products Inc. piston style.

2.6 THERMOMETERS AND PRESSURE GAUGES

.1 Refer to Section 22 05 20 Thermometers and Pressure Gauges.

2.7 TEMPERATURE AND PRESSURE RELIEF VALVES

.1 A.S.M.E. rated for the energy input to the system and the pressure rating of the equipment.

.1 Standard of Acceptance:

.1 Watts, Cash Acme.

2.8 PIPE JOINTS

.1 Solders and fluxes having a lead content and self-cleaning acid type fluxes are not acceptable.

.2 All copper to steel or iron and flanged adaptors shall be brass, not copper.

.3 All unions or similar interconnections between dissimilar metals shall be dielectric couplings.

.1 Standard of Acceptance:

.1 Epco Dielectric Pipe Fittings, Victaulic dielectric waterway

2.9 AIR VENTS

.1 Automatic float type, 1035 kPa [150 psig] max. operating pressure.

.1 Standard of Acceptance:

.1 Armstrong 11-AV, Maid-o-Mist 71, Taco 426, Amtrol.

2.10 TRAP SEAL PRIMERS

.1 Flow Actuated Type:

.1 Provide flow actuated type priming device piped to nearest fixture so that device will introduce regulated amount of water into trap whenever fixture is used.

.2 Standard of Acceptance:

.1 Watts A200-T, Zurn, Watts, Jay R. Smith

.2 Pressure Activated Type:

.1 Provide pressure actuated type priming device piped where the nearest fixture is remote to the floor drain requiring trap priming.

.2 Standard of Acceptance: Precision Plumbing Products Model P-1

Part 3 Execution

3.1 CONCEALED SUPPLY PIPING

.1 Concealed water supply piping to plumbing fixtures, trim items, equipment, hose bibbs, etc. shall be installed using cast brass 90 degree drop ear elbow or drop ear tees as the piping design dictates.

.2 Blocking shall be provided within the concealed space and the elbows and tees shall be secured to the blocking using brass screws to provide a rigid installation.

3.2 VALVE INSTALLATION

.1 Combined domestic and fire suppression systems:

.1 Coordinate with the fire suppression contractor regarding all valves in piping systems that serve both domestic and fire suppression systems. These valves shall be ULC and / or FM labeled for use in fire suppression systems and shall be provided with supervisory switches for monitoring their valve position by the fire alarm system.

.2 Where possible, disassemble solder end joint valves before soldering.

.3 Where disassembly and the subsequent reassembly is not possible, the contractor shall give special regard to solder jointing in order not to damage, melt or deform and valve parts.

.4 Shut Off Valves:

.1 Install shut-off or isolation valves whether shown on the drawings or not at the following locations:

.1 At the point where the water service first enters the building.

.2 At the base of each building riser.

.3 At each main branch supply point; provide a valve on each outlet leg from the tee or cross.

.4 At each single plumbing fixture (i.e. normally this requirement is satisfied by the provision of the angle valve specified with the specific fixture).

.5 At each single piece of equipment.

.6 At all points as indicated on the drawings.

.7 At all points where the plumbing code requires same.

.5 Balancing Valves:

.1 Install circuit balancing valves in hot water recirculating branch mains and branch connections to return mains whether indicated on drawings or not.

.6 Drain Valves:

.1 Install drain valves 18 mm [3/4"] minimum, or line size where the piping is smaller than 18 mm [3/4"].

.2 Install a hose-end adaptor, cap and chain on the discharge side of each drain valve or pipe to drain where indicated.

.7 Mixing:

.1 On both the up-stream hot and cold supplies, in an accessible location, provide positive swing check valves and strainers. This is a requirement in addition to any check valve device that is common to the mixing valve. Where required, provide an access panel to the check valves and strainers.

3.3 VACUUM BREAKER INSTALLATION

.1 Install at each fixture or item of equipment where contamination of the domestic water system can occur.

.2 Vacuum breaker installation shall be in complete accordance with Clause 1.3 Cross Connection Control and with the manual "Cross Connection Control Manual" published by the Pacific Northwest Section of the American Water Works Association.

.3 Vacuum breaker installation shall be in complete accordance with the manual "Cross Connection Control Manual" published by the Pacific Northwest Section of the American Water Works Association.

.4 All atmospheric type vacuum breakers shall be installed at least 300mm [12"] above flood level rim of fixture.

.5 All vacuum breakers serving fume hoods shall be installed outside fume hood.

.6 Provide drain pan with water deflecting enclosure on concealed pressure type vacuum breakers with drain line to appropriate drain.

.7 Complete testing of all vacuum breakers shall be carried out under this section of the work prior to final acceptance of plumbing systems. A certificate shall be submitted duly signed and witnessed that testing was satisfactory.

3.4 STRAINER INSTALLATION

.1 Install strainer blow-off connections.

.2 Blow-off connections shall be full drain connection size and shall include:

.1 Up to 50 mm [2"] - nipple and cap (hot services).

.2 65 mm [2½"] and larger - nipple, globe valve and nipple (hot services).

.3 All sizes (cold services) - plug the blow-off connection only.

3.5 PRESSURE GAUGES

.1 Install pressure gauge at all pump suction and discharge points and at each pressure reducing station inlet and outlet.

3.6 WATER HAMMER ARRESTORS

.1 Size in accordance with the Plumbing and Drainage Institute PD1-WH-201 sizing procedures.

.2 Install on branch lines to flush valves, solenoid valves, self-closing faucets, quick closing valves and on refrigeration, kitchen and laundry equipment incorporating solenoid valves.

3.7 PIPE JOINTS

.1 Install dielectric type couplings where copper piping and accessories connect to plumbing equipment such as steel storage tanks, pressure reducing stations and ductile iron pipe.

.2 Where the water service enters the building terminate at the edge of the building and excavation with a Smith Blair standard sleeve coupling having stainless steel nuts and bolts. Bridge the excavation with ductile iron pipe.

.3 Tie rods shall only be used in conjunction with fittings possessing integral tie lugs.

.4 Tie rods complete with their associated nuts and bolts shall be coated with two coats of asphaltic paint after installation.

3.8 AIR VENTS

.1 Install at all high points in domestic hot water recirculation system.

.2 Install on tees and not on horizontal piping or radiused elbows.

.3 Install 12 mm [½"] minimum isolating gate valve ahead of each air vent.

.4 Pipe all air vent discharge connections separately to nearest building drain using 6 mm [¼"] hard drawn copper.

3.9 TRAP SEAL PRIMERS VALVES

.1 Provide floor drain trap primers in watercloset rooms and other areas connected to the sanitary sewer in accordance with the plumbing code and as designated on the drawings.

.2 Locate at locations that are readily accessible by the building maintenance staff.

3.10 TESTING AND INSPECTION

.1 Testing shall consist of hydraulic pressure testing at 1,400 kPa [200 psig] for 8 hours.

.2 Submit signed and dated pressure test reports for all sections of the water distribution systems.

3.11 FLUSHING AND CHLORINATION OF WATER LINES

.1 Thoroughly flush all water piping so that it is free from scale, sediment and debris as soon as possible after the system is filled with water.

.2 On completion of installation and testing, all water piping shall be pre-flushed, chlorinated and flushed again in accordance with AWWA C-601.

.3 Retain a reputable firm qualified to supervise and inspect the chlorination and flushing procedures and perform chemical biological tests as required.

.4 The piping shall be chlorinated so that a chlorine residual of not less than 10 ppm remains in the water after standing for 24 hours. Hypochlorite and water is recommended as a disinfectant. AWWA C-601 recommends the amount of chlorine required.

.5 Submit to the Consultant a certificate from the testing firm stating that chlorination and flushing has been successfully completed.

.6 On projects with water piping being connected to the existing water distribution system including system piping modifications, piping extensions, tenant fit outs etc. flushing and

chlorination of all new piping remains a requirement. Provide all required isolation, fill and drain valves required to flush and chlorinate the new piping without impacting the existing system piping.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 Interior sanitary waste and vent piping shall be provided as depicted on the drawings to plumbing fixtures that will discharge sanitary waste and shall be connected to discharge to the existing sanitary waste piping as depicted on the drawings.

.2 Interior storm drainage piping and rainwater leaders shall be provided as depicted on the drawings from roof drains, area drains, planter drains and catchbasins that will discharge storm drainage or clear unpolluted wastewater and shall be connected to discharge to the existing storm drainage piping as depicted on the drawings.

.3 Non-functioning existing interior sanitary waste piping shall be removed where access is readily available or capped off and abandoned in place as referenced on the drawings.

Part 2 Products

2.1 INTERIOR DRAIN, WASTE AND VENT PIPE AND FITTINGS

.1 Above ground pipe and fittings:

.1 Class 4000 cast iron mechanical joint pipe and fittings with mechanical joint stainless-steel couplings to CSA CAN3-B70 up to 200 mm [8"].

.2 DWV copper drainage pipe with cast brass or wrought copper drainage pattern fittings with recessed solder joints.

.2 Additional Requirements

.1 Pressure waste piping from pumping stations and other equipment shall be pressure piping and fittings as specified for domestic water.

.2 Plastic (PVC or ABS) piping where used underground shall adapt to approved non-plastic material prior to penetration above the building slab.

.3 Class 4000 mechanical joint cast iron soil pipe, fittings and mechanical joint couplings shall be of one manufacturer.

.4 Copper to cast iron joints shall be male brass adaptors to tapped fittings.

.5 Nipples shall be cast iron or heavy brass.

2.2 FLOOR DRAINS

.1 Floor drains connected to the sanitary system shall include trap primer connections.

.2 Floor Drain FD-1: (standard for Tub Shower room 220 and showers).

.1 Cast iron floor drain with secondary drainage flange and 125 mm [5"] diameter nickel bronze strainer. Cast iron non-plated parts to be coated for rust prevention.

.2 Standard of Acceptance: Zurn ZN-415-B-P, Watts, Jay R. Smith, Mifab

Part 3 Execution

3.1 FLOOR DRAINS

.1 Install floor drains set low to provide proper drainage.

.2 Generally do not locate floor drains in the center of mechanical rooms. Locate floor drains in close proximity to the equipment and / or devices that will be discharging water to them, such that drain connections from the equipment and / or devices can be piped to the floor drains without creating a tripping hazard.

.3 Do not locate floor drains in front of doors.

.4 Water piping from trap primer to floor drain to be PEX tubing where cast into concrete and protected in a polyethylene sleeve where buried below slab. Provide Type L copper where exposed within the building.

3.2 SAFES, FLASHING AND VENT TERMINALS

.1 Terminate all vent terminals a minimum of 25 mm [1"] above the water level at which roof drainage overflows through roof overflow scuppers or drains.

.2 All cleanouts passing through walls or floors subject to hydrostatic pressure and waterproofed by means other than a membrane shall be provided with clamping collars and flashings of 25 kg/m ² [5 lb/ft²] lead.

.3 Supply and fix 25 kg/m² [5 lb/ft²] sheet lead flashings to all cleanouts and drains. Securely fix to flashing clamps and extend 300 mm [12"] beyond edge of cast iron fittings.

.4 Supply and install 25 kg/m² [5 lb/ft²] lead safes under built-up showers and mop sinks on any floor which is not slab-on-grade. The safes shall extend across the floors and up walls and curb to a minimum height of 150 mm [6"] and shall be turned into the floor drain flange, unless specifically noted otherwise. Seams shall be welded (burned), not soldered. Any metal shall be commercially pure lead only. Treat both sides of the safe with two coats of asphalt.

.5 Chloraloy 240 lining material may be used as an alternate to lead under built-up floor sinks and showers; and at floor drains and cleanouts. Materials shall be solvent welded to manufacturer's installation instructions. Lead shall not be used on roofs where the roofing material is applied by a torch-on method.

.1 Dow reinforced sheeting 45R may be used as an alternative to lead in all applications except in areas in which a rubberized or plastic membrane must be clamped to a drain.

.6 Vent flashing minimum 450 mm x 450 mm [18" x 18"] base dimension shall terminate flush with the top of 300 mm [12"] high vent pipe and the gap between the flashing and pipe shall be closed with a 25 kg/m² [5 lb/ft²] separate lead cap 75 mm [3"] high. The main flashing shall not be turned over the pipe.

.7 Provide intrinsically safe barriers for all sump pumps located within parking garages, vehicle service or parking bays and in other areas which can receive fuels.

3.3 PIPING

.1 Do not install ABS, PVC or other plastic piping upstream of any oil interceptors.

.2 Do not install piping with glued joints at temperatures below those recommended by the solvent manufacture.

3.4 TESTING AND INSPECTION

.1 Tests on the sanitary waste and storm drainage systems shall consist of hydraulic pressure testing of 3000 mm [10’] for 8 hours.

.2 An air test in accordance with the Plumbing Code may be used during freezing conditions.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 CODES AND STANDARDS

.1 All fixtures shall display CSA (Canadian Standards Association) approval where a CSA standard is available and in effect.

.2 Plumbing fittings shall be to CAN/CSA B125, Plumbing Fittings.

.3 Plumbing fixtures shall be to CAN/CSA B45, 'General Requirements for Plumbing Fixtures',

.4 Vitreous china plumbing fixtures shall be to CAN/CSA B45.1, 'Ceramic Plumbing Fixtures',

.5 Stainless steel plumbing fixtures shall be to CAN/CSA B45.4, 'Stainless Steel Plumbing Fixtures'.

.6 Plastic plumbing fixtures shall be to CAN/CSA B45.5, 'Plastic Plumbing Fixtures'.

1.3 COLOUR

.1 Vitreous china fixtures shall be white unless otherwise noted.

.2 Stainless steel fixtures shall be satin and/or mirror finish or a combination thereof.

.3 Exposed plumbing brass and metal work shall be heavy triple chromium plated.

1.4 QUALITY

.1 Plumbing fixture supply brass shall be of one manufacturer unless otherwise specified.

.2 Fixtures shall be free from flaws or blemishes. Surfaces shall be clear, smooth and bright and have dimensional stability.

.3 Plumbing fixtures and trim shall be brand new unless otherwise noted.

.4 All visible or exposed parts, trim, supplies, traps, tubing, nipples escutcheons, check valves on diverter supply lines and valves to sanitary and/or kitchen fixtures shall be chrome plated finish unless otherwise noted.

.5 All fittings shall have heavy duty stems.

Part 2 Products

2.1 WATER CLOSETS

.1 Provide braided stainless-steel flexible supplies for tank type water closets. Supply shall incorporate 12 mm [½"] chrome plated quarter turn mini ball valve stop.

.2 Water Closet WC-1:

.1 Floor mounted Toilet – Vitreous china – for flush meter – Exposed no touch – hardwired, Barrier free, ADA

.2 American Standard Madera Flowise Right Height Elongated #3461.001.020 HET Toilet, (16.5”) 419 mm high, vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, white finish, Floor Mounted, siphon jet flush action, operates in the range of 3.8 L to 6 L (1.0 US Gal to 1.6 US Gal) per flush, condensate channel, 305 mm x 254 mm (12" x 10") water surface, siphon jet flush action, condensate channel, elongated bowl, 54 mm (2-1/8") fully glazed internal trapway, floor outlet, bolt caps, 38 mm (1-1/2") dia. Top spud.

.3 Seat Bemis 1950SS Toilet Seat with seat cover, extra heavy duty, for elongated bowl, open front, solid plastic, with cover, stainless steel check hinges, metal flat washers stainless steel posts and nuts.

.4 Valve Moen Commercial 8310ACDF16, Dual Flush Exposed Flushometer for Top Spud Toilet, chrome plated, polished chrome finish, 4.8 L (1.28 US Gal) factory set flow, quiet action diaphragm type with dual filter by-pass, infrared sensor located flush valve, solenoid operated flush controller circuitry, Courtesy Flush electronic over-ride button, extended seat bumper on, V.P. Smooth design stop cap on bak-check angle stop (screwdriver operated), flush tube for 292 mm (11-1/2") rough-in, high pressure vacuum breaker, sensor located above the toilet, 5 VA Power Required per unit. Sensor to clear toilet seat cover. Provide 4" (102 mm) square electrical box for mounting sensor plate.

.5 Transformer Moen Commercial #104630, Box Mount Multi Unit Hard Wired Transformer, 120 VAC/ 12 VDC.

2.2 LAVATORIES

.1 Provide braided stainless-steel flexible supplies for lavatories. Supplies for lavatories shall incorporate 9 mm [3/8”] chrome plated quarter turn mini ball valve stop.

.2 Lavatory LAV-1:

.3 Lavatory Plumbing Fixture Schedule

.1 Wall hung basin electronic faucet - below deck mechanical water mixing valve. Barrier free, ADA

.2 American Standard Murro with EverClean #0954.904EC.020 Basin Sealed overflow, 3 holes, 4" (102 mm) center, 540 mm x 520 mm x 165 mm (21-1/4" x 20-1/2" x 6-1/2") high, Vitreous china, White Finish, for carrier with concealed arms, recessed self-draining faucet ledge.

.3 **Sloan SF-2000 Series #SF-2300 Electronic Faucet,** Chrome plated finish, Brass, 1.9 LPM (0.5 GPM) aerator spray outlet, 162 mm (6-3/8") projection reach, infrared sensor with screw adjustable range, under counter filtered solenoid valve with serviceable strainer filter, Module control assembly housed in splash proof junction box, 6 VDC plug-in adaptor with battery back-up. **Sloan #SFP-6, Plug-in Transformer,** 110 VAC/ 6 VDC, A. **Provide electrical duplex box with ground fault interrupter.**

.4 **Lawler #TMM-1070, Below Deck Mechanical Water Mixing Valve,** Bronze body, temperature adjusting dial, 10 mm (3/8") inlets and outlet compression fittings, high temperature thermostatic limit stop, shut-off with automatic reset when temperature exceeds 120 ºF (48.8 ºC), Integral checks, offer temperature range from full cold through 46 °C (114.8 °F).

.5 **Provide tee, adaptors and flex. copper tubing to suit installation. McGuire #PRODRAIN Open Grid Drain,** cast brass one piece top, 17 GA. (1.5 mm) mm tubular 32 mm (1-1/4") tailpiece, Less overflow holes.

.6 **McGuire #LFH170BV Faucet Supplies,** Chrome plated finish polished brass, commercial duty 1/4 turn ball valve angle stops, 13 mm (1/2") I.D. Inlet x 127 mm (5") horizontal extension tubes, convertible 1/4 turn/loose key handles, Escutcheon and flexible copper risers.

.7 **McGuire #8872C P-Trap,** heavy cast brass adjustable body, with slip nut, 32 mm (1-1/4") size, Shallow wall flange and Seamless tubular wall bend.

.8 **Watts #WCA-411 Basin Carrier,** concealed arms, wall flanges to attach to backing plate secured in wall with locking device and levelling screws, heavy gauge steel uprights with integral welded feet. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

2.3 JANITORS SINKS

.1 Janitor Sink MS-1:

.1 Refer to Drawing Schedules

.2 Service / mop sink - two handles faucet

.3 Franke Commercial #FSS222210/316-1 Corner Service / Mop Sink, 610 mm (24") wide x 610 mm (24") long x 559 mm (22") high deep, floor mounted, grade 18-10 16 GA. (1.5 mm) type 316 stainless steel, polished satin finish, 2 side 305 mm (12") high integral splashguard, undercoated to reduce condensation and resonance, one piece wall hangers, 51 mm (2") grid strainer included.

.4 Chicago Faucets #897-RCF Wall Mounted two handles Faucet, Rough Chrome Finish, 8" (203 mm) centerset, solid brass exposed body, ceramic 1/4 turn operating cartridge, unrestricted hose end outlet, 203 mm (8") projection spout with atmospheric vacuum breaker and bucket hook, 60 mm (2-3/8") metal vandal proof lever handles with blue and red index buttons, wall brace support. Provide P-Trap, same material as the connecting pipe drain.

.5 Hose and Wall Hook: 36” (914 mm) long hose with 3/4” (19 mm) chrome coupling, stainless steel wall bracket.

.6 Mop Hanger: Stainless steel #4 finish, 24” (610 mm) long with 3 rubber spring loaded clips.

.7 Provide a separate cold-water feed completed with back flow protection, shut off valve and funnel drain for chemical dispenser of MS-1.

2.4 SINKS – GENERAL

.1 Per CSA Z317.1 Overflows shall not be used for sinks as overflows “are difficult to clean and become contaminated very quickly, serving as reservoirs of bacteria.”

.2 All sinks shall be provided with offset drains to reduce the potential for aerosolization from the trap.

.3 All water supply outlets (faucets) shall be, per CSA 317.1, “equipped with non-aerated, splash free, laminar flow devices in all areas of the HCF. Devices with aerators or fine mesh screens shall not be used.”

.4 Sink SK-1 (staff room, counter mount, double big/small bowl, manual faucet):

.1 **BOWL:** Kindred QCLA2027R-8-3 Sink - Double compartment sink, 203 mm (8") centerset, Kitchen sink, with overall dimension 692 mm (27-1/4") long, 522 mm (20-9/16") wide, 203 mm (8") high, constructed from 20 gauge Stainless steel, Left bowl is 356 mm (14") long and right bowl is 254 mm (10") long, Left bowl is 406 mm (16") wide and right bowl is 406 mm (16") wide, Left bowl is 203 mm (8") deep and right bowl is 178 mm (7") deep, High-gloss finish on exposed surfaces, Factory installed EZ TORQUE™ fasteners, Colander (CA1W), Rear waste location, 89 mm (3-1/2") waste outlet diameter, 762 mm (30") minimum cabinet size.

.2 **FAUCET:** Chicago Faucets 201-RSL9E35VPABCP Faucet - Counter mounted, Manual, Two handles, Sink faucet, Polished chrome finish, 203 mm (8") centerset, Lead Free ANSI/NSF 61 and ANSI/NSF 372 compliant, ECAST® brass construction, Less supply, Quaturn™ compression cartridge (90° turn), 5.7 LPM (1.5 GPM) maximum flowrate, Pressure compensating Softflo™ aerator, Brass spout, 241 mm (9-1/2") spout reach, 232 mm (9-1/8") high, Lever handle, Less drain, 13 mm (1/2") NPSM supply inlet for 10 mm (3/8") or 13 mm (1/2") flexible riser.

.3 **MIXING VALVE:** Lawler 570-86821 Mixing Valve - Point of Use and Master Controlled Fixtures, Tempered water mixer, Lead Free Brass Body Construction, Nickel plated finish, 4 - 38 LPM (0.25 - 10 GPM) range for flow rate , To adjust the mixed outlet temperature of the valve, remove the cap to gain access to the adjusting spindle. The spindle should be rotated-clockwise to reduce the temperature, counter-clockwise to increase the temperature until the desired set point is reached, 15 LPM (4 GPM) flow rate @ 5 PSI pressure drop, The

temperature is adjusted with the help of Spindle, 140 mm (5-1/2") high, ASSE 1070, CSA B125.3, 1/2" MNPT, 95-115°F outlet water temperature range, 1/2" MNPT, Internal checks, Offers choice of temperature settings from 95° through 115°F., 125 psi max hydrostatic pressure, ±20% pressure variation, 40-80°F, 10°F, 180°F max, ±5°F, Protects against scalding and chilling, 34 LPM (9 GPM) flow rate at 45 PSI pressure loss.

.4 **SUPPLIES:** McGuire LFCK165 Supply - Lead free, Pipe to compression, Integral check supply kit, Chrome plated, 3/8" I.P.S x 3/8" O.D, 305 mm (12") chrome plated risers, Wheel handle, Faucet, Shallow wall flange.

.5 **WASTE:** McGuire 204C P-Trap - Solid heavy duty cast brass, Chrome plated, With cleanout plug, Cast brass slip nuts, 52 mm (2") minimum water seal.

.5 Sink SK-2 (stress test room, counter mount, single bowl, manual faucet):

.1 **BOWL:** Franke Commercial LBS4607-316P-1-3 Sink - Single compartment sink, 203 mm (8") centerset, Laboratory sink, with overall dimension 460 mm (18-1/8") long, 478 mm (18-13/16") wide, 178 mm (7") high, constructed from 18 gauge Type 316 Stainless steel, Bowl dimensions are 406 mm (16") long, 356 mm (14") wide, 178 mm (7") deep, Polished to #4 satin finish, Factory installed EZ TORQUE™ fasteners, Factory applied rim seal, Center waste location, 38 mm (1-1/2") (DN38) type 316 stainless steel tailpiece, 89 mm (3-1/2") type 316 stainless steel crumb cup strainer, Undercoated to reduce condensation and resonance, Codes and Compliances: ASME A112.19.3 compliant, CSA B45.4 compliant.

.2 **FAUCET:** American Standard 6540188.002 Faucet - MONTERREY, Counter mounted, Manual, Two handles, Sink/lavatory faucet, Polished chrome finish, 203 mm (8") centerset, Lead free compliant, Solid brass construction, Less supply, Ceramic disc cartridge, 5.7 LPM (1.5 GPM) maximum flowrate, Plain end with pressure compensating laminar flow insert in spout inlet, Gooseneck spout, 203 mm (8") spout reach, 318 mm (12-1/2") high, Vandal-resistant wrist blade handles, Less drain, less pop-up hole & rod, 13 mm (1/2") male threaded inlet shanks with brass coupling nut.

.3 **MIXING VALVE:** Lawler 570-86821 Mixing Valve - Point of Use and Master Controlled Fixtures, Tempered water mixer, Lead Free Brass Body Construction, Nickel plated finish, 4 - 38 LPM (0.25 - 10 GPM) range for flow rate , To adjust the mixed outlet temperature of the valve, remove the cap to gain access to the adjusting spindle. The spindle should be rotated-clockwise to reduce the temperature, counter-clockwise to increase the temperature until the desired set point is reached, 15 LPM (4 GPM) flow rate @ 5 PSI pressure drop, The temperature is adjusted with the help of Spindle, 140 mm (5-1/2") high, ASSE 1070, CSA B125.3, 1/2" MNPT, 95-115°F outlet water temperature range, 1/2" MNPT, Internal checks, Offers choice of temperature settings from 95° through 115°F., 125 psi max hydrostatic pressure, ±20% pressure variation, 40-80°F, 10°F, 180°F max, ±5°F, Protects against scalding and chilling, 34 LPM (9 GPM) flow rate at 45 PSI pressure loss.

.4 **SUPPLIES:** McGuire LFCK165LK Supply - Lead free, Pipe to compression, Integral check supply kit, Chrome plated finish, 3/8" I.P.S x 3/8" O.D, 305 mm (12") chrome plated risers, Loose key, Faucet, Shallow wall flange.

.5 **WASTE:** McGuire 204C P-Trap - Solid heavy duty cast brass, Chrome plated, With cleanout plug, Cast brass slip nuts, 52 mm (2") minimum water seal.

2.5 FLOOR DRAIN

.1 **Floor Drain FD-1**, Watts-Floor Drain, FD-100-C-A5-1 Epoxy coated cast iron, Floor drain, Adjustable Round 6 mm (1/4") thick top, 127 mm (5") diameter nickel bronze strainer, 100 (4") pipe size, Anchor flange, Trap primer tapping, Reversible membrane

clamp, Collar with primary and secondary weepholes, 52 cm² (8 sq. in) free area, Certification and Compliances include: ASME A112.21.1M compliant. Provide trap primer for floor drains.

2.6 EMERGENCY SHOWER AND EYE WASH COMBINED ESH-1

.1 **Recessed Safety Station with Drain pan, Exposed Shower Head** Guardian GBF2150 with Guardian G6040 option of thermostatic mixing valve, Thermostatic mixing valve to blend hot and cold water to deliver tepid water. Valve has flow capacity of 50 gallons (189 liters) per minute at 30 PSI (2.1 bar) pressure drop. Valve can be used to supply emergency shower or combination safety station. Depending on water supply size and pressure, valve can supply multiple units.

.2 SSBF-44* – Barrier Free, recessed, wall mounted combination eye/face wash and shower safety station with ceiling mounted exposed shower head, patented stainless steel shower-actuating arm and swing-down stainless steel combination eye/face wash drain pan. Unit construction shall be welded 16-gauge type 304 stainless steel with #4 brushed satin finish. Unit shall include stainless steel shower head, internal 20 GPM flow control, supply nipple, escutcheon, chrome-plated brass eye/face wash supply fittings, brass unions, and U.S made full-port brass ball valve for shower. Eye/face wash valve shall be AutoFlow™, plug-type design with PTFE coated O-rings to seal valve orifices, polypropylene FS-Plus™ spray heads with individual 3.2 GPM flow controls and polyurethane filters. Supplied with in-line strainer to protect eye/face wash valve and spray heads from debris in water line, and 2” IPS drain. Activate eye/face wash valve by rotating 90° from stored position. Unit shall include ANSI compliant sign.

.3 Performance: Unit complies with ADA requirements for accessibility by handicapped persons. Unit shall be fully factory assembled and hydrostatically tested to meet or exceed ANSI Z358.1 – 2014, and come with a full 2-year warranty.

.4 Fixture: Guardian GBF2150 with Guardian 6040 Thermostatic mixing valve.

.5 Domestic cold and hot water pipes to emergency shower to be completed with isolation valve, strainer, check valve and thermostatic mixing valve.

.6 **MIXING VALVE:** Guardian G6040 complete with thermostatic mixing valve

2.7 MIXING VALVES

2.8 THERMOSTATIC MIXING VALVES - GENERAL

.1 For all Fixtures: Per CSA Z317.1 set thermostatic mixing valve temperature so that hot water is supplied at a minimum temperature of 55°C within 1 min at outlets (i.e., the time needed to flush out the volume of water in the pipe run-out and heat-up the piping).

2.9 Hand Hygiene Sink HHS-1

.1 (Wall Hung Basin Electronic Faucet-Point of Use Thermostatic Water Mixing Valve)

.2 Provide braided stainless-steel flexible supplies for sinks. Supplies for sinks shall incorporate 12 mm [1/2”] chrome plated quarter turn mini ball valve stop.

.3 Hand Hygiene Sink HHS-1 (wall hung basin electronic faucet - point of use thermostatic water mixing valve

.4 **Basin:** American Standard ICU Basin #9118.111.020, Center hole only, 509 mm x 432 mm x 663 mm (20-1/16" x 17" x 26-1/8") high, Rectangular, Vitreous china with EverClean antimicrobial surface which inhibits the growth of stain and odor causing bacteria mold and mildew, White Finish, 65 mm (2-9/16") dia. Faucet perch, back of sink 93 mm (3-11/16") higher than faucet perch, Offset grid drain included, integrated mounting brackets, P-trap with Saniguard coating provided. Provide compatible shroud.

.5 **Faucet:** American Standard Selectronic I.C. #605B.193.002 Electronic Faucet, Polished Chrome finish, Center hole only, Vandal resistant brass construction, 1.5 GPM (5.7 LPM) pressure compensating laminar flow device in spout base with plain spout laminar flow end, Rigid gooseneck spout, 127 mm (5") projection reach, Self-adjusting sensor, AC Powered (Hard Wired). American Standard #PK00.HAC, Hardwired AC - Power Kit, Includes 10' long extension cable, C/W transformer. American Standard PK00.BBU Battery Back Up Includes standard CR-P2 lithium battery for back-up power, Allows Selectronic AC faucets and flush valves to continue operating during a power failure and maintains fail-safe operation, Installs between Selectronic product and AC Power Supply (Plug-In or Hard-Wired), 4- amstd, Selectronic Battery Back- Up.

.6 **Mixing valve**, Symmons MaxLine, Point of Use Thermostatic Water Mixing Valve, nickel plated bronze body, temperature adjusting spindle, 10 mm (3/8") inlets and outlet FNPT connections, Integral checks, temperature range between 35 °C (95 °F) and 46 °C (114.8 °F), housed in 356 mm x 356 mm x 152 mm (14" x 14" x 6") recessed box. Set valve temperature at 46 °C (114.8 °F). Note: Provide tee, adaptors and flex. copper tubing to suit installation.

.7 **Waste and Supplies**, McGuire #LFH165LKN3 Faucet Supplies, Chrome plated finish polished brass, heavy duty angle stops, 10 mm (3/8") I.P.S. Inlet x 76 mm (3") long rigid horizontal nipples, V.P. Loose keys, Escutcheon and flexible copper risers. McGuire #8872C P-Trap, heavy cast brass adjustable body, with slip nut, 32 mm (1-1/2") size, Shallow wall flange and Seamless tubular wall bend.

.8 **Carrier**, Watts #CA-311 Fixture Carrier, mounted on concrete floor, steel hanger plate, heavy gauge epoxy coated steel offset uprights with welded feet supports. For one unit: 102 mm (4") for two to six units in a row: 152 mm (6") finished metal stud wall to back of pipe space.

.9 **Acceptable product:** American ICU Basin with features and accessories as specified above.

2.10 CHILLED RECESSED BOTTLE FILLING STATION CRBFS-1

.1 Model 2000HSA.8 REVIVE Hydration Station motion activated bottle filling station motion-activated bottle filling station with architectural roots is recessed wall-mount wheelchair accessible, constructed of heavy duty, Type 304 Stainless Steel with a satin finish, and stainless steel satin finish back panel and louvered intrusion-proof grill. Bottle filler includes a 3000 gallon (11356 L) capacity, Electronic Lifecycle Control filter cartridge, with filter replacement indicator light, LED lighted 12″ sensor operated bottle opening with quick 1.1 gpm fill rate and laminar flow with front access for changing filter, smart energy savings feature powers down refrigeration system after 2 hours of non-use, auto purge feature automatically cycles water once every 24 hours, display menu which shows sensor range adjustment, factory reset, software/ firmware version readout and error readout, along with bottle counter showing number of bottles saved, and vandal-resistant sensor resists scratching and water droplet fowling. The mounting frame is of heavy gauge, galvanized steel. Provides enough access room for water stop, electrical junction box, filter and drain connections. Field-configurable as either filtered or non-filtered. The refrigeration system is hermetically sealed and delivers a minimum of 8 gph (30.3 L) of water at 50° F (10° C) cooled from 80° F (26.7° C) inlet water at 90° F (32.2° C) ambient. 115 Volts, 60Hz, rated watts: 370, full load amps: 5

.2 Provide a Reduced Pressure Back Flow Preventer (RPBP) for the domestic cold-water pipe serving the CRBFS-1.

.3 Provide a drainpipe for the CRBFS-1 as shown on the drawings.

.4 **BACKFLOW PREVENTERS:** Provide surface mounted Watts stainless steel reduced pressure backflow preventer (RPBP, Watts SS-009) at 12mm [1/2”] each for hot and cold-water supply to Owner supplied soap dispensing equipment. RPBPs to be located on the north wall, adjacent and above the Janitor’s sink. Provide a spring check-valves

down-stream on each supply. Provide a strainer up-stream on each supply. Wall mount the two backflow preventers over the Janitors sink, provide copper DWV drainpipe from each discharge port to indirectly drain into the Janitor's sink. Provide a wall elevation sketch illustrating the intended installation.

2.11 MIXING VALVES

.1 Mixing valves shall be thermostatic in operation, not mechanical mixing valves. This includes individual mixing valves at single fixtures or groups of fixtures including lavatories, sinks, showers, emergency fixtures etc.

.2 On both the up-stream hot and cold supplies, in an accessible location, provide isolation valves, positive swing check valves and strainers.

Part 3 Execution

3.1 FIXTURE INSTALLATION

.1 Connect fixtures complete with specified trim, supplies, drains accessory piping, vented traps, stops or valves, reducers, escutcheons and fittings for the proper installation of all fixtures and their respective supply fittings.

.2 Provide necessary hangers, supports, brackets, reinforcement, steel back-up plates and floor flanges to set fixtures level and square. Mount fixtures so that 90 kilogram [200 pound] mass will not loosen or distort mounting.

.3 Provide chrome plated quarter turn mini ball valves for all lavatories, sinks and tank type water closets.

.4 ABS p-traps and waste arms are not permitted.

.5 Waterclosets

.1 Water closets shall be connected to waste utilizing brass or cast iron floor flanges with lead stub or mechanical joint connections and wax seals.

.2 Provide braided stainless-steel flexible supplies for tank type water closets. Supply shall incorporate 12 mm [½"] chrome plated quarter turn mini ball valve stop.

.3 PEX or other plastic supplies are not acceptable.

.6 Lavatories and Sinks

.1 Provide braided stainless-steel flexible supplies for sinks and lavatories.

.1 Supplies for lavatories shall incorporate 9 mm [3/8”] chrome plated quarter turn mini ball valve stop.

.2 Supplies for sinks shall incorporate 12 mm [1/2”] chrome plated quarter turn mini ball valve stop.

.2 PEX or other plastic supplies are not acceptable.

.3 Double waste fittings for lavatories and sinks shall be a double sanitary tee. Provide a clean out access above flood level rim to vertical portion of pipe, equal to the diameter of the vertical pipe. Clean out access needs to be accessible with an access door.

.4 Control handles for all two handle mixing faucets shall be positioned with the cold control on the right and the hot control on the left. Activation shall be accomplished by rotating the cold control handle clockwise and the hot control handle counterclockwise.

.5 Faucets shall be complete with nuts and tailpieces.

.6 Provide appropriate gaskets and/or sealing washers that will prevent the entry of water into fixture trim or faucet holes or punchings in millwork.

.7 Gooseneck spouts shall have a clearance of 200 mm [8"] from nozzle tip to countertop, unless otherwise specified.

.8 Plastic control handles and spouts are unacceptable.

.9 Lavatory and sink P-traps shall be cast brass or tubular brass complete with either a cleanout or possess slip joint connections. Assembly shall be chrome plated where not concealed in millwork. Plastic drain and trap assemblies are not acceptable.

.10 Lavatory and sink P-traps shall be complete with either a cleanout or possess slip joint connections.

.11 Cleanouts serving fixtures in this Healthcare Facility shall be located at 1,830 mm above the finished floor level. At no point, shall a cleanout be less that a minimum of 150mm above the flood level rim of the fixture.

3.2 FIXTURE TRIM HOLES OR PUNCHINGS

.1 Fixture punchings for faucets or other trim shall not contain more punchings than necessary for the specified trim.

.2 Provide fixture and templates to the applicable trades for holes and cut outs required in all countertops.

3.3 WALLS AND FLOORS

.1 Fixtures mounted on glazed tile surfaces shall have ground faces to finished surface.

.2 Where plumbing fixtures come in contact with walls and floors, joints shall be sealed with Dow Corning anti-mildew 786 building sealant, made watertight and beaded smooth in a neat and workmanlike manner.

3.4 WATER HAMMER ARRESTORS

.1 Provide water hammer arrestors or shock absorbers on fixtures with flush valves and/or quick closing valves.

3.5 HANDICAP FIXTURES

.1 Water Closets

.1 Install all wall hung water closets designated for handicap use such that the top of the seat is 400 mm [15¾”] to 460 mm [18"] above the finished floor level.

.2 Install offset on handicap water closet flush valve connection to eliminate any interference with grab bar mounting.

.3 For sensor operated flush valves install the sensor above the level of the seat cover when it is in the fully raised position to ensure activation.

.4 For manual flush valve water closets install the flush valve such that the handle is facing the transfer or non-grab bar side of the water closet.

.2 Lavatories and Sinks

.1 Install offset P-traps with the run of the P-trap parallel to and close to wall.

.2 Supplies on handicap lavatories shall be offset to accommodate the offset P-trap.

.3 Insulate P-traps and waste arms at all handicap accessible lavatories and sinks with a manufactured insulation kit or 12 mm [½"] of fiberglass insulation and finished with a polyvinyl chloride jacket in a neat and workmanlike manner.

.4 Acceptable Manufactured Products: Truebro 'Handi Lav-Guard', Brocar Products Inc. 'Trap Wrap', Sexauer 'Handi Lav-Guard' Plumberex 'Handy Shield'.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 WORK INCLUDED

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Provide connection to existing medical gas systems.

.1 Allow for the connection to existing systems work to be completed outside of regular working hours.

.3 Provide new combination zone valve and alarm panel assembly.

.4 Provide new outlets and associated piping.

1.2 RELATED WORK

.1 Electrical Division 26

1.3 CODES STANDARDS AND APPROVALS

.1 Installation and workmanship of all Medical Gas Systems shall conform to:

.1 CSA Standard-Z7396.1 Medical gas pipeline systems —Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anaesthetic gas scavenging systems.

.2 CSA Standard Z9170.1 Terminal units for medical gas pipeline systems.

.3 NFPA-99 Health Care Facilities

1.4 INSTALLER CERTIFICATIONS

.1 An installer shall meet the requirements of the CSA Medical Gas Piping & Systems Installation Personnel Certification Program or equivalent.

.2 The installer shall maintain a current copy of relevant standards

.3 The installer shall provide evidence of qualification to install medical gas systems. The installer shall provide evidence of the quality management system under which the installer operates.

.4 Installers shall have a quality assurance program in accordance with the requirements of CSA B51 and shall be trained in quality control procedures.

.5 During the installation of a new system, or additions to or modification of an existing system, the installer shall verify each day that installed components are labelled in accordance with Z7396.1

.6 The Contractor shall submit as follows:

.1 CSA Z7396.1 Standard, prior to any installations, requires the installers to submit to the Health Care Facility evidence of a valid medical gas license that meet the requirements of the CSA Medical Gas Piping & Systems Installation Personnel Certification Program and evidence of a valid brazing license issued in BC for inclusion in its permanent records.

1.5 CERTIFICATION AND TESTING

.1 Medical gas system certification and testing will be completed by a certified testing agency hired directly by the owner. Include all costs associated with coordination and assistance required during certification and testing of the medical gas systems.

1.6 DESCRIPTION OF SYSTEMS

.1 The following medical gas systems are included in this section of the work:

.1 Medical Oxygen

.2 Medical Vacuum

.3 Medical Compressed Air

1.7 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 1.

.2 Submit shop drawings for:

.1 Zone Alarm Panels

.2 Outlets

.3 Valves

.4 Combination Valve/Alarm Panels

1.8 EXISTING MEDICAL GAS SERVICES

.1 It is the responsibility of this section of the work to maintain all existing medical gas systems in service while renovations and/or additions to the systems are in progress.

.2 No consideration will be given for failure to allow for all on-site conditions and requirements in this respect all within the tender price for the work.

1.9 CONNECTIONS

.1 Connect to existing medical gas piping systems as shown on drawings.

.2 Connection to existing systems and system shut downs to be completed outside of regular working hours.

1.10 OPERATING ALARMS – MASTER AND ZONE

.1 Master Operating Alarm panels shall be located at each of the following locations

.1 24-hour Nurse's Station / Switchboard.

.2 All alarms shall be routed to the BMS for further indication.

.2 Zone Alarms shall be located at each Nursing Care Station as indicated on the drawings.

.3 Alarm panels shall indicate the signals noted in the specific medical gas section.

.4 Alarm panels shall include appropriate line voltage/low voltage transformers, prewired for external single point line voltage connection.

.5 Line voltage shall be supplied to the alarm systems under the Electrical Section of the Work.

.6 All other low voltage wiring shall be provided by the controls contractor.

.1 from external transformers to power supply boxes

.2 from line pressure switches to alarm device

.3 from all medical gas field devices to alarm device

.4 from alarm devices to BMS system

.7 Supply and install individual electronic relays in a separate box adjacent to or inside operating alarm panel for each medical gas to allow remote computer readout to relay point. Relay to convert low voltage DC to dry contacts micro voltage.

1.11 DIRECT DIGITAL CONTROL (DDC)

.1 Include contacts and/or electronic relays as required as an integral part of the equipment supplied and installed to allow connection from system equipment to a DDC building management system.

.2 The systems and each condition to be monitored and/or controlled within each system for remote readout on the DDC building management system.

.3 Refer to Division 25 for further detail. Connection from systems equipment to DDC by Division 25.

Part 2 Products

2.1 MEDICAL GAS PIPING

.1 Above Ground: Type 'L' hard temper seamless copper tubing, ASTM-B819, factory cleaned, capped ends.

2.2 FITTINGS AND JOINTS

.1 Fittings shall be wrought copper pressure, factory cleaned with capped ends.

.2 Pipe joints shall be made utilizing a silver brazing alloy or similar high melting point (538°C [1,000°F] minimum) brazing metal conforming to AWS Classification BCuP-5. The foregoing alloy shall not be used where medical gas piping is exposed to the exterior elements.

.3 Valves and equipment shall be joined utilizing screwed joints. The male thread shall be tinned with soft solder.

.4 Litharge, glycerin or an approved oxygen luting or sealing compound is acceptable. Flux shall not be used on copper to copper connections. Flux conforming to AWS brazing flux No. 3A is permitted where silver brazing dissimilar metals in which case particular care shall be exercised to ensure that no flux penetrates to the inside of the pipe and the completed exterior of the joint is washed with hot water to remove all residual flux from the fitting and pipe joint.

2.3 ISOLATION/SERVICE VALVES

.1 Valves shall be ULC listed, 4-bolt design, bronze body, double seal, full port, union ball-type with Teflon (TFE) seats and Viton seals, “O” ring packing, bronze ball which seals in both directions, blow-out proof stem, having a pressure rating of 4137 kPa [600 psig].

.2 Valves shall be operated by a lever handle requiring only a quarter turn from a fully open position to a fully closed position.

.3 All valves shall be equipped with type “K” washed and degreased copper pipe stub extensions at both the inlet and outlet sides of the valve port to facilitate installation. Provide gauge/purge ports on the stubs on each side of the valve.

.4 Valves shall be designed so that it can be “swung-out” during installation to prevent damage due to heat transfer during the brazing operation. A label showing the appropriate gas services and pressure rating shall be attached to each valve.

.5 Each valve assembly shall be provided washed and degreased for oxygen service and pipe stub extensions shall be capped at both ends.

.6 The valve shall be supplied in a sealed plastic bag to prevent contamination prior to installation.

.7 Valves located downstream of zone valves and box assemblies shall be lockable.

.8 Butterfly valves may be used for 75 mm [3"] and larger sizes, ULC listed for medical gas service, bronze body, full lug style, maximum pressure rating of 4137 kPa [600 psig].

.9 Isolating /Service Valves:

.1 Standard of Acceptance: Amico Ball Valve with Extensions and Dual Purge Port

2.4 COMBINATION ZONE VALVE/AREA ALARM PANELS

.1 Each alarm valve combo unit shall consist of the following components:

.1 18-gauge steel valve box complete with a baked white enamel finish which can house one to six shut-off ball valves with tube extensions

.2 gas-specific sensor (DISS nut and nipple connection)

.3 hinged gas-specific compact alarm with illuminated LED digital display and an error message for an incorrect connection

.4 an aluminum frame and a pull-out removable opaque window.

.2 Affixed to the opposing sides of the box will be two adjustable steel brackets for the purpose of mounting the box to the structural support. The steel brackets shall accommodate various finished wall thicknesses and shall be field adjustable. The frame assembly shall be constructed of anodized aluminum and shall be mounted to the back-box assembly by standard self-tapping screws.

.3 The digital alarm shall read from 0-250 psig [0-1,724kPa] for pressure and 0-30" Hg [-100-0kPa] for vacuum. The digital read-out shall provide a constant indication of each service being measured. It will indicate a green "NORMAL" and a red "HIGH" or "LOW" alarm condition. If an alarm occurs, the "RED" alarm light shall flash and the audible alarm (which exceeds 90 decibels) will sound. Pushing the "ALARM MUTE" button will cancel the audible alarm, but the unit will remain in the alarm condition until the problem is rectified. A repeat alarm function shall, when enabled on the compact alarm module, be capable of turning on the buzzer again (after a preset time) if the fault condition has not been rectified.

.4 Each alarm module shall be individually microprocessor based and be field adjustable. The default set point on this alarm shall be +/- 20% variation from normal condition. In the calibration mode the following parameters shall be adjustable: high/low set-points, imperial/metric units, repeat alarm enable/disable (adjustable from 1 to 60 minutes) as well as psi, kPa or Bar readout (switch selected). Set points shall be adjustable by two on-board push buttons.

.5 Access to the shut-off valves shall be by merely pulling the ring assembly to remove the window from the frame. The window can be reinstalled without the use of tools only after the valve handles have been returned to the open position. The window shall be marked to prohibit unauthorized persons from tampering with the valves with the following silk-screen caution:

CAUTION: MEDICAL GAS CONTROL VALVE
CLOSE ONLY IN EMERGENCY

.6 The valve shall be a 3-piece ball-type design with a brass forging body and a chrome-plated brass ball for sizes 1/2" to 2". Seats shall be reinforced Teflon (PTFE) and seals Viton for 1/2"-2". A blow-out proof stem shall be used, and the valve shall have a maximum pressure rating of 600 psig [4,137 kPa].

.7 Valves shall be operated by a lever-type handle requiring only a quarter turn from a fully open position to a fully closed position. All valves shall be equipped with a type "K" washed and degreased copper pipe stub. Each valve will be identified for gas specification as indicated on the hinged alarm label.

.8 Unit shall be suitable for connection to 115 VAC / 60 Hz power supply.

.9 Standard of Acceptance: Amico Alert-1 Series Alarm/Valve Combo Unit

.10 Refer to drawings for the location of combination zone valve/ area alarm panels,

Alarm Valve Combo

2.5 MEDICAL GAS OUTLETS

.1 All outlets in the following areas shall be Quick Disconnect style to CSA Standard Z9170-1 Terminal units for medical gas pipeline systems.

.2 Refer to drawings for arrangement and quantities of medical gas outlets.

.3 Medical gas outlets shall be recessed wall outlets designed for concealed piping.

.4 Each outlet shall have a large colour coded front plate for ease of gas identification and aesthetic appeal. The front plate assembly shall contain indexing pins for safety keying the gas specific cover plate to the appropriate steel rough-in mounting plate.

.5 A one-piece chromed fascia plate shall frame the outlet. With the backbox rough-in mounted, the outlet shall adjust from 10 mm [3/8"] to 25 mm [1"] variation in wall thickness.

.6 The outlets shall be of modular latch valve design and include a gas specific 1.6 mm [16-gauge] steel mounting plate designed to permit on-site ganging of multiple outlets. Refer to architectural details for spacing and arrangement of outlets. Where architectural specifics are not indicated, use 127 mm [5"] spacing.

.7 Each rough-in box shall consist of a type "K", 6.4 mm [1/4"] inside diameter copper inlet pipe stub, which is silver brazed to the outlet body. Body shall be 32 mm [1-1/4"] diameter one-piece, brass construction. For positive pressure gas services, the outlet shall be equipped with a primary and secondary check valve. The secondary check valve shall be rated at a minimum 1379 kPa [200 psig] in the event the primary check valve is removed for maintenance.

.8 The latch/valve assembly shall only accept corresponding gas specific adapters.

.9 All outlets shall be UL listed, CSA approved, factory assembled, tested, cleaned for oxygen service, and supplied with temporary protective covers and packages to protect outlet during handling and installation at the job site.

.10 Each Medical Vacuum connection shall be supplied with a wall mounted vacuum bottle slide below the connection, suitable for wall and/or rail application to accommodate the installation. Provide backing in wall for each vacuum bottle slide.

.11 Standard of Acceptance: Amico DISS Alert-1 series Medical Gas Outlet

DISS

Part 3 Execution

3.1 OPERATING ALARMS –ZONE

.1 Zone Alarms shall be located as indicated on the drawings.

.2 Alarm panels shall indicate the signals noted in the specific medical gas section.

.3 Alarm panels shall include appropriate line voltage/low voltage transformers, prewired for external single point line voltage connection.

.4 Line voltage shall be supplied to the alarm systems under the Electrical Section of the Work.

.5 All other low voltage wiring shall be provided by the controls contractor.

.1 from external transformers to power supply boxes

.2 from line pressure switches to alarm device

.3 from all medical gas field devices to alarm device

.4 from alarm devices to BMS system

.6 Supply and install individual electronic relays in a separate box adjacent to or inside operating alarm panel for each medical gas to allow remote computer readout to relay point. Relay to convert low voltage DC to dry contacts micro voltage.

3.2 PIPING

.1 Maximum horizontal pipe hanger spacing:

Pipe Size mm [in.]	Hanger Spacing mm [ft.]
12 [½]	1800 [6]
18 - 25 [¾ - 1]	2400 [7.8]
30 [1¼] and larger	3000 [10]

.2 Care shall be exercised in applying the flux to avoid leaving any excess inside the completed joints.

.3 The outside of the tube and fittings shall be cleaned by washing with hot water after assembly.

.4 After installation of the piping, but before installation of the outlet valves, the line shall be blown clear by means of oil free, dry air or nitrogen.

.5 Care shall be taken to ensure that all medical gas lines are continuously purged with nitrogen during the brazing process to avoid the formation of particulate matter due to oxidation on the inside of the pipe at each joint. Removal of random test joint samples after installation as required by the Medical Gas Testing Agency to ensure no oxide buildup shall be the responsibility of this section of the work.

.6 Cooperate with and assist the electrical trade for his provision of ground connections to medical gas copper piping. These connections shall consist of a copper strap silver soldered to piping with a ground lug on free tab of copper strap for connection to the ground conductor.

3.3 CLEANING

.1 System cleaning shall be implemented as called for in CSA Standard-Z7396.1 Medical gas pipeline systems.

3.4 PIPING IDENTIFICATION

.1 All medical gas pipelines and outlets shall be identified according to CAN/CSA Standard-Z7396.1 Medical gas pipeline systems.

.2 All medical gas pipelines shall have a permanent medical gas pipeline identifier applied at 6.0 m [20 ft.] intervals, before and after barriers and behind access doors and inlet and outlet points. The identifier shall be in the form of a white band and conforming to the following:

.1 The width of the band shall be 50 mm [2”].

.2 If the identifier consists of a tape (e.g. of polyvinyl chloride), the tape shall be of enough length to overlap itself when applied to the pipe and shall have an adhesive, which retains it in position when applied as specified.

.3 Identifiers for medical gases are available from Canadian Liquid Air or Safety Supply Company in the form of Stick-O markers. The stick-on markers shall be used in pipe sizes up to 75 mm [3”] diameter and for larger pipe sizes, the Stick-O markers, or stenciling, may be used.

.4 In addition to the medical gas pipeline identifier required, each pipeline shall bear a label at 6 m [20 ft] intervals, before and after barriers and behind access doors and inlet and outlet points, which:

.1 Are lettered and coloured in accordance with the following table for medical gas colour coding,

.2 Has lettering at least 10 mm [3/8”] high,

.3 Are applied with the lettering parallel to the axis of the pipe: to be read (on vertical pipe) from right,

.4 Are of sufficient length to overlap itself when applied and has an adhesive, which retains it in position when applied.

.3 If a pipeline is painted for part or all of its length, the colour used shall be the background and identification colour specified in Column 2 of the Medical Gas Colour Coding Table below.

.4 All medical gas piping located within non-accessible areas shall be identified with their appropriate colour on a daily basis (as installed) by means of the application of spray paint for their entire length.

.5 During installation, on a daily basis, all piping, fittings, manifolds and terminal equipment shall be identified to ensure identification is maintained during installation.

.6 Outlets shall be provided with permanent identification plates, which shall be colour coded and shall have the names of the gas legibly marked therein.

.7 All permanent identifications shall have letters with a minimum height of 3 mm [1/8”] and shall be of the colour, wording and form specified in the Medical Gas Colour Coding Table above.

.8 Outlet identification plates shall be indexed to the specific gas outlets.

.9 Medical Gas Colour Coding Table:

Gas or gas mixture	Symbol	Background colour(s)	Lettering	Example
Medical air	MedAir	Half black, half white	Half white, half black	Medical Air
Carbon dioxide	CO_2	Grey	White or black	CO_2
Helium	He	Brown	White	Helium
Nitrogen	N_2 or HPN_2	Black	White	Nitrogen
Nitrous oxide	N_2O	Blue	White	Nitrous Oxide
Oxygen	O_2	White	Green	OXYGEN
Medical-surgical vacuum	MedVac	Yellow	Black	MEDVAC
Anaesthetic gas scavenging system	AGSS	Magenta	White	AGSS
Gas mixtures	Gas A%/Gas B% (e.g., O_2 95%/ CO_2 5%)	Half the colour for Gas A/half the colour for Gas B (as specified in this table) (e.g., half white, half grey for an O_2/CO_2 mixture)	Half the lettering for Gas A/half the lettering for Gas B (as specified in this table) (e.g., half green, half white or black for an O_2/CO_2 mixture)	O_2 95% CO_2 5%
Instrument air (air for dynamic devices)	—	Alternating white and black diagonal stripes	Black lettering in a white box	INSTRUMENT AIR

3.5 VALVES

.1 Valves shall be disassembled prior to soldering.

.2 Each isolation valve shall be provided with a 12 mm [½"] purge port immediately upstream of the valve. The purge port shall be provided with a 9 mm [3/8"] shut-off with a 12 mm [½"] DISS (gas specific) threaded outlet with cap and chain upstream of the shut-off.

.3 Emergency shut-off valves shall be located in common recessed boxes. Cover shall be 18 gauge sheet steel with satin chrome finish, internal surface identification and frangible front clear cover.

.4 Permanent lettering; not "stick on" labels, minimum 15 mm [0.6"] high adjacent each emergency valve box shall clearly identify which rooms are controlled by each emergency shut off valve.

3.6 OUTLETS

.1 All wiring and wiring methods shall conform to CSA Standard 22.1, The Canadian Electrical Code as adopted by the Province of British Columbia.

.2 All medical gas outlets located in multiples on common faceplates shall be positively grounded electrically to the satisfaction of the electrical inspection authority.

3.7 DEVICES INSTALLATION

.1 Pressure and vacuum switches for all sources of supply shall be installed in a location that is readily accessible for testing and servicing.

.2 Install all devices with adequate electrical cable to enable removal from DISS connection without disconnecting wiring.

3.8 INFORMATION TO BE SUPPLIED BY THE INSTALLER

.1 Record Drawings:

.1 A set of drawings prepared for the installation or modification of the medical gas systems, showing the pipe sizes, wiring details, alarm sensor locations, and the locations of mechanical and electrical works, shall be maintained on site during installation and shall be marked to show any changes or variations from the original drawings as installation proceeds.

.2 The drawings shall show the location of all concealed or buried piping and wiring.

.3 These marked drawings shall be called working as-built drawings and, upon completion of installation, shall become part of the permanent records of the health care facility.

.2 Instruction Manuals:

.1 The installer shall provide the owner with instructions for use of the

.1 monitoring and alarm systems

.2 terminal units

.3 local gas regulation control panels

.3 Maintenance Schedules:

.1 The installer shall provide the health care facility with instructions for recommended maintenance tasks and their frequency and a list of recommended spare parts for all aspects of the system that will be owned and operated by the health care facility.

END OF SECTION

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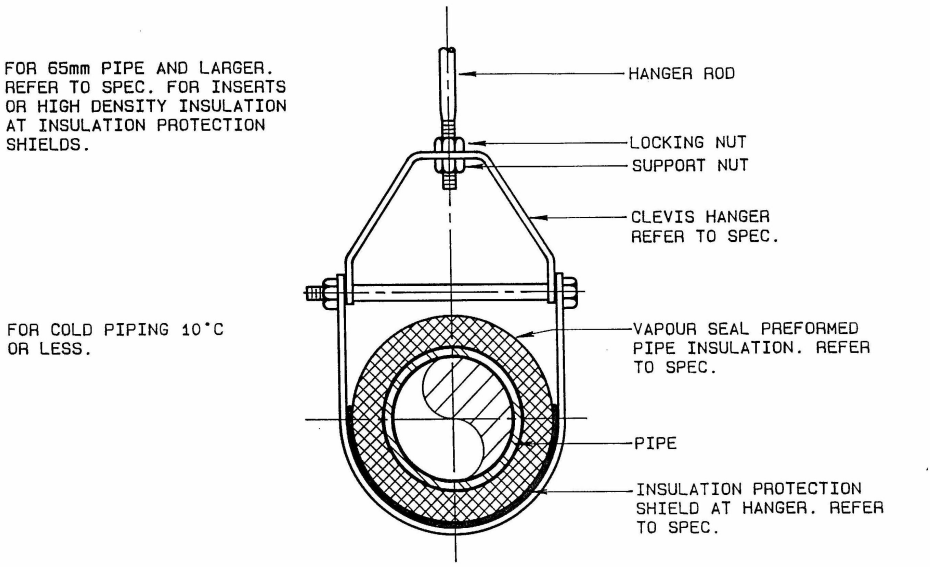
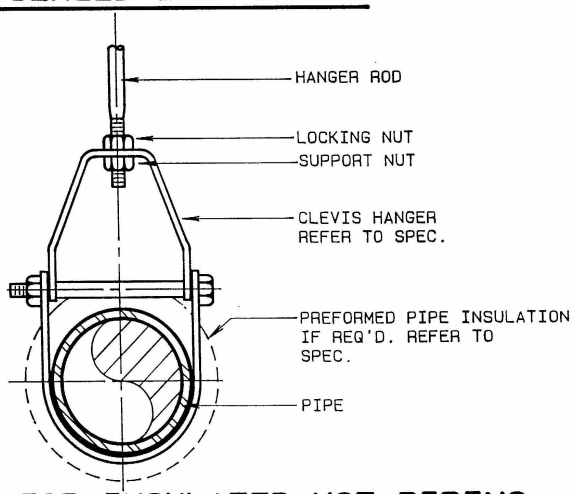
Part 1 Plumbing Details

1.1 PIPE HANGERS

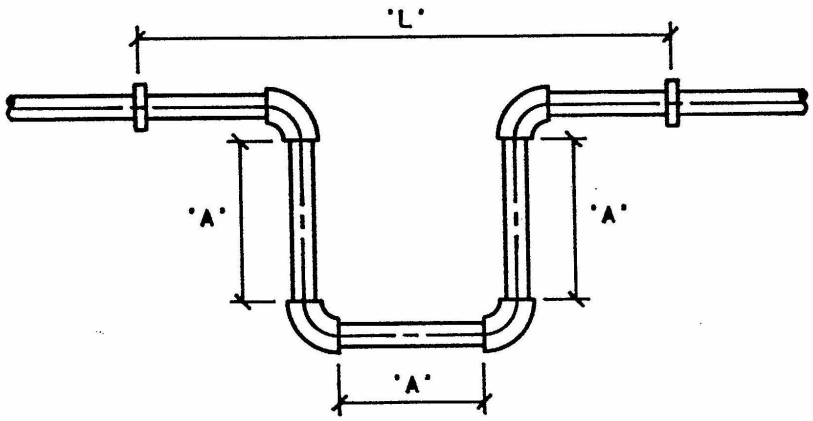


HANGER DETAIL FOR PIPING WITH VAPOUR SEALED INSULATION



HANGER DETAIL FOR INSULATED HOT PIPING TO 75mm OR ALL SIZES OF BARE PIPE

1.2 HOT WATER PIPING EXPANSION LOOP SIZING



DOMESTIC HOT WATER PIPE:

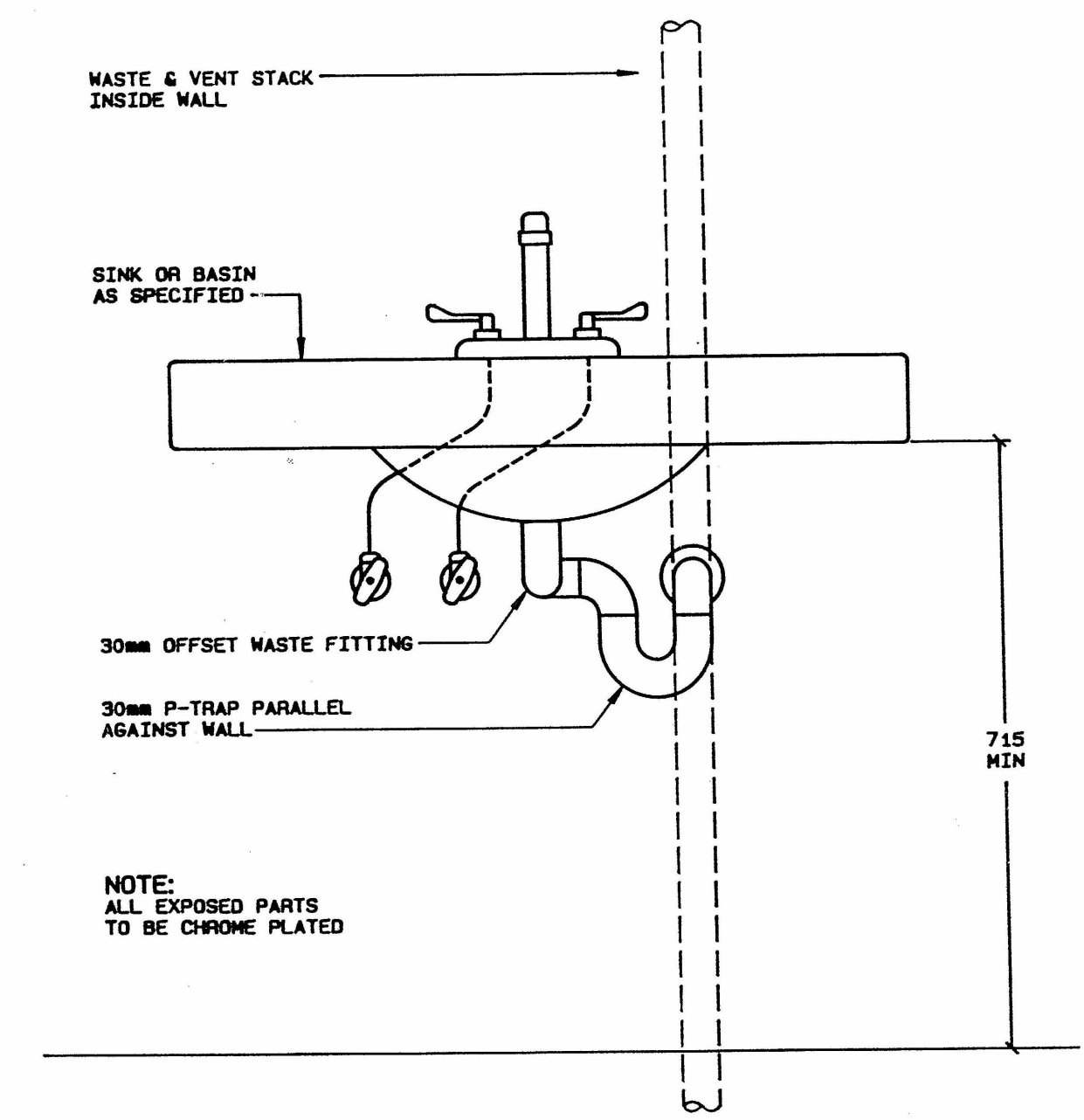
FOR COPPER PIPE THE MAXIMUM LENGTH OF 'L'=30M
FOR STEEL PIPE THE MAXIMUM LENGTH OF 'L'=45M

LOOP SIZE REQUIRED FOR THE ABOVE LENGTH BETWEEN ANCHORS:

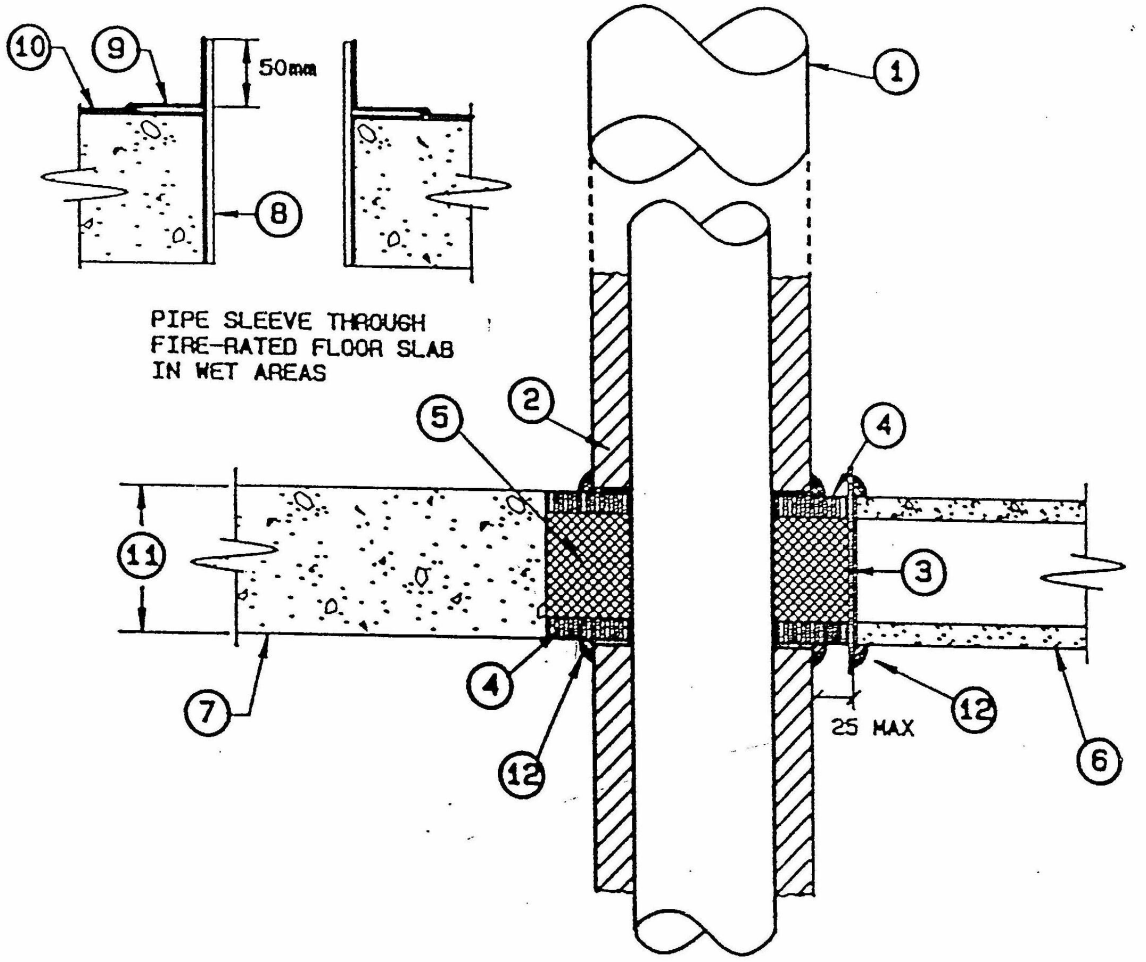
PIPE SIZE (mm)	LENGTH 'A' (mm)
12mm	300mm
20mm	600mm
25mm	750mm
30mm	750mm
40mm	825mm
50mm	900mm
65mm	1000mm
75mm	1100mm
100mm	1350mm
150mm	1500mm

IF THE LENGTH BETWEEN ANCHORS IS 1/2 THE LENGTH GIVEN ABOVE, MULTIPLY LOOP SIZES BY 2/3

1.3 Handicap Offset P-Trap



1.4 Pipe Penetrations - Rated Separations



NOTES:

1. UNINSULATED PIPE.
2. INSULATION (AS SPECIFIED) TO BUTT UP TO FIRE STOP.
3. 0.61mm (24 GA.) GALVANIZED STEEL SLEEVE (NOT REQ'D. FOR CORE DRILLED CONCRETE OPENINGS) (SEE NOTE 8 FOR WET AREAS).
4. MIN. 12mm (1/2") THICK - U.L.C. APPROVED FIRE STOP SEALANT. SEAL BOTH SIDES (TO MAINTAIN RATING ON GYPROC WALLS; TO RETAIN MINERAL WOOL INSULATION; TO SEAL VAPOUR BARRIER ON COLD PIPES).
5. MINERAL WOOL INSULATION - MANSON "CERAFIBER" OR CARBORUNDUM "FIBERFRAX" TIGHTLY PACKED.
6. FIRE RATED GYPROC WALL.
7. FIRE RATED CONCRETE FLOOR OR WALL.
8. PIPE SLEEVE (SCHED. 40).
9. FLANGE WELDED TO SLEEVE.
10. WATERPROOF MEMBRANE.
11. OVERALL THICKNESS OF MINERAL FIBER PACKING (5) AND FIRE STOP SEALANT (4) TO ENSURE REQUIRED FIRE - RESISTANCE RATING OF SEPARATION.
12. BEAD OF FIRE STOP SEALANT.
13. PIPE INSTALLATION TO ENSURE THAT NO PIPE EXPANSION OCCURS AT FIRESTOP.

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Part 1 General

1.1 CONFORMANCE

.1 The General Conditions, Supplements and Amendments shall govern this Division (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all sections of Division 21, 22, 23 and 25,and is intended to supplement the requirements of Division 01.

1.2 WORK INCLUDED

.1 Provide complete, fully tested and operational mechanical systems to meet the requirements described herein, in complete accordance with applicable codes and ordinances.

.2 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.

.3 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available.

.4 Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, establish orderly completion and the delivery of a fully commissioned installation.

.5 Follow manufacturer's recommended installation details and procedures for equipment, supplemented by requirements of Contract Documents.

.6 The most stringent requirements of this and other mechanical sections shall govern. Should inconsistencies exist such as the drawings disagreeing within themselves or with the specifications, the better quality and/or greater quantity of work or materials shall be estimated upon, performed and furnished unless otherwise ordered by the Consultant in writing during the bidding period.

.7 Drawings and specification are complimentary in nature and combined, create a complete set of construction documents. Any item called for by one and not by the other shall be interpreted as being called for by both.

.8 Any discrepancy between drawings and specifications leaving in doubt the true intent of work shall be brought to the attention of the Consultant immediately.

.9 All work shall be in accordance with the PROJECT Drawings and Specifications and their intent, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.

.10 Provide seismic restraints for all required equipment, piping and ductwork.

.11 Connect to equipment specified in other sections and to equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete; start-up and test. Include all field assembly of loosely/separately packaged accessories

.12 "Consultant" shall mean Stantec Consulting Ltd.

.13 Contractor shall be aware, and thereby allow accordingly, that they will be working in Hospital areas and departments that are designated to be continuously in a 24 hour operation by hospital staff. As such the hospital's operation and department function shall not be disrupted or compromised in any way. Particular attention shall be given to related work in Patient, Staff, and Visitor occupied areas. In these areas, the work is to be performed during night time hours as follows:

.14 Monday through Fridays daily: 22:00 to 06:00. (Contractor to confirm the dates and hours with the owner).

.15 Saturdays and Sundays daily: 06:00 to 06:00. (Contractor to confirm the dates and hours with the owner).

.16 Night-time and weekend work are required for all shutdowns and connections into existing, and for the coordination (ie. planning) of such work. Allow for multiple shut-downs and re-charges, to accommodate the work. (Contractor to confirm the dates and hours with the owner).

.17 All work is to be performed within a protective environment. Provide and conform to Infection Control standards (see Section 01 15 10).

.18 The contractor shall ensure that on a daily basis, prior to turning work areas over for Hospital operation, the area is left clean and all systems are fully functioning. Allow for multiple shut-downs and re-starts/charges to accommodate the work/schedule and multiple phases.

.19 Contractor shall allow for, coordinate and arrange for all systems shut-downs and re-charges, as needed to realize the works, for multiple times, during night time hours as needed.

.20 In order to minimize disruptions to hospital operations, pipe freezing (by Nitro Pipe Freeze, http://www.nitropipefreeze.com/) may be required. To this end, include and provide and allow for 1 instance of pipe freezing (on domestic services at 2"ø pipe and 1"ø pipe diameter) plus 2 instance of pipe freezing (on domestic services at 1"ø pipe diameter) plus 2 instance of pipe freezing (on domestic services at 1 ¼" ø pipe diameter). Refer to drawings M201, M202 and M203. Disclose this cost value in the tendered bid as an included unit cost per instance, per pipe size. If pipe freezing is not required (ie. shutdowns can be accommodated by FMO by means of existing equipment/systems without negative impact on operations), then the total value amount(s) shall be returned to the Owner.

1.3 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Where multiple versions of the same code are published, the most recent version shall be applied, unless noted otherwise by building codes and local by-laws.

.2 Divisions 21, 22, 23, and 25 work shall conform to the following codes, regulations and standards, and all other codes in effect at the time of award of Contract, and any others having jurisdiction.

.3 The latest revision of each code and/or standard shall generally apply unless building codes reference a previous version, or otherwise specified in the contract documents.

.4 Where multiple standards apply, the most stringent requirement shall be incorporated into the work.

.5 All products shall be approved by and be identified with the label or mark of a recognized testing agency as applicable, e.g ULC, cUL, ETL, CSA, etc.

.6 Where the contract documents indicate requirements more stringent requirement than any applicable code and/or standard, the contract documents shall be implemented.

.1 By-laws

.1 Local Building By-laws.

.2 CAN/CSA B214 Installation Code for Hydronic Heating Systems.

.3 CAN/CSA-C22.1 Canadian Electrical Code, Part I

.4 CAN/CSA-C22.2 Test methods for electrical wires and cables

.5 CAN/CSA-Z317.1 Special requirements for plumbing installations in healthcare facilities

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

.7 CAN/CSA-Z317.13 Infection Control during Construction, Renovation, and Maintenance of Healthcare Facilities

.8 CAN/CSA-Z7396.1 Medical Gas Pipeline Systems – Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anaesthetic gas scavenging systems

.2 National Fire Protection Association

.1 NFPA 10 Standard for Portable Fire Extinguishers

.2 NFPA 12A Standard on Halon 1301 Fire Extinguishing Systems

.3 NFPA 13 Standard for the Installation of Sprinkler Systems

.4 NFPA 90A Standard for the Installation of Air-Conditioning and Ventilating Systems

.5 NFPA 90B Standard for the Installation of Warm Air Heating and Air-Conditioning Systems

.6 NFPA-99 Health Care Facilities

.7 NFPA 101 Life Safety Code

.3 National Research Council of Canada

.4 Province of British Columbia

.1 B.C. Building Code

.2 B.C. Plumbing Code

.3 B.C. Fire Code

.4 B.C. Safety Authority Safety Standards Act

.5 B.C. Amendment to Canadian Electrical Code

.6 B.C. Electrical Safety Regulation

.7 B.C. Occupational Health & Safety (OHS) Regulations, WorkSafeBC

.8 R.S.B.C. c39 Safety Standards Act

.5 Underwriter's Laboratories of Canada

.1 CAN/ULC-S110 Test for Air Ducts

.2 CAN/ULC-S111 Fire Test for Air Filter Units

.3 CAN/ULC-S112 Fire Test of Fire-Damper Assemblies

.4 CAN/ULC-S115 Fire Tests of Fire Stop Systems

.6 SMACNA Publications

.1 SMACNA 001 Guidelines for seismic restraints of mechanical systems

.2 SMACNA 002 Rectangular Industrial Duct Construction Standards

.3 SMACNA 006 HVAC Duct Construction Standards, Metal and Flexible

.4 SMACNA 008 IAQ Guidelines for Occupied Buildings Under Construction

.5 SMACNA 012 HVAC Air Duct Leakage Test Manual

.6 SMACNA 014 HVAC Systems Commissioning Manual

.7 SMACNA Fire, Smoke, and Radiation Damper Installation Guide

.7 Miscellaneous Standards

.1 ASHRAE Standard 62.1 Ventilation for Acceptable Indoor Air Quality

.2 ASHRAE/IES Standard 90.1 Energy Standard for Buildings Except Low-Rise Residential Buildings

.3 ASHRAE Standard 202 The Commissioning Process for Buildings and Systems.

.4 ASHRAE Guideline 1.1 HVAC&R Technical Requirements For The Commissioning Process

.5 ASHRAE Guideline 1.3 Building Operations and Maintenance Training for the HVAC&R Commissioning Process

.6 ASHRAE Guideline 1.4 Procedures for Preparing Facility Systems Manuals

1.4 ALTERNATE PRICES

.1 Refer to Division 1 General Instructions.

.2 Show in the Tender the following "Alternate Prices" in the form of an extra or credit to the basic tender sum:

1.5 SEPARATE PRICES

.1 Refer to Division 1 General Instructions.

1.6 UNIT PRICES

.1 Refer to Division 1 General Instructions.

1.7 CASH ALLOWANCES

.1 Refer to Division 1 General Instructions.

.1 Cash Allowance #1: Unforeseen existing mechanical and plumbing services relocation.

.2 Cash Allowance #2: Smoke-Fire dampers if required at mechanical supply air ducts at the GL. L1/7 shaft.

1.8 SUSTAINABILITY

.1 Construction IAQ:

.1 Follow instructions and initiatives such as pollution preventions and recycling of materials, packaging and debris.

.2 HVAC & R equipment shall contain zero CFC or HCFC based refrigerants, and zero use of Halons in fire suppression equipment.

.3 For all Adhesives and Sealants Material Safety Data Sheets (MSDS) highlighting the materials Volatile Organic Compound (VOC) levels.

.4 During construction, meet or exceed the recommended Design Approaches of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines for Occupied Buildings under Construction.

.5 Protect stored on-site or installed absorptive materials from moisture damage.

.6 If air handling units are used during construction, filtration media with a Minimum Efficiency Reporting Value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE 52.2.

.7 Mechanical rooms should not be used to store construction or waste materials.

.8 During construction, all openings in supply, return and exhaust HVAC systems shall be protected from dust infiltration. Provide temporary ventilation as required.

.9 Duct Cleaning: Clean and sanitize all supply and return ductwork to ensure that dust and contaminants are effectively removed and contained. Sequence ductwork cleaning in a way that avoids re-contamination.

1.9 STANDARD OF ACCEPTANCE

.1 Means that an item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material

and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

.2 Acceptable Product manufacturers are listed in the list of Equipment Manufacturers in Section 23 99 65.

.3 Where two or more manufacturers are listed, the manufacturer's name shown underlined or shown with a model name and/or number was used in preparing the design. Tenders may be based on any one of those named, if they meet every aspect of the drawings and specifications.

.4 Where other than the underlined manufacturer or scheduled/specified manufacturer is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.

.5 Where two or more items of equipment and/or material, of the same type, are required, provide products of a single manufacturer.

.6 Install and test all equipment and material, in accordance with the detailed recommendations of the manufacturer.

.7 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

1.10 TENDER INQUIRIES

.1 All contractor queries during the tender period shall be made in writing to the consultant. Contractor queries will be collected, and suitable addenda will be issued for clarification. No verbal information will be issued by the consultant's office during tender. All tender queries may be e-mailed, faxed, mailed or couriered to the consultant's office. No telephone questions will be answered.

1.11 DETAILED PRICE BREAKDOWNS

.1 Tender Price Breakdown:

.1 Within ten (10) days after the award of contract submit price breakdowns similar to the Price Breakdown Forms included in Section 23 99 60.

.2 Submit a separate breakdown for each section of the mechanical work listed on the Progress Claim Summary Form in Section 23 99 60.

.2 Proposed Change, Notice of Change, Contemplated Change, etc.:

.1 Provide detailed itemized time and materials breakdowns to assess and evaluate each item indicated in the request for quotation. Indicate number of hours and labour rates, along with quantity of materials and unit costs.

.2 Each supplier and sub-contractor shall be detailed separately.

.3 Indicate mark-ups and allowances separately.

1.12 PROGRESS CLAIMS

.1 For each progress claim, submit a progress claim summary based on the Progress Claim Summary Form included in Section 23 99 60.

.2 Submit detailed price breakdowns for each section of the mechanical work listed on the Progress Claim Summary Form and for each change order item being claimed.

1.13 SCHEDULING

.1 Coordinate with Division 1, Construction Schedule.

.2 Incorporate within the Construction Schedule, a complete and realistic schedule, integrated with, and recognizing the reliance on, other divisions of the work. Consider the lead time for the review of operating and maintenance manuals, commissioning,

verification of system operation by the Consultant and the demonstration and instruction to the Owner.

.3 The schedule shall include but not limited to the following items:

.1 Installation and testing of piping systems and equipment.

.2 Installation and cleaning of duct systems and equipment.

.3 Chemical cleaning and treatment of piping.

.4 Control system installation.

.5 Air/Water balancing

.6 Air measurements of existing systems prior to any renovation work.

.7 Connection of electrical services to equipment by electrical contractor.

.8 Start-up of mechanical equipment and systems.

.9 Check-out of control systems.

.10 Commissioning of mechanical systems.

.11 Demonstration of systems and equipment to Consultant.

.12 Demonstration of systems and equipment to Owner.

.13 Preparation of maintenance manuals and as-built drawings.

.14 Submission of the various documents required prior to Ready-For-Takeover.

1.14 RESPONSIBILITIES

.1 Visit the site before tendering. Examine all local and existing conditions on which the work is dependent. No consideration will be granted for any misunderstanding, of work to be done, resulting from failure to visit the site.

.2 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.

.3 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Consultant during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.

.4 Examine carefully the mechanical, electrical, structural and architectural drawings and confirm that the work under this Sub-Contract can be satisfactorily carried out without changes to the building as shown on these plans.

.5 Be responsible for prompt installation of this work in advance of concrete pouring or similar work. Provide and set sleeves where required.

.6 During freezing weather, protect all materials in such a manner that no harm can be done to installations already in place and/or to materials and equipment on the job.

.7 On completion of the work, all tools and surplus and waste materials shall be removed, and the work left in a clean and perfect condition.

1.15 COORDINATION

.1 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Consultant's written approval.

.2 The drawings indicate the general location and route to be followed by the piping and ductwork. Where details are not shown on the drawings or only shown diagrammatically, the pipes and ductwork shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All ducts and pipes in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All pipes and ducts

shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.

.3 Work out jointly all interference problems on the site with other trades and coordinate all work before fabricating or installing any material or equipment. Where necessary produce interference drawings showing exact locations of mechanical equipment within service areas, shafts and the ceiling space. Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Consultant of space problems before fabricating or installing any material or equipment. On completion of the work demonstrate to the Consultant that all equipment installed can be properly and safely serviced and replaced where applicable. Remove and replace improperly installed equipment to satisfaction of the Consultant at no extra cost. Extras for improper coordination and removal of equipment to permit remedial work will not be allowed.

.4 When open web structural joists are used, obtain structural shop drawings to ensure adequate space is available for installation of pipes and ductwork.

1.16 HOISTS AND SCAFFOLDS

.1 Provide all necessary interior movable or roller scaffolds, platforms, lifts and ladders for the installation of the mechanical work.

1.17 REVIEW OF WORK

.1 The Consultant representative will review all work prior to it being concealed. All piping below ground must be approved prior to covering.

.2 All work shall be approved by all authorities having jurisdiction.

.3 All openings shall be sealed appropriately in particular in fire rated walls and floors. Sealing shall be inspected prior to covering.

1.18 REQUESTS FOR INFORMATION

.1 Where the Contractor determines that more information is required to complete the scope of work, submit a written “Request For Information” to the consultant before making assumptions as to intent.

1.19 PROVISION FOR FUTURE EQUIPMENT AND CONSTRUCTION

.1 Where contract documents don’t clearly indicate the future expansion requirements, but known services are required, submit a written “Request For Information”.

.2 Where space is indicated as reserved for future equipment or for future extension to building, leave such space clear and install piping, raceways and equipment so that connections can be made to future apparatus or building.

.3 Identify provisions and service terminations for future on Record Drawings.

1.20 PERMITS

.1 Obtain all required permits and pay all fees therefore and comply with all Provincial, Municipal, and other legal regulations and by-laws applicable to the work.

.2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

1.21 WARRANTY

.1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.

.2 Take note of any extended warranties specified.

.3 Refer to Section Division 25 for Control System warranty requirements.

.4 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of Ready-For-Takeover, which shall include one (1) complete summer and one (1) complete winter of uninterrupted operation. Warranty shall include any part of equipment, units or structures furnished hereunder that show defects in the works under normal operating conditions and/or for the purpose of which they were intended.

.5 The above parties further agree that they will at their own expense promptly investigate any mechanical or control malfunction, and repair or replace all such defective work, and all other damages thereby which becomes defective during the time of the guaranty-warranty.

1.22 ENERGY CONSUMPTION

.1 Consultant may reject equipment submitted for approval or review on basis of performance or energy consumed or demanded.

1.23 INFECTION CONTROL

.1 Refer to Division 1 for infection control measures. Conform to the requirements of CSA Z-317.2 Special Requirements for Heating, Ventilation, and Air Conditioning (HVAC) Systems in Healthcare Facilities

.2 Coordinate with General Contractor.

.3 Maintain negative pressurization in the work area. Exhaust shall be filtered.

1.24 ASBESTOS

.1 All material / products installed shall be free of asbestos.

1.25 ASBESTOS DURING RENOVATIONS

.1 If the Contractor, during renovations, should discover asbestos (or material suspected to be asbestos) on piping, ductwork, etc., he shall immediately cease all work in that area and contact the General Contractor or Owner's representative.

.2 The General Contractor or Owner's representative will take immediate appropriate action to verify presence of friable asbestos. The Contractor will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

.3 Refer to Division 2 for removal and disposal of asbestos.

.4 All work performed on systems with asbestos insulation must be reported to WorkSafeBC before work commences.

.5 Removal of all asbestos products shall be carried out in accordance with the applicable codes by a contractor experienced in this specialty.

1.26 WORKMANSHIP

.1 Workmanship shall be in accordance with well-established practice and standards accepted and recognized by the Consultant and the Trade.

.2 The Consultant shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance, quietness of operation, finish and appearance.

.3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Consultant.

1.27 PERFORMANCE VERIFICATION OF INSTALLED EQUIPMENT

.1 Installed mechanical equipment whose performance is questioned by the Consultant, may be subject to performance verification as specified herein.

.2 When performance verification is requested, equipment shall be tested to determine compliance with specified performance requirements.

.3 The Consultant will determine by whom testing shall be carried out. When requested, the contractor shall arrange for services of an independent testing agency.

.4 Testing procedures shall be reviewed by the Consultant.

.5 Maintain building comfort conditions when equipment is removed from service for testing purposes.

.6 Promptly provide the Consultant with all test reports.

.7 Should test results reveal that originally installed equipment meets specified performance requirements, Owner will pay all costs resulting from performance verification procedure.

.8 Should test results reveal that equipment does not meet specified performance requirements, equipment will be rejected, and the following shall apply:

.1 Remove rejected equipment. Replace with equipment, which meets requirements of Contract Documents including specified performance requirements.

.2 Replacement equipment will be subject to performance verification as well; using the same testing procedures on originally installed equipment.

.3 Contractor shall pay all costs resulting from performance verification procedure.

1.28 DRAWINGS AND MEASUREMENTS

.1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work and are not detailed installation drawings. Do not scale the drawings. Obtain accurate dimensions from the Architectural and Structural drawings.

.2 Consult the architectural drawings and details for exact locations of fixtures and equipment. Obtain this information from the Consultant where definite locations are not indicated.

.3 Take field measurements, where equipment and material dimensions are dependent upon building dimensions.

.4 Where imperial units have been indicated in brackets [ ] following the requirements in SI units, the conversion is approximate and provided for convenience. The SI units shall govern.

1.29 SEQUENCE OF WORK

.1 Before interrupting major services notify the Owner well in advance and arrange an acceptable schedule for the interruptions.

.2 Before interrupting any services complete all preparatory work as far as reasonably possible and have all necessary materials on site and prefabricated (where practical) and work continuously to keep the length of interruption to a minimum.

.3 Include for the cost of all work that may be required out of regular hours to minimize the period of service interruption when connecting into the existing systems.

.4 Work in the Boiler Room will interrupt and affect the existing steam plant. This and all other work in the existing building required for the operation of the systems in the new addition must be completed before the new addition is ready for occupancy.

1.30 BUILDING OPERATION DURING CONSTRUCTION

.1 In order to minimize operational difficulties for the building staff, the various trades must cooperate with the owner throughout the entire construction period and particularly ensure that noise is minimized.

.2 Convenient access for the staff and public to the building must be maintained at all times. Minor inconvenience and interruption of services will be tolerated, provided advance notice is given, but the Contractor will be expected to coordinate his work, in consultation

with the owner, so the operation of the facility can be maintained as nearly normal as possible.

1.31 EXISTING SE0RVICES

.1 Work includes changes to existing building and changes at junction of old and new construction. Route pipes, ducts, conduits and other services to avoid interference with existing installation.

.2 Relocate existing pipes, ducts, conduits, bus ducts and any other equipment or services required for proper installation of new work, including as required for temporary removal and re-installation to suit new installation work.

.3 Protect all existing services encountered, even when the removal of concealing surfaces reveals existing services other than what is shown on the drawings.

.4 Work with the Owner's staff to trace the originating source and points served. Obtain instructions from the Consultant when existing services require relocation or modifications, other than those already indicated in the Contract Documents.

.5 Remove existing plumbing fixtures, lighting fixtures, piping, ductwork, wiring, and equipment to suit new construction. Cut back and cap drain, vent and water outlets, conduits and electrical outlets, not being used.

.6 Arrange work to avoid shutdowns of existing services. Where shutdowns are unavoidable, obtain the Owner's approval of the timing, and work to minimize any interruptions.

.7 Shutdowns, to permit connections, will be carried out by maintenance staff.

.8 In order to maintain existing services in operation, temporary relocations and/or bypasses of piping and ductwork may be required.

.9 Be responsible for any damages to existing systems by this work.

.10 The interruption of utility services to permit tie-ins shall be arranged through the Owner’s representative. Application must be received in writing at least seven (7) calendar days prior to the date required for the shutdown. Service shutdowns shall only be carried out by Physical Plant and will normally be scheduled to occur during evenings or weekends. The Owner reserves the right to withhold permission for a reasonable period with respect to any shutdown, if the shutting-off of a service will interfere with important operations.

1.32 SHOP DRAWINGS AND PRODUCT DATA

.1 General

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

.2 Shop drawings shall be reviewed, signed and processed as described in in Division 1, Submittals.

.3 Submit shop drawings to the Consultant as listed in Sections 21 99 65 (Fire Suppression), 22 99 65 (Plumbing), and 23 99 65 (HVAC) Equipment Manufacturers.

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

.5 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been coordinated,

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

.6 Work affected by submittal shall not proceed until the review process is complete.

.7 Installed materials and equipment shall meet specified requirements regardless of whether shop drawings are reviewed by the Consultant.

.8 Shop drawings shall include the Contractor's stamp, signed by Contractor's authorized representative, certifying approval of submissions, verification of field measurements and compliance with Contract Documents.

.9 Shop drawings shall be reviewed by the General Contractor and Mechanical Sub-Contractor indicating that the shop drawings have been reviewed, coordinated with the work and that the shop drawings are submitted without qualifications. Shop drawings shall bear the ‘reviewed’ stamp dated and initialed by the General Contractor and Mechanical Sub-Contractor prior to submitting the shop drawings to the consultant. Shop drawings, which do not bear the contractors and sub-trades ‘reviewed’ stamp, initials and date will be rejected and sent back as ‘not reviewed’.

.10 Submit samples, in addition to drawings, of all items, which in the Consultant's judgment, can be better examined for capacity, quality, finish or detail by sample rather than by drawings. Samples shall be submitted before equipment or material is ordered.

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

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

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

.14 If shop drawings are rejected technically after 3 submissions, the Contractor at no additional expense to the Owner shall revert to the specified product and manufacturer for this project.

.2 Content

.1 Submissions shall include transmittal letter containing:

.1 Date.

.2 Project title and number.

.3 Name and address of:

.1 Trade Contractor

.2 Supplier

.3 Manufacturer

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

.5 Other pertinent data.

.2 Information shall be given in S.I. units.

.3 Provide title sheet.

.4 The project shall be identified.

.5 Identify each piece of equipment as related to specification section and project equipment schedules.

.6 Data shall be specific and technical.

.7 Information shall include all scheduled data.

.8 Material for maintenance and operating manuals is not suitable.

.9 Advertising literature will be rejected.

.10 The shop drawings/product data shall include:

.1 Clearly mark submittal material using arrows, underlining or circling to show differences from specified ratings, capabilities and options being proposed. Cross out non-applicable material. Specifically note on the submittal specified features such as special tank linings, pumps, seals, material, or painting.

.2 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with mounting point loads.

.3 Weights of all major equipment for review by the appropriate Consultant.

.4 Mounting arrangements.

.5 Detailed drawings of bases, supports and anchor bolts.

.6 Capacity and performance characteristics indicated on performance curves for fans and pumps.

.7 Sound Power Data, where requested.

.8 Motor efficiencies on motors 1H.P. and larger.

.9 List of the manufacturers and figure numbers for all valves, traps and strainers.

.10 Control explanation and internal wiring diagrams for packaged equipment.

.11 Control system drawings including a written description of control sequences relating to the schematic diagrams. Refer to additional requirements in Division 25.

.12 Submit as a shop drawing, an electrical equipment list for any equipment supplied by the mechanical contractor or his subtrades. The list is to be submitted in a timely fashion so that the electrical contractor can utilize the list as a final check prior to ordering motor control centres, starters, or disconnects. The list is to indicate the following:

.1 The horsepower size and number of motors.

.2 The minimum circuit amps (MCA) for packaged equipment such as roof top units.

.3 The voltage and phase of the motors.

.4 Whether or not a starter or a disconnect is included as part of the package.

.3 Format

.1 Submit electronic copy of Shop Drawings for each requirement requested in specification Sections and as Consultant may reasonably request. If electronic copy is not feasible, submit hard copies as necessary.

.2 Include blank space for review comments and multiple consultant stamps.

.3 An assembly of related components, e.g. grilles, registers and diffusers or plumbing fixtures, shall be submitted with a cover sheet with the contents indicated, identified by tag and model number.

.4 Coordination

.1 Where mechanical equipment requires electrical connections, power or other services, the shop drawings shall also be circulated through the Electrical Contractor or other "services" contractor(s) prior to submission to the Consultants.

.5 Keep one (1) copy of shop drawings and product data, on site, available for reference.

1.33 DUCT AND PIPE MOUNTED CONTROL EQUIPMENT

.1 The following automatic control equipment will be supplied by the Controls Contractor but installed by the appropriate trade sections of the Mechanical Contract:

.1 Automatic control valves.

.2 Temperature control wells.

.3 Pressure tappings.

.4 Flow switches.

.5 Automatic control dampers.

.6 Static pressure sensors.

1.34 MAINTENANCE OF BEARINGS

.1 "Turn over" rotating equipment at least once a month from delivery to site until start-up.

.2 "Run-in" sleeve type bearings in accordance with manufacturer's written recommendation. After "run- in", drain, flush out and refill with new charge of oil or grease.

.3 Protect bearings, shafts and sheaves against damage, corrosion and dust accumulation during building construction.

1.35 DEMOLITION

.1 Reference Standards

.1 Unless otherwise specified, carry out demolition work in accordance with CAN/CSA-S350, Code of Practice for Safety in Demolition of Structures.

.2 Existing Conditions

.1 Visit and examine the site and note all characteristics and irregularities affecting the work of this section.

.3 Protection

.1 Cease operations and notify the Prime Consultant immediately for special protective and disposal instructions when any asbestos materials are uncovered during the work of this section.

.2 Prevent debris from blocking surface drainage inlets and mechanical and electrical systems, which remain in operation.

.4 Salvageable Materials

.1 Except as otherwise indicated, salvageable materials from areas of demolition shall become the property of the Owner at his discretion. All material removed from the building not handed over to the Owner for salvage under this project shall be removed from site and disposed of as required by any applicable disposal regulations.

.5 Existing Services

.1 Disconnect and cap all mechanical services in accordance with requirements of local authority having jurisdiction. Natural gas supply lines shall be removed by the gas company or by a qualified tradesman in accordance with gas company instructions.

.2 Maintain all building services as required during demolition/removal of existing.

.6 Demolition

.1 Carry out demolition in a manner to cause as little inconvenience to the adjacent occupied building area as possible. Coordinate the activity with the Owner and/or the Consultant.

.2 Carry out demolition in an orderly and careful manner.

.3 All removal of existing equipment, pipes and ductwork that may affect occupied areas of the building to be done outside of regular office hours or as scheduled with the Owner.

1.36 SALVAGE

.1 All piping, ducting and equipment, which becomes redundant and is no longer required due to the work in this Contract, shall be completely removed.

.2 All existing items which need to be removed, and which have a reasonable salvage value, such as fans and motors, air terminals, plumbing fixtures, and valves, shall be carefully removed. The Owner shall have first right of refusal.

.1 If the Owner accepts any items, the Contractor shall move those items to the Owner's designated storage place on site. These items shall not become the property of the Contractor. Obtain a written receipt from the Owner detailing each of the items handed over.

.2 If the Owner declines any items, the Contractor shall remove those items from the site. The Contractor shall be responsible for all costs of removal and disposal of the materials and equipment that are not accepted by the Owner.

1.37 REUSED EQUIPMENT

.1 Where existing equipment is being relocated and re-used, check and report on the condition to the Consultant before reinstallation.

1.38 TEMPORARY HEATING

.1 If it is desired to use the building’s mechanical systems to provide temporary heat during construction, submit a formal request, with full details, to the Consultant. Obtain written permission from the Consultant prior to any building systems being utilized.

.2 The main air handling supply units shall not be used for temporary heat.

.3 Use of permanent systems for temporary heat shall not modify terms of warranty.

.4 During the temporary heating period, comply with the following conditions:

.1 Maintain the systems.

.2 Lubricate all equipment operated.

.3 Operate systems only with cleaned piping systems.

.4 Maintain chemical treatment of piping systems.

.5 Keep mechanical rooms broom clean.

.6 Operate fans at proper resistance with filters installed. Change filters at regular intervals.

.7 Operate with proper safety devices and controls installed and fully operational.

.8 Where air systems are used during temporary heating, provide filter media on return and exhaust air outlets.

.9 Where hydronic systems are used, all terminal heating devices shall be brought o “as-new” condition before Ready-For-Takeover review is requested.

.5 Before handing the systems over to the Owner, comply with the following conditions:

.1 Bring plant to as-new conditions.

.2 Where pumps are used for temporary heating, replace mechanical seals, regardless of condition, with new mechanical seals. All bearings for equipment used shall be checked, re-greased, oiled and cleaned to bring it back to an "As-New" condition.

.3 Replace all panel type air filters installed under this contract with new filters.

.4 Re-clean ductwork and heating/cooling coils as necessary and provide a report from the approved duct cleaning agency certifying that the ductwork is clean.

1.39 TEMPORARY OR TRIAL USAGE

.1 Temporary or trial usage by the Owner of mechanical equipment supplied under this contract shall not represent acceptance.

.2 Repair or replace permanent equipment used temporarily.

.3 Repair or otherwise rectify damage caused by defective materials or workmanship during temporary or trial usage.

1.40 SPARE PARTS

.1 Provide spare parts as follows:

.1 One set of air filters for each filter bank installed (pre and final filters).

.2 One box of 6 cartridge filters for each water filter installed

1.41 PROJECT CLOSE-OUT REQUIREMENTS

.1 The project closeout requirements are specifically listed in each section of this specification. The following is a summary of those requirements. Refer to detailed specifications in each section for further requirements. Also refer to Section 23 99 60 Mechanical Forms for list of required HVAC, Plumbing and Fire Systems Ready-For-Takeover submissions.

.2 Items designated with an asterisk (*) are required to be submitted one week prior to required date of Schedule C-B. All life safety systems must be operational and tested and demonstrated to Consultant prior to issuance of Schedule C. This includes, but not limited to, items such as fire pump, sprinklers, stair pressurisation fans, smoke exhaust system, parkade exhaust CO system (as applicable).

.1 Controls:

.1 Controls system completion report (check sheets).

.2 Controls system final electrical approval certificate.

.3 As built control drawings.

.4 Control training signed off by Owner (Indicate dates of training in letter and attendance).

.5 List of control manuals and documents turned over.

.6 Printed copy of control program and database. Printed to disk in word format acceptable.

.7 Disc of control system database.

.8 Calibration report for refrigeration, carbon monoxide and CO sensors.

.9 Airflow station start up and calibration report.

.10 *Provide historical trend log data for all control points.

.1 Trend logs shall cover a one-week period with hourly samples for all points.

.2 Points shall be grouped together on graphs where applicable, e.g all points connected to an air handling unit, or heat exchanger shall be together.

.3 The controls contractor shall review each set of trend data and provide detailed high level written commentary regarding performance of each item, including suggestions for improvement.

.4 Submit trend log graphs to the Commissioning agency for detailed review and comment.

.5 Submit trend logs with detailed comments from both agencies to the Consultant after verification of proper operation of all control sequences.

.2 Heating/Cooling

.1 *Boiler Inspection Branch certificate.

.2 *Gas fired appliances/gas line/pressure piping certificate.

.3 *Registration certificates for all pressure vessels.

.4 Pressure test reports for heating, chilled and refrigeration lines.

.5 Vibration isolation report.

.6 *Seismic inspection report.

.7 Valve tag chart.

.8 As built drawings.

.9 *Welding certificate and x-ray reports.

.10 *Flushing and cleaning of piping report.

.3 HVAC

.1 *Fire damper test report letter and schedule.

.2 *As built drawings.

.3 Duct cleaning certificate.

.4 *Fume hood verification/air balance

.4 Miscellaneous

.1 Identification Schedules.

.2 Seismic Engineer’s Letters of Assurance

.3 Demonstrations to Owner signed off by Owner.

.4 List of incomplete or deficient work prepared by each sub trade.

.5 Contractor's Letter of Guarantee

.6 Signed-off Ready-For-Takeover inspection report.

.7 Power Smart documentation for chiller, VSDs etc.

.8 List of spare parts signed off by Owner.

.9 LEED documentation.

.10 Sustainability documentation.

.5 Plumbing

.1 *Final plumbing acceptance inspection report from city/municipality.

.2 Valve tag chart for plumbing system.

.3 *Pressure test reports for sanitary, storm and domestic water.

.4 Back flow prevention test reports.

.5 *As built drawings.

.6 O&M information.

.7 Final gas inspection acceptance inspection.

.8 *Inside water service chlorination report.

.6 Sprinkler System
- .1 Sprinkler material and test certificate.
- .2 *Sprinkler contractor's schedule 'C' letter of assurance.
- .3 *Final sprinkler acceptance inspection report from municipality.
- .4 Valve tag chart and low point drains.
- .5 Back flow prevention test reports.
- .6 *As built documents.
- .7 O&M information. Spare sprinklers, cabinet and wrench.

.7 Other reports including:
- .1 Manufacture start-up reports
- .2 Acid neutralizer alarm panel.
- .3 Air compressor and dryer.
- .4 Air and Water Balance.
- .5 Commissioning.
- .6 Dust collector.
- .7 *Fire stop letter of assurance.
- .8 Chillers / Boilers
- .9 Heating, chilled and condenser chemical treatment.
- .10 Roof top gas fired units.
- .11 VFDs

1.42 READY-FOR-TAKEOVER (“RFT”) REQUIREMENTS

.1 The contractor shall submit the following documentation to the Consultant a minimum of 5 working days prior to the project occupancy site walk-through or occupancy date, whichever is scheduled first. The dates will be established by the project architect, project manager or Certified Professional. It is the contractor’s responsibility to provide all documentation to the Consultant in a timely manner. If all documentation is not received, the Consultant may not be able to issue their associated Schedule C-B in support of the building occupancy application and any associated consequences shall become the responsibility of the contractor.

.2 Before the Consultant is requested to inspect for Ready-For-Takeover of the work:
- .1 Commission all systems and prove out all components, interlocks and safety devices.
- .2 Submit a letter certifying that all work (including calibration of instruments and balancing of systems) is complete, operational, clean and all required submissions have been completed. Use Form MF190 in Section 23 99 60 for this purpose.
- .3 A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Consultant, this list indicates the project is excessively incomplete, a Ready-For-Takeover inspection will not be performed.

.3 The work will not be considered to be ready for use or Ready-For-Takeover (“RFT”) until the following requirements have been met:
- .1 All reported deficiencies have been corrected.
- .2 Testing and balancing completed.
- .3 Operating and Maintenance Manuals completed.
- .4 "As built" record drawing ready for review.

.5 System Commissioning has been completed and has been verified by Consultant.

.6 All demonstrations to the owner have been completed.

.7 All documents required on Form MF189, Section 23 99 60 have been submitted.

.4 Letters of assurance will not be issued until the following requirements have been met:

.1 All items listed in .1 and .2 above have been completed.

.2 Certificate of Fire Damper Installation (MF172).

.3 Certificate of Penetrations through Separations (MF173).

.4 Seismic engineer's letter of assurance and final inspection report.

.5 Ready-For-Takeover requirements are met.

.6 Signed off copy of final inspection report.

.7 Sprinkler and fire alarm test verification, sprinkler materials and test certificate and engineer's letter of assurance.

.8 Plumbing inspection report / card.

.9 Certificate of Backflow Prevention Device.

1.43 DEFICIENCY HOLDBACKS AND DEFICIENCY INSPECTIONS

.1 Work under this Division which is still outstanding when Ready-For-Takeover is certified will be considered deficient and a sum equal to at least twice the estimated cost of completing that work will be held back.

.2 It is expected that outstanding work will be completed in an expeditious manner and the entire holdback sum will be retained until the requirements for Total Performance of Division 21, 22, 23 and 25 work have been met and verified.

Part 2 Products

2.1 ACCESS DOORS

.1 Standard of Acceptance: Maxam, Milcor, Acudor

.2 General:

.1 Supply flush mounted access doors, for installation by Building Trades in furred ceilings and walls, for maintenance and/or adjustment purposes of all mechanical system components and accessories, inspection of life safety or operating devices, and where specifically indicated, including,

.1 Valves

.2 Volume and splitter dampers

.3 Fire dampers

.4 Cleanouts and traps

.5 Coils and terminal units

.6 Expansion joints

.7 Control components

.2 Locate access doors so that all concealed items are readily accessible for adjustment, operation, and maintenance. Locate in service and storage areas wherever possible.

.3 Mark removable ceiling tiles used for access with color coded pins. Refer to Section 20 05 53, Identification for Mechanical Systems.

.4 Access doors in rated fire separations and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch.

.1 Door shall be filled with minimum 50 mm [2”] thick fire rated insulation to suit rating.

.2 Door shall have automatic closer, be self-latching, no straps, and contain an interior latch release.

.5 Access doors shall be flush mounted with 180° opening door, round safety corners, concealed frame, flange and full length piano hinges.

.1 Provide plaster lock and anchor straps and tabs to suit wall or ceiling construction type.

.2 Provide full stud framing behind drywall around access door flange.

.6 Frame shall be 1.5 mm (16 ga.) steel. Door shall be 0.9 mm (18 ga.) steel, welded pan type.

.7 Do not locate in paneled, feature or special finish walls, without prior approval of the Consultant. If so, match the feature wall module sizes.

.8 Refer to Division 08 for additional access hatch requirements.

.3 Finishes:

.1 Wet areas (e.g., washrooms): stainless-steel.

.2 General areas: Base metal shall be steel with primer coast of rust inhibitive electrostatic powder baked gray enamel, suitable for field painting.

.4 Access Doors – Non-secure:

.1 Constructed of steel, prime coated, except:

.1 Constructed of stainless steel in areas finished with tile or marble surfaces

.2 Constructed of stainless steel with neoprene gasketed door in damp and high humidity areas

.2 Generally fitted with screwdriver operated latches, except:

.1 in areas subject to security risks (Public Corridors, Psychiatric Patient Areas, Public Washrooms), provide keyed cylinder locks with similar keys.

.3 Plaster or wet wall construction: flush with wall or ceiling type with concealed flange.

.4 Tile, ceramic tile, marble, terrazzo, plaster or wet wall construction in washrooms and other special areas: flush with wall or ceiling type with concealed flange.

.5 Feature wall construction: Recessed wall type that is selected to complement and conform with the architectural module, treatment, or paneling. The size shall conform to adjacent finishes, to achieve minimum specified sizes.

.1 Door panel shall be recessed to receive ceiling or wall material to give finished appearance showing only hinge and fasteners.

.6 Access doors are not required in removable ceilings. Provide coloured marking devices after completion of ceilings, at four corners of each panel below point requiring access. Colour code markers to show service or device above.

.5 Secure Access Doors

.1 Secure access doors shall comply with Patient Safety Standards Materials and Systems Guidelines as recommended by the New York State Office of Mental Health.

.2 Latches shall be bolt-type, operated by flush key device. All locks shall be keyed alike. Keyed locks must be strong enough stop attempted breaches.

.3 Provide non-loopable ADA pulls.

.6 Size:

.1 Unless otherwise noted, access doors shall be minimum:

.1 600mm x 600mm [24" x 24"] for body entry

.2 300mm x 450mm [12" x 18"] for hand entry

.3 200mm x 200mm [8" x 8"] for cleanout access.

.4 Access doors in building surfaces shall be at least as large as duct access panels accessed through them and shall be oversized when necessary. Size to suit masonry modules when located in a masonry wall.

2.2 FIRE STOPPING AND SMOKE SEAL MATERIALS

.1 References:

.1 CAN4-S115-M, Standard Method of Fire Tests of Firestop Systems.

.2 ASTM E814 Standard Method of Fire Tests and Through-Penetration Firestops.

.3 1997 Certifications Listings Intertek Testing Services N.A. Ltd. (Warnock Hersey).

.4 Underwriters Laboratories of Canada. Listing of Equipment and Materials Vol. 3 Fire Resistance Ratings -Revision 4/95.

.2 Work Included:

.1 Furnish all labour, material, equipment and services necessary to supply and install firestopping and smoke seals around mechanical service piping and duct penetrations through fire rated wall and floor assemblies, as indicated and as specified.

.3 Quality Assurance:

.1 The work of this section shall be carried out only by an approved specialist firm, employing skilled tradesmen experienced in firestopping and smoke seal application and approved, licensed and supervised by the manufacturer of fire stopping materials.

.2 All work to be of the highest quality according to best trade practice and in strict accordance with manufacturer's printed specifications.

.4 Submittals:

.1 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation.

.2 Submit manufacturers' product data for materials and prefabricated devices. Include assembly/location design system number references with copies of test information. Construction details should accurately reflect actual job conditions.

.3 For building assemblies which do not correspond to any previously tested and rated assemblies, submit proposals based on related designs using accepted fireproofing design criteria.

.5 Materials:

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC CAN4-S115 and not to exceed opening sizes for which they are intended.

.2 Service penetration assemblies and design numbers: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19. 1997 Certification Listings Intertek Testing Services N.A. Ltd. (Warnock Hersey).

.3 Service penetration firestop components: Certified by ULC in accordance with CAN4-S115 and listed in ULC Guide No. 40 U19.13 and ULC Guide No. 40

U19.15 under the Label Service of ULC or equivalent approved tests by Warnock Hersey.

.4 Fire resistance rating of installed fire stopping assembly shall be not less than the fire resistance rating of surrounding floor and wall assembly.

2.3 MENTAL HEALTH FACILITY REQUIREMENTS

.1 Heating and cooling units, ventilation outlets, and associated equipment installed in patient-occupied areas of mental health units shall be in accordance with the following:

.1 accessible components of HVAC equipment shall be securely fastened;

.2 removable portions of HVAC equipment shall be securely attached with tamper-proof fasteners;

.3 air diffusers, grilles, and registers shall be of a type that prohibits the insertion of foreign objects;

.4 exposed HVAC components within rooms shall be constructed with rounded corners and fastened with tamper-resistant screws; and

.5 HVAC equipment shall be of a type that minimizes the need for maintenance within rooms.

2.4 OPERATING AND MAINTENANCE MANUALS

.1 Prepare instruction manuals which include equipment manufacturers' operating and maintenance bulletins, a report on the balancing of the air and water systems and a report on chlorination of water mains.

.2 Comply with requirements indicated in Division 1.

.3 The manufacturers' bulletins shall include:

.1 General description of the unit or system, with component parts, and their operational procedures.

.2 Normal maintenance and minor troubleshooting of each major item.

.3 Start-up and shut-down requirements for each system.

.4 Engineering data and tests.

.5 Wiring diagrams.

.6 Control diagrams.

.7 Servicing and lubrication schedule, and list of lubricants required.

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

.9 Spare parts list.

.10 Local source of supply for replacement parts.

.4 Provide three hard copies in suitably labelled stiff Accopress binders, to the Consultant at least 10 days prior to the Ready-For-Takeover review date. The front cover of the manual indicates the Name of Project and Name of Manual.

.5 Provide digital format manuals as follows,

.1 Digital manuals shall be supplied on CD or USB drive

.2 The digital version content and organization for each manual shall be arranged in a manner identical to the hard copy version.

.3 Utilize Adobe Acrobat 11 (or later) Portable Document Format (PDF). Include a copy of Adobe Acrobat Reader 11 (or later)

.4 The information shall be organized into sections in a user-friendly format that is easy to search for specific information. An indexing system shall be included that remains on an expandable portion of the screen and allows the end user to scroll through the manual information that appears on the main portion of the screen.

.1 Refer to the Control Sections for Building Management System manual requirements.

.6 Submit a draft copy of the Manual to the Consultant for approval, thirty (30) days prior to start-up of the systems and equipment.

.7 After receiving approval of the draft copy, make any corrections as may be required and then furnish three (3) final copies to the Consultant at least ten (10) days prior to the Ready-For-Takeover date. Provide more than one volume if the overall thickness of a single binder would exceed 100 mm [4"].

.8 Printed hard cover manuals shall be supplied in three (3) post hard back Acco expansion style "Fliplock" binders, with stamped lettering on the front cover and spine showing the following:

.1 Name of Project

.2 Name of Manual - "Operating and Maintenance Manual
Mechanical Systems"
Volume - "X" of "Y"

.9 Digital format manuals shall be supplied on USB drives.

.1 The digital version content and organization for each manual shall be arranged in a manner identical to the hard copy version.

.2 Utilize Adobe Acrobat 11 (or later) Portable Document Format (PDF). Include a copy of Adobe Acrobat Reader 11 (or later)

.3 The information shall be organized into sections in a user-friendly format that is easy to search for specific information. An indexing system shall be included that remains on an expandable portion of the screen and allows the end user to scroll through the manual information that appears on the main portion of the screen.

.4 The final Digital copies are to be copied to CD media with a custom CD label.

.5 The custom CD label shall include: Project Name, Location of Project, Date of Assembly, name of Mechanical Consultant, and shall be titled “Operating & Maintenance Manual for Mechanical Systems.”

.6 The Digital Manual shall be enhanced with the following features: Bookmarks, Internet Links, Internal Document Links and Optical Character Recognition (OCR). Refer to Scanning Requirements and Organizational Requirements listed below.

.7 Scanning Requirements:

.1 All pages contained within the hard copy manual are to be scanned and/or digitized to Adobe Acrobat 11 (or later) PDF. Include table of contents with links to the referenced pages.

.2 Provide a minimum 300 DPI for all scanned pages.

.3 All scanned material may be searched for text with minimum 60% Optical Character Recognition (OCR).

.4 All scanned shop drawings are to be scanned to a minimum 216mm x 279mm [8.5” x 11”] size. If the original page size is 279mm x 432mm [11” x 17”], the digital copy shall also be 279mm x 432mm [11” x 17”].

.5 Rotation of scanned page images/texts shall be displayed within +/- 20 degrees.

.8 Organizational Requirements:

.1 Digital Manual shall be organized in the same manner as the approved Hard Copy Manual. (e.g. Tabs 1.1, 1.2, 1.3, 2.0, 3.0, etc.)

.2 Bookmark all major tabs and subsections

.3 Bookmark each set of shop drawings

.4 Link the Table of Contents page to the referenced sections

.5 Insert an introduction / summary page for all sections indicating major subsections. Link these pages to their referenced sections

.6 Link the system descriptions to the referenced schematic drawings.

.7 Insert internet links and internal document links to mechanical equipment manufacturers / suppliers / contractors official websites; and to mechanical equipment shop drawings.

.8 Use the following colour code for links: internet links shall be light blue with underline, internal document links shall be dark blue (excludes AutoCAD schematic links), and links to other PDF files shall be dark green.

.9 It is the responsibility of the mechanical contractor to provide high quality documentation for scanning.

.10 The digital version of the manuals and the hard cover version shall be prepared by the same company.

.11 Digital Manual shall be reviewed by the Mechanical Consultant for content and layout prior to final submission.

.12 All information within the hard copy manual shall be included within the Digital Manual. At the Owner's / Consultant's discretion the following exceptions may be made so that the manual may be available for use by the Owner at an earlier date:

.1 The final Balance Report may be provided as a later submission in Adobe Acrobat 11 (or later) Portable Document Format (PDF). In this case, Balance Report(s) may be kept separate from the Digital Manual.

.2 The final Commissioning Report may be provided as a later submission in Adobe Acrobat 11 (or later) Portable Document Format (PDF). In this case, the Commissioning Report(s) may be kept separate from the Digital Manual.

.10 After Ready-For-Takeover has been declared, the agency shall visit the site, to explain and instruct the representative designated by the Owner on the use of the maintenance program.

.11 The record cards shall be suitable for filing in the existing filing system.

2.5 RECORD DRAWINGS

.1 Comply with requirements indicated in Division 1 – Project Record Documents.

.2 Maintain one hard copy set of contract drawings, including all supplementary and revision drawings on site, solely for the purpose of recording, in red, any change and/or deviation from the Contract Drawings as it occurs. Include elevations and detailed locations of buried services.

.3 The set of drawings will be provided to the contractor by the Consultant at the contractors cost.

.4 The marked-up set of drawings will be reviewed on site monthly by the consultant during the construction process. This review will form a requirement for approval of the monthly progress claim.

.5 Back filling shall not occur until underground services dimensions are marked on the on-site record set.

.6 The Record Drawings shall include, but not limited to, the following changes and shall be recorded daily:

.1 Size, location, arrangement, routing and extent of ductwork, piping, terminal units, equipment, fixtures, clean-outs, valves, rough-in, etc. above and below grade inside the building and including dimensioned locations of buried piping from building walls

.2 Location of fire dampers.

.3 Location of all heat traced piping and associated controllers.

.4 Location of back flow preventers.

.5 Location of water hammer arrestors.

.6 Water lines: Invert elevations to be recorded at each junction, changes of direction and every 30 m [100 ft.] run.

.7 Sanitary Sewers: Invert elevations and locations to be recorded at each clean-out.

.8 Storm Drains & Sewers: Invert elevations to be recorded at each manhole, clean-out, changes of direction and every 30 m [100 ft.] run.

.9 Gas Lines: Invert elevations to be recorded at each junction, at building entry point and at changes of direction.

.10 All services located below ground level and in or below a building slab.

.11 All valve stations, trap stations, coils dampers and ductwork not easily accessible.

.12 Location, tagging, and numbering of all valves as specified in Section 23 05 53

.7 CAD Drafting:

.1 Refer to Division 1 for cost of preparing record drawings.

.2 Obtain the services of the Consultant or an approved CAD draftsperson to transfer all changes to amend the CAD files in the latest version of AutoCAD.

.3 Include all details from revision drawings, addenda, and change orders. Label each drawing in the lower right corner in letters of at least 12mm [1/2"] high as follows:

.1 "AS BUILT DRAWINGS," Contractors name and date.

Part 3 Execution

3.1 CONCEALMENT

.1 Conceal all piping, ductwork and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.

.2 Do not install piping and conduit in outside walls or roof slabs unless specifically directed, in which case, install them with the building insulation between them and the outside face of the building.

3.2 ACCESSIBILITY

.1 Install all work so as to be readily accessible for adjustment, operation and maintenance. Furnish access doors where required in building surfaces for installation by building trades. Refer to item "Access Doors."

3.3 PIPING EXPANSION

.1 Install piping with all necessary changes of direction, expansion loops, anchors and guides so that expansion and contraction will not overstress the piping and equipment piping connections.

.2 Expansion loops shall be of all welded construction with long radius elbows; cold sprung 50% and located between anchors.

.3 Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B.31.

3.4 PROTECTION OF WORK

.1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.

.2 Mask machined surfaces. Secure covers over equipment openings and open ends of piping, ductwork and conduits, as installation work progresses.

.3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.

.4 Refinish damaged or marred factory finish.

.5 Air systems to have air filters installed before fans are operated. Install new air filters before system acceptance.

3.5 CUTTING, PATCHING, DIGGING, CANNING, AND CORING

.1 Lay out all cutting, patching, digging, canning and coring required to accommodate the mechanical services. Coordinate with other Divisions.

.2 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls. Openings through structural members of the building shall not be made without the approval of the Consultant.

.3 Be responsible for correct location and sizing of all openings required under Division 21, 22, 23 and 25, including pipe sleeves and duct openings. Allow oversized openings for fire dampers and pipe penetrations where insulation is specified.

.4 Verify the location of existing service runs and steel reinforcing within existing concrete floor and walls prior to core drilling and/or cutting. Repairs to existing services and structural components damaged as a result of core drilling and cutting is included in this section of the work.

.5 The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.

.6 All openings shall be core drilled or diamond saw cut.

3.6 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

.1 Provide pipe sleeves for all piping passing through fire-rated walls and floors. Sleeves to be concentric with pipe.

.2 Submit shop drawings(s) of listed assemblies for each type of penetration through a rated assembly.

.3 All piping, tubing, ducts, wiring, conduits, etc. passing through rated fire separations shall be smoke and fireproofed with ULC approved materials in accordance with CAN4-S115-11 (R2016) and ASTM E814 standards and which meet the requirements of the Building code in effect. This includes new services, which pass through existing rated separations, and all existing services, which pass through a new rated separation or existing separations whose rating has been upgraded.

.4 Sleeves shall be sized to suit fire stopping methods employed for bare pipes, conduits, insulated pipes, and bare and insulated ducts without fire dampers, and

.5 Sleeves shall be sized to suit conditions of approval given in manufacturers installation instructions for fire and smoke dampers.

.6 Fire resistance rating of installed firestopping assembly shall not be less than fire resistance rating of surrounding assembly indicated on Architectural drawings.

.7 All smoke and fire stopping shall be installed by a qualified Contractor who shall submit a letter certifying that all work is complete and in accordance with this specification. Use Mechanical Form MF173 in Section 23 99 60 for this purpose.

.8 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions in formed, sleeved or cored penetrations.

.9 Combustible pipe penetrations through fire separations that are required to have a fire resistance rating shall be as follows:

.1 Intumescent firestopping material contained in a metal housing that is certified for firestopping use. Installation shall be implemented in full compliance with the certified installation procedures. Standard of Acceptance: FGC Fireguard Corp. DONUT Firestop for flat surfaces; 3M Brand (Intumescent) Fire Barrier, Dow Corning Fire Stop Intumescent Wrap for Q-deck.

.10 Sleeves for fire-rated floor slabs in wet or dry areas shall be as noted on the Standard Details.

.11 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

.12 Sleeves for interior partition (i.e. drywall) shall be as noted on the Standard Details.

.13 Sleeves for interior concrete or block walls shall be steel pipe or removable plastic pipe.

3.7 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

.1 Pipes and ducts passing through separations that have no fire resistance (non-rated separations) do not require a sleeve, but the insulation at the separation shall be wrapped with 0.61 [24 ga] thick galvanized sheet steel band to which to apply the flexible caulking compound to, to achieve a tight seal.

.2 Sleeves for concrete perimeter walls and foundation walls shall be cast iron sleeve or Schedule 40 steel pipe with annular fin continuously welded at midpoint and protruding 150 mm [6”] beyond sleeve diameter. Annular fin shall be embedded into centre of wall.

.3 Sleeves for non-rated floor slabs in wet or dry areas shall be steel pipe.

.4 Sleeves for interior concrete or block walls shall be steel pipe or removable plastic pipe.

3.8 LINK SEALS

.1 Fit each pipe passing through floor slab in contact with ground or basement walls below grade with link seal between sleeve and bare pipe.

.2 Submit manufacturer’s literature and schedule showing location, service, inside diameter of wall opening, sleeve length and pipe outside diameter.

.3 Link seal:

.1 Manufactured from modular synthetic rubber links with stainless steel hardware.

.2 Loosely assembled with bolts to form continuous rubber belt around pipe, with pressure plate under each bolt head and nut.

.3 Constructed to provide electrical insulation between pipe and sleeve.

.4 Installation

.1 Determine inside diameter of each wall opening or sleeve before ordering seal.

.2 Position seal in sleeve around pipe and tighten bolts to expand rubber links until watertight seal is obtained.

3.9 ACCESS DOORS

.1 Install access doors at all concealed cleanouts, traps, unions, expansion joints, valves, control valves, air vents, water hammer arrestors, special equipment, trap primers, vacuum breakers and any other equipment for which subsequent periodic access will be required during the life of said equipment.

.2 Locate access doors so that all concealed items are readily accessible for adjustment, operation, maintenance, and replacement.

.3 Do not locate access doors in feature walls or ceilings without the prior approval of the Consultant. Locate in service areas and storage rooms wherever possible.

.4 Installation shall be by Building Trades in furred ceilings and walls. Coordinate accordingly.

.5 At time of instruction of owners operating staff, hand-over and obtain signed receipt for 4 sets of each type of key used to lock access doors.

.6 Provide coloured marking devices after completion of ceilings, at four corners of each panel below point requiring access. Colour code markers to show service or device above.

3.10 ESCUTCHEONS AND PLATES

.1 Provide on pipes passing through finished walls, partitions, floors and ceilings.

.2 Plates shall be stamped steel, split type, chrome plated, or stainless steel, concealed hinge, complete with springs, suitable for external dimensions of piping/insulation. Secure to pipe or finished surface. For all pipes passing through suspended ceilings and uninsulated piping passing through walls. Outside diameter shall cover opening or sleeve.

.3 Where pipe sleeve extends above finished floor, escutcheons or plates shall clear sleeve extension.

.4 Do not install escutcheons and plates in concealed locations.

3.11 EQUIPMENT SUPPORTS, PLATFORMS, LADDERS, AND BASES

.1 Provide stands and supports for equipment and materials supplied.

.2 Supports:

.1 Fabricate platforms, gratings, ladders, piping and equipment supplementary supporting steel, and trench and pit covers, from steel and provided by this Division.

.2 Concrete housekeeping bases for mechanical equipment which are in direct contact with floor slab, to be provided by this Division.

.3 Concrete bases for equipment supported on vibration isolation materials (inertia pads), to be provided by this Division.

.4 Construct equipment supports of structural steel or steel pipe. Securely brace. Employ only welded construction. Bolt mounting plates to the structure.

.5 Support ceiling hung equipment with rod hangers and/or structural steel.

.6 Work to be done by firms specializing in these fields.

.7 Submit shop drawings for steel and concrete work, prepared by licensed Professional Engineers.

.3 Concrete bases for housekeeping pads:

.1 Lay out concrete bases and curbs required under Divisions 21, 22, 23 and 25. Coordinate with Division 3. All concrete work is under Division 3.

.2 Constructed using plywood form work and 20 Mpa [3000 lb] concrete.

.3 Bases and curbs shall be keyed to the floor and incorporate reinforcing bars and/or steel mesh. Chamfer edges of bases at 45 degrees.

.4 Dowel to concrete floor slab with not less than 13 mm [1/2”] diameter steel rods.

.5 Plan dimensions:

.1 150 mm [6”] larger all around than base of apparatus for non-seismic applications,

.2 200 mm [8”] larger all around than base of apparatus for seismically restrained equipment, and

.3 finished to make smooth, neat surfaces with corners chamfered 25 mm [1”].

.6 Height conforming to following table;

.1 Equipment:

.1 Stationary, not motorized: 100mm [4”]

.2 Motorized: 150mm [6”]

.7 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25 [1"] above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout.

.4 Installation:

.1 Locate supporting steel to permit removal of parts for service or repair, and to allow clear access to valves, fittings, and equipment,

.2 Set equipment on supporting frames and brackets and install hangers, anchor bolts, vibration mountings and snubbers.

.3 Set equipment base plates on housekeeping pads on minimum 13 mm [1/2”] epoxy grout and fill hollow portion of base with concrete.

.4 Install anchor bolts, vibration mountings and snubbers between equipment and housekeeping pad, or inertia pad and housekeeping pad.

.5 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.6 Provide anchorage, dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.7 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.8 Supply items for casting into concrete or building into masonry to appropriate trades together with setting templates.

.9 Touch-up field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.10 Where gratings or trench covers are cut in field or damaged, touch up with zinc rich paint.

.11 Hot equipment subject to thermal expansion:

.1 Fasten equipment to building structure to accommodate thermal expansion in accordance with manufacturer's instructions. In the absence of such instructions, fasten equipment support legs as follows unless otherwise noted,

.1 rigidly fasten one support point which is closest to piping connections,

.2 for supports located on the same transverse or longitudinal axis, provide guides with vertical restraint tabs, aligned in direction of fixed support point,

.3 Provide 3mm [1/8"] thick PTFE (Teflon) glide pads beneath each support leg.

3.12 EQUIPMENT RESTRAINT

.1 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

3.13 EQUIPMENT INSTALLATION

.1 Provide unions and flanges to permit equipment maintenance and disassembly and to minimize disturbance to piping and duct systems and without interfering with building structure or other equipment.

.2 Provide means of access for servicing equipment including permanently lubricated bearings.

.3 Pipe equipment drains to floor drains.

.4 Line up equipment, rectangular cleanouts and similar items with building walls wherever possible.

3.14 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other divisions.

3.15 MISCELLANEOUS METALS

.1 Be responsible for all miscellaneous steel work relative to Division 21, 22, 23, 25 of the Specifications, including but not limited to:

- .1 Support of equipment
- .2 Hanging, support, anchoring, guiding and relative work as it applies to piping, ductwork, heat exchangers, hot water storage tanks, expansion tanks, fans and mechanical equipment.
- .3 Earthquake restraint devices - refer to Section 23 05 49.
- .4 Pipe anchor and/or support posts.
- .5 Ceiling ring bolts - secure to structure or steel supports.
- .6 All steel work shall be primed and undercoat painted ready for finish under Division 9. Refer to drawings for details.

3.16 FLASHING

.1 Flash and counterflash where mechanical equipment passes through weather or water proofed walls, floors, and roofs.

.2 Flash, vent and soil pipes projecting 75 mm [3”] minimum above finished roof surface with lead worked 25 mm [1”] minimum into hub, 200 mm [8”] minimum clear on side with minimum 600 x 600 mm [24” x 24”] sheet size. For pipes through outside walls turn flange back into wall and caulk.

.3 Flash floor drains over finished areas with lead 250 mm [10”] clear on sides with minimum 900 x 900 mm [36’” x 36”] sheet size. Fasten flashing to drain clamp device.

.4 Provide curbs for mechanical roof installations 200 mm [8”] minimum high above roof insulation. Flash and counterflash with galvanized steel, soldered and made waterproofed.

.5 Provide continuous lead or neoprene safes for built-up mop sinks, and shower stalls located above finished rooms. Solder at joints, flash into floor drains and turn up 150 mm [6”] into walls or to top of curbs and caulk into joints.

3.17 DIELECTRIC COUPLINGS

.1 On all "OPEN" systems provide wherever pipes of dissimilar metals are joined.

.2 Provide insulating unions for pipe sizes 50mm [2”] and under and flanges for pipe sizes 65mm [2.5”] and larger.

.3 Provide felt or rubber gaskets to prevent dissimilar metals contact.

.4 Standard of Acceptance: Capital, Walter Vallet, EPCO.

3.18 LUBRICATION OF EQUIPMENT

.1 Lubricate all new equipment prior to being operated, except sealed bearings, which shall be checked.

.2 Use the lubricant recommended by the manufacturer for the service for which the equipment is specified.

.3 Extend lubricating connections and sight glasses to the outside of housings, where lubricating positions are not readily accessible.

.4 Submit a check list, showing that all operated equipment has been lubricated prior to and during any temporary heating period and the demonstration and instruction period.

3.19 PAINTING

.1 Clean exposed bare metal surfaces supplied under Division 21, 22, 23 and 25 removing all dirt, dust, grease and millscale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.

.2 After equipment has been installed and piping and insulation is completed, clean rust and oil from exposed iron and steel work provided under this Division, whether or not it has been factory prime painted.

.3 Paint all pipe hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.

.4 Repaint all marred factory finished equipment supplied under Division 21, 22, 23 and 25, which is not scheduled to be repainted, to match the original factory finish.

.5 In "occupied" areas of building touch up any damage to prime coat resulting from shipping or installation and leave ready for final painting under Finishes, Division 9.

.6 In "un-occupied" areas of the building such as mechanical equipment rooms, boiler rooms, fan rooms, crawl spaces, pipe tunnels and penthouses:

.1 paint exposed galvanized metal surfaces with one coat of zinc dust galvanized primer and one coat of 100% Alkyd base enamel in an approved colour; and

.2 paint exposed iron or steel work with one coat of chrome oxide phenolic base primer and one coat of 100% Alkyd base enamel in an approved colour.

.7 Natural gas and fire protection piping shall be painted for identification purposes over their entire lengths throughout all exposed areas and in the mechanical room(s) as follows:

.1 Gas: Yellow, C.G.S.B. 505-101

.2 Fire: Red, C.G.S.B. 509-102

.8 Coordinate with Division 9.

.9 Painting of all equipment and materials, supplied under Division 21, 22, 23 and 25, installed in mechanical equipment areas and inside finished areas of the building or exposed outside the building, is included under Division 9 of the Specification.

.10 Painting by Division 9 shall be in accordance with the following Colour Schedule for Mechanical Equipment Areas:

Item	Primer (Note **)	Colour Finish
Ductwork, Plenums and Miscellaneous Steel		
• not galvanized	1. Damp-proof Red 2. Zinc Chromate	Grey
• galvanized	Clear blue undercoat	White (2 coats)
• plenum access doors and 200 mm [8”] around doors	Clear blue undercoat	Grey
Exposed Misc. Metal (supplied under this contract)	1. Damp-proof Red 2. Zinc Chromate	To be determined on site

Item	Primer (Note **)	Colour Finish
Fan Casings and Bases	1. Damp-proof Red 2. Zinc Chromate	Grey
Fire hose cabinets and sprinkler control cabinets		Painted inside and out to match wall finish or as determined by Architect.
Guards – Belt and Coupling	1. Damp-proof Red 2. Zinc Chromate	To match equipment
Handrails	Red Primer	Aluminum
Insulation Covering (on piping, tanks, heat exchangers, breeching, etc.)	White Primer	White
Piping (uninsulated)		
• fire lines (standpipes, sprinklers)	Red Primer	Red
• services other than above	Red Primer	White
Valve Bodies (uninsulated)		
• hot water heating, antifreeze heating	Red Primer	Aluminum (high temp.)
• services other than above	Red Primer	To match associated piping

Note ** 1. denotes first primer coat and 2. denotes second primer coat.

3.20 EQUIPMENT PROTECTION AND CLEAN-UP

.1 Protect equipment and material in storage, on site and after installation until final acceptance. Leave factory covers in place. Take special precautions to prevent entry of foreign material into working parts of piping and duct systems.

.2 All mechanical equipment stored on site shall be kept in a dry, heated and ventilated storage area.

.3 Thoroughly clean piping, ducts and equipment of dirt, cuttings, and other foreign material.

.4 Protect bearings and shafts during installation. Grease shafts and sheaves to prevent corrosion. Supply and install necessary extended nipples for lubrication purposes.

.5 Provide, install and maintain 30% efficient temporary filters to return and exhaust air openings from ceiling spaces to prevent air born dust from entering ducts, plenums and coils. Install filters to return air grilles when fans are operated, and building is not at a clean condition.

3.21 FINAL CLEANING AND ADJUSTMENTS

.1 Conduct final cleaning.

.2 Thoroughly clean exterior surface of exposed piping, and vacuum external surfaces of exposed ducts and interior surfaces of air handling units. Clean strainers in piping systems and install clean filters in air handling systems.

.3 Remove tools and waste materials on completion of work and leave work in clean and perfect condition.

.4 Calibrate components and controls and check function and sequencing of systems under operating conditions.

.5 Supply lubricating oils and packing for proper operation of equipment and systems until work has been accepted.

3.22 START-UP

.1 Before starting the plant, provide a certificate stating that the plant is ready for start-up and the following conditions have been met. Use forms in Section 23 99 60 for this purpose.

.1 All safety controls installed and fully operational.

.2 Qualified personnel available to operate the plant.

.3 Permanent electrical connections made to all equipment.

.4 All air filters installed.

.5 Pump and fan drives properly aligned by a journeyman millwright.

.6 All mechanical equipment rooms, including plenums, vacuum cleaned.

3.23 START-UP AND PERFORMANCE REPORTS

.1 Required reports

.1 Provide the following Start-Up and Performance Testing reports:

.1 Equipment start-up report

.2 Authorities report

.3 Acoustic survey report

.4 Controls / BMS operation report

.2 Equipment start-up report

.1 Provide a test report in spreadsheet format which summarizes the following data for each piece of equipment which is powered or has automatic controls:

.1 equipment ID and name,

.2 motor insulation megger test - result and initialed by contractor,

.3 motor rotation (bump test) - result and initialed by contractor,

.4 equipment Start-Up report status - status and initialed by contractor,

.5 manufacturer Start-Up report status – status and initialed by contractor,

.6 test completion date.

.2 Provide a test report in spreadsheet format which summarizes the following data for testing of piping systems:

.1 system name

.2 system limits (if system is not tested in its entirety),

.3 type of test (pneumatic, hydrostatic),

.4 pressure at start of test,

.5 pressure at end of test,

.6 duration of test,

.7 contractor dated and initialed,

.8 expansion tank initial pressure,

.9 expansion tank final pressure,

.10 backflow preventers have been tested - status and initialed by contractor,

.11 pressure relief valves installed – record setpoint and initialed by contractor.

.3 Equipment/System Start-Up Test Report

.1 Provide a separate start-up report for each piece of the following equipment. The SMACNA “Systems Ready to Balance Check List”, where applicable, may be used for this report.

.1 HVAC Units

.2 Duct Systems

.3 Pumps

.4 Refrigeration Equipment

.5 Hydronic piping systems

.6 Sprinkler systems (to NFPA 13)

.4 Manufacturer's Start-Up Test

.1 Provide a separate start-up report for each piece of the following equipment, utilizing the manufacturer's start-up check list. This report may be prepared by the manufacturer's service representative:

.1 chemical water treatment - pipe cleaning,

.2 chemical water treatment - passivating and inhibition,

.3 adjustable frequency drives,

.4 Building Automation Systems.

.3 Authorities review

.1 Submit copies of authorities-having-jurisdiction inspection and test reports, including:

.2 Plumbing and drainage municipal inspector reports

.3 BC Safety Authority for pressure vessel and piping inspection reports

.4 ESA field certification reports

.4 Acoustic survey

.1 Provide acoustic survey test report:

.5 Controls / Building Management System

.1 Provide controls test reports.

.6 Specific Equipment Performance Tests

.1 Performance data

.1 In addition to tests specified elsewhere, perform the following equipment performance tests. If contractor's standard forms provide for additional data, also submit such additional data.

.1 Some equipment tests may need to be performed during the alternate season testing.

.2 Include nameplate data and as-tested results.

.7 Report Submissions

.1 Deficiencies

.1 Immediately report to Consultant, any deficiencies in the systems or equipment performance resulting in design requirements being unobtainable.

.2 Draft report

.1 On completion of the start-up, testing, adjusting and balancing of all systems, submit to the Consultant, two (2) typewritten copies of a full report on all tests, adjustments, and balancing performed.

.2 Attachments including systems schematics with numbered terminals for referring to data above.

.3 Spot checks

.1 After review of the Draft Report by the Consultant and at the Consultants direction, retest up to 30% of all measurements in locations as directed by the Consultant, at no cost extra to the contract.

.2 If results indicate unusual testing inaccuracy, omissions, or incomplete balancing/adjustment, in the opinion of the Consultant, re-balance entire affected system(s) at no increase in Contract Price.

.4 Interim report

.1 After completion of any retesting described above, submit three (3) typewritten copies of the interim report, in a 3-hole “D” style binder, and two (2) CD or DVD electronic copies in pdf format.

.5 Final report

.1 Submit to Consultant following completion of alternate season testing and balancing. Submit three (3) typewritten copies, and two (2) CD or DVD Adobe PDF in the same formats as the initial report specified above.

.6 Additional testing

.1 The Consultant may request such additional testing in connection with this project as he deems necessary.

.2 Perform additional testing and balancing at the rates quoted. Costs will be deducted from the Mechanical Subcontractor's allowance for the additional Testing and Balancing work as approved by the Consultant.

3.24 DEMONSTRATION AND INSTRUCTION TO OPERATING STAFF

.1 Provide certified personnel to demonstrate plant operation and to instruct operating staff on operation of mechanical equipment. Provide maintenance specialist personnel to instruct operating staff on maintenance and adjustment of mechanical equipment and any changes or modification in equipment made under terms of guarantee.

.1 The demonstration shall include:

.2 Operation and sequencing of all automatic control dampers and automatic temperature control devices.

.3 Operation of smoke venting and pressurization systems including smoke dampers and fire fighters control panel.

.4 Operability of randomly selected fire dampers.

.5 Operation and maintenance requirements of all air, gas and water systems and equipment under each mode of operation including:

.1 Automatic controls.

.2 Hot water/glycol heating system.

.3 Ambient temperature loops and ground source loops.

.4 Fire protection systems.

.5 Plumbing Systems.

.6 Fans.

.7 Coils.

.8 Pumps.

.9 Specialty systems.

.2 Provide instruction during regular work hours prior to acceptance and turn-over to operating staff for regular operation.

.3 Use Operating and Maintenance manuals for instruction purposes.

.4 Submit the proposed instructional agenda for approval.

.5 Finalize demonstration and instructions by obtaining a signed statement from the Owner that the demonstration and instructions have been given satisfactorily. Use Forms in Section 23 99 60 for this purpose.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE

.1 Flexible pipe connections.

.2 Expansion joints and compensators.

.3 Pipe loops offset and swing joints.

1.3 APPLICABLE CODES AND STANDARDS

.1 This project is deemed to be a post-disaster design.

.2 ASTM A53 Standard Specification for Pipe, Steel, Black and hot dipped, zinc-coated, welded and Seamless

.3 ASTM F1120 Standard Specification for Circular Metallic Bellows Type Expansion Joints for Piping Applications

.4 ASME B31.1 Power Piping Code.

1.4 REFERENCE STANDARD

.1 Conform to Standard of "Expansion Joint Manufacturers Association" and manufacturer's recommendations.

1.5 SYSTEM PRESSURE RATINGS

.1 All hydronic accessories, valves and fittings in EC and MH building suitable for a maximum working pressure of 1033 kPa [150 psig].

.2 All hydronic accessories, valves and fittings below EC shall be suitable for a maximum working 1378 kPa [200 psig].

1.6 DESIGN REQUIREMENTS

.1 Provide design services, sealed by a professional engineer licensed in the province of British Columbia, for the design of pipe anchors including pipe stress design and resulting forces and moments at point of building attachment for the following pipe sizes and/or systems.

- .1 any piping system using expansion joints,
- .2 chilled water: NPS 10 and larger
- .3 condenser water: NPS 10 and larger
- .4 hot water heating, max 93°C (200 F): NPS 8 and larger
- .5 steam, low pressure < 100 kPa (15 psig): NPS 8 and larger
- .6 steam > 100 kPa (15 psig): NPS 4 and larger.
- .7 glycol heating or cooling systems where indicated on the drawings, in accordance with temperatures and pipe sizes described above.

1.7 SHOP DRAWINGS

.1 Submit manufacturers product data sheets for expansion joint equipment showing

- .1 Manufacturer, model number, piping service, pressure and temperature rating.
- .2 Design allowances for axial, lateral and angular movement.
- .3 Nominal size and overall dimensions.

.2 All grooved joint couplings, fittings, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

- .1 All castings shall be date stamped for quality assurance and traceability.

.3 Grooved joint couplings and fittings shall be shown on drawings and product submittals and shall be specifically identified with the applicable style or series designation.

.4 Submit sealed design drawings for pipe anchors, and include;

.1 plan drawings showing location of anchors and guides,

.2 fabrication details,

.3 pipe expansion forces,

.4 resulting reaction force and bending moments at building connection,

.5 building fastening details.

.6 Examine piping layout and notify the Consultant of additional anchors or expansion joints required to adequately protect system.

1.8 GENERAL REQUIREMENTS

.1 Make provision for expansion and contraction of all pipe work. All piping shall be anchored and supported in such a manner that strain and/or weight does not come upon any apparatus and pipe branch connections.

.2 Examine piping layout and notify the Consultant of additional anchors or expansion joints required to adequately protect system.

.3 Expansion joints and compensators shall be installed and guided as per manufacturer's recommendations.

.4 All equipment shall be connected with unions or flanges to provide for easy removal.

.5 Where piping passes through walls or floor slabs, the sleeves shall be of sufficient size to accommodate the expansion and the pipe insulation without binding or crushing the insulation or preventing the expansion of the piping.

Part 2 Products

2.1 SLIP TYPE EXPANSION JOINTS

.1 Application:

.1 for axial pipe movement,

.2 travel: 100 mm (4 in) to 300 mm (12 in) single unit, 200 mm (8 in) to 600 mm (24 in) for double units.

.3 size: NPS 1-1/2 to NPS 24

.4 Working pressure: 2070 kPa (300 psig) saturated steam.

.5 factory tested to 1 ½ times maximum working pressure; furnish test certificate.

.2 Construction:

.1 body and packing housings: Class 300 carbon steel pipe to ASTM A 53, Grade B,

.2 wall thickness to match service pipe with flanges or weld ends to match service pipe jointing specification.

.3 adjustable packing gland or fixed packing gland arrangement with a packing injection assembly, arranged for repacking under full line pressure.,

.4 slip pipe of carbon steel pipe to ASTM A 53, Grade B, hard chrome plated,

.5 anchor base constructed of steel welded to body on double units,

.6 internal and external guides in packing housing with concentric alignment of slip pipe,

.7 extension limit stop of stainless steel, with accessible and removable pins,

.8 not less than six packing rings of Teflon or graphite impregnated material,

.9 lubricating fittings with grease nipple, pet cocks, and lubricant gun with hose assembly or plunger body of heavy wall carbon steel and plunger of carbon steel with hex head for use with socket wrench.

.10 lubricant: to manufacturer's recommendations. .

.11 drip connection coupling with drain plug.

2.2 CONTROLLED FLEXING EXPANSION JOINTS

.1 Application:

.1 for axial and lateral movements,

.2 travel: up to 190 mm (7.5 in) axial and 8 mm (1.5 in) lateral depending on size.

.3 size: NPS 3 to NPS 18

.4 Working pressure: 2070 kPa (300 psig) at up to 425°C (800°F)

.5 factory tested to 1 ½ times maximum working pressure; furnish test certificate.

.2 Construction:

.1 bellows hydraulically formed, type 304 stainless steel for specified fluid,

.2 two-piece nickel iron reinforcing or control rings,

.3 flanges or weld ends to match service pipe jointing specification,

.4 austenitic stainless-steel liner oriented with direction of flow,

.5 carbon steel tie rods,

.6 carbon steel painted shroud.

2.3 EXTERNALLY PRESSURIZED EXPANSION JOINTS

.1 Application:

.1 for axial movements,

.2 travel: 100 mm (4 in) to 200 mm (8 in) single unit, 200 mm (8 in) to 400 mm (16 in) double unit.

.3 size: NPS 2 to NPS 12

.4 Working pressure: 2070 kPa (300 psig) at up to 425°C (800°F)

.5 factory tested to 1 ½ times maximum working pressure; furnish test certificate.

.2 Construction:

.1 external pressurized design,

.2 housing: ASME A53 Gr B carbon steel,

.3 connections: ASME/ANSI B16.5 flanges, weld ends to ASME/ANSI B16.9, or grooved ends as applicable.

.4 bellows: hydraulically formed, three ply laminated, ASTM A240 T321 stainless steel or specified fluid,

.5 internal steel liner,

.6 internal and external guides.

2.4 EXPANSION COMPENSATORS (BELLOWS TYPE)

.1 Application:

.1 for axial movements,

.2 travel: 50 mm (2 in) to 75 mm (3 in) carbon steel, 50 mm (2 in) for copper.

.3 size: NPS ¾ to 4 for carbon steel, and NPS 3/4 to 3 for copper

.4 Working pressure: 2070 kPa (300 psig) at up to 400°C (700°F)

.5 factory tested to 1 ½ times maximum working pressure; furnish test certificate.

.2 Construction:

.1 external pressurized design,

.2 pipe: schedule 40 ASME A53 Gr B carbon steel,

.3 bellows: hydraulically formed, three ply laminated, ASTM A240 T321 stainless steel for specified fluid,

.4 connections:

.1 steel pipe: ASME/ANSI B16.5 flanges with floating flange as required, weld ends to ASME/ANSI B16.9, or grooved ends as applicable.

.2 copper tubing: female copper solder type ends for copper pipe,

.5 flow liner: ASTM A240 T304 stainless steel,

2.5 FLEXIBLE RUBBER JOINTS

.1 Application:

.1 for axial, lateral and angular movements,

.2 travel:

.1 axial: up to 55 mm (2-1.4 in) for double arch, and 19 mm (3/4 in) for single arch

.2 lateral: up to 35 mm (1-1./8 in) for double arch, and 9.5 mm (3/8 in) for single arch

.3 angular: 35° for double arch, and 15° for single arch.

.3 size: NPS 1-1/2 to NPS 12 for double arch, NPS 14 to 20 for single arch.

.4 Working pressure: 1450 kPa (210 psig) at up to 37C (100F)

.5 factory tested to 1 ½ times maximum working pressure; furnish test certificate

.2 Construction:

.1 spool type, reinforced EPDM inner liner and outer cover, with wire reinforced flange collars.

.2 NPS 1-1/2 to 12: two filled arches with stabilizing ring,

.3 NPS 14 to 20: one filled arch.

.4 tie rod control units with vibration isolation washers,

.5 retaining rings, and

.6 neoprene covers.

2.6 FLEXIBLE METAL HOSE CONNECTIONS

.1 Construction:

.1 inner hose: corrugated T304 stainless steel,

.2 outer jacket: braided T304 stainless steel wire mesh,

.3 threaded or female soldered end connections up to NPS 2, flanged NPS 2½ and larger,

.4 selected for 1034 kPa (150 psig) working pressure and 93 C (200 F) working temperature,

2.7 FLEXIBLE CONNECTIONS – HIGH TEMPERATURE

.1 Double braided, heat resistant, up to 200°C [392°F] bronze braid, up to 230°C [446°F] stainless steel braid.

.2 Chemically inert and resistant to steam and moisture.

.3 Capacity to absorb 150 mm [6"] with length across flexible portion not less than six [6] diameters.

.4 Provide adapter unions. Flanges shall be steel Class 300.

2.8 GUIDES

.1 Construction:

.1 fabricated from steel

.2 guide spider clamped to pipe

.3 guide body with split bolted housing and angle bracket base.

2.9 ANCHORS

.1 Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B.31.

.2 Anchors shall securely attach piping to structural members. Size the anchors to accommodate the forces due to the pipe expansion and weight.

.3 Where bolts secure anchor to the structure, weld the bolts to the plate. Arrange anchors so that bolts are in shear not in tension.

.4 Provide anchors on both sides of expansion devices, as indicated on the drawings, and as required to control the flexing of the piping system.

2.10 EXPANSION LOOPS

.1 Provide expansion loops as required.

.2 Expansion loops shall be of all welded construction with long radius elbows. The three legs of the expansion loop shall be equal.

Part 3 Execution

3.1 INSTALLATION

.1 Install all piping systems with due regard and provision for expansion avoiding strain or damage to equipment and building. Pay particular attention to piping running horizontal across building expansion joints and provide adequate expansion and contraction for all such piping.

.2 Only major expansion configuration and fittings have been shown on the drawings. Provide all required additional compensators, loops and swing connections.

.3 Where necessary provide 2 pipe guides per side of expansion joint or expansion loop so that movement takes place along axis of pipe only.

.4 Install expansion loops, cold sprung 50% of the calculated expansion.

.5 Install at least three [3] elbows in all branch connections. Where space does not permit 3 elbows, install braided flexible pipe connectors in accordance with manufacturer's recommendations. Three [3] elbow branch connections shall have sufficient developed length to ensure that excessive stresses are not generated in the piping and in no case less than 900 mm [36"].

3.2 EXPANSION JOINTS

.1 Install expansion joints, where shown on the drawings, in strict accordance with the manufacturers detailed installation instructions.

.2 Take care to be aware of the temperature at which the expansion compensator is installed to properly establish the length.

.3 Ensure that expansion joints are not damaged during hydrostatic testing.

.4 The piping shall be tested hydrostatically with the expansion joints in place using cold water.

.5 Select expansion joints to compensate for thermal expansion in pipe between anchors with not less than 25% safety margin, calculating expansion based on the following operating temperatures;

.1 for heating systems, from-18°C (0°F) ambient up to maximum possible operating fluid temperature, but not less than 93°C (200°F) for water and design saturation temperature for steam,

.2 for cooling systems, from 15°C (60°F) ambient down to 5°C (40°F).

.6 Provide expansion joint types as follows:

Service	Limits	Type
Heating water piping	NPS 20 and larger	Slip
Condensate piping, heating piping cooling piping Condenser water piping	NPS 10 to NPS 18	Ring Controlled
	NPS 2 to NPS 12	Externally Pressurized
	NPS 4 and smaller	Expansion Compensator
Domestic Hot Water piping Domestic Recirculation Water piping	NPS 2 and larger	Externally Pressurized
	NPS 3 and smaller	Expansion Compensator
Domestic Cold Water piping	NPS 2 and larger	Externally Pressurized

.7 Support and guide piping adjacent to expansion joints;

.1 support piping on each side of expansion joint as specified herein,

.2 support expansion joint when provided with mounting supports,

.3 do not rely on pipe guides to support piping and expansion joint

.8 Bellows Type:

.1 Install a union at one end of each screwed expansion joint.

.2 Remove slippage bolts and spacers after installation.

.3 Locate expansion joints centrally between anchors and position guides to manufacturer’s specific requirement. Provide structure as required to properly mount guides.

.4 Ensure that piping is properly aligned through expansion joints, over the full travel.

.5 Adjust the installed length of the expansion joints to suit the ambient temperature at the time of installation.

.9 Sleeve Type:

.1 Locate expansion joints centrally between anchors and position guides to manufacturer's specific requirement. Provide structure as required to properly mount guides.

.2 Set and secure base, if base mounted. Provide structure as required.

.3 Ensure that piping is properly aligned through the expansion joints, over the full travel.

.4 Adjust the installed length of the expansion joints to suit the ambient temperature at the time of installation.

.5 Pack the joints for service.

.10 Grooved End Type:

.1 Install in accordance with Victaulic written instructions.

.2 Gaskets shall be of an elastomer grade suitable for the intended service and shall be molded and produced by the coupling manufacturer.

.3 The grooved coupling manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of grooved joint products. The representative shall periodically visit the jobsite and review contractor is following best recommended practices in grooved product installation. (A distributor’s representative is not considered qualified to conduct the training or jobsite visit(s).)

3.3 EQUIPMENT CONNECTOR INSTALLATION

.1 Install equipment connectors on piping connections to equipment and select connector types as follows:

Service	Limits	Connector Type
Refrigeration equipment	Chilled Water Piping	Braided
	Condenser Water Piping	Braided or Flexible Rubber
	Refrigerant Relief Piping	Braided
Domestic Hot Water Tanks	Inlet and Discharge piping NPS 3 and larger	Flexible Metal Hose
	Inlet and Discharge piping NPS 2 ½ and smaller	None required
Steam, heating and cooling coils, and humidifiers	Air handling units supported on spring vibration isolators	Flexible Metal Hose
	Other air handling units	None required
Hot water reheat coils	All sizes	Flexible Metal Hose

.2 Connector and hose sizing:

.1 Nominal diameter: same size as pipe.

.2 Length: selected at not less than manufacturers catalogued minimum active length for the configuration, and not more than 1.5 times this minimum recommended length.

.3 Support or guide piping firmly adjacent to equipment connectors and prevent pipes from swaying.

.4 Where equipment connectors are to be installed at steam coils, locate connectors;

.1 Between control valve and coil on steam supply side, and

.2 After steam trap on condensate line.

.5 Where equipment connectors are to be installed at chilled and/or hot water coils, locate connectors;

.1 Between strainer and coil on the supply side, and

.2 Between coil and control valve on return side

.6 At reheat coils installed in terminal boxes or in ductwork, arrange equipment connectors so there are no bends, and no axial offsets greater than the OD of the connector measured from the centerline of the connector.

3.4 PIPING ANCHORS INSTALLATION

.1 Anchors;

.1 Submit shop drawings sealed by a professional engineer licensed in the jurisdiction of the project,

.2 Include connection loads to the building structure to be reviewed by the structural engineering consultant

.2 Fabricate piping anchors from structural steel angles, channels, or plates secured directly to piping and the building structure:

.1 Single leg design, for piping NPS 4 and smaller and where distance between side of pipe and building attachment point is 200 mm (8”) and less

.2 Minimum four-contact point design for all other distances

3.5 PIPE GUIDES INSTALLATION

.1 Guides;

.1 Submit shop drawings sealed by a professional engineer licensed in the jurisdiction of the project,

.2 Include connection loads to the building structure to be reviewed by the structural engineering consultant

.2 Guide locations:

.1 As required, and

.2 For each expansion joint and expansion loop, provide two guides on each side of and adjacent to the joint or loop;

.1 Locate the first guide within 4 x pipe diameters from joint or loop,

.2 Locate the second guide within 10-14 x pipe diameter from first guide and additional guides as required to suite anchor design, and

.3 Guide expansion joints as per expansion joint manufacturer requirements.

.3 Guide installation:

.1 Factory fabricated type, pipe rolls, or structural steel shapes

.2 Secured to building structure and arranged to restrict lateral displacement and bowing of pipe adjacent to expansion joint or loop,

.3 Supported from building structure with structural steel angles, channels or plates,

.4 Guide may be omitted between joint and anchor where an anchor is located within minimum distance in accordance with expansion joint manufacturer installation instructions.

3.6 INSPECTION OF ANCHOR AND GUIDE INSTALLATION

.1 Make arrangements and pay for expansion joint manufacturer's field representative to review anchors and guides around expansion joints on;

.1 Domestic hot water and recirculating water piping NPS 6 size and larger

.2 Heating system and chilled water piping NPS 6 size and larger

.2 Submit written report, prepared by field representative, confirming that expansion joints, anchors, and guides are installed in accordance with joint manufacturers recommendations.

3.7 START-UP AND TESTING

.1 Prior to placing expansion joint in service, apply match-marks to joint flanges/connectors to record axial, lateral, rotation and angular movement of joint connections.

.2 After system is at operating temperature, inspect match-marks and record displacement of joint connections compared to pre- start conditions.

.3 Submit report including photos of displaced match-marks.

3.8 FLEXIBLE HOSES - BRAIDED

.1 Install braided flexible hoses where shown on the drawings and as the flexible connections to designated heating/cooling terminal units.

.2 On screwed connections, install a union on one end.

.3 Take care not to torque the hose.

.4 Ensure braided flexible hoses are not damaged during hydrostatic testing.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 23 05 49 for required seismic restraint of piping.

1.2 APPLICABLE CODES AND STANDARDS;

.1 ASME B31.1 Pressure Piping Code

.2 Manufacturers Standardization Society of Valve and Fittings Industry (MSS)

.1 MSS SP-58 Pipe Hangers and Supports - Materials Design and Manufacture

.2 MSS SP-69 Pipe Hangers and Supports - Selection and Application

.3 MSS SP-77 Guidelines for Pipe Support Contractual Relationships

.4 MSS SP-90 Guidelines for Terminology for Pipe Hangers and Supports

1.3 CONCRETE ANCHORS

.1 As per the BC Building Code, power-actuated or drop in fasteners shall not be used to resist tension forces for the support or restraint of the piping systems or their components. All fasteners shall be reviewed and approved by the Supporting Professional Engineer for Seismic Restraints prior to installation.

1.4 GENERAL

.1 Provide hangers and supports to secure equipment in place, prevent vibration, protect appropriate against damage from earthquake, maintain grade, provide for expansion and contraction and accommodate insulation.

.2 The contractor shall arrange and pay for the services of a BC registered professional engineer to provide all required engineering services necessary for the complete design, sizing and detailing of all anchors and anchor supports to structure required for the project. Submit details to the Consultant for review.

.3 Provide insulation protection saddles on all insulated piping.

.4 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS-SP58.

.5 Set inserts in position in advance of concrete work. Use grid system in equipment rooms.

.6 Support from (top of) structural members. Where structural bearings do not exist or inserts are not in suitable locations, suspend hangers from steel channels or angles. Provide supplementary structural members, as necessary.

.7 Do not suspend from metal deck.

.8 Hangers for copper pipe shall be copper plated or plastic dipped unless pipe hangers bear on piping insulation (cold services).

.9 Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.

.10 Hangers and strut located in corrosive areas shall be type 316 stainless steel with stainless steel hardware.

1.5 SPECIAL REQUIREMENTS FOR SUPPORTS

.1 In certain locations in the project there may numerous large pipes that are required to be suspended from the slab above. The Contractor shall install the anchors and supports in an approved manner to ensure the entire installation (seismic, gravity and lateral forces) will be compliant with the BC Building Code.

.2 Cast-In-Place Anchors:

.1 Anchors, Bolts, Nuts, and Washers: Bolts and studs, nuts, and washers shall conform to ASTM A307, Grade A, and ASTM A449, ASTM A563, and ASTM F436, as applicable. Hot-dip galvanized bolts and studs including associated nuts and washers in accordance with ASTM A153.

.3 Drilled-In Anchors:

.1 Installer Qualifications

.1 Drilled-in anchors shall be installed by a Contractor with at least five years of experience performing similar installations.

.4 Installer Training:

.1 Conduct a thorough training with the manufacturer or the manufacturer's representative for the Installer on the project. Training shall consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:

.1 hole drilling procedure

.2 hole preparation & cleaning technique

.3 adhesive injection technique & dispenser training / maintenance

.4 rebar dowel preparation and installation

.5 proof loading/torqueing

.5 Field Quality Control:

.1 Testing: 25% of each type and size of drilled-in anchor shall be proof loaded by an independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Engineer. If any of the tested anchors fail to achieve the specified torque or proof load all anchors shall be tested, unless otherwise instructed by the Engineer.

.2 Tension testing should be performed in accordance with ASTM E488.

.3 Torque shall be applied with a calibrated torque wrench.

.4 Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed D/10, where D is the nominal anchor diameter.

1.6 SHOP DRAWINGS

.1 Submittals shall include:

.1 upper attachment.

.2 hanger rods.

.3 pipe attachment.

.4 riser clamps.

.5 shields and saddles.

.6 inserts.

.2 Submit details for supports, guides, and anchors for glass, fibre-reinforced plastic, and plastic piping systems.

.3 Submit design drawings for custom fabricated trapeze hangers, sealed by a professional engineer licensed in the project location jurisdiction.

.1 Shop drawing details shall include:

.1 construction detail drawings for each loading condition,

.2 span deflection calculations,

.3 building attachment load calculations and type.

.2 Provide services of engineer who sealed the custom trapeze hanger shop drawings to conduct a general review of the completed installation on site.

Part 2 Products

2.1 ATTACHMENTS

.1 Concrete:

.1 Do not use inserts in base material with a compressive strength less than 13.79 MPa [2000 psi] [refer to structural drawings].

.2 All inserts supporting piping shall have a factor of safety of 5. All other inserts shall have a factor of safety of 4.

.3 All inserts shall be ICBO approved. Use only ICBO design load ratings.

.4 Inserts for cast-in-place concrete: galvanized steel wedge. ULC listed for pipe NPS 3/4 through NPS 8

.1 Standard of Acceptance: Grinnell/Anvil Fig. 281

.5 Carbon steel plate with clevis for surface mount: malleable iron socket with expansion case and bolt. Minimum two expansion cases and bolts for each hanger

.1 Standard of Acceptance: Grinnell/Anvil, plate fig. 49, socket fig. 290, expansion case fig. 117

.6 Drilled, adhesive type:

.1 Adhesive anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.

.2 For use in concrete housekeeping bases (in vertical downward position) where the distance to the edge of the concrete base could cause weakness if a mechanical expansion type anchor were used.

.3 Rod assemblies shall extend a minimum of 50 mm [2"] into the concrete slab below the housekeeping bases.

.4 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.

.5 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.

.2 Steel Beam (bottom flange):

.1 Cold piping NPS 2 and under: malleable iron C clamp

.1 Standard of Acceptance: Grinnell/Anvil fig. 61

.2 Cold piping NPS 2-1/2 and larger and all hot piping: malleable iron beam clamp

.1 Standard of Acceptance: Grinnell/Anvil fig. 292.

.3 Steel Beam (top):

.1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp

.1 Standard of Acceptance: Grinnell/Anvil Fig. 61.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer

.1 Standard of Acceptance: Grinnell/Anvil fig. 227.

.4 Steel Joist:

.1 Cold piping NPS 2 and under: steel washer plate with double locking nuts

.1 Standard of Acceptance: Grinnell/Anvil fig. 60.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: steel washer plates with double locking nut, carbon steel clevis and malleable iron socket

.1 Standard of Acceptance: Grinnell/Anvil: washer plate, fig. 60; clevis, fig. 66; socket, fig. 290.

.5 Steel Channel or Angle (bottom):

.1 Cold piping NPS 2 and under; malleable iron C clamp

.1 Standard of Acceptance: Grinnell/Anvil fig. 86.

.2 Cold piping NPS 2-1/2 and larger and all hot piping; universal channel clamp

.1 Standard of Acceptance: Grinnell/Anvil fig. 226.

.6 Steel Channel or Angle (top):

.1 Cold piping NPS 2 and under: malleable iron "top of beam" C clamp

.1 Standard of Acceptance: Grinnell/Anvil fig. 61.

.2 Cold piping NPS 2-1/2 and larger and all hot piping: steel jaw, hook rod with nut, spring washer and plain washer

.1 Standard of Acceptance: Grinnell/Anvil fig. 227.

2.2 MIDDLE ATTACHMENTS (ROD)

.1 Carbon steel black (electro-galvanized/cadmium plated for mechanical rooms) continuous threaded rod

.1 Standard of Acceptance: Grinnell/Anvil fig. 146 or Myatt fig. 434.

2.3 PIPE ATTACHMENTS

.1 Cold piping, steel or cast iron: hot piping steel, with less than 25 mm [1"] horizontal movement; hot piping, steel, with more than 300 mm [12"] middle attachment (rod) length: adjustable clevis

.1 Standard of Acceptance: Grinnell/Anvil fig. 260.

.2 Cold copper piping; hot copper piping with less than 25 mm [1"] horizontal movement; hot copper piping with more than 300 mm [12"] middle attachment (rod) length: adjustable clevis copper plated

.1 Standard of Acceptance: Grinnell/Anvil fig. CT-65.

.3 Suspended hot piping, steel and copper, with horizontal movement in excess of 25 mm [1"]; hot steel piping with middle attachment (rod) 300 mm [12"] or less; pipe roller

.1 Standard of Acceptance: Grinnell/Anvil fig. 174 or Grinnell/Anvil fig. 181 up to NPS 6 and Grinnell/Anvil fig. 171 NPS 8 and larger.

.4 Bottom supported hot piping, steel and copper: pipe roller stand

.1 Standard of Acceptance: Grinnell/Anvil fig. 271.

.5 Spring hangers; where required to offset expansion on horizontal runs which follow long vertical risers

.1 Standard of Acceptance: Grinnell/Anvil fig. 171 single pipe roll hanger with Grinnell/Anvil fig. 178.

2.4 RISER CLAMPS

.1 Steel or cast iron pipe: galvanized carbon steel

.1 Standard of Acceptance: Grinnell/Anvil fig. 261 or Myatt fig. 182.

.2 Copper pipe: carbon steel copper finished

.1 Standard of Acceptance: Grinnell/Anvil fig. CT-121.

2.5 SADDLES AND SHIELDS

.1 Cold piping NPS 2 and under: protection shield with pipe insulation under shield with uninterrupted vapour barrier

.1 Standard of Acceptance: Kingspan “K Block” – high density insulation

.2 Cold piping NPS 2-1/2 and over: protection shield with high density insulation under shield with uninterrupted vapour barrier

.1 Standard of Acceptance: Kingspan “K Block” – high density insulation.

.3 Hot piping NPS 3 and under: insulation over pipe hanger.

.4 Hot piping NPS 4 and over: protective saddle with insulation under saddle

.1 Standard of Acceptance: Grinnell/Anvil fig. 160 to 166.

2.6 TRAPEZE HANGERS

.1 Performance:

.1 Manufactured:

.1 to product load listings.

.2 Custom fabricated:

.1 maximum deflection between supports: 1/250 (0.4%) of span

.2 minimum factor of safety : 5 times load to ultimate tensile or compressive strength.

.2 Construction:

.1 Carbon steel shapes, to suit load application:

.1 hollow steel section,

.2 equal leg El section, or

.3 double C channel “strong-back”, with welded clips.

.3 Hanger rods:

.1 as specified above, and

.2 minimum two support rods,

.3 rods selected for minimum factor of safety of 5 times load to ultimate tensile or compressive strength of rod.

.4 Pipe restraint:

.1 restrain pipes from lateral movement with:

.1 bolt-on angle brackets or pipe U-bolts for manufactured hangers,

.2 welded-on angles for fabricated hangers.

.5 Finish:

.1 electro-galvanized finish in mechanical rooms and outdoors.

.2 black steel finish in other areas.

2.7 WALL SUPPORTS

.1 Horizontal pipe adjacent to wall:

.1 Angle iron wall brackets with specified hangers.

.2 Vertical pipe adjacent to wall.

.1 Exposed pipe wall support for lateral movement restraint

.1 Standard of Acceptance: Grinnell/Anvil fig. 262 or 263.

.2 Channel type support

.1 Standard of Acceptance: Burndy, Canadian Strut, Cantruss or Unistrut - (arrangement to be acceptable to B.C. Boiler Inspection Department).

2.8 FLOOR SUPPORTS

.1 Horizontal pipe.

.1 Do not support piping from the floor unless specifically indicated.

.2 Vertical pipe.

.1 Mid-point of risers between floor slabs - adjustable fabricated steel supports. Refer to Section 23 05 49 Seismic Restraints.

.3 Steel or cast iron pipe:

.1 floor supported, black carbon steel riser clamps to MSS SP-58, type 42, ULC listed, field-welded pipe lugs.

.2 suspended, black carbon steel riser clamps to MSS SP-58, type 42, ULC listed, 4 or 6 bolt pattern, field-welded pipe lugs.

.4 Copper pipe:

.1 carbon steel, copper finished, riser clamps to MSS SP-58, type 8.

2.9 VARIABLE LOAD SUPPORTS

.1 Performance:

.1 Selected for piping loads and estimated travel under service conditions.

.2 Construction:

.1 carbon steel housing and spring,

.2 pre-compressed spring,

.3 load indicator,

.4 welding to ASME Section IX

.5 welded attachment points

.6 finish: semi gloss primer coat.

2.10 CONSTANT LOAD SUPPORTS

.1 Performance:

.1 maintains constant support load under variable hanger displacements.

.2 selected for piping loads and estimated travel under service conditions, with a minimum safety factor of 25 mm (1 in) extra travel or 20% of total travel, whichever is greater.

.2 Construction:

.1 to WW-H-171E, ANSI/MSS SP-69 and 58

.2 carbon steel housing and spring,

.3 combination hanger moment arm and balancing spring design,

.4 horizontal and vertical arrangements,

.5 load adjustment and load indicator scale,

.6 factory set for load and travel,

.7 welding to ASME Section IX

.8 welded attachment points

.9 finish: semi-gloss primer coat.

2.11 RODDING FOR MECHANICAL JOINT PIPE

.1 Plain end cast iron and asbestos cement drain waste and vent pipe, NPS 5 and over,

.1 bell clamps and rodding at each joint

.2 bell clamp and rodding at each tee branch

2.12 ROOF SUPPORTS

.1 Support piping and ducts on the roof with an engineered modular pipe, conduit, and duct support system designed for installation without roof penetrations, flashing or damage to the roofing material.

.2 Standard of Acceptance: Dura-Blok

.3 The system shall consist of bases made of 100% recycled rubber.

.1 Provide reflective strip on both sides allow for visibility

.2 Mount channel component on top of block with bolts.

.3 Provide 25mm [1”] space between multiple blocks to allow water to flow freely around longer assemblies.

.4 Provide additional weight bolted to framing members as required for stability.

.5 Provide additional vertical and horizontal channel components as required, all bolted together.

.6 Provide hold down straps for ducts and u-clamps for pipes and conduits. Allow pipes to expand and contract freely.

.4 Field fabricated wood supports will not be accepted.

Part 3 Execution

3.1 COORDINATION WITH CONCRETE WORK

.1 Supply and deliver inserts to site in ample time to be built into work.

.2 Set and correctly locate inserts for pipes and equipment hangers. Secure inserts firmly to formwork before concrete is poured.

3.2 HANGER SPACING

.1 Support piping and conduit directly from or on structural building elements. Do not support pipe or conduit directly from other services.

.2 Adjust hanger spacing noted below to suit specific pipe manufacturer’s recommendations (specifically related to plastic pipe).

.3 Spacing and middle attachment (rod) diameter as specified in paragraphs below or as in table below, whichever is more stringent.

.1 Plumbing piping: most stringent requirements of the Plumbing Code or authority having jurisdiction.

.2 Fire protection: to applicable fire code; toggle hangers are unacceptable.

.3 For Gas Piping refer to Gas Code CAN/CGA-B149.1.

.4 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.

.5 Within 300 mm [12"] of each horizontal elbow, tee, joints, etc.

.4 Maximum hanger spacing table.

Pipe Size: NPS	Rod Diameter mm [ins]	Maximum Spacing Steel Pipe m [ft]	Maximum Spacing Copper Pipe m [ft]
½	10 [3/8]	1.8 [6]	1.5 [5]
¾, 1	10 [3/8]	2.4 [8]	1.8 [6]
1¼ , 1½	10 [3/8]	3.0 [10]	1.8 [6]
2	10 [3/8]	3.0 [10]	3.0 [10]
2½ , 3, 4	12 [1/2]	3.0 [10]	3.0 [10]
5, 6, 8	16 [5/8]	3.0 [10]	
10, 12	22 [7/8]	3.0 [10]	

3.3 HANGER INSTALLATION

.1 Adjust hangers to equalize hanger loads, to support piping true to line and grade, and to minimize loads transferred through connections to equipment and outlets

.2 Offset hanger so that rod is vertical in operating position.

.3 Install hanger to provide minimum 12 mm [½"] clear space between finished covering and adjacent work.

.4 Support vertical piping at every other floor.

.5 Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

.6 Where practical, support riser piping independently of connected horizontal piping.

.7 Install plastic inserts between steel studs and piping.

.8 For beam clamps, extend hanger rod tight to underside of beam with top bolt and washer.

3.4 ACOUSTICALLY SENSITVE AREAS

.1 Use spring hangers and spring isolators for all piping, ducts and equipment exiting the basement mechanical room to minimize vibration transfer.

.2 Hangers in the ceiling space of acoustically sensitive areas shall be resilient type such as Mason WHR. Refer to acoustical report for vibration isolation requirements for this type of areas.

3.5 INSERTS

.1 Use inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams wherever practicable.

.2 Set inserts in position in advance of concrete work. Provide reinforcement rod in concrete for inserts carrying piping over 100 mm (4”) or ducts over 1500 mm (60”) wide.

.3 Where concrete slabs form finished ceiling, finish inserts, flush with slab surface.

.4 Where inserts are omitted, drill through concrete slab from below and provide rod with recessed square plate and nut above slab, in concealed locations.

.5 Provide a test mock up for review.

.6 Provide inserts for above chillers, pumps and sump pumps to permit equipment servicing. Provide an eyebolt.

.7 Inserts shall be installed in accordance with manufacturer’s recommendations and in no case closer than 2.1 m (7 ft.) apart.

.8 Install anchors per manufacturer instructions.

.9 The contractor shall arrange an anchor manufacturer’s representative to provide onsite installation training for all of their anchorage products. The Seismic Engineer shall receive documented confirmation that all of the contractor’s personnel who install anchors are trained prior to the commencement of installing anchors.

.10 Anchor capacity is dependent upon spacing between adjacent anchors and proximity of anchors to edge of concrete. Install anchors in accordance with spacing and edge clearances indicated on the drawings.

.11 Existing reinforcement bars in the concrete structure may conflict with specific anchor locations. Unless noted on the drawings that the bars can be cut, the contractor shall review existing structural drawings and shall undertake to locate the position of the reinforcing bars at the locations of the concrete anchors by GPR, X-RAY, or other means.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Provide vibration isolation on all motor driven equipment, piping and ductwork such that noise transmitted to occupied space by any other path than airborne is less than airborne noise transmitted from mechanical space to occupied space. The following are considered minimum requirements to meet this criterion.

1.2 REGULATORY REQUIREMENTS

.1 Supply isolators and seismic restraints meeting the structural requirements of the British Columbia Building Code, with respect to seismic snubbers, or provide equivalent requirements where integral seismic restraint is provided in isolators / bolting.

.2 Vibration isolator housings are considered a safety guard with respect to isolated equipment and any contained compressed springs. Include "Fail Safe" seismic restraint in all vibration isolation designed to hold mechanical equipment and springs in place.

1.3 APPLICABLE CODES AND STANDARDS

.1 Comply with the latest edition of the following:

.1 British Columbia Building Code and local by-laws

.2 SMACNA - “Seismic Restraint Manual Guidelines for Mechanical Systems”

.3 NFPA 13 - Installation of Sprinkler Systems

.4 ASHRAE Handbook – HVAC Applications

.5 VISCMA (The Vibration Isolation and Seismic Control Manufacturers Association)

1.4 SCOPE

.1 Isolate motor driven mechanical equipment.

.2 Provide restraints for equipment mounted on vibration isolation to limit movement during start-up and normal operation.

.3 Isolator and base type designations shall comply with the appropriate chapter of current ASHRAE Applications Handbook, as a minimum.

.4 Information shown here is to establish minimum standards. Vibration isolation equipment shall be selected to maintain noise levels in building in accordance with acoustical consultant’s requirements.

1.5 SHOP DRAWINGS, QUALIFICATIONS AND SUBMITTALS

.1 Anchorage of all equipment shall be certified by a B.C. registered professional structural engineer who specializes in seismic restraint of resiliently mounted systems.

.2 All seismic integral isolation mounts or snubbers shall be O.S.H.P.D. (Office of Statewide Health and Planning Department – State of California) approved and the associated OSHPD number clearly indicated on the seismic device. Where OSHPD certification is not available for a restraint device, results of tests consistent with OSHPD procedures and approvals shall be submitted and certified by a B.C. registered professional structural engineer.

.3 Obtain all relevant equipment information and provide shop and placement drawings for all vibration isolation elements and steel bases for review before materials are ordered.

.4 Provide attachment to both the equipment and the structure meeting the specified forces involved. Attachment details to the structure to be reviewed by the structural consultant for the project.

.5 Submit samples of materials required to complete the work of this section for inspection and review when requested.

.6 Submit product data sheets for isolation components.

.7 Show fabrication details, location and size of anchor bolts and concrete requirements for inertia bases.

.8 Provide vibration isolation equipment by one manufacturer.

.9 Submit samples of materials required to complete the work of this section for inspection and review when requested.

1.6 GENERAL

.1 Provide vibration isolation on all motor driven equipment with motors of 1/2 HP and greater power output (as indicated on the motor nameplate) and on piping and ductwork, as specified herein. For equipment less than 1/2 HP, provide vibration isolation grommets at the support points.

.2 Provide seismic restraint for all equipment including all seismic restraint related hardware (bolts and anchors) from point of attachment to equipment through to and including attachment to structure. The required anchors shall be indicated on the shop drawings and shall be clearly identified for the correct location and so as to be readily identified after installation. Provide clear instructions for their installation. Refer to Section 23 05 49, Seismic Restraints.

.3 Place isolators under equipment so that the minimum distance between adjacent corner isolators is at least equal to the height of the centre of gravity of the equipment. Include height of centre of gravity on shop drawings. Otherwise, design for increased forces on the supports, and submit design calculations with shop drawings for approval. In particular, provide chiller isolation meeting this requirement.

.4 Ensure isolation systems have a vertical natural frequency no higher than one third of the lowest forcing frequency, unless otherwise specified. Use dynamic stiffness correction factors for elastomers and do not exceed 60 durometer.

.5 Isolators and restraining devices, which are factory supplied with equipment, shall meet the requirements of this section. Isolation supplier to check with pump supplier for number and location of isolators and if there is a requirement for structural or inertia bases.

.6 Provide concrete inertia bases or structural steel bases, where specified or required by equipment manufacturers, located between vibrating equipment and the vibration isolation elements, unless the equipment manufacturer certifies direct attachment capabilities. Coordinate with Division 3 for the provision of concrete work.

.7 Coordinate with Division 3 for the provision of housekeeping pads at least 100 mm [4"] high under all isolated equipment, or greater thickness where specified. Provide at least 300 mm [12"] clearance between drilled inserts and edge of housekeeping pads. Housekeeping pads to be tied to structure with reinforcement to meet Code seismic requirements.

.8 For isolated equipment, design anchors, bolts, isolators and bases to meet Code requirements. For larger isolators, where the Code requirement cannot be met by the isolator housing, provide Type 6 seismic snubbers or Type 6P where post-disaster requirement is specified.

.9 Use ductile materials in all vibration and seismic restraint equipment.

.10 Follow structural consultant's instructions for drilled inserts re: installation of anchors.

.11 Coordinate with Section 23 33 00 "Duct Connectors – Vibration Isolation" for all ductwork connections to fans or plenums.

.12 Provide flexible connectors between equipment and piping where required by manufacturers to protect equipment from stress and reduce vibration in the piping

system. Meet connector manufacturer's installation specifications as well as equipment manufacturer's requirements.

.13 Coordinate with Electrical Division 26 for the provision of a minimum 180° hanging loop of flexible conduit for all electrical connections to isolated equipment.

.14 Supply all isolators fully assembled and clearly labelled with full instructions for installation by the contractor.

Part 2 Products

2.1 ISOLATORS - GENERAL

.1 Supply all of the vibration isolation equipment by one approved supplier with the exception of isolators, which are factory installed and are standard equipment with the machinery. Confirm with manufacturer that these factory-installed isolators meet the seismic requirements of this specification.

.2 Select isolators at the supplier's optimum recommended loading and do not load beyond the limit specified in the manufacturer's literature.

.3 Design springs in accordance with the Society of Automotive Engineers' Handbook Supplement 9 entitled "Manual on Design and Application of Helical and Spiral Springs - SAE". Provide neoprene isolators and components using maximum 60 duro "Bridge bearing quality neoprene", as defined by CSA Standard CAN3-S6. Ensure design of isolation and restraint elements allows adequate clearance to avoid binding.

.4 Design springs "iso-stiff" (kx/ky = 1.0 to 1.5) with a working deflection between 0.3 and 0.6 of solid deflection.

.5 Provide hot dipped galvanized housings and neoprene coated springs, or other acceptable weather protection, for all isolation equipment located out of doors or in areas where moisture may cause corrosion.

2.2 AIR COMPRESSOR

.1 Provide dedicated air compressor, controls, piping and accessories as required for vibration isolators.

2.3 ISOLATORS - TYPE 1, PADS

.1 Neoprene or neoprene / steel / neoprene pad isolators. Select Type 1 pads for a minimum 2.5 mm [0.1"] 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 the hemi-grommets). Size bolt and hemi-grommet for minimum lateral clearance. Use grommets only on light-weight equipment.

.2 Standard of Acceptance:

.1 Mason WMW, Super W pads

.2 Mason Industries Type HG Hemi-Grommets

.3 EAR Grommets

2.4 ISOLATORS - TYPE 2, RUBBER FLOOR MOUNTS

.1 Rubber/neoprene-in-shear isolators designed to meet specified seismic requirements. Select isolators for a 4 mm [0.15"] minimum static deflection, and bolt to structure. In the case of rubber isolators, provide protection in the design of the isolator to avoid contact of the rubber element to oil in the mechanical room.

.2 Standard of Acceptance

.1 Mason BR, maximum 50 durometer.

2.5 ISOLATORS - TYPE 3, SPRING FLOOR MOUNTS

.1 Spring mounts complete with levelling devices, selected to achieve 25mm deflection under load. Springs to incorporate a minimum 6 mm [1/4"] thick neoprene sound pad or cup having a 1.3 mm [0.05"] minimum deflection under load. Design isolator to meet specified seismic requirements.

.2 Standard of Acceptance:

.1 Mason SSLFH, Mason SSLR (for chillers and cooling towers only).

2.6 ISOLATORS - TYPE 3A, SPRING FLOOR MOUNTS

.1 As per Type 3 except 50mm deflection.

2.7 ISOLATORS - TYPE 4, HANGER MOUNTS

.1 Spring hangers, c/w 6 mm [1/4"] thick neoprene cup/bushing sized for 1.3 mm [.05"] minimum deflection, or neoprene hangers.

.2 Standard of Acceptance:

.1 Mason HD (non- spring), WDNHS (with spring)

2.8 ISOLATORS - TYPE 4A, HANGER MOUNTS

.1 As per Type 4 except 50mm deflection.

2.9 ISOLATORS - TYPE 6, SEISMIC SNUBBERS.

.1 Seismic snubbers c/w minimum 3mm [1/8"] neoprene bushing and 6mm [1/4"] air gap. Snubber to act omni-directionally. Ensure bushing can easily be turned by hand after installation

.2 Standard of Acceptance:

.1 Mason Z-1225.

2.10 CLOSED CELL FOAM GASKETS / NEOPRENE GROMMETS - TYPE 7

.1 20 mm [3/4"] thick continuous perimeter closed cell foam gasket to isolate base of package type equipment, AHU's, exhaust fans, etc. from concrete floors / roof curbs. Select width for nominal 3psi loading under weight of equipment and allow for 25% compression 5mm [3/16"]. Increase width of curb using steel shim if necessary to accommodate gasket. For light equipment such as exhaust fans, deflection should be a minimum of 0.05". Contractor to check fire rating requirements specified for project.

.2 Standard of Acceptance:

.1 American National Rubber-EPDM-SBR blend SCE 41 type neoprene.

.2 Mason Industries Type HG Hemi-Grommets.

2.11 PIPE RISER GUIDE / ANCHOR - TYPE 8

.1 Telescoping all direction acoustical pipe anchor consisting of two concentric steel tubes separated by 12 mm thick neoprene isolation material. Hot application isolators.

.2 Standard of Acceptance:

.1 Mason ADA and VSG (H).

.2 Generator exhausts, PRV stations, etc - CMT VA 50247/25 Cushions, CMT W302 isolators.

2.12 FLEXIBLE CONNECTORS – TYPE 9

.1 Twin sphere flexible connectors with floating flanges c/w control rods

.2 Standard of Acceptance:

.1 Mason MFTNC Connector.

.2 Mason ACC Control Cables.

2.13 CONCRETE INERTIA BASES

.1 Concrete inertia bases to be a minimum of 1.5 times the weight of the isolated equipment. Generally base thickness shall be 1/12 of the longest dimension of the base, but not less than 150 mm [6"]. Include with base a steel channel concrete form with required steel reinforcement (as determined necessary by suppliers' registered professional engineer). Provide additional steel as required by sleeves or inserts to receive equipment anchor bolts.

.2 Use height saving brackets in all mounting locations to maintain a 35 mm [1-1/2"] clearance below the base.

.3 Bases to be furnished with built-in motor slide rails. Motor location as specified/scheduled.

.4 Standard of Acceptance:

.1 Mason type K.

2.14 STEEL BASES

.1 Construct structural steel bases sufficiently rigid to keep deflection and misalignment within acceptable limits as determined by the equipment manufacturer.

.2 Use height saving brackets in all mounting locations to provide a base clearance of 35 mm [1-1/2"].

.3 Bases to be furnished with built-in motor slide rails. Motor location as specified/scheduled.

.4 Steel bases supplied as integral part of equipment to be supplied meeting the above requirements.

.5 Standard of Acceptance:

.1 Mason type WF.

Part 3 Execution

3.1 INSTALLATION

.1 Execute the work in accordance with the specifications and the manufacturer's instructions and only by workmen experienced in this type of work.

.2 For all equipment mounted on vibration isolators, provide a minimum clearance of 50 mm [2"] to other structures, piping, equipment, etc.

.3 Before bolting isolators to the structure, start equipment and balance the systems so that the isolators can be adjusted to the correct operating position before installing (seismically rated) anchors and/or welding.

.4 After installation and adjustment of isolators verify deflection under load to ensure loading is within specified range and isolation is being obtained.

.5 Where hold down bolts for isolators or seismic restraint equipment penetrate roofing membranes, provide "gum cups" and sealing compound to maintain waterproof integrity of roof. Ensure sealing compound is compatible with isolator components such as neoprene. Co-ordinate with roofing section of specifications and with roofing subcontractor.

.6 Use Type 1 pads only where specified.

.7 Under equipment mounted on Type 3 or 3A mounts, which do not meet the seismic requirement, provide Type 6 seismic snubbers.

.8 Select Type 4 spring hangers for a minimum static deflection of 25 mm [1"] for all ceiling hung fans, and air handling units, emergency generator exhaust piping and silencers, steam PRV's and any other vibrating sources.

.9 Provide Type 4 resilient hangers on all piping, tanks, etc. connected to a vibrating source, if the piping is in excess of NPS 1-1/2 dia. Provide the hangers for a distance of 6.0 m [20 ft] for a NPS 2 pipe and 12 m [40 ft] for a NPS 10 pipe and chiller pipes. Isolate other pipe sizes for a proportionate distance. Isolate all piping serving cooling tower and chiller, including air-cooled chillers.

.10 Use the lowest RPM scheduled for two-speed equipment in determining isolator deflection.

.11 Provide concrete inertia bases on centrifugal fans where specified.

.12 Where ductwork, piping or boiler exhaust stacks, etc., connected to or serving noise generating equipment, is routed through walls, floors, piping chases, etc. position ductwork, piping, stacks, etc. to avoid contact with the concrete structure, future framing, drywall and other finishes which may radiate noise. Use Type 2 and Type 8 mounts. Submit proposed details to meet this requirement. This requirement includes piping from cooling tower, chiller and emergency generator exhaust.

.13 Make no connections between mechanical room equipment and drywall partitions, adjoining occupied spaces. Mount all equipment designed for wall mounting on non-critical, block work or concrete walls. Connect hangers to concrete structure only. Where structure is steel, connect to major structural beams only, or to structural angles with gussets attached to concrete shear walls. Do not attach to light framing members such as OWSJ's. Do not connect to edge of beam flange (e.g. with clips). Weld nut or threaded sleeve to bottom flange at centre, directly below web, to accommodate threaded hanger rod.

.14 Provide Type 8 resilient elements in pipe anchors, where pipe anchors are within 12 m [39 ft.] of a vibrating source or if located in pipe chases.

.15 Protect neoprene isolator components from overheating or use type 8 mounts.

.16 Be responsible for ensuring that flexible duct connections (see Section 23 33 00) are installed with a minimum of 40 mm [1-1/2"] metal-to-metal gap. Use flanges to ensure that flexible connectors are clear of the airstream.

.17 Isolate variable frequency drive controller using isolators or soft grommets such that structure borne noise transmission to occupied space is less than airborne noise transmission. Controller supplier to provide all isolation, including wiring connections, to control flanking noise transmission. Provide isolation meeting all seismic requirements.

.18 Provide stabilizing springs limiting movement at flexible connections to 25% of fabric width under steady state conditions and 40% at start up.

.19 Floor or pier mounted equipment: Isolate all floor or pier mounted equipment on Type 3 isolators, unless otherwise specified.

.20 Slab on grade mounted equipment: For equipment mounted on a slab on grade mount on type 3A isolators unless otherwise specified.

.21 Where the weight of equipment may change significantly due to draining or similar as in cooling towers or chillers, provide limit stops to limit isolator extension.

3.2 INSPECTIONS

.1 The supplier shall provide assistance to the contractor as necessary during the course of installation of isolation equipment.

.2 The supplier shall inspect the complete installation after system startup and establish that the isolators for each piece of equipment are properly installed and adjusted. Correct any mal-performance. The supplier shall submit a statutory declaration to the Consultant stating that the complete vibration isolation installation is installed in accordance with his drawings and instructions and operates to his satisfaction. Form MF175 in Section 23 99 60 should be used for this purpose.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of the British Columbia Building Code and local by-laws.

1.3 APPLICABLE CODES AND STANDARDS

.1 This project is deemed to be a post-disaster design.

.2 Comply with the latest edition of the following:

.1 SMACNA - “Seismic Restraint Manual Guidelines for Mechanical Systems”

.2 NFPA 13 - “Installation of Sprinkler Systems”

.3 ASHRAE - “HVAC Applications, Seismic and Wind Restraint Design”

.4 Applicable Codes and Standards.

.5 VISCMA (The Vibration Isolation and Seismic Control Manufacturers Association)

.6 Manufacturers Standardization Society of Valve and Fittings Industry (MSS): MSS SP-127 Bracing for Piping Systems Seismic - Wind - Dynamic Design, Selection, Application.

1.4 SEISMIC RESTRAINT DESIGN AND INSPECTION

.1 Arrange and pay for the services of a B.C. registered professional structural engineer who specializes in the restraint of building elements. This structural engineer, herein referred to as the seismic engineer shall provide all required engineering services related to seismic restraints of non-vibration isolated equipment, ductwork and piping as indicated below.

.2 The seismic engineer shall provide assistance to the contractor as necessary during the course of restraint of equipment, ductwork and piping.

.3 The seismic engineer shall certify that the installation fully meets the stipulated Post Disaster requirements.

.4 The seismic engineer shall inspect the completed seismic installation and shall submit a statutory declaration to the consultant stating that the complete seismic installation is installed in accordance with his drawings and instructions, and it complies with the regulatory requirements. Prior to Ready-For-Takeover (“RFT”), the seismic engineer shall provide letters of assurance for all mechanical, plumbing and fire protection systems.

1.5 SCOPE

.1 Provide restraint on all piping, ductwork, equipment and machinery, which is part of the building mechanical service systems to prevent injury or hazard to persons and equipment and to retain equipment in its normal position in the event of an earthquake. This specification covers equipment, which is not specifically covered in SMACNA.

.2 Provide design, selection and provision of materials, installation instructions, installation and inspection of seismic restraint of mechanical piping, ductwork, fire protection and equipment.

.3 Provide all seismic restraint related hardware, (including bolts and anchors) from point of attachment to equipment through to and including attachment to structure.

.4 When equipment is mounted on concrete housekeeping pads, and / or concrete curbs the anchor bolts shall extend through the pad into the structure.

.5 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

.6 Seismic restraints may only be omitted where permitted by SMACNA.

.7 The requirements under this Section are in addition to the requirements for equipment, piping and duct supports and vibration isolation specified in other Sections.

.8 Where specifications of materials of this Section differ from those in other Sections, this Section governs, including but not limited to vibration isolation devices.

.9 Provide cable restraints on all isolated equipment and seismic restraint on all other equipment, piping and ductwork, all in general accordance with SMACNA Guidelines (see Products).

.10 The roof mounted exhaust fans and associated exhaust air duct to be seismically restraint.

1.6 SPECIAL REQUIREMENTS FOR SUPPORTS

.1 In some locations in the project there may be large pipes that are required to be suspended from the slab above. The Contractor shall install the anchors and supports in an approved manner to ensure the entire installation (seismic, gravity and lateral forces) will be compliant with the BC Building Code.

.2 Cast-In-Place Anchors:

.1 Anchors, Bolts, Nuts, and Washers: Bolts and studs, nuts, and washers shall conform to ASTM A307, Grade A, and ASTM A449, ASTM A563, and ASTM F436, as applicable. Hot-dip galvanized bolts and studs including associated nuts and washers in accordance with ASTM A153.

.3 Drilled-In Anchors:

.1 Installer Qualifications

.1 Drilled-in anchors shall be installed by a Contractor with at least five years of experience performing similar installations.

.2 Installer Training:

.1 Conduct a thorough training with the manufacturer or the manufacturer's representative for the Installer on the project. Training shall consist of a review of the complete installation process for drilled-in anchors, to include but not limited to:

.1 hole drilling procedure

.2 hole preparation & cleaning technique

.3 adhesive injection technique & dispenser training / maintenance

.4 rebar dowel preparation and installation

.5 proof loading/torqueing

.4 Field Quality Control:

.1 Testing: 25% of each type and size of drilled-in anchor shall be proof loaded by an independent testing laboratory. Adhesive anchors and capsule anchors shall not be torque tested unless otherwise directed by the Engineer. If any of the tested anchors fail to achieve the specified torque or proof load all anchors shall be tested, unless otherwise instructed by the Engineer.

.2 Tension testing should be performed in accordance with ASTM E488.

.3 Torque shall be applied with a calibrated torque wrench.

.4 Proof loads shall be applied with a calibrated hydraulic ram. Displacement of adhesive and capsule anchors at proof load shall not exceed D/10, where D is the nominal anchor diameter.

1.7 SYSTEMS

.1 Seismically restrain the following equipment and systems:

.1 Piping:

.1 medical gas, natural gas, vacuum, petroleum based liquids and compressed air, 25mm [1”] pipe and larger,

.2 piping located inside of mechanical equipment and service rooms, 30mm [1¼”] pipe and larger,

.3 all other piping 65mm [2½”] pipe and larger.

.2 All ductwork and piping:

.1 rectangular and oval ductwork with cross sectional area 0.55 sq.m [6 sq.ft] and greater,

.2 round ducts with diameters 710 mm [28”] and larger.

.3 Equipment:

.1 vibration isolated equipment,

.2 rigidly or gravity supported equipment.

1.8 DESIGN CRITERIA

.1 Restraint systems as indicated in SMACNA "Seismic Restraint Manual Guidelines for Mechanical Systems", Seismic Hazard Level SHL A. If lesser restraint than recommended by SMACNA SHL A is proposed to meet local Code seismic requirements, provide shop drawings of details certified by a B.C. Registered Professional Engineer.

.2 Design seismic restraint systems to conform to the British Columbia Building Code for the project location:

.3 For all pipework and duct systems, the vertical uplift force is restrained by the systems as defined in the SMACNA standard.

1.9 SHOP DRAWINGS

.1 Submit shop drawings of all restraining devices, not covered in the SMACNA Guidelines, including details of attachment to the structure, either tested in an independent testing laboratory or approved by a B.C. Registered Professional Engineer.

.2 Submit shop drawings in accordance with Division 1.

.3 Submit test certificates for each seismic restraint device, identifying maximum tested load capacities.

.4 Submit calculations for each piece of restrained equipment, piping, ductwork and conduit, including seismic forces, restraint selection, and selection data.

.5 Provide a calculation analysis summary (spreadsheet is acceptable) for each piece of equipment, including the following information:

.1 Equipment ID

.2 Floor level

.3 Horizontal seismic force factor

.4 Equipment weight

.5 Horizontal seismic force

.6 Vertical uplift seismic force (where applicable)

.7 Equipment centre of gravity in three directions

.8 Design condition (worst case) overturning moment

.9 Number of restraint fastenings

.10 Pull-out tension per fastener

.11 Horizontal shear per fastener

.12 Pull-out tension load rating per fastener

.13 Horizontal shear rating per fastener.

.6 Include worst case combination of tension and shear loads at each snubber and restraint location.

.7 Include anchor bolt diameters, embedment depth, full welding details including type and length for field welds, and required housekeeping base dimensions.

.8 Calculations to be sealed by a Professional Engineer licensed in the Province of British Columbia.

.9 Proposed inserts or connections to structure to follow directions of project structural consultant.

1.10 QUALITY ASSURANCE

.1 Pre-Construction meeting:

.1 Request and arrange a meeting with the Consultant to review seismic restraint approach, prior to any restraint installation. Obtain approval from the Consultant before commencing work.

.2 Testing and Review

.1 Install the first three lateral and three longitudinal braces for each of: each fire protection systems; one (1) building service piping system; and one (1) ductwork system.

.2 request and arrange for a review of the installation by the Consultant. Obtain approval of the installation before commencing remainder of the work.

.3 Provide services of the manufacturer's technical representative to conduct site inspections of the Work in progress, and to conduct a final inspection of the work. Provide a copy of the final inspection report to the Consultant for review.

.4 Request and arrange for a construction review by the Consultant of the completed seismic restraint installation, before any ceilings are installed.

Part 2 Products

2.1 SEISMIC SNUBBER RESTRAINTS

.1 Single-Axis Limit Stop Snubber Assemblies:

.1 steel construction, attached to equipment structure and equipment, maximum of 6 mm¼" seismic movement.

.2 designed to restrict movement in one axis.

.3 minimum 6 mm [¼"] thick resilient neoprene pads to prevent metal-to-metal impact.

.4 minimum four (4) snubbers for each piece of equipment.

.2 Multi-Axis Limit Stop Snubber Assemblies:

.1 interlocking steel construction, attached to equipment structure and equipment, maximum of 6 mm [¼"] seismic movement.

.2 designed to restrict movement in two (2) or three (3) axis.

.3 minimum 6 mm [¼"] thick resilient neoprene pads to prevent metal-to-metal impact.

.4 minimum two (2) snubbers for each piece of equipment.

2.2 SEISMIC VIBRATION ISOLATORS

.1 All Direction Neoprene Isolator:

- .1 molded, oil resistant neoprene compound, with encapsulated cast-in-place top steel load plate, and steel base plate with anchor holes designed for seismic loads in all directions with no metal-to-metal contact.

.2 Restrained Spring Isolator – Constant Load:

- .1 colour coded seismic-controlled spring isolator, single or multiple spring coils, with minimum 6 mm [¼"] neoprene pad.
- .2 removable coil spring element without having to disturb supported equipment.
- .3 lateral stiffness greater than 1.2 times rated vertical stiffness.
- .4 minimum 50% overload capacity
- .5 non-welded spring elements: epoxy coated, with a minimum 1000 hour rating when tested in accordance with ASTM B-117.
- .6 steel housing design to limit lateral and vertical movement of the supported equipment.
- .7 neoprene snubber, to limit maximum equipment movement in any direction to 6 mm¼".
- .8 adaptor base suitable sized for larger anchors, when required to suit anchorage capacity.

.3 Restrained Spring Isolator – Variable Load:

- .1 colour coded seismic-controlled spring isolator, single or multiple spring coils, with minimum 6 mm [¼"] neoprene pad.
- .2 removable coil spring element without having to disturb supported equipment.
- .3 lateral stiffness greater than 1.2 times rated vertical stiffness.
- .4 minimum 50% overload capacity
- .5 non-welded spring elements: epoxy coated, with a minimum 1000 hour rating when tested in accordance with ASTM B-117.
- .6 steel housing design to limit lateral and vertical movement of the supported equipment.
- .7 top load plate with adjustable and leveling bolts.
- .8 adjustable vertical restraints
- .9 isolation washers
- .10 bottom load plate with internal non-skid isolation pads and anchor holes
- .11 hot dipped galvanized for outdoor installations.
- .12 neoprene snubber, to limit maximum equipment movement in any direction to 6 mm [¼"].
- .13 adaptor base suitable sized for larger anchors, when required to suit anchorage capacity.

2.3 PIPING AND DUCTWORK RESTRAINT

.1 Cable Restraints for Suspended Piping and Ductwork:

- .1 manufactured system consisting of cable, building attachment, and vertical rod reinforcement assembly,
- .2 field-built assemblies are not acceptable,
- .3 steel wire strand cables:
  - .1 galvanized steel aircraft cable
  - .2 sized for seismic load with a safety factor of 2,

.3 arranged for restraint in both longitudinal and transverse directions.

.4 Rope connections: overlap wire “U” clips, or, tool-less wedge insert lock connectors.

.5 Connector strength rating equal to 90% of cable breaking strength rating.

.4 Building and equipment attachment brackets: designed to permit free cable movement in all directions up to a 45 degree misalignment:

.1 protective thimbles at sharp corners to protect against cable wear,

.2 Selected to exceed the cable working design load by 50%,

.3 Single sided “C” beam clamps are not acceptable.

.5 Vertical Suspension Rods:

.1 braced to avoid potential for buckling due to vertical up-lift forces,

.2 structural steel angle or formed channel brace selected to prevent support rod buckling,

.3 brace attached to support rod with a series of adjustable clips, without the use of hand-tools.

.2 steel angles or channels:

.1 sized for seismic load with a safety factor of 2,

.2 arranged for restraint in both longitudinal and transverse directions.

.3 Rigidly Mounted Equipment Restraint

.1 Undercut or Heavy-Duty Sleeve type, for post concrete-cure installation:

.1 carbon steel bolt, nut and sleeve,

.2 selected for concurrent shear and tension loads with a safety factor not less than 2.0 x estimated load.

Part 3 Execution

3.1 GENERAL

.1 Design seismic restraints to;

.1 keep equipment in place during and after seismic events in accordance with local building code,

.2 resist vertical loading simultaneously with transverse or longitudinal seismic loading

.2 It is the responsibility of the contractor to ascertain that an appropriate size device be selected for each individual piece of equipment.

.3 Give special consideration to design for adjacent connections, insulation treatment, thermal movement, vibration isolation, and relation to building seismic joints.

.4 Building structure attachments;

.1 concrete construction:

.1 cast in place anchor

.2 drill-in wedge anchor

.2 steel construction:

.1 double sided beam clamp, loaded perpendicular to beam, or

.2 specifically designed welded or bolted connection.

.3 single sided “C” type beam clamps for support rods for piping, ductwork, conduit, bus duct, cable trays or other equipment are unacceptable as seismic restraint anchor points.

.4 Brace installation;

.1 install cable restraints snug,

.2 install solid braces only in rigidly supported situations,

.3 brace hanger rods forming a part of seismic restraint to accept resulting compressive loads,

.4 transverse and longitudinal braces to be no more than 45° above or below centerline of pipe, duct, or tray.

.5 Equipment:

.1 equipment secured rigidly to wall, floor, or housekeeping pad to have resilient neoprene bushings and washers between equipment and anchor bolts.

3.2 SELECTION OF BRACING DETAILS

.1 Select application type;

.1 single hanger or

.2 trapeze support.

.2 Determine required force level, based on weight of equipment and specified factors.

.3 With required force level, develop transverse and longitudinal brace spacing for single or trapeze hanger in accordance with;

.1 break length into separate straight runs, which are considered to be single straight section between any bends except where bend is at an offset of less than 610mm [24”],

.2 brace each straight run in transverse direction at both ends. Check required spacing for transverse bracing and compare it to the length of straight run. If length of straight run is greater than allowable distance for transverse bracing add transverse braces until spacing does not exceed allowable transverse brace distance,

.3 each straight run must have at least one longitudinal brace. Add longitudinal braces so that the spacing does not exceed allowable longitudinal brace spacing. Transverse brace may act as longitudinal brace for an adjacent run when it is located within 610mm [24”] of adjacent straight run,

.4 where several short runs occur one after other, each straight run requires longitudinal brace when adjacent short runs exceed offset length of 610mm [24”]. When adjacent short runs do not exceed maximum offset length the longitudinal braces can act as transverse braces as long as allowable transverse brace spacing is not exceeded. Multiple offsets can be treated as single run when the total offset is less than maximum offset length,

.5 when flexible connection or swing joint is used, such as at pipe drop to mechanical equipment, pipe may cantilever at length equal to or less than half allowable transverse brace spacing. When pipe drop cantilever is greater than half allowable transverse brace spacing, support to floor is required.

.4 Select brace anchorage detail.

.5 Calculate hanger rod load and select rod attachment to structure to suit.

.6 Check if rod stiffeners are required to prevent hanger rod from buckling under compressive load.

3.3 INSTALLATION

.1 Install seismic restraint devices in accordance with manufacturer’s instructions.

.2 Install snubber devices only after equipment is installed and operating, to ensure no metal-to-metal contact.

.3 Seismic restraint manufacturer to provide training to the installation contractor on installation methods.

.4 Anchors on piping systems used for thermal expansion may be used as both a lateral and longitudinal restraint where they are designed for concurrent thermal and seismic loadings.

.5 Pipe and duct penetrations through floors are acceptable as lateral restraints, provided sleeves and fire stopping materials are installed correctly.

.6 Racked piping systems may have the rack braced (laterally, longitudinally, or combination thereof), provided each pipe supported by the rack is restrained to the rack.

.7 Each lateral or longitudinal brace must be secured to the building structure, and not any other building service.

.8 Pipe and duct penetrations through masonry and poured concrete wall partitions are acceptable as a lateral restraint, provided sleeves and fire stopping materials are installed correctly.

.1 Drywall partitions, including demountable partitions, are not to be used for lateral restraint.

3.4 EQUIPMENT RESTRAINTS

.1 Floor Mounted Vibration Isolated Equipment

.1 Select basic vibration isolator as per Section 23 05 48.

.2 Select seismic restraint for each piece of equipment either:

.1 integrated seismic vibration restraint, or

.2 vibration isolator as per 23 05 48 combined with seismic snubbers.

.3 Do not mix type of restraint on the same piece of equipment.

.2 Suspended Vibration Isolated Equipment

.1 Provide restraint in accordance with the SMACNA guideline and manufacturers' instructions.

.2 Do not mix cable restraints and rigid bar restraints on the same piping or duct system, except:

.1 On piping or ductwork which is suspended on vibration isolators, use cable type SCR restraints and provide a small amount of slack in the cable to prevent vibration short-circuiting.

.3 Select basic vibration isolator as per Section 23 05 48.

.4 Provide cable restraints in longitudinal and lateral directions.

.5 Connect slack cable restraints to ceiling hung equipment in such a way that the axial projection of the wires passes through the centre of gravity of the equipment.

.6 Provide hanger rod reinforcement.

.7 Do not use ductwork or piping restraints to restrain equipment.

.8 Orient restraint wires on ceiling hung equipment at approximately 90 degrees to each other (in plan), and tie back to the ceiling slab at an angle not exceeding 45 degrees to the slab.

.9 On piping systems, provide transverse slack cable restraints at a maximum spacing of 12 m [40 ft] and longitudinal restraints at 24 m [80 ft] maximum spacing, or as limited by anchor/slack cable performance. For pipes greater than 250mm [10”], reduce transverse restraint spacings to 6.0 m [20 ft]. Small pipes may be rigidly tied to big pipes for restraint, but not the reverse.

.10 Transverse bracing for one pipe section may also act as longitudinal bracing for the pipe connected perpendicular to it, provided the bracing is installed within

600 mm [24”] of the elbow or T, and if the connected pipe is the same or smaller in size. Do not use branch lines to restrain main lines.

.11 Provide flexibility in piping joints or sleeves where pipes pass through building seismic or expansion joints.

.12 At vertical pipe risers, wherever possible, support the weight of the riser at a point or points above the centre of gravity of the riser. Provide lateral guides at the top and bottom of the riser, and at intermediate points not to exceed the transverse spacings discussed above for horizontal pipes, with guide clearance not exceeding 3 mm [1/8”].

.13 Vary adjacent spacing of restraints on a piping run by 10% to 30% to avoid coincident resonances.

.14 Install restraints at least 50 mm [2"] clear of all other equipment and services.

.15 Adjust restraint cables such that they are not visibly slack, or such that the flexibility is approximately 40 mm [1-1/2"] under thumb pressure for a 1.5 m [5 ft] cable length (equivalent ratio for other cable lengths). Adjust the clearance at cable strap/spacer piece restraints to not exceed 6 mm [1/4"].

.16 Provide transverse and axial restraints as close as practical to a vertical bend.

.17 At steel trusses, connect to top chords and follow truss manufacturer's instructions.

.3 Rigidly Floor Mounted Equipment

.1 Anchor all floor mounted equipment with anchor bolts, minimum four bolts for rectangular equipment bases, and three bolts for circular equipment bases.

.2 For round equipment, such as expansion tanks with floor-support ring without mounting flanges, use snubbers or custom seismic snubbers.

.3 Provide resilient neoprene bushings and washers between equipment and anchor bolt.

.4 Surface wall-mounted Equipment and Panels

.1 Select bolts for concurrent shear dead-weight without deduction for uplift load, and tension restraint load.

.2 In block-wall;

.1 up to three bolts, each bolt rated for 2.0 times estimated restraint load, or

.2 for four bolts or more, each bolt is rated for 1.0 times estimated concurrent load.

.3 In dry-wall;

.1 minimum of four self-tapping screws drilled into the studs, with each screw rated for 1.0 times estimated restraint load.

.5 Recessed wall-mounted Equipment and Panels

.1 Same as for surface mounted equipment, except fasten through top bottom and sides of panels to adjacent block wall or wall studs.

3.5 AIR TERMINALS

.1 Where air terminals are installed in mechanical grid ceilings, provide at least two 12 ASWG galvanized steel wire seismic security bridles per air terminal tied either to the building structure or to ceiling hanger wires.

.2 Attach security bridles at opposite corners of each air terminal and in such a manner that the air terminal cannot fall.

.3 Provide all necessary brackets for attachment of security bridles to the air terminals.

3.6 MIXING BOXES AND AIR VALVES

.1 Provide seismic restraints in accordance with details in SMACNA Guidelines or alternatively slack cables may be used.

3.7 ISOLATED PIPING AND EQUIPMENT

.1 For post disaster installations, provide vertical rod stiffeners when rod length is greater than 50 rod diameters.

3.8 MANUFACTURER'S SERVICES

.1 Review design drawings and specifications, and shop drawings.

.2 Provide design and selection of seismic restraints, and preparation of shop and installation drawings.

.3 Provide training of contractor personnel for the installation of seismic restraints.

.4 Conduct site inspections of the Work in progress, and to conduct a final inspection of the work. Provide a copy of the final inspection report to the Consultant for review, including photographs of representative installations of each type of restraint used in the Work.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 APPLICABLE CODES AND STANDARDS

.1 Mechanical systems identification, including piping, ducts and equipment, shall be in accordance with:

.1 CSA B-149.1

.2 CAN/CGSB 24.3

.3 ANSI/ASME A13.1

.4 CSA Z-7396.1

1.3 SHOP DRAWINGS

.1 Submit list of nameplates, with proposed wording, prior to engraving.

.2 Identification Schedules

.1 Submit schedules of the following for review, prior to framing:

.1 Pipe Identification Colours.

.2 Valves.

.3 Ceiling Access Identification Colours.

.4 Duct Access Identification Colours.

Part 2 Products

2.1 GENERAL

.1 Manufactured identification systems:

.1 laminated vinyl or polyester,

.2 resistant to chemical, ultraviolet,

.3 operating temperature: -25°C to 121°C [-12°F to 250°F]

2.2 MANUFACTURER'S NAMEPLATES

.1 Each piece of manufactured equipment shall have a metal nameplate, with raised or recessed letters. Mechanically fasten plate to equipment.

.2 Manufacturer's nameplates shall indicate manufacturer's name, equipment model, size, serial number and electrical characteristics and pertinent information for any other services connections.

.3 Include ULC, (Underwriters' Laboratories Canada) or CSA, (Canadian Standards Association) registration logos and those of other agencies, as required by the respective agencies.

.4 Nameplates shall be located so that they are easily read. Do not insulate or paint over nameplates.

2.3 EQUIPMENT IDENTIFICATION NAMEPLATES

.1 Identification plates are in addition to manufacturers plates.

.2 Identification plates:

.1 provided for equipment identified with number designations in schedules and equipment selection sheets.

.2 marked with equipment ID, service and power source using wording and numbering used in contract documents, e.g. supply fan SF-1, cooling coil CC-1, pump P-1

.3 Apply nameplates securely in conspicuous places, on cool surfaces.

.4 Identify systems, and areas or zones of building being serviced.

.3 Fabrication:

.1 laminated plastic,

.2 black lettering on white background for “Normal” power equipment

.3 white lettering on red background for “Emergency” power equipment

.4 minimum size 90mm x 40mm x 2.5mm [3” x 1½” x 1/8”],

.5 engraved with 10 mm [7/16”] high lettering.

.6 use 25 mm [1"] high lettering for major equipment.

2.4 PIPING IDENTIFICATION

.1 Piping Identification

.1 Each piping system shall be colour coded for identification and labelled with the system identification code letters, including temperature and pressure, if applicable, and directional flow arrows in accordance with the Pipe Identification Colour Schedule. See diagram for sizes of lettering and bands.

.2 Flexible coil-wrap manufactured markers:

.1 plastic coated markers with integral printing, or plastic cover with field applied self-adhesive markers,

.2 applicable WHIMS pictogram for identification of material hazard.

.3 Self-adhesive manufactured pipe markers, flow arrows and colour bands:

.1 Identification colour bands for primary and secondary colours to indicate the type and degree of hazard

.2 Standard of Acceptance: Brady vinyl cloth tape bands or Brady vinyl tape bands, with adhesive compatible with the surface temperature.

.4 Colour band tape with flow direction arrows,

.1 waterproof and heat resistant plastic marker tags for pipes and tubing 20mm [¾”] nominal and smaller.

.2 applicable WHIMS pictogram for identification of material hazard.

.5 Stenciled pipe markers:

.1 stenciled letters and numbers: 12 mm [½”] high lettering on pipes 50mm [2”] and smaller, and 25mm [1”] high for pipes 65mm [2.5”] and larger, showing pipe service, pipe size and arrows showing direction of flow.

.2 colour bands: 50mm [2”] wide, using primary and secondary colours conforming to Pipe and Valve Identification Table. Paint to conform to CGSB 1-GP-60M.

.3 direction arrows:

.1 150mm [6”] long by 50mm [2”] wide for piping 75mm [3”] nominal or larger outside diameter including insulation,

.2 100mm [4”] long by 20mm [¾”] wide for smaller diameters.

.3 applicable WHIMS pictogram for identification of material hazard

2.5 VALVE IDENTIFICATION

.1 Provide every valve job with a numbered tag showing valve type and size, attached to valve stem or wheel handle with nonferrous chain or S-hook.

.1 Valve identification is not required at the following valves:

.1 inside fire hose cabinets,

.2 radiation heating units, unit heaters, or fixture stops,

.3 within sight of equipment or apparatus they control provided there is no branch piping between valve and equipment served.

.2 Tags may be of brass, aluminum, metalphoto, lamicoid or fiberglass, stamped or engraved, of 25 mm [1"] minimum diameter.

.3 Identification information:

.1 indicating service, sequential valve number by service or specific equipment ID for control valves, location identifier, purpose of valve, valve type and size.

.2 valve type designation:

.1 B (ball valve), GT (gate valve), GL (globe valve), CBV (circuit balancing valve), BF (butterfly valve).

.3 valve size:

.1 for valve size, use NPS designation.

.4 Prepare flow diagrams for each system showing pumps, heat transfer equipment, schematic piping and tagged valves.

.5 Provide a tag schedule for each system, designating number, service, function, size, and location of each tagged item and normal operating position of each valve.

.6 Submit two copies of valve tag schedules, encased in clear plastic, bound in vinyl covered, hardbacked 210mm x 297mm [8½" x 11"] three ring binders.

.7 All fuel oil valves shall be identified in conformance with CPPI 1990, "Using the CPPI color-symbol to mark equipment and vehicles for product identification".

2.6 OUTSIDE SERVICES - BURIED PIPING

.1 Materials:

.1 detectable metallized tape that can be located with a metal detector, labeled with name of service, at maximum 800 mm [32"] intervals.

2.7 OUTSIDE SERVICES - VALVE BOXES

.1 Valve box covers for underground services shall be painted in accordance with the following colour classification.

.1 Yellow: Dangerous Materials

.2 Blue: Protective Materials

.3 Green: Safe Materials

.4 Red: Fire Protection Equipment

.2 Painting shall be done by the painting Sub-Contractor.

.3 Valve box covers shall be identified as to the type of service, e.g., water, irrigation, gas, etc.

2.8 DUCTWORK IDENTIFICATION

.1 Paint stencilled letters 25mm [1:"] high identifying,

.1 duct service,

.2 fan number, and

.3 arrows showing direction of flow,

Part 3 Execution

3.1 PIPING IDENTIFICATION - GENERAL

.1 Install markers on cleaned and prepared surfaces free of dirt and oil.

.2 Provide manufactured tape markers:

.1 self-adhesive type:

.1 indoor uninsulated piping,

.2 indoor insulated piping with PVC or smooth metal jackets,

.2 flexible coil-wrap:

.1 outdoor piping,

.2 indoor insulated piping with canvas or embossed metal jackets.

.3 Provide stencil markers:

.1 Paint stenciled letters and numbers identification marks showing pipe service, pipe size and showing direction of flow.

.2 Paint flow direction arrows adjacent to each identification mark.

.3 Paint colour bands adjacent to each identification mark.

.4 Locations:

.1 Identify piping (pipe markers and direction arrows) at the following locations:

.1 Adjacent to major valves and where valves are in series at no more than 2 m [6.5 ft] intervals.

.2 At least once in each room and at 15 m [50 ft.] maximum spacing in open areas. Exception: gas piping to be identified at 2 m [6.5 ft] intervals in ceiling plenums.

.3 maximum every 15 m [50 ft] along length of pipe, except for medical gas, natural gas and fuel oil,

.4 Adjacent to all major changes in direction.

.5 At point of entry and leaving each pipe chase and/or confined space and piping accessible at each access opening.

.6 At the beginning and end points of each run; and, at each piece of equipment in each run.

.7 maximum every 6 m [20 ft] along length of pipe for natural gas and fuel oil,

.8 within 1 m [3 ft] of each side of barriers, floors and walls,

.9 within 1 m [3 ft] of and behind access doors,

.10 within 1 m [3ft] of piping termination point.

.5 Provide schedules in each major mechanical room and at least one schedule will be required on each floor having a minor mechanical room. Frame schedules under glass in matching frames and hang where directed.

.1 Include one copy of schedules in each operating and maintenance manual.

3.2 PIPING IDENTIFICATION – MEDICAL GAS

.1 Refer to Section 22 63 02 for Identification of Medical Gases.

3.3 PIPING IDENTIFICATION – BURIED PIPING

.1 Provide tracer tape along entire length of pipe at a depth of:

.1 600 mm [24”] mm below top of grade for water piping,

.2 150 mm [6”] above top of natural gas, propane, or fuel oil piping, and medical gas piping.

.2 This tape is in addition to any required electrical tracing wire that may be required under other sections.

3.4 VALVE IDENTIFICATION

.1 Provide valves with a numbered tag showing valve type and size, attached to valve stem or wheel handle with nonferrous chain or S-hook.

.2 Valves to be tagged include:

.1 Valves on all main piping circuits.

.2 Valves on all major branch lines.

.3 Valves on minor branch lines in horizontal service spaces, vertical service spaces and mechanical equipment rooms.

.4 Drain valves and hose bibbs on systems containing glycol.

.5 Control valves.

.3 Valve identification is not required at the following valves:

.1 inside fire hose cabinets,

.2 radiation heating units, unit heaters, or fixture stops,

.3 within sight of equipment or apparatus they control provided there is no branch piping between valve and equipment served.

.4 control valve stations, steam trap stations, fixture stops, system drain valves other than glycol.

.4 Prepare flow diagrams for each system showing pumps, heat transfer equipment, schematic piping and tagged valves.

.5 Provide a tag schedule for each system, designating number, service, function, size, and location of each tagged item and normal operating position of each valve.

.6 Schedule the valve numbers using a sequential numbering system indicating location, service and normal position (open or closed). Numbers shall be prefixed by the letter "P" or the letter "H" indicating that the valve is on plumbing or heating service.

.7 Submit two copies of valve tag schedules, encased in clear plastic, bound in vinyl covered, hardbacked 210mm x 297mm [8½" x 11"in] three ring binders.

.8 All fuel oil valves shall be identified in conformance with CPPI 1990, "Using the CPPI color-symbol to mark equipment and vehicles for product identification".

3.5 DUCTWORK IDENTIFICATION

.1 Identify plenum access doors as to accessed items, e.g. Filter F-1, Supply Fan SF-1, Cooling Coil CC-1.

.2 Stencil on all plenum doors, downstream from air filter bank. "Do not open when fan operating".

.3 Identify all ductwork in mechanical equipment rooms to denote system and/or zone served and an air flow direction arrow.

.4 Identify automatic control dampers concealed in ductwork. Identify the "open" and "closed" position of the operator arm on the outside of the duct or duct insulation.

.5 Identify all hazardous exhaust ducts, e.g. fume hood, radioactive exhaust at not greater than 3 metre [10 ft.] and at least once in each partitioned space. Radioisotope exhaust ducts shall be marked with a radiation-warning symbol. See detail MD 01 005 in Section 23 99 50.

.6 Identification letters shall be 50 mm [2"] high black letters on white background. Flow arrows shall be 50 mm [2"] wide by 150 mm [6"] long black arrows on a white background. Stencil over final finish only.

3.6 CEILING ACCESS IDENTIFICATION

.1 Secure 6 mm [1/4"] self-adhesive coloured dots, (Brady Quik Dots or Avery Data Dots), to the ceiling, to identify the location of access to equipment concealed above the ceiling according to the following schedule:

	Colour
Concealed equipment and cleaning access	Yellow
Control equipment, including control valves, dampers and sensors	Black
Fire and smoke dampers	Red
Fire protection including sprinkler equipment including drains	Red
Heating/Chilled water, DCW, DHW isolation valves	Green
Pipe mounted equipment, other than fire, smoke and sprinkler equipment	Green

.2 When T-bar ceilings are installed adhere coloured dots to T-bar framing, adjacent to panel to be removed.

3.7 DUCT ACCESS IDENTIFICATION

.1 Secure 50 mm [2"] high, Gothic style self-adhesive stick on-letters, (Letrasign or Brady Quick-Align) on duct access panels to identify their usage, according to the following schedule:

	Colour	**Letters**
Cleaning and service access	black.	C.A
Controls including sensors	black	C
Dampers, (backdraft, balance and control)	black	D
Fire dampers	red	F.D.
Smoke dampers and detectors	red	S.D.

3.8 EQUIPMENT IDENTIFICATION

.1 Secure engraved laminated plastic identification tags (black face and white centre) on the following items:

.1 Temperature control instruments, gauges and panels, coordinated with control diagrams identification.

.2 Electrical switchgear supplied under Division 21, 22, 23.

.3 Refer also to the Controls Section.

3.9 IDENTIFICATION SCHEDULES

.1 Submit schedules of the following for review, prior to framing:

.1 Pipe Identification Colours.

.2 Valves.

.3 Ceiling Access Identification Colours.

.4 Duct Access Identification Colours.

.2 Schedules will be required in each major mechanical room and at least one schedule will be required on each floor having a minor mechanical room. Frame schedules under glass in matching frames and hang where directed.

.1 Include one copy of schedules in each operating and maintenance manual.

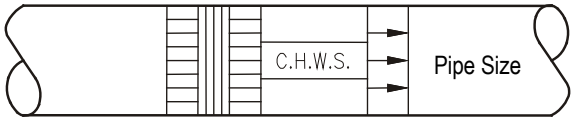
3.10 PIPE IDENTIFICATION COLOUR SCHEDULE

.1 Refer to Section 22 63 02 for Identification of Medical Gases.

Service	**Identification Lettering**	**Primary Colour**	**Secondary Colour**
Cold Water Service	C.W.	green	-
Combined standpipes	C.S.	red	white
Domestic H.W. Recirc.	D.H.W.R.	yellow	black
Domestic H.W. Supply	D.H.W.S.	yellow	black
82°C [180°F]	82°C [180°F]		
Domestic H.W. Supply	D.H.W.S.	yellow	black
60°C [140°F]	60°C [140°F]		
Exhaust Piping	-	yellow	black

Service	Identification Lettering	Primary Colour	Secondary Colour
Fire lines W.S.	W.S.	red	white
Glycol Heating Return	GLR - do not drain	yellow	black
Glycol Heating Supply	GLS - do not drain	yellow	black
Hot Water Return	H.W.R.	yellow	black
Hot Water Supply	H.W.S.	yellow	black
Sprinkler lines	S.P.R.	red	white

3.11 PIPE IDENTIFICATION BANDING COLOURS



.1 Letters:

.1 13 mm [1/2"] high – 30mm [1-1/4”] pipe & smaller.

.2 25 mm [1"] high – 40mm [1-1/2”] up to 65mm [2-1/2”] pipe.

.3 50 mm [2"] high – 75mm [3”] and larger pipe.

.2 Bands:

.1 38 mm [1-1/2"] wide, except arrow bands 50 mm [2"] wide.

.3 Colours:

.1 horizontally hatched - primary colour.

.2 vertically hatched - secondary colour.

.3 black letters and arrows on yellow primary colour background

.4 white letters and arrows on red, blue or green backgrounds.

3.12 FUEL OIL SYSTEM IDENTIFICATION

.1 Contractor shall provide and install a lamicoid placard to be placed inside the spillbox at the Fill Pipe at a location clearly visible to the delivery person, and shall state the following “WARNING: IN THE EVENT OF SPILLAGE OR AN EMERGENCY, CONTACT THE BUILDING MAINTENANCE AT (xxx) xxx-xxxx.”

.2 The phone number and exact location of placard shall be coordinated with the building maintenance manager.

.3 Transfer points in piping systems for flammable and combustible liquids shall be identified in conformance with CPPI, “Using the CPPI Color-Symbol System to Mark Equipment and Vehicles for Product Identification.”

.4 “Vent piping to be labeled as ‘DIESEL FUEL VENT’. All piping labels to be maximum 2.5 metres [8’] apart.”

.5 Provide placards conforming to Transport Canada - Transportation of Dangerous Goods Regulations (TDGR) SOR/2008-34, identifying stored combustible liquid and the capacity of the storage tanks. Placards shall be posted in a conspicuous location outside the room, and that information shall be included in the fire safety plan.

.6 Two signs must be affixed to the exterior of the fire room door, one being a TDG placard as shown below and a second sign stating “Diesel Fuel Storage xxxx Litres”. White background, black letters, letters being not less than 30 mm high.

3.13 NON-POTABLE WATER:

.1 Distribution piping for non-potable water systems shall be clearly identified in accordance with CSA B128.1 and CAN/CGSB-24.3

.2 Pipe for non-potable water systems shall be

.1 Marked with the legend WARNING: NON-POTABLE WATER — DO NOT DRINK; and

.2 Purple in colour, or marked with a continuous purple stripe.

.3 Markings on pipe for non-potable water systems shall be

.1 permanent, distinct, and easily recognizable;

.2 in legible letters and numerals at least 6 mm [1/4”] high, except where the size of the pipe makes 6 mm [1/4”] letters and numerals impractical

.3 of a colour that contrasts with the colour of the pipe; and

.4 repeated at intervals of not more than 1.5 m [5’].

.4 Outlet points shall be clearly and permanently marked with the legend WARNING: NON-POTABLE WATER — DO NOT DRINK and with a sign as depicted,

.1 The sign shall be not less than 100 mm × 100 mm [4” x 4”].

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 CODES AND STANDARDS

.1 Procedures shall be in accordance with AABC'S National Standards for Field Measurement and Instrumentation and ASHRAE Standards.

1.3 CONTRACTOR QUALIFICATIONS

.1 Prior to finalizing contractual arrangements with the balancing agency, submit the names, qualifications and years of direct field testing and balancing experience in the testing and balancing field for all members of the balancing team that is scheduled to carry out the balancing work.

.1 The senior site technologist must have a minimum of five years testing and balancing experience of similar projects.

.2 Provide a list of a minimum of ten comparable projects successfully completed by all key members of the balancing team.

1.4 TESTS

.1 Give at least written 24 hour notice of date for tests.

.2 Do not externally insulate or conceal work until tested and approved. Follow construction schedule and arrange for tests.

.3 Conduct tests in presence of Consultant. Arrange for the Owner’s representative to be present.

.4 Bear costs including retesting and making good.

.5 Refer to Piping Sections for specific test requirements.

.6 Refer to Ducting Sections for specific test requirements.

.7 Prior to tests, isolate all equipment or other parts which are not designed to withstand test pressures.

1.5 TESTING AND BALANCING - GENERAL

.1 Employ an approved independent testing and balancing agency to test and balance the following systems.

.1 Heating hot water system(s).

.2 Antifreeze (glycol) system(s) (heating and heat recovery).

.3 Supply air system(s).

.4 Return air system(s).

.5 Exhaust air system(s).

.6 Fire/smoke pressurization system(s).

.7 Existing systems.

.2 The Agency shall be responsible to the Contractor but report jointly to the Consultant and the Contractor. Report in writing to the Consultant any lack of cooperation and any discrepancies or items not installed in accordance with the contract documents.

.3 The balancing agency shall agree to perform spot checks, where requested, in the presence of the Consultant's designated representative.

.4 Work with the agency to:

.1 Ensure that all mechanical systems are complete and ready to be balanced and provide enough time for testing and balancing prior to Ready-For-Takeover.

.2 Make corrections to achieve system balance without delay, include all corrections made during the balancing procedure on "As Built" Drawings. Mechanical Contractor to provide “As Built” information to the balancing agency before balancing commences.

.3 Adjust fan drives, change blade pitch angles and change sheaves and belts as directed by the agency.

.4 Maintain all systems in full operation during the complete testing and balancing period.

.5 Employ control technicians to adjust the control systems as required to facilitate the balancing process.

.6 Employ the journeyman millwright to check the alignment of any V-belt drives and/or shaft coupling drives if they have been adjusted during the balancing process. Belt tension correctness to be verified.

.5 Consult with the Consultant to clarify the design intent where necessary or in case there are any problems foreseen as the balancing processes.

.6 Complete air balance before commencing water balance where heating/cooling coils are installed in the air system. Balancing shall not commence until systems have been cleaned and treated and the air removed from within the piping systems.

.7 Accuracy: Balance to maximum flow deviation of 10% at terminal device and to 5% at equipment. Measurements to be accurate to within plus or minus 5% of actual values.

.8 This agency shall remove and re-install ceiling tile to provide access to ductwork and piping. The balancing agency will make good any damage or soiling caused by his forces.

.9 Instrument calibration: At the Consultants request, the balancing agency shall submit a dated calibration chart for all instruments.

.10 Permanently mark final settings on valves, dampers and other adjustment devices. Set and lock all memory stop balancing devices.

.11 Seal all holes with snap plugs or approved alternate method, used for flow and pressure measurements.

.12 The controls contractor and balancing agency are to allow for checking and making adjustments during the 12-month warranty period, when weather conditions provide natural loads and in cases where complaints arise.

.13 Submit a draft balance report to the Consultant for approval and submit approved copies to the agency preparing the O & M manuals for inclusion in each operating and maintenance manual. Provide field notes in the balancing report to clearly identify unusual conditions, problem areas and report on any cases where the specified flow rates or conditions could not be achieved by adjustment. Identify outstanding problems that cannot be corrected by the balancing team or that will not be corrected by the installing trades (e.g. in cases where additional balancing dampers are required).

.14 Submit a statutory declaration to the Consultant, certifying that the testing and balancing procedures have been completed, that complete factual reports have been distributed and that directions have been given to the Contractor to correct faults and omissions and, finally, that follow-up testing, after correction of faults and omissions, has been completed and recorded. Form MF170 in Section 23 99 60 should be used for this purpose. Reports to be signed by the senior member of the balancing team.

.15 Employ the testing and balancing agency to test all fire dampers as follows:

.1 Test all fire dampers (including combination smoke/fire dampers). The test shall be made by releasing the fusible link and witnessing closure of the damper. All fire dampers shall be left in the open position.

.2 A set of prints shall be marked up to show that each damper has checked for closure, accessibility and installation or provide schematic mechanical drawing showing all fire damper locations, label all fire dampers on drawing and reference to form MF172 in Section 23 99 60. The prints shall be certified correct by the agency and submitted to the consultant with completed test certificate MF172.

1.6 BALANCING - AIR SYSTEMS

.1 Prior to demolition, in renovated areas, measure and record supply, return and exhaust airflow into existing areas that are not included in the renovations. After renovations are completed, rebalance existing branches to the conditions as found in the pre-construction measurements. Provide written report indicating all areas that have been pre-measured including Pitot tube traverse sheets.

.2 Adjust duct and terminal balance dampers and adjust or change drive sheaves and fan blade pitch angles to obtain design quantities (within +/-10%) at each outlet and inlet.

.3 Use terminal balance dampers to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. The sheet metal sub-contractor shall provide additional dampers where required by the balancing agency to achieve a satisfactory balance without creating objectionable sounds levels.

.4 Make air quantity measurements in ducts by "Pitot Tube" traverse of entire cross-sectional area of duct. Provide a Pitot tube traverse test sheet for each major duct branch.

.5 Measure air quantities at each air terminal.

.6 Maintain the design relationship between the supply and exhaust air system quantities.

.7 Check to ensure that supply and return air quantities provide reasonable building pressurization. Test building pressurization levels in variable volume systems throughout full range of fan delivery rates, under both heating and cooling conditions. Exit doors and elevator shafts should be checked for air flow so that exterior conditions do not cause excessive or abnormal pressure conditions. Document abnormal building leakage conditions noted.

.8 Adjust the air terminals to obtain the optimum air distribution pattern. The total airflow through each air valve/mixing box should be adjusted and reported by the balancing agency for maximum and minimum flow conditions.

.9 Controllers on air valves/mixing boxes are to be checked by the Controls Contractor and the Commissioning Agency.

.10 The Controls Contractor and the Commissioning Agency shall verify that room thermostats / sensors are cycling valves/mixing boxes properly.

.11 Air systems shall be balanced with clean filters in place, at a total of 105% to 110% of specified total airflow rates.

.12 Where variable air volume systems are installed, take measurements at maximum and minimum flows. Record the minimum operating duct static pressure setpoint for air handling system.

.13 In conjunction with the Controls Contractor set and verify the outdoor air damper minimum position. The balancing agent shall measure the O/A volume during minimum O/A condition when the air valves/mixing boxes are at a simulated minimum system condition.

.14 Balance to maintain the required pressures. Report to the Consultant where the desired pressure differential cannot be achieved within 10% of the design values for further direction. This may indicate a problem with how well the rooms are sealed or excessive leakage needs to be dealt with.

.15 Include in the air balance report:

.1 Date of test, Name and address of building and balancing technician's name.

.2 Range of outdoor air temperature during the balancing period.

.3 System schematics indicating damper positions, design and measured air quantities at each inlet and outlet. Show room numbers and floors.

.4 If installation permits, record both air terminals and fan discharge traverse air volumes to establish system leakage.

.5 Main branch duct traverses. Maximum and minimum outdoor air quantities.

.6 Static pressure across each component in an air handling system at full flow.

.7 Face velocities across major components such as filter or coils.

.8 Static pressure across each fan.

.9 System static pressures at selected points throughout a VAV supply duct system and in main branch ducts in low velocity systems.

.10 Fan and motor speed.

.11 Motor size, starting time, amps and voltage.

.12 Coil air entering and leaving temperatures (D.B. and W.B.).

.13 Maximum and minimum zone supply air temperatures under prevailing conditions at time of test.

.14 Provide fan performance curve for each new air handling system.

.15 Air pressure map (i.e. positive, negative, neutral) and directional airflow for all spaces.

1.7 BALANCING - LIQUID SYSTEMS

.1 Set balance valves and balance fittings to provide required or design flow rates for each system component.

.2 Use installed flow measuring devices to determine flow rates for system balance. Where flow measuring devices are not installed, base flow balance on the air and liquid temperature difference across terminal heating/cooling elements and coils, acknowledging the different design temperature drops/rises used in the design of the systems.

.3 Effect system balance with automatic control valves fully open to heat transfer elements.

.4 Trim pump impellors to match pump performance to system characteristics rather than artificially increasing system pressure drops to match pump characteristics. Additional costs incurred in trimming the impellors will be considered as an extra.

.5 Check air vents to ensure that they are correctly installed and are operating properly. The mechanical contractor shall ensure that all air is removed from within the piping system and that there is flow throughout all piping systems before the balancing is started.

.6 Include in the liquid balance report:

.1 Date of test, Name and address of building and balancing technician's name.

.2 Range of outdoor air temperature during the balancing procedure.

.3 Heating/Cooling Coils: Tag, service & location. Specified and actual capacity, flow, liquid pressure drop, liquid entering and leaving temperatures, air-side entering and leaving temperatures.

.4 Flow measuring devices: Flow rates.

.5 Terminal heating/cooling elements: Entering and leaving liquid temperatures.

.6 System schematics: Specified and actual flow rates.

END OF SECTION

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Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 RESPONSIBILITIES

.1 Provide external thermal insulation for plenums and ductwork as called for. Note items listed that do not require insulation.

.2 Provide internal acoustical insulation for plenums and ductwork, as called for. Do not externally insulate any ductwork that is specified to be internally insulated, unless indicated otherwise.

.3 Journeyman insulation applicators, skilled in this trade, shall perform the work.

.4 Be responsible for ensuring that enough space is always provided to allow proper installation of insulation materials.

1.3 REGULATORY REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the B.C. Building Code and NFPA 90A. Generally, the flame spread rating throughout the material shall not exceed 25 and the smoke developed classification shall not exceed 50.

.2 Insulation thickness and insulating values shall be in accordance with the most stringent of the National Energy Code of Canada for Buildings (NECB) or ASHRAE 90.1.

.1 Note that ASHRAE 90.1 specifies that R values shall match wall or roof insulation values for outdoor ducts and outdoor air plenums. Provide shop drawings to demonstrate compliance.

.3 Duct linings shall be in accordance with CSA Z317.2

1.4 CODES AND STANDARDS

.1 Material and method of application to comply with or be tested in accordance with the latest applicable versions of the following Standards,

.1 B.C. Building Code and local by-laws

.2 B.C. Insulation Contractors Association (BCICA) Standards Manual.

.1 Use the latest edition of the BCICA Standards Manual as the base reference standard if insufficient detail/information is contained herein, or if the BCICA Standard is more stringent.

.3 Thermal Insulation Association of Canada (TIAC) National Insulation Standard, excluding section 12

.4 ASHRAE/IES 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings

.5 ANSI/NFPA 90A Air Conditioning and Ventilating Systems and Installation.

.6 ANSI/NFPA 90B Warm Air Heating and Air Conditioning Systems.

.7 CGSB 51-GP-10M Thermal Insulation, Mineral Fiber, Block or Board, for Ducting.

.8 CGSB 51-GP-11M Thermal Insulation, Mineral Fiber, Blanket for Piping, Ducting, Machinery and Boilers.

.9 ASTM C518 Standard Test Method for Steady State Thermal Transmission Properties by Means of Heat Flo Meter Apparatus

.10 ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation

.11 ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

.12 CAN/CGSB-51.12 Cement, Thermal Insulating and Finishing.

.13 CAN/CGSB-51.40 Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.

.14 CGSB 51.53-95 Polyvinyl Chloride) Jacket Sheeting, for Insulated Pipes Vessels and Round Ducts.

1.5 QUALITY ASSURANCE

.1 The British Columbia Insulation Contractors Association (BCICA) Quality Standards Manual, latest edition including additions and amendments, shall be used as reference standard, supplemented by this specification where more stringent requirements are specified.

.2 All materials shall, as a minimum, meet this specification and BCICA Quality Standards for Mechanical Insulation (Commercial and Institutional Buildings) Manual (QSMIM).

.3 Work shall be performed by tradespersons with a Red Seal or TQ designation in the Heat and Frost trade, and/or apprentices / helpers supervised by qualified journeypersons.

1.6 QUALIFICATIONS AND SAMPLES

.1 Submit, for approval, substantiating manufacturer's documentation (and samples when requested) for all materials, applications and finishing methods to establish that all will satisfy this specification and meet all applicable code requirements, before commencing work.

.2 Submit, for approval, samples of each type of firestopping, smoke seal and accessory.

.3 Provide shop drawing for duct liner and thermal insulation. Indicate thickness, R value and finish

1.7 MINIMUM STANDARDS

.1 All ductwork shall be insulated to meet or exceed the minimum requirements of the National Energy Code of Canada. In addition, the requirements of ASHRAE 90.1 are also applicable to this project. The more stringent insulation value (between the two codes) will be the level required for this project.

.2 ASHRAE 90.1 specifies that R values shall match wall or roof insulation values for outdoor ducts and outdoor air plenums. Provide shop drawings to demonstrate compliance.

.3 Refer to the following table taken from NECB Insulation of Ducts for additional information:

Temperature Difference, (1) °C	**Min. Thermal Resistance (RSI) for Ducts and Plenums $m^2*°C/W$**	**Min. Thermal Resistance (RSI) for Run-outs, (2) $m^2*°C/W$**
< 5	0	0
5 to 22	0.58	0.58
>22	0.88	0.58

Notes:

(1) The temperature difference at design conditions between the space within which the duct is located and the design air temperature of the air carried by the duct. Where duct is used for both heating and cooling purposes the larger temperature difference shall be used.

(2) Ducts not exceeding 3 metres in length connecting to terminal grilles or diffusers.

1.8 DEFINITIONS

.1 "CONCEALED" means insulated mechanical services in chases, furred spaces, shafts and hung ceilings.

.2 "EXPOSED" will mean not concealed. For greater certainty, the following locations are considered exposed:

.1 Services in all mechanical and electrical rooms.

.2 Services in space beneath raised floors.

1.9 ASBESTOS

.1 All material / products installed shall be free of asbestos.

Part 2 Products

2.1 GENERAL

.1 Flame spread and smoke density of all products shall not exceed 25/50 per ASTM E84 with or without integral jacket.

2.2 DUCT INSULATION - EXTERNAL

.1 External flexible glass fibre insulation with integral vapour barrier.

.1 Minimum density - 12 kg/cu.m. [0.75 lbs/cu. ft.].

.2 Thermal Conductivity (uncompressed) at 24°C [75°F] - 0.042 W/sq.m/°C [0.29 btu/h/sq.ft/°F]

.3 Flame Spread/Smoke Developed rating throughout the material shall not exceed 25/50.

.4 Standard of Acceptance:

.1 Certainteed SoftTouch Duct Wrap 75

2.3 DUCT INSULATION - INTERNAL

.1 Duct Liner – Flexible (fiber free foam)

.1 Internal, flexible, elastomeric, non-particulating, fiber free, formaldehyde free, low VOC, acoustical insulation with antimicrobial coating

.2 Minimum Noise Reduction Criteria (NRC): 0.6 as per ASTM C423 ‘Type A mounting’.

.3 Thermal Conductivity at 24°C [75°F]- 0.036 W/sq.m/°C [0.25 btu/h/sq.ft/°F]

.4 Flame Spread/Smoke Developed rating throughout the material shall not exceed 25/50.

.5 Standard of Acceptance:

.1 Armacell AP/Coilflex,

.2 Flexible Duct Liner

.1 Not permitted in supply air, return air ducts or outside air intake systems.

.2 Yellow or light coloured internal flexible, glass fibre acoustical insulation with a non-woven fiberglass mat facing on one side.

.3 Mat shall be complete with an EPA-registered antimicrobial agent on the airstream side.

.4 Flame Spread/Smoke Developed rating throughout the material shall not exceed 25/50.

.5 Minimum density - 24 kg/cu.m. [1.5 lbs/cu. ft.].

.6 Minimum sound absorption (NRC) of 0.70 as tested per ASTM C423 using type "A" mounting.

.7 Thermal Conductivity at 24°C [75°F]- 0.033 W/sq.m/°C [0.24 btu/h/sq.ft/°F]

.8 Standard of Acceptance:

.1 Certainteed Toughgard-R

.3 Rigid Duct Liner

.1 Not permitted in supply air, return air ducts or outside air intake systems.

.2 Yellow or light coloured internal rigid resin bonded glass fibre acoustical insulation with a non-woven fiberglass mat facing on one side.

.3 Mat shall be complete with an EPA-registered antimicrobial agent on the airstream side.

.4 Flame Spread/Smoke Developed rating throughout the material shall not exceed 25/50.

.5 Minimum sound absorption (NRC) of 0.70 as tested per ASTM C423 using type "A" mounting.

.6 Thermal Conductivity at 24°C [75°F]- 0.033 W/sq.m/°C [0.24 btu/h/sq.ft/°F]

.7 Standard of Acceptance:

.1 Certainteed Rigid Liner Board with Toughgard Facing

2.4 ACCESSORIES

.1 All adhesives and sealants shall meet the VOC limits of the South Coast Air Quality Management District Rule #1168, as summarized in Low Emitting Materials section of the LEED Canada Reference Guide. (70 g/L or less) MSDS sheets for VOC content shall be submitted with the adhesive and sealant shop drawings for approval.

.2 Finish Jacket

.1 Canvas Jacket

.1 Fire rated, 6-ounce fire retardant canvas jacket

.2 Flame spread and smoke density does not exceed 25/50 per ASTM E84

.3 Standard of Acceptance:

.1 Robson Flamex FR Canvas

.2 Metal Jacket

.1 0.53 mm [22 ga] aluminum, smooth finish

.2 Preformed elbows

.3 Stainless-steel bands

.4 Standard of Acceptance:

.1 Johns Manville Metal Jacketing System

.3 Jacket Fastenings:

.1 Thermocanvas and All Service:

.1 Stainless-steel staples (flare type)

.2 Compatible jacket finishing tape and contact adhesives as recommended by the jacket manufacturer.

.4 Lagging Adhesive (Canvas Jackets): Childers' CP-50A, Epolux's Cadalag 336, Foster's 30-36.

.5 Vapor Seal Adhesive (Fibrous Glass Insulation): Childers' CP-82, Epolux's Cadoprene 400, Foster's 85-75 or 85-20.

.6 Vapor Barrier Mastic/Joint Sealer (Fibrous Glass Insulation): Childers' CP-30, Epolux's Cadalar 670, Foster's 95-44 or 30-35.

.7 Adhesive (Flexible Elastomeric Foam): Armstrong's 520, Childers' CP-80, Epolux's Cadoprene 488, Foster's 82-40.

.8 Adhesive (Reinforcing Membrane): Childers' Chil-Spray WB CP-56.

.9 Mastic (Reinforcing Membrane): Childers' AK-CRYL CP-9.

2.5 SCOPE OF INSULATION

.1 Scope 1: External Flexible Insulation with vapour barrier. (Exposed ducts within a room, which is being served by the exposed ducts, do not require external insulation unless there is a chance for condensation to occur).

	Thickness	
Service	**Mm**	**[ins]**
All cooling and heating supply ducts; - where the temperature difference between the space within which the duct is located and the design air temperature in the duct, is less than or equal to 22.2°C [40°F] – minimum RSI-0.3522 [R-2] (see Note 1 below)	40	[1.5]
All cooling and heating supply ducts; - where the temperature difference between the space within which the duct is located and the design air temperature in the duct, is greater than 22.2°C [40°F] – minimum RSI-1.0566 [R-6] (see Note 1 below)	50	[2]
Outdoor air ductwork and plenums (from intake to mixing plenum). (see Note 1 below)	50	[2]
Exhaust air discharge through roof (including sides and bottom of plenum). - (see Note 1 below)	50	[2]
Exhaust air ductwork outside the building. (see Note 1 below)	50	[2]
All exhaust air ductwork from outside wall or roof to 1.5 m [5 ft.] inside building. - (see Note 1 below)	25	[1]

.2 Scope 2: Internal Flexible Duct Liner

	Thickness	
Service	**mm**	**[ins]**
All ductwork where indicated by single hatching, unless noted otherwise] – minimum RSI-1.0566 [R-6] (see Note 1 below)	25	[1]
All exposed supply ductwork in the mechanical room (from A.H.U. discharge to duct shaft), outdoors, or where indicated with double hatching] – minimum RSI-1.0566 [R-6] (see Note 1 below)	50	[2]

.3 Scope 3: Internal Rigid Duct Liner

	Thickness	
Service	**mm**	**[ins]**
Built-up site fabricated air handling unit(s). Line sheet metal walls and tops from inlet dampers to discharge dampers. Do not line transverse walls containing coils, filters or fan discharge. (see Note 1 below)	50	[2]
Built-up site fabricated heat recovery exhaust unit(s). Line sheet metal walls and tops.] – minimum RSI-1.0566 [R-6] (see Note 1 below)	50	[2]
Cold and hot supply air plenums. Line walls, tops and bottoms from discharge dampers to supply duct connections.] – minimum RSI-1.0566 [R-6] (see Note 1 below)	50	[2]
All outdoor air plenums. Line sheet metal walls and top.] – minimum RSI-1.0566 [R-6] (see Note 1 below)	50	[2]

.4 Note1: ASHRAE 90.1 specifies that R values shall match wall or roof insulation values for outdoor ducts and outdoor air plenums. Provide shop drawings to demonstrate compliance.

Part 3 Execution

3.1 APPLICATION

.1 Apply external insulation to ductwork only after all tests have been made and systems accepted by the Consultant as airtight.

.2 Apply insulation and insulation finish in a workmanlike manner so that the finished product is uniform, smooth in finish, pleasing to the eye and with longitudinal seams concealed from view. Apply ductwork insulation materials, accessories and finishes in accordance with manufacturer's recommendations.

.3 Insulation and vapour barrier shall be continuous through all non-rated separations.

3.2 INSULATION TERMINATION

.1 Terminate insulation short of all control, smoke and fire dampers so as not to interfere with their operation.

3.3 INSULATION FOR COOLING COIL HEADERS AND RETURN BENDS

.1 Pack flexible glass fibre insulation around headers and return bends on all cooling coils in built-up air handling units to control condensation.

3.4 EXTERNAL FLEXIBLE INSULATION

.1 Round ducts and rectangular ducts/plenums under 610mm [24"] in diameter/width,

.1 Apply insulation adhesive in 100 mm [4"] wide strips on 300 mm [12"] centres on lower half and bottom of ducts.

.2 Cut insulation to required size allowing for 50 mm [2”] overlap at each joint and apply to exterior of duct. Secure insulation with wire fastening on approximately 500 mm [20”] centres.

.3 Adhesive coverage of one hundred percent (100%) prior to applying duct wrap is an acceptable alternative to wire fastenings.

.2 Round ducts over 610mm [24"] in diameter,

.1 Apply insulation adhesive with 100% coverage on lower half and bottom of ducts.

.2 Cut insulation to required size allowing for 50 mm [2”] overlap at each joint and apply to exterior of duct. Secure insulation with wire fastening on approximately 500 mm [20”] centres.

.3 Rectangular ducts/plenums over 610mm [24"] in width,

.1 Spot-weld pins 6mm [1/4"] longer than the insulation thickness, one per 0.1 sq.m [1 sq ft] of duct minimum. If pins are installed in the field, a capacitor gun shall be used.

.2 Cut insulation to required size allowing for 50 mm [2”] overlap at each joint and apply to exterior of duct.

.3 Impale the insulation over the pins and hold in place using metal clips. Alternatively, use an assembly consisting of a welded pin with integral head washer welded in place over the insulation. (Clinched pins not acceptable).

.4 Adhere foil faced vapour barrier tape over all butt joints, raw edges, holding washers and other points of penetration of the insulation vapour barrier jacket on all exposed hot and cold ducts and all concealed cold ducts.

3.5 INTERNAL FLEXIBLE DUCT LINER APPLICATION

.1 General

.1 Foam materials, if used as internal insulation, shall only be used in locations where spinning/oscillating cleaning systems will not be used (e.g., terminal units, air intakes, supply plenums (up to AHU), or exhaust plenums.) Such materials shall

.1 be made of fibre-free, closed cell foam that is specifically designed for internal lining of air ducts;

.2 have smooth, cleanable surfaces; and

.3 comply with applicable requirements regarding foam materials.

.2 Spinning or oscillating elements in duct cleaning equipment can damage exposed duct linings. Glass or mineral fibre acoustic insulation, if used as interior duct lining, shall be

.1 isolated from the air stream by a moisture-proof protective film; and

.2 protected from physical damage by a resilient covering (e.g., perforated metal).

.2 Ducts 610 mm [24"] in width and less require no further adhesion.

.1 Adhere insulation with insulation adhesive applied with 100% coverage to the whole of the metal surface, with the glass fibre mat side of insulation exposed to the airstream.

.3 Ducts sides and plenum panels greater than 610 mm [24"] in width

.1 Spot-weld pins 6mm [1/4"] longer than the insulation thickness, one per 0.1 sq.m [1 sq ft] of duct minimum. If pins are installed in the field, a capacitor gun shall be used.

.2 Impale insulation or the pins or clips, with the coated side of the insulation exposed to the airstream and secured with holding washers. Cover holding washers with reinforcing membrane and insulation coating / sealer.

.4 Seal all transverse joints, raw edges, and other points of penetration of the coating with reinforcing membrane and insulation coating/sealer.

.5 Seal all longitudinal joints with insulation coating sealer.

.6 No raw edges of internal insulation material shall be exposed to the moving airstream.

.7 Duct sizes noted on the drawings is dimension inside the insulation. Metal duct sizes shall be increased to allow for the internal acoustic insulation thickness.

.8 On high velocity duct systems apply insulation as per manufacturer's recommendations.

.9 Adhere alpha temp cloth over the internal surface of all glass fibre acoustic insulation. Overlap all edges and seal all joints with insulation adhesive/coating/sealer.

3.6 INTERNAL RIGID DUCT LINER APPLICATION

.1 Adhere the internal rigid duct liner in the same manner as specified for internal flexible duct liner.

.2 Adhere Alpha Temp #1610/1067 UL Class #1 Material film over the internal surface of all glass fibre acoustic insulation. Overlap all edges and seal all joints with insulation adhesive/coating/sealer.

.3 Cover plenum wall insulation with galvanized perforated metal sheet having over 50% open area. Protective metal shall be held in place by securing it to the projecting pins with washers.

.4 Cover plenum wall insulation with solid galvanized sheet metal for 1200 mm [48"] downstream from cooling coils.

.5 Cover insulated walk-on plenum floors with solid galvanized sheet metal to protect insulation from damage. Provide supports under sheet metal to prevent insulation and pins from being crushed.

.6 On high velocity duct systems apply insulation as per manufacturer's recommendations.

.7 All sheet metal and perforated sheet metal is under Section 23 31 00.

3.7 DUCTWORK INSULATION FINISHES

.1 "Concealed" ductwork insulation, in horizontal and vertical service spaces, will require no further finish.

.2 "Exposed" ductwork insulation, in unfinished floor spaces will have no further finish.

.3 "Exposed" duct insulation in warehouse type spaces shall be painted with one sealer coat of insulation coating.

.4 "Exposed" ductwork insulation "inside" finished floor spaces, fan room shall be finished with two coats of white, foil-finishing, insulation coating.

.5 "Exposed" insulated ductwork [outside] [in fan room] shall be recovered all around with an aluminum jacketing system. Exterior application shall be a vapour sealed installation. Over the insulation, moisture barrier and then apply 0.53 mm [22 ga] thick stucco embossed aluminum. The moisture barrier shall be continuous. The longitudinal seams of the jacketing shall be located to shed water. Attach with holding straps at 150 mm [6"] on centres. Provide a complete aluminum jacket system using all of the parts, accessories and installation procedures of the manufacturer. Seal all outdoor jacketing watertight with an exterior grade flexible waterproof caulking.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 RESPONSIBILITIES

.1 Provide thermal insulation on all piping, valves, fittings and radiant ceiling panels, as called for and as scheduled. Note items listed that do not require insulation.

.2 Journeyman insulation applicators, skilled in this trade, shall perform the work.

.3 Be responsible for ensuring that enough space is always provided to allow proper installation of insulation materials.

1.3 REGULATORY REQUIREMENTS

.1 Flame spread ratings and smoke developed classifications shall be as required by the B.C. Building Code and NFPA 90A. Generally, the flame spread/smoke developed rating throughout the material shall not exceed 25/50. Materials shall not flame, smolder, glow, or smoke at the temperature to which they are exposed in service.

.2 Insulation thickness and insulating values shall be in accordance with the most stringent of the National Energy Code of Canada for Buildings (NECB), and ASHRAE 90.1

1.4 APPLICABLE CODES AND STANDARDS

.1 Material and method of application to comply with or be tested in accordance with the latest version of the following standards,

- .1 B.C. Building Code and local by-laws
- .2 B.C. Insulation Contractors Association (BCICA) Standards Manual.
  - .1 Use the latest edition of the BCICA Standards Manual as the base reference standard if insufficient detail/information is contained herein, or if the BCICA Standard is more stringent.
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- .4 ASHRAE/IES 90.1 Energy Standard for Buildings except Low-Rise Residential Buildings
- .5 ANSI/NFPA 90A Air Conditioning and Ventilating Systems and Installation.
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- .7 CGSB 51-GP-11M Thermal Insulation, Mineral Fiber, Blanket for Piping, Ducting, Machinery and Boilers.
- .8 ASTM C533 Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation
- .9 ASTM C534 Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
- .10 ASTM C552 Standard Specification for Cellular Glass Thermal Insulation
- .11 ASTM C553 Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications
- .12 ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation
- .13 ASTM C1126 (Gr.1) Standard Specification for Faced and Unfaced Rigid Cellular Phenolic Thermal Insulation
- .14 CGSB 51-GP-52MA Vapour Barrier, Jacket and Facing Material for Pipe, Duct, and Equipment Thermal Insulation.

.15 CAN/CGSB-51.2 Thermal Insulation, Calcium Silicate, for Piping, Machinery and Boilers.

.16 CAN/CGSB-51.12 Cement, Thermal Insulating and Finishing.

.17 CAN/CGSB-51.40 Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.

.18 CGSB 51.53-95 Polyvinyl Chloride) Jacket Sheeting, for Insulated Pipes Vessels and Round Ducts.

1.5 MINIMUM STANDARDS

.1 All piping shall be insulated to meet or exceed the minimum requirements of the National Energy Code of Canada and ASHRAE 90.1. The more stringent insulation value (between the two codes) will be the minimum level required for this project.

1.6 QUALITY ASSURANCE

.1 The British Columbia Insulation Contractors Association (BCICA) Quality Standards Manual, latest edition including additions and amendments, shall be used as reference standard, supplemented by this specification where more stringent requirements are specified.

.2 All materials shall, as a minimum, meet this specification and BCICA Quality Standards for Mechanical Insulation (Commercial and Institutional Buildings) Manual (QSMIM).

.3 Work shall be performed by tradespersons with a Red Seal or TQ designation in the Heat and Frost trade, and/or apprentices / helpers supervised by qualified journeypersons.

1.7 QUALIFICATIONS AND SAMPLES

.1 Submit, for approval, substantiating manufacturer's documentation (and samples when requested) for all materials, applications and finishing methods to establish that all will satisfy this specification and meet all applicable code requirements, before commencing work.

.2 Submit, for approval, samples of each type of firestopping, smoke seal and accessory.

1.8 DEFINITIONS

.1 "CONCEALED" means insulated mechanical services in chases, furred spaces, shafts and hung ceilings.

.2 "EXPOSED" will mean not concealed. For greater certainty, the following locations are considered exposed:

.1 Services in all mechanical and electrical rooms.

.2 Services in space beneath raised floors.

1.9 ASBESTOS

.1 All material / products installed shall be free of asbestos.

Part 2 Products

2.1 GENERAL

.1 Flame spread and smoke density of all products shall not exceed 25/50 per ASTM E84 with or without integral jacket.

2.2 FIRE STOPPING AND SMOKE SEAL MATERIALS

.1 Refer to Section 23 05 00

2.3 PREFORMED PIPE COVERING

.1 Mineral Fibre – All temperatures

.1 Formaldehyde-free

.2 All service vapour retarder jacket (ASJ)

.3 Pressure sensitive self-sealing longitudinal lap.

.4 Suitable for operating temperatures of -18°C to 538°C [0°F to 1,000°F]

.5 Thermal conductivity at 24°C [75°F] – 0.033 W/sq.m/°C [0.23 btu/h/sq.ft/°F]

.6 Thermal conductivity at 93°C [200°F] – 0.04 W/sq.m/°C [0.28 btu/h/sq.ft/°F]

.7 Thermal conductivity at 260°C [500°F] – 0.0744 W/sq.m/°C [0.51 btu/h/sq.ft/°F]

.8 Standard of Acceptance:

.1 Manson Alley K-ASJ

.2 Flexible Polymer Foam

.1 Polymer foam insulation

.2 Self-sealing edge

.3 Flame spread and smoke density does not exceed 25/50 per ASTM E84

.4 Thermal Conductivity at 24°C [75°F] – 0.036 W/sq.m/°C [0.25 btu/h/sq.ft/°F]

.5 Standard of Acceptance:

.1 Nomaco therma-cel Seam-Seal

.3 Flexible Closed Cell Elastomeric

.1 Elastomeric foam insulation

.2 Flame spread and smoke density does not exceed 25/50 per ASTM E84

.3 Thermal Conductivity at 24°C [75°F] – 0.035 W/sq.m/°C [0.245 btu/h/sq.ft/°F]

.4 Standard of Acceptance:

.1 AP ArmaFlex

2.4 ACCESSORIES

.1 Insulation Fastenings:

.1 1.6 mm [16 ga.] galvanized wire or 1.6 mm thick copper wire as commercially available.

.2 Finish Jacket

.1 Canvas Jacket

.1 Fire rated, 6-ounce fire retardant canvas jacket

.2 Flame spread and smoke density does not exceed 25/50 per ASTM E84

.3 Standard of Acceptance:

.1 Robson Flamex FR

.2 PVC Finishing Jacket

.1 minimum 0.50 mm [0.02”] thick, white

.2 minimum 0.50 mm [0.020"] thick premoulded one-piece fitting covers.

.3 Standard of Acceptance:

.1 Proto PVC, Speedline PVC, Zeston PVC.

.3 Metal Jacket

.1 0.53 mm [22 ga] aluminum, smooth finish

.2 longitudinal slip joints and 50 mm [2"] end laps

.3 factory applied protective liner on interior surface

.4 0.51 mm [22 ga.] thick, die shaped fitting covers

.5 Stainless-steel bands

.6 Standard of Acceptance:

.1 Johns Manville Metal Jacketing System

.3 Jacket Fastenings:

.1 Thermocanvas and All Service:

.1 Stainless-steel staples (flare type)

.2 Compatible jacket finishing tape and contact adhesives as recommended by the jacket manufacturer.

.2 PVC Jacket and Fitting Covers:

.1 PVC self-adhesive tape, plastic pop rivets, bonding cement.

.4 Adhesives:

.1 As recommended by the insulation or jacket manufacturer.

.2 All adhesives and sealants shall meet the VOC limits of the South Coast Air Quality Management District Rule #1168, as summarized in Low Emitting Materials section of the LEED Canada Reference Guide. (70 g/L or less) MSDS sheets for VOC content shall be submitted with the adhesive and sealant shop drawings for approval.

.3 Flexible elastomeric and flexible closed cell insulation adhesive

.1 Standard of Acceptance:

.1 Armstrong 520, Therma-Cel 1590, RubatexR-373, Zipcoat 8A.

.4 Vapour barrier jacket adhesive:

.1 Standard of Acceptance:

.1 Bakelite 230-39, Childers CP-82, Epolux Cadoprene 400, Foster 85-20.

.5 Fabric adhesive, to insulation pipe covering:

.1 Standard of Acceptance:

.1 Bakelite 120-18, Childers CP-52, Epolux Cadalag 336, Foster 30-36, Robson White Lag.

.5 Coatings:

.1 Vapour barrier coating on reinforcing membrane or on insulating cement:

.1 Standard of Acceptance:

.1 Bakelite 120-09, Childers CP-50, Epolux Cadalag 336, Foster 30-36.

.2 Childers CP-30 (refrigeration suction lines only).

.2 Flexible elastomeric and flexible closed cell insulation finish coating:

.1 Standard of Acceptance:

.1 Armstrong, Bakelite 120-13, Rubatex, Zipcoat.

.6 Reinforcing Membrane:

.1 Glass reinforcing membrane as commercially available.

.7 Insulating Cement:

.1 Standard of Acceptance:

.1 Fibrex Superkote, Partek No. 1, Ryder Thermokote MW high temperature.

.8 Finishing Cement:

.1 Standard of Acceptance:

.1 Ryder Thermokote 1 FW.

.9 Preformed Insulation fittings:

.1 Standard of Acceptance:

.1 Shur-Fit, Moulded Acoustic Products or from insulation fabricators.

Part 3 Execution

3.1 SCOPE OF INSULATION WORK

.1 Heating Pipe, Fittings and Valves:

.1 Insulate the following systems, unless otherwise noted:

.1 Hot water heating supply and return piping.

.2 Antifreeze heating supply and return piping.

.3 Flexible branch connections to ceiling radiant heat panels.

.4 Hot gas piping.

.5 Trace heated drain lines from freezer and cold rooms.

.2 DO NOT insulate the following, unless otherwise noted:

.1 Piping located within perimeter heating enclosures.

.2 Relief piping.

.3 Drain lines.

.4 Small branch risers to terminal heating elements just above floor level, from 150 mm [6"] below floor slab up to heating element.

.5 Flexible interconnections between ceiling radiant heating panels.

.6 Condenser water piping inside building.

.3 Insulate the following valves and fittings if the pipe is insulated:

.1 Elbows, tees, reducers.

.2 Valve bodies on valves and check valves, over 65mm [2.5”].

.3 Flanges.

.4 Strainers.

.4 The following hot pipe fittings that operate above 60° C [140° F] shall be coated with Thermalite –SG as per manufacturer’s specifications to prevent skin burns:

.1 Valves, 65mm [2.5”] and smaller.

.2 Valve bonnets.

.3 Unions.

.4 Drip legs.

.5 Flexible connections.

.6 Expansion joints.

.7 Check valve covers.

.5 DO NOT insulate the following, unless otherwise noted:

.1 Drain lines for sumps 15°C [60°F] and over.

.6 Insulate and vapour seal the following fittings, if the pipe is insulated:

.1 Elbows, tees, reducers.

.2 Valves, (bodies and bonnets) except check valve covers.

.3 Strainers

.4 Flanges

.5 Unions.

.2 Plumbing pipes, fire suppression pipes, fittings, valves:

.1 Refer to Section 21 07 19 and 22 07 19 for additional information.

.2 Insulate the following systems, unless otherwise noted:

.1 Domestic cold water system including meter body

.2 Domestic hot water supply and recirculation piping.

.3 Domestic tempered water supply and recirculation piping.

.4 Underside of drain bodies, rainwater leaders, storm drainage piping and fittings for the entire system.

.5 All drains, lines, stacks, fire standpipes and sprinkler mains in unheated areas (insulation shall cover heat tracing cables).

.6 Water valves, flanges, PRV's, strainers, check valves.

.7 Traps on handicapped lavatories].

.8 Sprinkler / standpipe system from domestic water connection point to 5 metres [16 ft] downstream thereof or to the inlet of the alarm valve, whichever is less.

.9 Interior irrigation / hose bibb supply piping.

.3 DO NOT insulate the following, unless otherwise noted:

.1 Piping used exclusively for fire protection (unless in unheated spaces).

.2 Soil stacks, vents, etc.,

.3 All special service piping, e.g. gas, compressed air, etc.

.4 Unions.

.5 Flexible connections or expansion joints (unless noted on the drawings).

.6 Check valve covers.

.7 Strainer leg and basket covers.

.8 Flexible fixture connections.

3.2 PIPE INSULATION THICKNESS TABLE - MM [INS]

		NOMINAL PIPE SIZE (NPS)				
Service	**Design Operating Temperature**	**Runouts 50mm [2"] and less (note 1)**	**25mm [1"] and less**	**25mm - 40mm [1" - $1^1/_2$"]**	**40mm - 100mm [$1^1/_2$" - 4"]**	**100mm – 200mm [4" – 8"]**
Glycol Heat Recovery	10°C [50°F]	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]
Hot Water / Glycol Heating	50-90°C [120-200°F]	40 [1.5]	40 [1.5]	40 [1.5]	50 [2]	50 [2]
Hot Water / Glycol Heating	96-120°C [205-250°F]	65 [2.5]	65 [2.5]	65 [2.5]	65 [2.5]	75 [3]
Continuous C.W. Drainage	5 oC [40 oF]	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]
Domestic Cold Water	5 oC [40oF]	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]
Domestic Hot & Tempered Water Supply and Recirculation	40-60 oC [105-140oF]	25 [1]	25 [1]	25 [1]	40 [1.5]	40 [1.5]
Domestic Hot & Tempered Water Supply and Recirculation	60-93 oC [141-200oF]	40 [1.5]	40 [1.5]	40 [1.5]	50 [2]	50 [2]
Self-Regulated Heater Traced DHW Piping	40-60oC [105-140oF]	25 [1]	40 [1.5]	40 [1.5]	50 [2]	50 [2]

		NOMINAL PIPE SIZE (NPS)				
Service	**Design Operating Temperature**	**Runouts 50mm [2"] and less (note 1)**	**25mm [1"] and less**	**25mm - 40mm [1" - 1 1/2"]**	**40mm - 100mm [1 1/2" - 4"]**	**100mm – 200mm [4" – 8"]**
Buried & Exterior Rainwater Storm Drainage	5oC [40oF]	none	none	none	None	none
Above Grade Interior Rainwater Storm Drainage	5oC [40oF]	25 [1]	25 [1]	25 [1]	25 [1]	25 [1]

Note 1: Runouts to individual terminal units not to exceed 3.7 m [12 ft] in length.

Note 2: All piping forming part of the HVAC system or plumbing domestic hot water or domestic hot water recirculation piping, and located outside the building envelope (including piping located within unheated areas of the building such as underground parking levels) shall be insulated for the level specified in the Table for steam piping at pressures 334 kPa [121 psig] and greater.

3.3 CONNECTIONS TO EXISTING PIPING

.1 Make good all existing insulation disturbed or removed to facilitate alterations and additions to existing piping.

3.4 HEAT TRACED PIPING

.1 All piping, subject to freezing is specified to be heat traced. Insulation shall cover heat tracing.

3.5 APPLICATION

.1 Apply insulation to piping only after all tests have been made and systems accepted by Consultant as tight.

.2 Apply insulation and insulation finish in a workmanlike manner so that the finished product is uniform in diameter, smooth in finish, pleasing to the eye and with the longitudinal seams positioned to be concealed from view. Apply piping insulation materials, accessories and finishes in accordance with manufacturer's recommendations.

.3 On piping NPS 2-1/2 and larger with insulation and vapour barrier, install high density insulation above hanger shield. Insert to be slightly longer than the length of shield. Maintain integrity of vapour barrier over full length of pipe without interruption at sleeves, fittings and supports. Pro-pipe Supports by Shur-Fit or equivalent products are acceptable.

.4 Insulation and vapour barrier shall be continuous through all non-rated separations.

3.6 INSULATION TERMINATION POINTS

.1 Terminate insulation 75 mm [3"] back from all uninsulated fittings to provide working clearance and terminate insulation at 90° and finish with reinforced scrim cloth and vapour barrier mastic system. Cover onto pipe and over the insulation vapour barrier. On concealed hot services terminate insulation 75mm [3"] back from all uninsulated fittings, cut off at 90° and apply reinforced scrim cloth and breather mastic system.

.2 Cut back insulation at 45° and finish with a silicone caulking sealant around the base of thermometer wells, pressure gauges, flow switches and pressure and control sensors.

3.7 VERTICAL RISERS

.1 On vertical pipe over 75 mm [3"] provide insulation supports welded or bolted to pipe, directly above lowest pipe fitting. Thereafter, locate on 4.5 m [15 ft.] centres.

3.8 HOT APPLICATION 26°C [80°F] TO 200°C [400°F]

.1 Piping:

.1 Install medium temperature pipe insulation with integral jacket to pipe and hold in place by stapling the flap, with spreading staples at 75 mm [3"] centres. Pipe insulation with integral self-sealing jacket will not require additional fastening.

.2 Install strips of vapour barrier jacket over butt joints and secure with spreading staples.

.2 Fittings:

.1 Insulate fittings, to thickness of adjacent pipe insulation, with oversize sections of the pipe insulation mitred to fit tightly, or with preformed insulation fittings (Shur-Fit or equivalent) or from insulation fabricator.

.3 Valves, Strainers:

.1 Insulate valve bodies and strainers with fitted pipe insulation, or mitred blocks all to thickness of adjacent pipe insulation or insulate with preformed insulation fittings (Shur-Fit or equivalent) or from insulation fabricator. Drains, blowoff plugs and caps shall be left uncovered.

.4 Flanges and Victaulic Fittings:

.1 Do not insulate flanges on condenser/heat pump water piping inside the building.

.2 Insulate flanges on condenser/heat pump water piping outside the building complete with appropriate insulation covers.

.3 Insulate flanges with oversized pipe insulation or mitred blocks to the thickness of the adjacent pipe insulation. Insulation to overlap adjoining insulation at least 75 mm [3"]. Alternatively, use preformed insulation fittings (Shur-Fit or equivalent).

3.9 COLD APPLICATION 10°C [50°F] AND LESS

.1 Piping:

.1 Install low/medium temperature pipe insulation with integral vapour barrier jacket to pipe and hold in place by securing the jacket flap. Seal all flaps with vapour barrier adhesive. Pipe insulation with integral self-sealing vapour barrier jackets will not require additional fastening.

.2 Install strips of vapour barrier jacket over butt joints with vapour barrier adhesive. Over wrap butt strips by 50 percent for insulation O.D. 300 mm [12”] and above apply strips on 250 mm [10”] centres for additional securement.

.2 Fittings:

.1 Insulate fittings to thickness of adjacent pipe insulation with sections of the pipe insulation mitred to fit tightly, or preformed insulation fittings (Shur-Fit or equivalent), then apply reinforcing membrane embedded barrier coating and apply finish vapour barrier coating.

.2 Alternatively, insulate fittings with tightly placed flexible insulation and apply premoulded 25/50 rated PVC fitting covers. Apply vapour-barrier adhesive and tape on all joints and overlaps. Demonstrate continuity of vapour barrier.

.3 Valves, Strainers:

.1 Insulate valve bodies, bonnets and strainers with fitted pipe insulation, or mitred blocks all to thickness of adjacent pipe insulation, then apply reinforcing membrane embedded in barrier coating.

.2 Alternately, insulate with preformed insulation fittings (Shur-Fit or equivalent) covered with reinforcing membrane, secured in place with a continuous barrier. Drains, blow-off plugs and caps shall be left uncovered.

.4 Unions, Flange and Victaulic Fittings:

.1 Insulate cold unions and flanges with oversized pipe insulation or mitred blocks to the thickness of the adjacent pipe covering, then apply reinforcing membrane embedded in barrier coating and final coating of vapour barrier mastic.

.2 Alternately, insulate with preformed insulation fittings (Shur-Fit or equivalent) covered with reinforcing membrane, secured in place and with continuous vapour barrier.

3.10 ANTI-SWEAT COATING

.1 Coat with an anti-sweat coating - "No Sweat" by Robson Thermal Mfg. Ltd. or approved alternate the following uninsulated cold surfaces:

.1 Connecting surfaces of thermometers, pressure gauges, flow switches, controllers, etc.

.2 The coating thickness shall be as recommended by the coating manufacturer for the system operation conditions.

3.11 PIPE INSULATION FINISHES

.1 "Concealed" insulation in horizontal and vertical service spaces will require no further finish.

.2 "Concealed" pipe insulation in damp locations, e.g. pipe trenches shall have a vapour barrier jacket, vapour sealed.

.3 "Exposed" flexible insulation shall be painted with a heavy brush coating of foam plastic white insulation coating.

.4 "Exposed" insulation inside the building shall be finished as follows:

.5 Basic Finish:

.1 Apply pipe insulation with an integral all-service type jacket. Cover longitudinal and circumferential joints with jacket finishing tape neatly applied. Alternately secure jacketing longitudinal joint using integral self-sealing lap. Cover circumferential joints with jacket finishing butt strips. Over wrap strips by 50 percent. For insulation O.D. 300 mm [12”] apply strips on 250 mm [10”] centres for additional securement. PVC, especially, .020” thick should not be used as a vapour barrier alone. Should have ‘ASJ’ or mastic system under it. Over insulation on short pipe runs and piping adjacent to fittings, valves, etc., jacket to be field applied.

.2 Over insulated fittings apply tack coat of vapour barrier mastic and embed reinforcing membrane and cover with same mastic. Over insulated valve bodies, valve bonnets, strainers and flanges, apply all-service jacketing using necessary fastenings and jacket finishing tape and with the reinforced mastic system on irregular surfaces.

.6 Canvas Finish:

.1 Over a factory applied integral all-service type jacket on the pipe insulation, apply canvas jacket.

.2 Over insulated fittings apply PVC fitting covers and canvas jacket.

.3 Over insulated valve bodies, valve bonnets, strainers and flanges apply purchased PVC covers or field fabricate from PVC sheeting secured with solvent bonding cement and apply canvas jacket.

.4 Finish fabric with one (1) coat of fabric coating.

.7 Aluminum Finish:

.1 Use in areas subject to traffic or mechanical damage, and all insulation outdoors, and were specifically called for on mechanical dwg’s or equipment schedules.

.8 "Exposed" outdoor insulation shall be finished as follows:

.1 Insulation shall have a vapour sealed vapour barrier jacket.

.2 Over the pipe insulation jacket apply aluminum weather protecting jacket. The longitudinal seam shall be located to shed water. Secure the jacket using necessary metal banding on approximately 250 mm (10”) centres and at the overlaps. Screws are not permitted on cold operating systems, since they will penetrate the vapour barrier.

.3 Over insulated fittings, valve bodies, valve bonnets, strainers and flanges apply metal jacket or preformed metal fittings to provide a complete jacket system. Secure with necessary fastenings.

.4 Seal all outdoor jacketing watertight.

3.12 INSULATION PACKING OF PIPE SLEEVES

.1 Tightly pack the space between all pipe sleeves and pipe or between pipe sleeve and pipe insulation with mineral wool insulation.

.2 Apply fire stop compound to prevent transmission of sound and/or passage of fire/smoke.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 QUALITY ASSURANCE

.1 The commissioning shall be executed in accordance with the intent of:

- .1 ASHRAE Standard 202 - The Commissioning Process for Buildings and Systems.
- .2 ASHRAE/NIBS Guideline 0 - The Commissioning Process
- .3 ASHRAE Guideline 1.1 - HVAC&R Technical Requirements For The Commissioning Process
- .4 ASHRAE Guideline 1.3 - Building Operations and Maintenance Training for The HVAC&R Commissioning Process
- .5 ASHRAE Guideline 1.4 - Procedures for Preparing Facility Systems Manuals
- .6 ASHRAE Guideline 1.5 - The Commissioning Process for Smoke Control Systems
- .7 NIBS Guideline 3 - Building Enclosure Commissioning Process BECx
- .8 ASTM E2813-12e1 ‐ Standard Practice for Building Enclosure Commissioning

.2 For list of acceptable Commissioning Agencies, refer to Section 23 99 66.

1.3 RESPONSIBILITIES

.1 Be responsible for the performance and commissioning of all systems and equipment supplied under the Sections of Division 21, 22, 23 and 25.

.2 Commissioning is the process of advancing the installation from the stage of static completion to full working order in accordance with the contract documents and design intent. It is the activation of the completed installation.

.3 In consultation with the General Contractor, ensure that sufficient time is allowed and fully identified on the construction schedule for the proper commissioning of all mechanical systems

1.4 COMMISSIONING AND DEMONSTRATION

.1 Submit a schedule for the commissioning phase of the work. This schedule shall show:

- .1 Equipment start-up schedule.
- .2 Submission dates for the various documents required prior to Ready-For-Takeover.
- .3 Timing of the various phases of the commissioning, testing, balancing and demonstration process.

.2 Commissioning is concluded when air and water systems have been balanced and the installation is in full working order and acceptable for use. The work will include the following:

- .1 Balancing of the air systems as specified in this section.
- .2 Balancing of the liquid systems as specified in this section.
- .3 Set up air diffusers, registers and grilles for optimum distribution/comfort.
- .4 Set up and test all implosion/explosion doors.
- .5 Set up constant volume and variable volume fans.
- .6 Adjust mixing boxes and air valves as necessary.
- .7 Plug all air pressure and flow measuring holes.
- .8 Adjust vibration isolators and earthquake restraints for optimum performance.

.9 Verification and certification of the sealing of all HVAC penetrations through fire separations (rated & non-rated) and sound separations. Forms in Section 23 99 60 shall be used for this purpose.

.10 Verification of water tightness of all roof and exterior wall penetrations.

.11 Verification that all coil drain pans operate.

.12 Set up all automatic control valves/dampers and automatic temperature control devices.

.13 Testing and debugging of B.M.S. (Building Management System).

.14 Set up and test all alarm and protective devices.

.15 Calibration and adjustment of the smoke venting and pressurization systems.

.3 At the conclusion of commissioning, demonstrate the operation of the systems to the Consultant and then to the Owner's Operating Staff. For demonstration and instruction to Operating staff requirements, refer to this section of the specification and also to Division 25.

.4 The verification process shall include the demonstration of the following:

.1 The ease of access that has been provided throughout for servicing coils, motors, drives, fusible link fire dampers, smoke dampers, control dampers and damper operators.

.2 Location of and opening and closing of all access panels.

.3 Operation of all automatic control dampers and automatic temperature control devices.

.4 Operation of all alarm and protective devices.

.5 Proper response of all mixing boxes and air valves to thermostats and volume adjustment controls.

.6 Operation of all smoke dampers and all smoke pressurization and removal provisions.

.7 Operability of randomly selected fire dampers.

.8 Noise level from typical mixing boxes and air valves under extreme operating conditions.

.9 Operation of all equipment and systems under each mode of operating, and failure, including:

.1 B.M.S. (Building Management System) control features.

.2 Fans.

.3 Coils.

.5 At the completion of the commissioning, testing, balancing and demonstration submit the following to the Consultant:

.1 A letter certifying that all work specified under this contract is complete, clean and operational in accordance with the specification and drawings.

.2 Completed copies of all commissioning check lists plus copies of start-up reports from specialty contractors and vendors.

.3 "AS-BUILT" record drawings, as specified.

.4 B.C. Boiler Inspection Dept. approval of boiler, pressure vessels and pressure piping installations.

.5 Fire Commissioner's approval of oil fuel installations.

.6 B.C. Gas Inspection Dept. approval of boiler on gas firing.

.7 A list of all alarm and protective devices tested, with the final operating settings.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 23 05 49 for required seismic restraint of piping.

1.2 REFERENCE STANDARDS

.1 Do all piping system work in accordance with ASME/ANSI B31.9 code and CSA B51.

1.3 REGULATORY REQUIREMENTS

.1 All components, products and fabrication techniques shall be provided in compliance with the Regulations and Requirements of the Local Authority Having Jurisdiction.

.2 Installation of, and repair or alterations to, pressure piping systems shall be performed only by licensed Contractors and licensed Welders, certified for the work being done in accordance with the Regulations and Requirements of the Local Authority Having Jurisdiction.

.3 All field welding to be in accordance with the procedures of CSA-W117.2 and the current edition of ASME/ANSI B31.1 or B31.9 Code.

1.4 SYSTEM PRESSURE RATINGS

.1 Pipe Fittings:

.1 Piping systems 860 kPa [125 psig] or less operating pressure - 860 kPa [125 psig] rating.

.2 Piping systems 870 kPa [126 psig] to 1730 kPa [250 psig] operating pressure - 1730 kPa [250 psig] rating.

.2 Valves:

.1 Suitable for maximum system operating temperature and pressure.

1.5 SHOP DRAWINGS

.1 Submit detailed shop drawings of valves in accordance with Section 23 05 00. Shop drawings shall clearly indicate valve make, model, location, type, size and pressure rating and Provincial CRN number.

Part 2 Products

2.1 GENERAL

.1 All products shall be registered with the regulatory authority in accordance with CSA B51.

2.2 PIPE

.1 Steel Pipe:

.1 12mm [1/2”] to 50mm [2”]: ASTM A795.

.2 65mm [2.5”] to 250mm [10”]: Schedule 40 to ASTM A53 Grade B

.3 300mm [12”] and over: 9.5 mm [0.375"] wall thickness to ASTM A53 Grade B.

.4 for the following systems:

.1 Hot water heating

.2 Glycol heating

.3 Glycol heat recovery

.4 Relief valve vents

.2 Stainless Steel Pipe:

.1 50mm [2”] and under: Schedule 5S 304/304L stainless steel to ASTM A312

.2 for the following systems:
- .1 Heat pump water
- .2 Condenser water - closed or open circuit
- .3 Brine (except in and under ice rink floor slab)
- .4 Pressure drains
- .5 Domestic water

.3 Steel and Stainless-Steel Pipe:
- .1 200mm [8”] and under: Schedule 80 to ASTM A53 Grade B.
- .2 250mm [10”] and over: 12.7 mm [1/2"] wall thickness to ASTM A53 Grade B.
- .3 All sizes: Schedule 10, 316 stainless steel,
- .4 for the following systems:
  - .1 Aqueous Ammonia (40% Max) 40mm [1.5”] and over (verify gasket suitability).

.4 Galvanized Steel Pipe: to ASTM A53, Grade B, galvanized with average coating of 0.55 kg/sq.m. as follows:
- .1 Schedule 40
- .2 for the following systems:
  - .1 Pressure drains: 65mm [2.5”] and over.

.5 Copper Pipe: to ASTM B88, Type K, or L hard drawn copper tubing.
- .1 Type L, hard drawn:
  - .1 Pressure drains 50mm [2”] and under.
- .2 Type L hard drawn may be used as an alternative to steel piping for the following systems:
  - .1 Hot water heating.
  - .2 Chilled water.
  - .3 Condenser water.
- .3 Type K, hard drawn:
  - .1 Air vent overflow where exposed.
  - .2 Domestic hot water preheat.
- .4 Type K, soft drawn:
  - .1 Air vent overflow where concealed.

2.3 PIPE JOINTS - STEEL PIPING

.1 50mm [2”] and under: screwed fittings, except where otherwise noted, with teflon tape and rectroseal teflon paste or pipe dope.

.2 65mm [2.5”] and over: welding fittings and flanges to CSA W47.1.

.3 Flanges: raised face, steel weld neck, lap or back-welded slip on type. Use flat face for attachment to cast iron valves.
- .1 Grooved piping systems including Victaulic is not allowed to be used for hydronic heating piping system.

.4 Flange Bolts and Nuts, carbon steel: to ANSI B18.2.1 and ANSI B18.2.2.

.5 Flange gaskets:
- .1 860 kPa [125 psig] system pressure and under: non-asbestos gaskets for mating surfaces.
- .2 Over 860 kPa [125 psig] system pressure: stainless steel spiral wound non-asbestos gaskets.

2.4 PIPE FITTINGS - STEEL PIPE

.1 Pipe fittings, screwed, flanged or welded:

.1 Cast iron pipe flanges: Class 125 to ANSI B16.1.

.2 Cast iron screwed fittings: Class 125 to ANSI B16.3.

.3 Steel pipe flanges and flanged fittings: to ANSI B16.5.

.4 Steel butt-welding fittings: to ANSI B16.9a.

.5 Unions, malleable iron ground joint type: Class 150 to ANSI B16.3.

2.5 PIPE JOINTS - COPPER PIPE

.1 All sizes, soldered or brazed as specified in “EXECUTION”.

.2 50mm [2”] to 200mm [8”]: rigid copper couplings with offsetting angle-pattern bolt pads and flush seal gasket grade "EPDM" gasket for temperature range -34°C [-30°F] to 110°C [230°F] may be used on chilled water, domestic water and condenser water systems.

.1 Manufactured to copper-tube dimensions. (Flaring of tube or fitting ends to accommodate IPS sized couplings is not permitted.)

2.6 PIPE FITTINGS - COPPER PIPE

.1 Cast bronze: to ANSI B16.18.

.2 Wrought copper and bronze: to ANSI B16.22.

2.7 FLANGES - COPPER PIPE

.1 Brass or bronze: to ANSI B16.15.

.2 Cast iron: to ANSI B16.4.

2.8 PIPE JOINTS – STAINLESS STEEL PIPE

.1 12mm [1/2”] to 50mm [2”]: plain end, Type 304/304L

.2 65mm [2.5”] and larger: welded.

2.9 PIPE FITTINGS – STAINLESS STEEL PIPE

.1 Precision, cold drawn, austenitic stainless steel.

2.10 VALVES GENERAL

.1 Wherever possible all valves shall be of one manufacturer.

.2 Provide valves with manufacturer's name and pressure rating clearly marked on outside of body. All valves must be suitable in all respects for service used.

.3 All valves shall have a Provincial CRN number which is current.

.4 Include lock shield handles where shown or noted.

.5 Provide valves located more than 2100 mm [7 ft] from floor in equipment room areas with chain operated sheaves. Extend chains to 1800 mm [6 ft] above floor and hook to clips arranged to clear walking aisles.

.6 Use non-rising stem valves where there is insufficient clearance for stem to rise.

.7 Where butterfly valves are installed to permit removal of equipment, they shall be of the threaded full lug type. They may be of the wafer type if an additional pair of flanges (not those installed to contain the valve) are installed.

2.11 GATE VALVES

.1 50mm [2"] and under: screwed:

.1 Bronze body, rising stem, solid wedge disc, union or screwed bonnet.

.2 Standard of Acceptance:

.1 Class 125 [860 kPa] - Crane 1700, Grinnell 3010, Kitz 24, Nibco T-134, Red-White/Toyo 293

.2 50mm [2"] and under: soldered:

.1 Bronze body, rising stem, solid wedge disc, screwed bonnet.

.2 Standard of Acceptance:

.1 Class 200 W.O.G. [1380 kPa] - Crane 1700S, Grinnell 3080SJ, Kitz 44, Nibco S-134, Red-White/Toyo 299.

.3 65mm [2.5"] and over:

.1 Flanged, cast iron body, rising stem, O.S. & Y, solid wedge disc, bronze trim, bolted bonnet.

.2 Standard of Acceptance:

.1 Class 125 [860 kPa] - Crane 465-1/2, Grinnell 6020A, Kitz 72, Nibco F-617-0, Red-White/Toyo 421A.

2.12 GLOBE VALVES

.1 50mm [2"] and under: screwed:

.1 Bronze body, rising stem, renewable composition or bronze disc, union bonnet.

.2 Standard of Acceptance:

.1 Class 125 [860 kPa] - Crane 1703, Grinnell 3240, Kitz 03, Nibco T-235-Y, Red-White/Toyo 220

.2 50mm [2"] and under: soldered:

.1 Bronze body, rising stem, renewable composition or bronze disc, screwed bonnet.

.2 Standard of Acceptance:

.1 Class 200 W.O.G. [1380 kPa] - Crane 1703S, Grinnell 3240SJ, Kitz 10, Nibco S-211-YW, Red-White/Toyo 212.

2.13 BUTTERFLY VALVES

.1 65mm [2.5”] and over:

.1 Ductile iron body with bronze disc, stainless steel stems and extended neck to clear minimum of 50 mm [2"] thick insulation.

.2 Threaded full lug type or wafer type (with or without integral flanges).

.3 Resilient EPT or EPDM seat.

.4 Operators (unless otherwise specified in the Controls Section):

.1 200mm [8”] and under: lever handle with minimum 10 position ratchet and disc position indicator.

.2 250mm [10”] and over: worm gear operator.

.5 Standard of Acceptance:

.1 Class 125 [860 kPa] W.O.G. – Center Line, Crane, Demco, Dezurik, Grinnell, Keystone, Kitz, Nibco WD-2100 or LD-2100, Norriseal, Red-White/Toyo

.6 Standard of Acceptance:

.1 Class 200 [1380 kPa] W.O.G. –, Crane, Demco, Dezurik, Grinnell, Keystone, Kitz, Nibco WD-2100 or LD-2100, Norriseal, Red-White/Toyo

.2 Operators (unless otherwise specified in the Controls Section):

.1 200mm [8”] and under: lever handle with minimum 10 position ratchet and disc position indicator.

.2 250mm [10”] and over: worm gear operator.

.7 350mm [14”] to 600mm [24”]:

.1 Ductile iron body with PPS (polyphenylene sulfide) coated ductile iron disc.

.2 Disc mounted elastomer seal.

.3 17-4PH stainless steel stem. (Stem shall be offset from the disc centerline to provide full 360-degree circumferential seating.)

2.14 BALL VALVES

.1 50mm [2"] and under: screwed:

.1 Forged brass body, threaded cap, chrome plated ball, PTFE seats, blow out proof stem.

.2 Ball valves for isolation service shall have a large/full port.

.3 Ball valves for balancing service shall have a reduced port and valve handle shall have a memory stop.

.4 Standard of Acceptance:

.1 Class 600 W.O.G. [4140 kPa] - Crane F9202, Grinnell 3700, Kitz 58, Nibco T-585-70, Red-White/Toyo 5044A.

.2 50mm [2"] and under: soldered:

.1 Forged brass body, threaded cap, chrome plated ball, PTFE seats.

.2 Ball valves for isolation service shall have a large/full port.

.3 Ball valves for balancing service shall have a reduced port and valve handle shall have a memory stop.

.4 Standard of Acceptance:

.1 Class 500 W.O.G. [3450 kPa] - Crane F9222, Grinnell 3700SJ, Kitz 59, Nibco S-585-70, Red-White/Toyo 5049A.

2.15 BALANCE FITTINGS AND PLUG VALVES

.1 32mm [1-1/4”] and under:

.1 Bronze body and bronze trim, rising stem, renewable composition disc, globe type with memory stop, Lockshield, male union connection, angle and straight type.

.2 Standard of Acceptance:

.1 Class 100 [690 kPa] - Dahl 13000-M series, Toyo 250 or 251.

.2 40mm [1.5”] and over:

.1 Up to 50mm [2"]: screwed

.2 65mm [2.5”] and over: flanged

.3 Cast iron body, non-lubricated eccentric plug with resilient coating EPT or RS 55, suitable for 121°C [250°F] operating temperature, stainless steel bearings, adjustable memory stop, plug type suitable for wrench adjustment.

.4 Standard of Acceptance:

.1 Class 175 W.O.G. [1210 kPa] - DeZurik 400, Keystone Ballcentric.

.3 80mm [3”] and over:

2.16 AUTOMATIC FLOW LIMITING VALVES

.1 General: Devices shall automatically limit the rated flow quantity between differential pressure ranges of 14 to 310 kPa [2 to 45 psig].

.2 50mm [2"] and under:

.1 Body shall be forged brass ASTM B283 Class 600 W0G, 163°C [325°F].

.2 Return from coil: (downstream side of Temperature Control Valve); Combination assembly including:

.1 Body fitted with ball shut off valve, hard chrome plated, Teflon Ball Seals and Viton O-Rings.

.2 Flow limiting cartridge shall be accessible non-clogging piston type with ± 5% accuracy.

.3 Two P/T Plugs, union for accepting temperature control valve (by controls contractor).

.3 Return from coil: (upstream side of Temperature Control Valve); Combination assembly including:

.1 Full port union with manual air vent and P/T test plug.

.4 Supply to coil; Combination assembly including:

.1 Ball valve, strainer P/T test plug and blow down drain valve.

.3 65mm [2-1/2”] and larger:

.1 Body shall be epoxy coated ductile iron ASTM A536 2758 kPa [400 psig] 177°C [350°F].

.2 Flow cartridges 304 SS moving parts in brass housing, 14 to 310 kPa (2 to 45 psig) 1.9 to 144 l/s (30 to 2282 USgpm)

.3 P/T Plugs, thermometer well and drain.

.4 Provide a dual hose temperature/pressure meter kit with flow conversion chart and carrying case.

.5 Standard of Acceptance:

.1 Delta, Griswold, Belimo

2.17 CIRCUIT BALANCING VALVES

.1 50mm [2"] and under: copper alloy body, screwed, 'Y' pattern globe.

.2 65mm [2-1/2”] and larger: cast iron body, flanged, 'Y' pattern globe.

.3 Maximum pressure 1715 kPa [250 psig] and maximum temperature 121°C [250°F].

.4 Calibrated balancing valve with memory, positive shut-off, inlet and outlet pressure measuring connections with integral shut-offs and drains.

.5 Calibration charts and adjustment tools to be included.

.6 Provide one (1) differential pressure meter kit suitable for direct readout c/w connection hoses suitable for the system pressure.

.7 Standard of Acceptance:

.1 Tour & Andersson: STAD (to 50mm [2”]) or STAF/STAG (65mm [2-1/2”] and larger), Nexus, Armstrong

2.18 SWING CHECK VALVES

.1 50mm [2"] and under: screwed:

.1 Bronze body, bronze swing disc, screw in cap, regrindable seat.

.2 Standard of Acceptance:

.1 Class 125 [860 kPa] - Crane 1707, Grinnell 3300, Kitz 22, Nibco T-413-B, Red-White/Toyo 236

.2 50mm [2"] and under: soldered:

.1 Bronze body, bronze swing disc, screw in cap, regrindable.

.2 Standard of Acceptance:

.1 Class 200 W.O.G. [1380 kPa] - Crane 1707S, Grinnell 3300SJ, Kitz 23, Nibco S-413-B, Red-White/Toyo 237.

.3 65mm [2-1/2”] and larger:

.1 Ductile iron body, EPDM seat, stainless steel swing disc, coupled cap.

.4 65mm [2-1/2”] and larger: flanged:

.1 Cast iron body, renewable or regrindable seat, bronze swing disc, bolted cap.

.2 Standard of Acceptance:

.1 Class 125 [860 kPa] - Crane 373, Grinnell 6300A, Kitz 78, Nibco F-918, Red-White/Toyo 435A.

2.19 SILENT CHECK VALVES (SPRING TYPE)

.1 50mm [2"] and under: screwed:

.1 Bronze body, bronze trim, stainless steel spring, (heavy duty spring in vertical down flow application)

.2 Standard of Acceptance:

.1 Class 125 [860 kPa] – Conbraco 61-500, Durabla, Grinnell 3600, Mueller 303AP

.2 65mm [2-1/2”] and larger:

.1 Cast ductile iron, with stainless steel spring and shaft, for vertical or horizontal installation.

.1 65mm [2-1/2”] and 80mm [3”]: Aluminum bronze single disc, with disc mounted elastomer seal and PPS coated seat.

.2 NPS 4 through 12: EPDM encapsulated ductile iron single disc with welded-in nickel seat.

.3 NPS 14 through 24: AGS grooved ends, stainless steel dual disc(s), with EPDM seat.

.2 Cast steel, wafer style, bronze trim, stainless steel spring (heavy duty spring in vertical down flow application).

.1 Standard of Acceptance:

.1 Class 125 [860 kPa] - Apco, Centerline, Durabla, Duo-Chek II, Nibco W-910, Moygro or . Mueller 71

2.20 COMBINATION BALANCE/CHECK VALVES

.1 Integrated shut off, non-slam check valve and balance valve.

.2 Suitable for 2065 kPa [300 psig] and 110°C [230°F].

.3 Cast iron body, stainless steel trim, bronze seat and disc.

.4 Connections:

.1 50mm [2"] and under: screwed.

.5 Select for system flow rate, and allowable pressure drop at a velocity not exceeding 1.8 m/s (6 fps).

.6 Standard of Acceptance:

.1 Armstrong Flo Trex, Bell & Gossett Triple Duty, Taco Multi-purpose,

2.21 NEEDLE VALVES

.1 Bronze body, screwed, globe type with cadmium plated steel stem.

.2 Standard of Acceptance:

.1 Class 400 [2760 kPa] - Crane 88/89, RP&C 60-100.

.3 Application: Install needle valves where petcocks or manual vents are indicated.

2.22 RADIATOR VALVES

.1 Screwed bronze body with bronze trim, wheel handle, rising stem, renewable composition disc, male union connections, angle and straight type.

.2 Standard of Acceptance:

.1 Class 100 [690 kPa] - Dahl 11041 or 11042, Dunham Bush 200B or 246B, Kitz 100 series, Sarco type R or RP, Red-White/Toyo 252 or 253.

2.23 THERMOSTATIC RADIATOR VALVES

.1 Screwed nickel plated brass body, stainless steel spindle, EPDM rubber valve disc, straight and angle type.

.2 Valves complete with sensors, operators and capillary tubing.

.3 Remote sensors/operators to have 8 m [26 ft] capillary tube.

.4 Capillary tubing to be run concealed in walls and ceilings, sheathed in 20 mm [3/4"] dia. plastic tubing.

.5 Notes:

.1 Valves on wall fin units and radiant ceiling panels in patient rooms to have remote wall mounted sensors/operators.

.2 Valves in public areas to have valve mounted operators with remote wall mounted sensors.

.3 Valves on convector units to have valve mounted operators and sensors.

.6 Standard of Acceptance:

.1 Danfoss

2.24 DRAIN VALVES

.1 Globe type, bronze body with bronze trim and composition disc.

.1 Standard of Acceptance:

.1 Crane 1703, Dahl 2343, Kitz 03, Nibco T-235-Y, Red-White/Toyo 220

.2 Brass ball valve with forged brass cap and chain, 20mm [3/4”] male threaded hose end, lockshield in public areas. Working pressure 1724 kPa [250 psig] to 121°C [250°F].

.1 Standard of Acceptance:

.1 Crane F9202CC, DAHL #50-430 [50.430LS], Kitz 68AC, Red-White / Toyo 5046.

Part 3 Execution

3.1 PIPING

.1 Ream pipe ends. Clean scale and dirt, inside and outside before and after assembly. Remove welding slag or other foreign material from piping.

.2 During construction, protect all openings in piping and equipment, by capping or plugging to prevent entry of dirt.

.3 Screw, or weld, fittings (unless otherwise specified) for all piping systems up to 50mm [2”].

.4 Weld (unless otherwise specified) all piping systems 65mm [2.5”] and over.

.5 Ammonia systems - weld all sizes 40mm [1.5”] and larger.

.6 Install piping to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

.7 Avoid piping in exterior walls unless otherwise directed. If required, install this piping protected from the outside by the building insulation and vapour barrier.

.8 Maintain a minimum of 25 mm [1"] space between adjacent flanges or pipe insulation, whichever has the larger diameter.

.9 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.

.10 Saddle type branch fittings may be used on mains, if branch line is half size or smaller than main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.

.11 Install all thermometer wells and immersion sensor wells specified under the Controls Section. Where wells will restrict flow in small diameter pipes (40mm [1.5”] and smaller) install a section of oversized pipe at least 50mm [2”].

.12 Remake leaking joints using new materials, do not caulk or cement leaking threaded joints.

.13 Use eccentric reducers at pipe size changes, flush on top side, to permit positive venting and drainage.

.14 Do not use thread protection couplings, close nipples, running nipples or street elbows.

.15 Install dielectric type unions or flanges Clearflow Dielectric Waterways on "OPEN" type systems, where copper piping connects to steel. eg. domestic hot water tanks.

.16 Avoid locating water and drain piping over electrical equipment. Where this is unavoidable, provide galvanized drip pans under such pipe and weld piping and fittings. Provide drain and piping from drip pans to satisfactory floor drain.

.17 Bull head tees shall not be used for converging flows.

3.2 PIPE GRADING

.1 Grade all piping to provide positive drainage and venting. Slope as follows:

.1 Supply mains and branches - up in the direction of flow, minimum 1:480 [1" in 40 ft].

.2 Return mains and branches - down in the direction of flow, minimum 1:480 [1" in 40 ft].

.3 Reverse return supply and return mains - up in the direction of flow, minimum 1:480 [1" in 40 ft.].

.4 Grade horizontal drainage and vent piping down in direction of flow, 2% minimum.

.5 On closed system, equip low points with 20 mm [3/4”] drain valves. Provide, at high points on lines and on equipment connections, collecting chambers and high capacity float operated air vents.

3.3 SOLDERING AND BRAZING

.1 Pressure fluid systems - with chemical treatment (heating, chilled and condenser water) BRAZE with silver base brazing alloy, 538°C [1000°F] melting point.

.2 Pressure fluid systems - without chemical treatment, (heat recovery, domestic water) SOLDER with 95/5 tin-antimony.

.3 Non-pressure systems, (drains) SOLDER with 50/50 tin lead.

.4 Piping connections to radiant ceiling panels, SOLDER with 95/5 tin-antimony.

3.4 CONNECTIONS TO EQUIPMENT AND TO EXISTING PIPING

.1 Install unions or flanges at connections to all equipment and specialty components and at all connecting points to existing systems which, for reasons of separation for testing, will require to be blank flanged or capped.

.2 Install removable sections of pipe or 300 mm [12"] spool pieces on the suction side of end suction pumps and where required for ease of maintenance.

.3 Connect to equipment in accordance with manufacturer's instruction unless otherwise noted.

.4 Arrange piping connections to allow ease of access and for removal of equipment.

.5 Align and independently support piping connections adjacent to equipment to prevent piping stresses being transferred.

.6 Do not reduce equipment connection sizes by bushing.

.7 Branch connections to existing steel piping may be made using double strap service saddles - Smith Blair #313 or Dresser #91.

.8 Connections to existing copper piping systems may be made using or mechanical type couplings (flair or union types) provided they are compatible with the existing system's operating and test pressures and temperatures.

.9 Provide fire-stopping for all existing pipes at fire separations.

.10 Where shut down of a service is not possible, a hot-tap process shall be used for the tie-in connection of the services. The hot-tap welding in-place requires special equipment and the services of a journeyman welder with applicable experience.

.11 When connecting to an existing antifreeze system, the antifreeze solution shall be drained into temporary storage tanks. Do not drain into sanitary / storm system.

3.5 DRAIN CONNECTIONS

.1 Pipe the discharge from all liquid relief valves, liquid safety valves, high capacity air vents, steam drip pan elbows, equipment blowdowns, water columns, overflows and piping system drains to the nearest building drain. Install a brass, bronze or copper receiving funnel on the drain where shown.

.2 Drains from drain pans shall be DWV copper ASTM B306 32 mm [1-1/4"] minimum size.

.3 Drain and vent piping shall be of the same material as the piping system to which it is connected, except where otherwise specified.

.4 Where item being drained is under pressure, provide a deep seal trap.

3.6 EXPANSION OF PIPING

.1 Install all piping systems with due regard and provision for expansion avoiding strain or damage to equipment and building. Pay particular attention to piping running horizontal across building expansion joints and provide adequate expansion and contraction for all such piping.

.2 Only major expansion configuration and fittings have been shown on the drawings. Provide all required additional compensators, loops and swing connections.

.3 Provide anchors, where shown. Anchors shall be fabricated from mild steel plate and structural steel angle and channel sections, in accordance with ANSI B.31.

.4 Expansion loops shall be of all welded construction with long radius elbows.

.5 Install expansion loops, cold sprung 50% of the calculated expansion.

.6 Install at least three [3] elbows in all branch connections. Where space does not permit 3 elbows, install braided flexible pipe connectors in accordance with manufacturers recommendations. Three [3] elbow branch connections shall have sufficient developed length to ensure that excessive stresses are not generated in the piping and in no case less than 900 mm [36"].

3.7 VALVES

.1 Install valves with stems upright or angled 45 degrees above horizontal unless approved otherwise.

.2 Install control valves with their stems upright unless approved otherwise and with adequate clearance for removal of actuators.

.3 Use gate valves or (ball valves for 50mm [2”] and under) to shut off branch takeoffs and to isolate equipment.

.4 Butterfly valves may be used as an alternative to gate valves on chilled water, condenser water, hot water heating, heat pump and glycol heat recovery systems.

.5 Use globe valves to control flow in circuits; except, where balancing cocks are specifically specified.

.6 Use plug type globe valves in control valve bypass connections.

.7 Use plug cocks for balance valves in water return branch mains and branch connections to return mains and for shut off and balancing on glycol circuits.

.8 Install balance fittings or valves in the return piping connections to each terminal heating and cooling unit - eg. radiators, unit heaters, fan coil units, heating and cooling coils.

.9 Install radiator valves in the supply connections to each convection heating element.

.10 Provide isolation valves in all systems such that floor by floor for horizontal systems, all risers in a vertical system and zone areas on a large horizontal system can be isolated.

.11 Provide valves upstream of all meters, gauges, automatic air vents, etc. for isolation purposes.

.12 Use swing or spring loaded check valves, in horizontal and vertical upflow pipes and on the discharge of pumps. Spring loaded water check valves shall be located 8 pipe diameters downstream of pumps or elbows.

.13 Use silent check valves where specifically shown in vertical pipes with downward flow.

3.8 DRAIN VALVES

.1 Install drain valves at each low point in the piping system and at specific drain locations shown on the drawings.

.2 Install 20mm [3/4”] drain valves at all downfed terminal heating and/or cooling units.

.3 Install 40mm [1.5”] or 20mm [3/4”] on line sizes less than 40mm [1.5”] drain valves at all low points in the piping systems to facilitate draining.

.4 Install a hose end adaptor on the discharge side of each drain valve, or pipe to drain where indicated.

.5 Use a 40mm [1.5”] hose and connect it to the discharge side of the drain valves, to flush the piping system during the pipe cleaning process.

.6 Install brass caps with restraining chains, on hose end adaptors, in public areas.

3.9 PIPING TESTS

.1 Notify the Consultant and the Inspection Authority having jurisdiction, 48 hours in advance of intended test dates.

.2 Before testing piping, isolate all equipment, which cannot withstand the test pressure.

.3 Do not insulate, backfill or conceal until tests have been completed and approved by the inspection authorities.

.4 Examine all systems under test for leaks.

.5 Joints shall remain dry during the test. A general sweating around a weld shall be reason for rejection.

.6 Remake all leaking connections and joints.

.7 Tests shall be limited to new piping only.

.8 New connections to existing piping shall be warranted.

.9 Initial Hydrostatic test:

.1 150% of working pressure, but not less than 860 kPa [125 psig] for 1 working day.

.10 Final Hydrostatic test:

.1 150% of working pressure, after piping connections to all equipment are complete, maintain until all parts of piping systems have been inspected.

3.10 WELDING TESTS

.1 Provide x-ray inspection of 10% of all welds on High Pressure steam mains.

.2 The welded joints in piping shall be gamma ray radiographed by a specialized firm. Radiography shall be performed in accordance with Article 3 of Section 5 of the ASME Boiler and Pressure Vessel Code and CGSB-48-GP-2.

.3 Radiograph over full circumference.

.4 Radiographs shall be interpreted by the Consultant and representative of firm carrying out radiographing.

.5 Replace welds of poor or doubtful quality at Contractor's expense.

.6 In the event of weld rejection, the Owner has the right to insist on further testing at the Contractor's cost. Repairs will also be at the Contractor's cost.

.7 Leave welds uncovered until inspected and approved by the Consultant or Boiler Inspection Branch.

3.11 FLUSHING AND CLEANING

.1 Flushing and cleaning shall commence only after all piping tests have been completed.

.2 Chemically clean the following piping systems as recommended by an approved professional chemical cleaning and treatment agency who shall supervise the work:

.1 Heating hot water system(s).

.2 Glycol heating system(s).

.3 Glycol heat recovery system(s).

.3 Flush out all traces of chemicals with clean water after chemical cleaning is complete.

.4 Install final connections to heat pump units after flushing is complete.

.5 Remove, clean and reinstall all strainer baskets.

.6 Submit a report signed by a principal of the Agency, which certifies that the cleaning has been satisfactorily completed.

3.12 CHEMICAL TREATMENT

.1 Chemically treat water systems in accordance with Section 23 25 00.

3.13 TESTING AND BALANCING

.1 Balance all piping systems in accordance with the requirements of Section 23 05 93.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REFERENCE STANDARDS

.1 The provision of all specialty components shall be in accordance with ANSI/ASME B31 Codes for Building Services Piping.

1.3 REGULATORY REQUIREMENTS

.1 All water specialty components shall be provided in compliance with the Regulations and Requirements of the Local Authority Having Jurisdiction.

1.4 SYSTEM PRESSURE RATINGS

.1 Piping systems 860 kPa [125 psig] or less operating pressure - 860 kPa [125 psig] rating.

.2 Piping systems 870 kPa [126 psig] to 1730 kPa [250 psig] operating pressure - 1730 kPa [250 psig] rating.

Part 2 Products

2.1 AIR VENTS AUTOMATIC - HIGH CAPACITY TYPE

.1 Non-Serviceable Type

.1 Casing and internal parts suitable for system operating pressure and temperature.

.2 All metal construction with outlet threaded to accept vent tubing connection.

.3 Automatic float type.

.4 Shrader type venting valve.

.5 Standard of Acceptance:

.1 345 kPa [50 psig] maximum operating pressure -Armstrong 11-AV, Dole 75, Maid-O-Mist 7, Taco 423, Watson McDaniel AE1800.

.2 517 kPa [75 psig] maximum operating pressure -Armstrong 11-AV, Dole 75, Maid-O-Mist 7, Taco 426, Watson McDaniel AE1800.

.3 1035 kPa [150 psig] maximum operating pressure -Armstrong 11-AV, Maid-O-Mist 71, Taco 426, Watson McDaniel AE1800.

2.2 AIR VENTS MANUAL - HIGH CAPACITY

.1 Globe Type

.1 Bronze body, union bonnet, screwed, 450 brinell hardened stainless steel trim and plug type disc.

.2 Standard of Acceptance:

.1 Class 125 [860 kPa] - Crane 14-1/2 LP, Jenkins 2032, Kitz 17S, Red-White/Toyo 214

.2 Class 200 [1380 kPa] - Crane 212P, Jenkins 2050, Kitz 17S, Red-White/Toyo 214.

2.3 AIR VENTS MANUAL - RADIATOR TYPE

.1 Needle Type

.1 Bronze or steel body, screwed, needle valve.

.2 Manual key operator.

.3 860 kPa [125 psig] maximum operating pressure and 121°C [250°F] maximum operating temperature.

.4 Standard of Acceptance:

.1 Maid-O-Mist 816.

.2 Hydroscopic Type

.1 Bronze or steel body, screwed, hydroscopic discs.

.2 Manual screwdriver or key operator.

.3 Standard of Acceptance:

.1 345 kPa [50 psig] maximum operating pressure - Dunham Bush V19B, Maid-O-Mist 72, Taco 417.

.2 517 kPa [75 psig] maximum operating pressure -Maid-O-Mist 72, Taco 417.

2.4 FLEXIBLE HOSE ASSEMBLIES

.1 Scope: For connecting to air valve reheat coils, fan coil units etc.

.2 EPDM rubber inner core, stainless steel exterior braid, steel crimp ferrules and brass or bichromate steel threaded ends.

.3 End connections are male solid NPT one end and male swivel NPT on the other end.

.4 Suitable for hot water applications up to 110 ° C [230° F].

.5 Standard of Acceptance:

.1 Unisource Manufacturing Inc. H-P Flex.

2.5 PRESSURE REDUCING STATION - COLD WATER

.1 Screwed, bronze or cast iron body, suitable to 1380 kPa [200 psig], composition seat.

.2 Each reducing station to include:

.1 Gate valve, strainer, union, pressure reducing valve, union, gate valve.

.2 Bypass with globe valve.

.3 20 mm [3/4"] relief valve.

.4 Standard of Acceptance:

.1 Cashco, Watts.

2.6 PRESSURE RELIEF VALVES - WATER

.1 Screwed, bronze body or cast iron body with expanded outlet.

.2 ASME rated.

.3 Coordinate with Heat Exchangers Schedules.

.4 Standard of Acceptance:

.1 Bronze body: Watts 174A, NPS 3/4 to NPS 2.

.2 Iron body: Watts 740, NPS 3/4 x 1 to NPS 2 x 2-1/2.

2.7 PRESSURE RELIEF VALVES - PUMP BYPASS

.1 Hydraulically operated, single seated globe valve controlled by a direct acting spring valve and diaphragm pilot valve.

.2 Main and Pilot Valve - cast iron body, stainless steel seat and reinforced synthetic rubber diaphragm.

.3 Suitable for system operating temperature and pressure.

.4 Connections:

.1 NPS 2 and under, screwed.

.2 NPS 2-1/2 and over, flanged.

.5 Refer to drawings and/or schedules for flow rates (min., normal, max.) and relief pressure range or set point.

.6 Standard of Acceptance:

.1 Singer Model 106-RPS.

2.8 PRESSURE RELIEF VALVES - PUMP BYPASS

.1 Differential pressure overflow valve to control pump pressure.

.2 Screwed, bronze body with stainless steel spring.

.3 Standard of Acceptance:

.1 Braukmann DU146.

2.9 STRAINERS

.1 NPS 2 and under: bronze body, screwed connections.

.2 NPS 2-1/2 and over: cast iron body, flanged connections.

.3 NPS 2 and over: Y or T type strainer with grooved ends with ductile iron body (to NPS 12) or factory-fabricated steel body (NPS 14 to 24).

.4 Suitable for maximum system operating pressure. Where system pressure exceeds 860 kPa [125 psig], use 2065 kPa [300 psig] strainer bodies.

.5 Basket Screen:

.1 Stainless steel perforated screen.

.2 35 holes/cm^2, 1.2 mm dia. perforations, 36% open area.

.3 21 holes/cm^2, 1.6 mm dia. perforations, 41% open area.

.4 5 holes/cm^2, 3.2 mm dia. perforations, 40% open area.

.5 2.5 holes/ cm^2, 5.2 mm dia. perforations, 57% open area.

.6 Standard of Acceptance:

.1 Victaulic Series 732 (Y-type) or W730 (T-type) for all grooved end strainers; or Spirax/Sarco (flanged), Muleller 315M or 758, Kitz 15 or 80, Red-White/Toyo 380 0r 318A.

2.10 SUCTION GUIDE

.1 Cast body or Integrated long radius elbow; strainer and suction entrance guide vanes.

.2 Suitable for 2065 kPa [300 psig] and 110°C [230°F].

.3 Cast ductile iron body, stainless steel strainer, stainless steel guide vanes.

.4 Stainless steel start-up mesh.

.5 Connections:

.1 NPS 2 and under, screwed.

.2 NPS 2-1/2 and over, flanged or grooved inlet/flanged outlet.

.6 Select for system flow rate and allowable pressure drop.

.7 Standard of Acceptance:

.1 Armstrong Suction Guide, Bell & Gossett Suction Diffusers, or Taco Suction Diffuser, Mueller 721 or 722, Victaulic Series 731G or W731G suction diffuser for grooved joint systems.

Part 3 Execution

3.1 AIR VENTS - AUTOMATIC - HIGH CAPACITY TYPE

.1 Install automatic high capacity air vents at each high point in the piping systems and where shown on the drawings.

.2 Install on tees and not on horizontal pipe runs or elbows.

.3 Install a 12 mm [1/2"] minimum isolating gate valve ahead of each air vent, unless air vent has an integral shut-off valve.

.4 Fit all vents on top of an air-collecting chamber.

.5 Pipe all air vent discharge connections, (except for glycol) separately, to the nearest building drain, using 6 mm [1/4"] hard drawn copper tube. Label ends with permanent labels.

.6 Pipe all air vent discharge connections, (except for glycol) separately, to a water-tight solder jointed, 1.2 mm [16 ga.] copper drain pan, using 6 mm [1/4"] hard drawn copper tube where exposed and soft copper where concealed. Label ends with permanent labels.

.7 Pipe all air vent discharge connections from the glycol circuit, separately back to the glycol mixing tank, using 6 mm [1/4"] hard drawn copper tube.

3.2 AIR VENTS - MANUAL - HIGH CAPACITY

.1 Install manual air vents at high points in the piping systems where shown on the drawings.

.2 Install on tees and not on horizontal pipe runs or elbows.

.3 Install isolating gate valve ahead of each vent valve.

.4 Pipe air vent discharge connections to nearest building drain.

3.3 AIR VENTS MANUAL RADIATOR TYPE

.1 Install manual/automatic low capacity air vents on the return side of each water heating/cooling terminal element installed above the connection mains piping.

.2 Fit air vent on top of an air collecting chamber of 20mm [3/4”] pipe, 150 mm [6"] high.

.3 Arrange air vents so that screwdriver slots or key openings are easily accessible.

.4 Drill access holes through radiation enclosures, where necessary.

.5 Do not use this style of air vent for glycol systems.

3.4 FLEXIBLE HOSES HEAT PUMPS

.1 Install flexible hoses on the supply and return loop water connections to each heat pump.

.2 Install a union on one end.

.3 Use flexible hoses to bypass heat pumps during pipe cleaning.

3.5 FLOW CONTROL VALVES - AUTOMATIC

.1 Install automatic flow control valves where shown on the drawings in accordance with the manufacturer's instructions.

.2 Hand over temperature/pressure meter kit and calibration charts to the Owner's representative, at substantial performance and obtain receipt.

3.6 CIRCUIT BALANCING VALVES

.1 Install flow measuring balancing valves where shown on the drawings in accordance with the manufacturer's instructions.

.2 Hand over differential pressure meter kit and calibration charts to the Owner's representative, at substantial performance and obtain receipt.

3.7 PRESSURE REDUCING STATIONS - COLD WATER

.1 Install water make-up stations for each hot water, chilled water and other closed water systems where shown on the drawings.

.2 Pipe relief valve to drain.

3.8 PRESSURE RELIEF VALVES - WATER

.1 Install pressure relief valve(s) on each heat exchanger to prevent over pressuring.

.2 Select relief valves to relieve full heat input of the heat supply side.

.3 Pipe relief valve to drain.

.4 Where one line vents several relief valves, cross sectional area shall equal sum of individual vent areas.

3.9 STRAINERS

.1 Install pipe line strainers where shown on the drawings.

.2 Provide isolation valves on either side of the strainer to permit cleaning without draining the system.

.3 Blowdown connections:

.1 Strainers, 50mm [2”] and under - hot services: nipple and cap.

.2 Strainers, 65mm [2.5”] and over - hot services: nipple, globe valve and nipple.

.3 Strainers, all sizes - cold services: plug.

3.10 SUCTION GUIDE

.1 Install suction guides on the suction of centrifugal pumps, where shown on the drawing and/or where scheduled in accordance with manufacturer's recommendations.

.2 "Startup" strainer baskets must be removed prior to commissioning of systems.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 All sections of Division 23 Specifications form part of Contract Documents and are to be read, interpreted and coordinated with all pages. Conform to General Conditions and Division; Instructions to Bidders, Contract General Conditions and Supplements thereto form part of this Division and contain items related to mechanical work.

1.2 SCOPE

.1 Provide for cleaning and degreasing of all systems that use glycol or water as a heat transfer medium.

.2 Provide for cleaning and disinfection of domestic hot and cold systems.

.3 Provide all temporary strainers, connections and by-pass lines as required.

.4 Provide equipment to add chemicals to the systems as specified herein.

.5 Provide equipment to operate and control the system as specified herein. Provide appropriate protection so that capped off unused piping does not corrode.

.6 Provide corrosion coupons for all closed and open loop circulation systems as specified herein.

.7 Piping systems to be chemically treated include the following new systems:

.1 Hot water heating system(s).

1.3 QUALITY ASSURANCE

.1 The water treatment chemicals and treatment process shall be supplied and performed by the Contractor. This work shall be supervised by the Water Treatment Specialist who, upon completion shall certify that the process is satisfactory and submit a report outlining the cleaning operation and the treatment process.

.2 Notify Consultant 48 hours prior to chemical cleaning so that work may be verified and inspected.

1.4 REFERENCE STANDARDS

.1 Do HVAC water treatment in accordance with ASME Boiler Code Section VII, and requirements and standards of regulating authorities, except where specified otherwise.

1.5 SUBMITTALS

.1 Submit shop drawings including proposed chemicals, quantities, calculations, procedures and equipment to be supplied. Provide written operating instructions and system schematics.

.2 Provide written report containing log and procedure of system cleaning, giving times, dates, problems encountered and condition of water.

.3 Submit written report containing test results and list of chemicals added every 14 days from time of commissioning to acceptance.

.4 Provide monthly visits to check chemical treatment, take water samples and recommend any necessary changes to treatment. Provide written report.

1.6 WATER TREATMENT SERVICE

.1 The Water Treatment Specialist shall provide supervision of installations, set-up and adjustments and shall submit a written report on system operations.

.2 All chemicals, feed systems and test equipment shall be provided by the Water Treatment Specialist.

.3 Treatment chemicals shall not contain hydrazene.

.4 Treatment chemicals shall be non-foaming.

.5 The Water Treatment Specialist shall instruct the maintenance personnel before substantial completion. Written instructions of the treatment, dosages control charts and test procedures shall be included in the maintenance manuals.

.6 The Water Treatment Specialist shall provide monthly visits to check chemical treatment, take water samples and recommend any necessary changes to treatment, and provide a written report for a period of one year after substantial completion. Provide sufficient chemicals to treat the system from the time of commissioning to acceptance of the building. In addition, provide a stock of chemicals, filters and corrosion coupons suitable for 12 months normal operation. The minimum amount of chemicals provided shall include the following:

.1 One spare 189L [50 USgal] drum of chemicals for each open system requiring treatment.

.2 One spare 19L [5 USgal] pail of biocide for each open system requiring treatment.

.3 One spare 19L [5 USgal] pail of chemicals for each closed system requiring treatment.

.7 Provide a test kit suitable for all chemical treatments used. The test kit shall be made available for on-site tests and provide a Myron 3 range TDS meter to check conductivity. Hand over the kit to the Building Operator at project completion - obtain receipt.

.8 Provide one mild steel and one copper corrosion coupon package to monitor corrosion rate for each open and closed systems.

Part 2 Products

2.1 MATERIALS

.1 System Cleaner:

.1 Use a Sodium Metasilicate, Sodium Nitrite and a wetting agent compound which in solution removes grease and petroleum products. Concentration level to be determined by Water Treatment Specialist.

.2 Standard of Acceptance: PACE Chemicals Ltd. - PURGEX L-24.

.2 Closed System Treatment (Hot Water, Chilled Water):

.1 Use an all-organic based corrosion inhibitor. Maintain levels at 60 to 100 ppm.

.2 The use of Nitrite only, Molybdate only or Sulphite only will not be accepted.

.3 Standard of Acceptance: PACE Chemicals Ltd. - BAR COR CWS-105

.3 Provide sufficient chemicals to treat the system from the time of commissioning to acceptance of the building. In addition, provide a stock of chemicals, filters and corrosion coupons suitable for twelve (12) months normal operation.

.4 Materials which may contact finished areas must be colourless.

2.2 TEST KITS

.1 Provide test kits to determine proper systems treatment, including but not limited to the following:

.1 Closed System Test Kit:

.1 To determine proper level of inhibitor in closed system treatment.

.2 Standard of Acceptance: PACE Chemicals Test Kit #105

.2 Open System Test Kit:

.1 To determine proper levels of pH, Chloride, and Phosphonate in recirculating water.

.2 Standard of Acceptance: PACE Chemicals Test Kit #106

.3 Total Dissolved Solids Meter:

.1 3 ranges, 0-50 ppm, 0-500 ppm, 0-5000 ppm equivalent to Myron 532T1. For use in controlling dissolved solids and calculations of cycles of concentration and blowdown.

Part 3 Execution

3.1 PRE-OPERATIONAL CLEANING AND CHEMICAL TREATMENT

.1 All systems must be chemically cleaned and flushed before water treatment is added. This includes partial or complete filling for pressure testing.

.2 Provide drain connections to drain system in one hour.

.3 All drains for chemical treatment shall be piped to the sanitary sewer.

.4 Install totalizing water meter(s) and record capacity in each system.

.5 After all components of the piping system have been pressure tested and proven to be in full operational condition and leak free, flush entire system with fresh, clean make-up water to remove loose mill scale, sediment, and construction debris.

.6 After initial flushing has been completed, clean all strainer screens.

.7 System pumps may be used for cleaning, provided that pumps are dismantled and inspected, worn parts repaired with new gaskets and seals installed. Submit used seals.

.8 Add cleaner to closed systems at concentration levels recommended by the Water Treatment Specialist.

.9 For hot water heating systems, apply heat while circulating, raise temperature slowly to 70ºC [158ºF and maintain at 70ºC [158ºF] for minimum of 12 hours. Remove heat and circulate at 40ºC [104ºF] or less. After cleaning, drain system as rapidly as possible. Flush system by opening drain valves and opening bypass valve on water make-up to system. Continue flushing until tests show pH, Iron, TDS and Chloride levels of water leaving system are the same as entering system. Install corrosion coupons, refill system and immediately add water treatment to proper level.

.10 For chilled water systems, circulate for 48 hours. After cleaning, drain system as rapidly as possible. Flush system by opening drain valves and opening bypass valve on water make-up to system. Continue flushing until tests show pH, Iron, TDS and Chloride levels of water leaving system are the same as entering system. Install corrosion coupons, refill system and immediately add water treatment to proper level.

.11 For steam boilers, fill to normal operating level with cleaning solution. Apply heat slowly and raise steam pressure to normal operating pressure. Hold pressure for four hours. Remove heat and allow to sit for 15 minutes. Blow out boiler connections for 5-10 seconds. Refill boiler with clean water, apply heat and raise pressure. Hold pressure for one hour, remove heat, settle for 15 minutes, blow out connections and refill. Repeat this procedure three times. Allow boiler to cool, then drain. Open inspection ports and wash out with clean water. Refill boiler and bring up to pressure. Add water treatment and test to ensure proper levels.

.12 For steam piping systems, raise steam pressure to normal operating pressure. Hold pressure for four hours. Remove heat and allow to sit for 15 minutes. Flush steam system piping with clean water. Repeat flushing as necessary until wash water is clean and free of debris. Install corrosion coupons.

.13 Use neutralizing agents upon recommendation of the Water Treatment Specialist and as approved by Consultant.

.14 Inspect, remove sludge and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

.15 Flush open systems with clean water for minimum of one hour. Drain completely and refill. Continue flushing until tests show pH, Iron, TDS and Chloride levels of water leaving system are the same as entering system. Stop flushing. Immediately add corrosion inhibitor and test to ensure proper level.

3.2 CLEANING AND CHLORINATION OF POTABLE WATER PIPING

.1 All domestic water piping shall be thoroughly flushed so that it is free from scale, sediment, construction debris, etc.

.2 On completion of installation and testing of the potable water systems, pre-flush, chlorinate with Sodium Hypochlorite to AWWA C651 specifications and let stand for 24 hours. Thoroughly flush again until flush water meets AWWA standards.

.3 Retain an independent inspection firm to supervise and inspect the chlorination and flushing procedures and perform chemical tests as required.

.4 Submit to the Consultant, a certificate from the testing firm, stating that the chlorination and flushing have been successfully carried out.

.5 Standard of Acceptance: PACE Chemicals Ltd.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 23 05 49 for required seismic restraint of ductwork.

1.2 SUBMITTALS

1.3 REFERENCE STANDARDS

.1 The construction and installation of ductwork and plenums shall be in accordance with the latest edition of the following referenced SMACNA manuals and ASHRAE handbooks.

.1 SMACNA - H.V.A.C. Duct Construction Standards.

.2 SMACNA - H.V.A.C. Air Duct Leakage Test Manual.

.3 ASHRAE - Handbook - Equipment Volume.

1.4 GENERAL

.1 Duct sizes on drawings indicate clear inside dimensions. For acoustically lined or internally insulated ducts, maintain inside duct dimensions.

.2 Where duct sizes are shown in nominal metric sizes, round and oval duct sizes may be supplied in the nearest available sizes in equivalent imperial units.

.3 Proper sized openings shall be arranged for in the correct locations through all slabs and walls. Openings shall be planned to include for the installation of fire dampers at all rated fire separations.

.4 Where ducts penetrate roofs, provide roof curbs with flashing and counterflashing.

.5 Arrange for 100 mm [4"] high by 100 mm [4"] wide concrete curbs around all duct penetrations through floor slabs outside of duct shafts.

.6 The project drawings are diagrammatic and although efforts have been made to provide information regarding the number of offsets and transitions, not all are necessarily shown. Changes may be required in duct routings, elevation and duct shape to eliminate interference with structure and other services. All required adjustments shall be established when coordinating and field measuring the work prior to fabrication and must be provided as part of the contract and all associated costs must be considered and included.

.7 Ductwork used on this project shall be clean and free from scale, corrosion and deposits. All ductwork shall be degreased and wiped clean of all oil and other surface films with appropriate solvents prior to installation.

.8 All ductwork shall be delivered clean to the site and maintained in clean condition. Dirty ductwork shall be removed from site.

.9 Where welded ductwork is indicated, the welding shall be continuous with Everdur welding. Tack welding is unacceptable except as specifically noted. Paint damaged areas with zinc coating after welding.

.10 Provide seismic restraints for ductwork in accordance with SMACNA "Guidelines for seismic restraints of mechanical systems and plumbing piping systems".

Part 2 Products

2.1 DUCTWORK - GENERAL

.1 Ducts and plenums shall be galvanized steel unless indicated otherwise.

.1 Galvanized steel shall have a 380 g/sq.m. [1-1/4 oz/sq.ft] galvanizing coat both sides to ASTM A525 G90.

2.2 DUCTWORK AND PLENUM PRESSURES

.1 Provide ductwork and plenums fabricated from galvanized steel for the static pressure categories listed below.

.1 1500 Pa [6" W.G.] static pressure.

.1 Stair, vestibule and elevator pressurization ducts.

.2 Smoke evacuation ducts.

.3 Supply ductwork and plenums downstream from the discharge automatic control dampers listed below, up to the furthest smoke/fire dampers at the ends of supply duct risers (emerging from duct shafts) or to supply duct smoke dampers, in the walls of mechanical rooms.

.1 DISCHARGE DAMPERS

CD-

.2 1000 Pa [4" W.G.] static pressure.

.1 All supply air ductwork downstream from supply air handling units discharge, to the upstream side of mixing boxes/air valves.

.2 All exhaust and return air ductwork downstream from return/exhaust air valves to the return/exhaust fans and downstream from the return/exhaust fans to the air handling units and/or outdoor relief.

.3 All outdoor intake plenums in mechanical room(s).

.3 500 Pa [2" W.G.] static pressure

.1 All supply ductwork downstream from mixing boxes/air valves to terminal air outlets.

.2 All supply ductwork and plenums on systems without mixing boxes/air valves.

.3 All return air ductwork and plenums, except where otherwise specified.

.4 All exhaust and relief air ductwork and plenums, except where otherwise specified (welding/sawdust exhaust).

.5 All outdoor air ductwork and plenums, except as otherwise specified.

2.3 DUCTWORK - 500 PA [2" W.G.] STATIC PRESSURE

.1 Provide galvanized iron ductwork for system operating pressures 500 Pa [2" W.G.] and less. Ductwork shall be constructed, reinforced, sealed and installed to withstand 1-1/2 times the working static pressure.

.2 Construct rectangular ductwork in accordance with Section I including Tables 1-5, 1-10, 1-11, 1-12, 1-13 and Figs. 1-4 through 1-18 of the SMACNA Duct Standards.

.3 Nomasco "Ductmate System, Lockformer TDC" or Exanno "Nexus System" may be used for rectangular duct joints.

.4 At least two opposite faces of all rectangular ductwork must be joined together using a type of joint, which cannot pull apart.

.5 Construct rectangular duct fittings in accordance with Section II including Figs. 2-1 to 2-11 and Figs. 2-16 to 2-18 of the SMACNA Duct Standards.

.6 Construct round ductwork in accordance with Section III including Table 3-2 and Figs. 3-1 and 3-2 of the SMACNA Duct Standards but excluding beaded crimp joints and snaplock seams.

.7 Construct flat oval ductwork in accordance with Section III including Table 3-4 and Fig. 3-6 of the SMACNA Duct Standards. Joints and seams shall be similar to those indicated for round ducts. Flat oval duct to be used for positive pressure application only.

.8 Construct round and flat oval duct fittings in accordance with Section III including Table 3-1 and Figs. 3-3 through 3-6 of the SMACNA Duct Standards. Round elbows shall have a

centreline radius of 1.0 times duct diameter. Sheet metal gauge of fittings and elbows shall be not less than the thickness of that specified for longitudinal seam straight duct. Adjustable elbows are not permitted.

2.4 DUCTWORK - 750 PA [3"] AND GREATER STATIC PRESSURE

.1 Provide galvanized iron ductwork for system operating pressure over 500 Pa [2" W.G.]. Ductwork shall be constructed, reinforced, sealed and installed to withstand 1-1/2 times the working static pressure.

.2 Construct rectangular ductwork in accordance with Section I including Tables 1-6 through 1-13 and Figs. 1-2 through 1-18 of the SMACNA Duct Standards.

.3 Nomasco "Ductmate System", Exanno "Nexus System" or "Lockformer TDC, TDF system", may be used for rectangular duct joints.

.4 Construct rectangular duct fittings in accordance with Section II including Figs. 2-1 through 2-11 of the SMACNA Duct Standards.

.5 Construct round ductwork in accordance with Section III including Table 3-2 and Figs. 3-1 and 3-2 of the SMACNA Duct Standards.

.6 Construct flat oval ductwork in accordance with Section III including Table 3-4 and Fig. 3-6 of the SMACNA Duct Standards. Joints and seams shall be similar to those indicated for round duct. Flat oval duct to be used for positive pressure application only.

.7 Construct round and flat oval duct fittings in accordance with Section III including Table 3-1 and Figs. 3-3 through 3-6 of the SMACNA Duct Standards. Round elbows shall have a centreline radius of 1.5 times duct diameter. Construct 90 deg. elbows of not less than 5 tapered sections. All seams and joints in round or oval duct fittings and elbows shall be spot welded lap seams at not more than 50mm [2"] spacing and all inside seams sealed with approved duct sealant. If the zinc coating is burned off the steel during welding, the joints shall be painted to prevent corrosion. Sheet metal gauges of fittings and elbows shall be not less than the thickness of that specified for longitudinal seam straight duct but suitably thick for welding methods used.

2.5 PLENUMS - 500 PA [2"] STATIC PRESSURE

.1 Provide galvanized steel low pressure plenums suitable for 500 Pa [2" W.G.] positive or negative pressure, for central plant ventilating and air conditioning equipment.

.2 Construct plenums in accordance with Section VI including Figs. 6-1 through 6-3 of the SMACNA Duct Standards.

.3 Where the building structure does not form the bottom surface of a walk-in plenum, fabricate plenum floor panels of 1.78 mm (14 ga.] galvanized steel, with angle iron reinforcing such as to limit deflection of the floor panels to a maximum of 6.4 mm [1/4"] under a concentrated load of 115 kg [250 lbs] at mid span.

.4 Where plenum floors are internally lined, install a 1.47 mm [16 ga.] thick galvanized steel panel on top of the insulation.

.5 Apply silicone sealant CGE Silpruf 2000 series or Dow Corning 781/732 between plenum base angles and concrete or curbs before bolting together.

.6 Reinforce all openings in plenum walls with 40 mm x 40 mm x 4.8 mm [1-1/2" x 1-1/2" x 3/16"] angle iron, secured to the main vertical and horizontal reinforcing angles.

.7 Construct access door and casing around door as per SMACNA, casing access doors, Fig. 6-12. Section C-C with angle iron frame sized to suit plenum wall. Doors constructed of 16-gauge metal.

.8 Arrange access doors so that they open against the airflow and static pressure.

.9 Weld all joints on condensate drain pans. Construct the pans from 1.45 mm [16 ga.] thick stainless-steel type #302 or #304. Install a minimum of 32 mm [1-1/4"] piping connection, complete with water seal at least 100 mm [4"] deep, from the pan drain connection to the nearest building drain. Install drain connections so that they shall completely drain the pans.

.10 Seal piping penetrations through plenum walls, with gland seals as detailed in Fig. 6-10 of the SMACNA Duct Standards.

.11 Bulkheads mounting air filters and air coils shall be airtight to prevent air bypass around filters and/or coils.

2.6 PLENUMS - 750 PA [3"] AND GREATER STATIC PRESSURE

.1 Provide medium/high pressure galvanized steel plenums suitable for the specified pressures.

.2 Construct plenums in accordance with Section VI including Figs 6-3 through 6-9 of the SMACNA Duct Standards. If requested, pressure test the plenums to the specified static pressure (positive or negative) to demonstrate the structural integrity.

.3 Where the building structure does not form the bottom surface of a walk-in plenum, fabricate plenum floor panels of 1.78 mm [14 ga.] galvanized steel, with angle iron reinforcing such as to limit deflection of the floor panels to a maximum of 6.4 mm [1/4"] under a concentrated load of 115 kg [250 lb.] at mid span.

.4 Where plenum floors are internally lined, install a 1.47 mm [16 ga] thick galvanized steel panel on top of the insulation.

.5 Apply silicone sealant, CGE Silpruf 2000 series or Dow Corning 781/732 between plenum base angles and concrete or curbs, before bolting together.

.6 Reinforce all openings in plenum walls with 50 mm x 50 mm x 6.4 mm [2" x 2" x 1/4"] angle iron secured to the main vertical and horizontal reinforcing angles.

.7 Construct access door and casing around door as per SMACNA, casing access doors, Fig. 6-12. Section C-C with angle iron frame sized to suit plenum wall. Doors constructed of 16 gauge metal.

.8 Arrange access door so that they open against the airflow and static pressure.

.9 Weld all joints on condensate drain pans. Construct the pans from 1.45 mm [16 ga.] thick stainless-steel type #302 or #304. Install a 32 mm [1-1/4"] piping connection complete with water seal, from the drain pan connections to the nearest building drain. Install drain connections so that they shall completely drain the pans.

.10 Water Seal Depth:

.1 130 mm [5"] for 750 Pa [3" W.G.] systems.

.2 150 mm [6"] for 1000 Pa [4" W.G.] systems.

.3 200 mm [8"] for 1500 Pa [6" W.G.] systems.

.4 300 mm [12"] for 2500 Pa [10" W.G.] systems.

.11 Seal piping penetrations through plenum walls with gland seals as detailed in Fig. 6-10 of the SMACNA Duct Standards.

.12 Bulkheads mounting air filters and air coils shall be air tight to prevent air bypass around filters and/or coils.

2.7 DUCTWORK AND PLENUM SEALERS

.1 Provide duct sealing compounds for use in fabrication of all ductwork and plenum joints.

.2 All ductwork shall be sealed to SMACNA Seal Classification A.

.3 For further details refer to Section 23 33 00, Duct Accessories.

2.8 DUCTWORK - ALUMINUM

.1 The following ductwork shall be fabricated from aluminum:

.1 Exhaust ductwork from showers/baths, to the extent noted on the drawings.

.2 Discharge ductwork through the roof, where noted on the drawings.

.2 Low Pressure Aluminum ductwork shall be constructed in accordance with Clause 2.2 "Ductwork - 500 Pa [2"] Static Pressure".

.3 For round and rectangular aluminum ductwork, use four gauges heavier than that scheduled in Table 1-5 or Tables 1-14, 1-15, 1-16 of the SMACNA Duct Standards for galvanized ductwork.

.4 Aluminum shall be utility grade.

.5 Support aluminum ductwork using aluminum straps, cadmium plated threaded rods, aluminum flat bar or aluminum angle hangers. Support shall be similar to that specified for galvanized iron ductwork.

2.9 DUCTWORK - STAINLESS STEEL - RECTANGULAR

.1 The following ductwork shall be fabricated from stainless steel:

.1 All exhaust ducts carrying moisture such as Dishwasher, Cartwasher, Washer/Sanitizer. Exhaust duct from unit to the discharge point.

.2 Duct sections containing duct mounted humidifiers.

.3 Where indicated on the drawings.

.2 Low-pressure stainless-steel ductwork shall be suitable for system operating pressures 500 Pa [2" W.G.] or less.

.3 Material: 1.14 mm [18 ga.], 316L stainless steel, with No. 2B finish where concealed and No. 4 finish where exposed. (Exposed areas shall include finished occupied areas of the building but not mechanical rooms).

.4 Do not cross break duct panels. Grade to drain as indicated.

.5 Weld all longitudinal seams and lateral joints and finish all exposed seams and lateral joints by grinding smooth and buffing to finish of the sheet. Do not penetrate stainless steel with screws, bolts or rivets.

.6 Provide gasketted companion flange connections where necessary to connect to equipment. Flanged connections shall be made up by slipping a formed 1.8 mm [14 ga.] thick matching stainless-steel welded angle frame over the end of the duct, leaving space for continuously welding the frame to the duct on the inside.

.7 Provide escutcheon trim bands around all duct ceiling penetrations.

.8 Provide gasketted cleanouts (not smaller than 450 mm x 300 mm [18" x 12"], with formed 1.8 mm [14 ga.] thick matching stainless steel welded angle reinforcing frames, in the side of the ductwork at not more than 6 m [20 ft.] intervals, changes in direction and base of risers. Cleanouts shall be fastened with wing nuts at 150 mm [6"] centres. Cleanouts openings shall terminate not less than 40 mm [1-1/2"] from the bottom of the duct.

.9 Gaskets shall be 3 mm [1/8"] thick teflon or an approved alternate.

.10 Support exposed ductwork with 50 mm x 1.8 mm [2" x 14 ga.] matching stainless steel (No. 4 finish) U-strap hangers on 2.4 m [8 ft.] centres.

2.10 DUCTWORK - ACOUSTICALLY LINED

.1 Where rectangular ductwork is indicated to be acoustically insulated with flexible acoustic duct liner, liner shall be installed in accordance with instructions and Figures 2-22 through 2-25, SMACNA Duct Standards. Duct sizes shown are inside the duct liner.

.2 Where round ductwork is indicated to be acoustically insulated, it shall consist of two concentric round ducts with 25 mm [1"] thick flexible fibrous glass duct liner between the two ducts. The inner duct shall be perforated and correspond to the duct diameter noted on the drawings. The outer duct shall be suitable for the static pressure and shall be sealed airtight where it joins the adjacent ductwork.

2.11 DUCTWORK – OUTDOORS

.1 The internally or externally insulated supply, return and exhaust ducts (down stream of heat recovery coils) including silencers, located outdoors on the roof, shall be constructed watertight.

.2 All joints shall be caulked with a water impervious sealant. TDC clips should be continuous on the top and sides of the ducts.

.3 The top of the finished product (waterproof membrane) should be pitched to avoid pooling of water.

.4 After pressure testing, the exterior of the ducts and the duct silencers shall be wrapped with a waterproof membrane. The details of this membrane need to be researched but could be as follows:

.1 Membrane consisting of a SBS rubberized asphalt compound, integrally laminated to a reinforced aluminum foil, providing a waterproof membrane.

.2 Standard of Acceptance:

.1 Bakor Foilskin

2.12 PLENUM INSULATION COVERING

.1 Sheet Metal

.1 Provide 0.76 mm [22 ga] galvanized sheet metal covering on acoustically lined plenum walls for a distance of 1.2 m [4 ft] downstream from cooling coils.

.2 Perforated Metal

.1 Provide 0.76mm [22ga] thick perforated galvanized sheet metal covering on all acoustically lined plenum walls (except immediately adjacent to down stream side of cooling coils).

2.13 COIL END COVERS

.1 Provide coil end casings to eliminate coil frame air leakage.

.2 Provide for cooling coil ends to drip condensate to the coil drain pan. Insulate the inside of the coil end casing to prevent casing condensation and provide closure panels to retain insulation.

2.14 WIRE MESH SCREENS

.1 Provide wire mesh screens in all air intake openings where noted on the drawings.

.2 Screens shall be constructed from aluminum wire 1.3 mm diameter [16 ga].

.3 Screen mesh shall be 12.7 mm [1/2"].

.4 Mount screens in 0.66 mm thick [20 ga] folded aluminum frames.

2.15 COUNTER FLASHINGS

.1 Counter flashings - galvanized sheet steel of 0.8 mm [22 gauge] minimum thickness.

.2 Counter flashings are attached to mechanical equipment and lap the base flashings on the roof curbs.

.3 All joints in counter flashings shall be flattened and solder double seam. Storm collars shall be adjustable to draw tight to pipe with bolts. Caulk around the top edge. Storm collars shall be used above all roof jacks.

.4 Vertical flange section of roof jacks shall be screwed to face of curb.

Part 3 Execution

3.1 DUCTWORK & PLENUM INSTALLATION

.1 Where a duct contains a fire or smoke damper, construct the duct so that the free area of the duct is maintained through the fire or smoke damper.

.2 Where a duct is to be internally insulated, enlarge the duct so as not to reduce the duct free area.

.3 Make the taper of diverging transitions less than 20 deg. and the taper of converging transitions less than 30 deg., in accordance with Fig. 2-9 of the SMACNA Duct Standards. Maximum divergence upstream of equipment to be 30 deg. and 45 deg. convergence downstream.

.4 Elbows:

.1 Elbows shall be long radius with a centerline radius of minimum 1.5 x duct width.

.2 If 1.5 radius elbows are not installed, use short radius elbows fitted with turning vanes or square elbows fitted with turning vanes.

.5 Turning vanes:

.1 Turning vanes shall be double thickness.

.2 Vanes in galvanized sheet metal ducts shall be constructed from galvanized steel, minimum thickness 0.76 mm [22 ga].

.3 Vanes shall be spaced at 40 mm [1-1/2"] centres and shall turn through 90 deg., with a radius of 50 mm [2"].

.4 Vanes shall not include a straight trailing edge. Refer to Figs. 2-3 and 2-4 of the SMACNA Duct Standards.

.5 Vanes and runners in aluminum ducts shall be constructed from aluminum. Aluminum vanes shall be 0.86 mm thick [18 ga].

.6 Where indicated, install adjustable air turning devices, where full radius take-off fittings cannot be installed, in accordance with Fig. 2-16 of the SMACNA Duct Standards.

.1 Adjustment shall be accessible outside the duct with lockable quadrant operator or through the grille or register with key-operated worm gear mechanism.

.6 Cross-break or bead all metal duct panels unless otherwise noted.

.7 For 500 Pa [2"] pressure systems, install tie rods to limit the maximum unsupported vane length to 914 mm [36"]. Refer to Fig. 2-4 of the SMACNA Duct Standards.

.8 For 750 Pa [3"] and greater pressure systems, install tie rods to limit the maximum unsupported vane length to 460 mm [18"]. Refer to 2-4 of the SMACNA Duct Standards.

.9 Install duct necks before grilles, registers and diffusers and cushion heads after diffuser take-offs as required to suit site conditions.

.10 Do not cross-break duct panels on 750 Pa [3"] and greater static pressure systems.

.11 Roof mounted ducts shall have standing seams and shall be sealed weather tight.

.12 Ducts handling moist air:

.1 Do not cross-break bottom duct panels when ductwork is handling moisture.

.2 Construct ductwork handling moisture with three-sided bottom sections and a separate top panel. Install the three-sided bottom sections and internally seal the transverse joints with CGE Silicone Sealant "Silpruf". Then install the top panels and seal the top panel seams and joints.

.3 Grade all ductwork handling moisture, a minimum of 1:120 [1" in 10 ft] back to the source or at low points in the ductwork, provide a 150 mm [6"] deep drain sump and 32 mm [1-1/4"] dia. drain connection with deep seal trap and pipe to drain.

.13 Moisture in plenums:

.1 Provide floor drains in outside air and humidifier sections with deep seal traps.

.2 Provide moisture collection sections inside all louvres for outside air and exhaust air.

.14 Support ductwork using galvanized steel straps, cadmium plated threaded rods, flat bar or angle hangers. Attachments to the structure shall be compatible with the structure and selected for the load of the ductwork. Install ductwork hangers in accordance with Section IV including Tables 4-1 through 4-3 and Figs. 4-1 through 4-9 of the SMACNA Duct Standards.

.15 Support duct risers at their base and at each floor and at not greater than 3.7 m [12 ft] intervals.

.16 Prior to the fabrication of ductwork, co-ordinate and field measure all ductwork to ensure a complete installation respecting all other services. Provide all necessary fittings, offsets, and alternate construction methods to facilitate the installation.

.17 Arrange ductwork and plenums so that duct and plenum mounted equipment can be easily removed.

.18 Arrange access doors so that they open against the airflow and static pressure.

.19 Provide necessary baffling in manufactured or built-up mixed air plenums to ensure good mixed air temperature with variations of not more than ± minus 5°C [23°F] under all operating conditions.

.20 Ducts passing through non-rated fire separations, sound insulated walls and through non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with silicon sealant to prevent passage of smoke and/or transmission of sound. (U.L.C. approved fire stop sealant is not a requirement). Where ducts are insulated provide a 0.61 mm [24 ga] thick galvanized steel band tightly fitted around insulation and then caulk to band.

.21 During construction, protect openings in ductwork, from dust infiltration, by covering with polyethylene, and protect floor outlet duct openings with metal caps.

.22 Where ductwork is required to pass through open web steel joists, coordinate with the joist fabricator before fabricating ductwork.

.23 Where ducts penetrate roofs, install sleeves and roof curb c/w flashing and counterflashing. Pack sleeves in roof with glass fibre insulation.

.24 Provide drip pans under piping and shields for protection of electrical panels and equipment.

.25 Unless noted otherwise, line all builder's shafts and air plenums used as ducts and plenums with sheet metal.

3.2 DUCT PENETRATIONS IN PRESSURE SENSITIVE ROOMS

.1 All ducts passing through walls, floor and ceiling slabs of rooms that are required to be maintained at negative or positive pressure, shall be tightly fitted and sealed on both sides of the separation with smoke seal caulking sealant to prevent the transmission of air.

3.3 DUCTWORK LEAKAGE TEST

.1 Leakage test all 750 Pa [3"] and greater static pressure supply ductwork installed under this contract, as recommended in the SMACNA H.V.A.C. Air Duct Leakage Test Manual, 1985 Standards, to a static pressure 500 Pa [2" W.G.] in excess of the specified ductwork design static pressure.

.2 Use equipment capable of demonstrating leakage.

.3 Test the first 30 m [100 ft] of installed ductwork in the presence of the Consultant.

.4 Test a 30m [100ft] section of 500 Pa [2"] static pressure ductwork, where complete systems over 30m [100 ft] long are installed under this contract to a static pressure of 500 Pa [2" W.G.].

.5 The total allowable leakage for the entire system shall be not greater than [5] percent of the total system capacity.

.6 Submit test reports for all ducts tested.

3.4 DUCTWORK AND PLENUM CLEANING

.1 Responsibility

.1 This Contractor shall be responsible for and ensure that all ductwork installed under this contract is internally CLEAN when handed over to the Owner. This responsibility includes the entire systems, from outdoor air intakes to air terminals and from air terminals to relief outlets. It includes all ductwork, lined and unlined, all plenums and all equipment within or connected to ducts and plenums.

.2 The surfaces shall be considered clean when all foreign materials capable of particulating and visible to the naked eye are removed.

.2 Installation Procedure

.1 All ductwork shall be wiped clean prior to installation.

.2 LEED Requirement: Oil film on sheet metal shall be removed before shipment to Work Site. Ducts shall be inspected to confirm that no oil film is present.

.3 Oil film on sheet metal shall be removed before shipment to Work Site. Ducts shall be inspected to confirm that no oil film is present.

.4 Close all dampers immediately following installation thus checking the operation and retarding movement of contaminants through the system.

.5 Seal all openings at the end of each day and at such other time as site conditions dictate.

.6 Floor openings to be capped with sheet metal or floor grilles plus 0.15 mm [6 mil] thick poly sheet.

.7 Other openings to be covered with 0.15 mm [6 mil] thick poly sheet taped so as to be airtight.

.3 Cleaning Procedure

.1 All ductwork shall be handled and installed in accordance with the advanced level specified in SMACNA's Duct Cleanliness for New Construction Guidelines

.2 Supply and return ducts shall be cleaned in accordance with NADCA General Specifications for the Cleaning of Commercial Heating, Ventilation and Air Conditioning Systems. Verification of HVAC system cleanliness shall be in accordance with the latest NADCA ACR Standard.

.1 If visual inspection (Method 1 in NADCA ACR) is inconclusive, surface comparison testing (Method 2 in NADCA ACR) should be used.

.2 If surface comparison testing is inconclusive, vacuum testing (Method 3 in NADCA ACR) should be used.

.3 On completion of the duct and plenum installation and prior to the installation of air terminals and prior to balancing of the air systems, but not until the areas are substantially clean (floors have been swept and vacuumed) and all "dirty" construction has been completed, employ an approved Cleaning Agency to vacuum clean the following:

.1 All air handling units.

.2 All plenums.

.3 All supply and return air ducts.

.4 All exhaust air ducts.

.4 All components within each system shall be thoroughly cleaned and shall include but not be limited to the following: coils, fans and motors, silencers, air terminals and mixing boxes / air valves.

.5 When connecting to existing supply ductwork, clean existing supply ducts upstream from connection back to the filters. Clean existing supply ductwork downstream from new connections to outlets.

.6 Provide fire-stopping for all existing duct at fire separations.

.7 Cleaning shall generally be by high-capacity power vacuum. High-pressure compressed air, wire brushing and/or non-toxic solvent cleaning shall be used where dirt or scale cannot be removed otherwise. Coils shall be de-scaled.

.8 The Cleaning Contractor shall be responsible for removing and replacing filter media. This contractor will remove the temporary filters and replace with new after cleaning the systems.

.9 The Cleaning Contractor shall mark balancing damper positions before cleaning and return them to their original position when cleaning is completed unless the system is still to be balanced.

.10 Reinstall any grilles, registers and diffusers, which may have been removed for cleaning purposes.

.11 After the duct systems have been cleaned, they should be resealed if they are not being used. Provide filter media on the return air terminals if the return air fans are run after cleaning has been completed.

.12 The Cleaning Agency shall perform a full inspection of the duct interior. Utilizing a fibre optic borescope with dedicated light source, inspect interior ductwork surfaces, and ductwork accessories including terminal units, mixing boxes / air valves, ductwork liners, duct-mounted coils, filters, dampers, humidifiers and all other appurtenances within the ductwork system.

.13 Spot checks will be made by the Consultant during the cleaning process to verify that the required standard is being met. When Ready-For-Takeover (“RFT”) is claimed, final spot checks will be made to verify that the ducts are clean. Make available for the use of the Consultant a fibre optic borescope with dedicated light source. If any ducts are found to be unclean, then they shall be recleaned.

.14 Ducts serving very clean areas served with 85% NBS or HEPA filters shall be reviewed by the Consultant utilizing the equivalent of a white glove wipe technique.

.15 Submit a report from the cleaning agency that certifies all specified air systems have been cleaned (e.g. Mechanical Form MF 171).

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 QUALITY ASSURANCE

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards

Part 2 Products

2.1 BACKDRAFT DAMPERS - LIGHT DUTY

.1 Minimum Requirements:

.1 1.4 mm thick [16 ga] galvanized steel or aluminum channel frame.

.2 0.41 mm thick [24 ga] embossed aluminum blades.

.3 Full blade length shafts, brass bearings.

.4 Felt or neoprene anti-chatter blade strips.

.5 Maximum blade height per section, 610 mm [24"], use multiples for larger dimensions.

.6 Maximum blade length of 460 mm [18"], use multiples for larger dimensions.

.7 Manufacturer's label.

.8 Where a balanced backdraft damper (BBD) is indicated the damper shall incorporate an adjustable counterbalance weight and lever.

.9 Maximum pressure drop across damper at 4.06 m/s [800 FPM] shall be 35 Pa [0.14" w.g.]

.2 Standard of Acceptance:

.1 E.H. Price BDD

2.2 BACKDRAFT DAMPERS - MEDIUM DUTY

.1 Minimum Requirements:

.1 1.4 mm thick [16 ga] galvanized steel or aluminum channel frame.

.2 1.2 mm thick [15 ga] aluminum blades, complete with stiffening ribs/bends.

.3 Full blade length shafts; brass, ball or nylon bearings.

.4 Felt or neoprene anti-chatter blade strips.

.5 Blade connecting linkage with eyelet and pin bearings.

.6 Maximum blade length of 760 mm [30"], use multiples for larger dimensions.

.7 Manufacturer's label.

.8 Where a balanced backdraft damper (BBD) is indicated the damper shall incorporate an adjustable counterbalance weight and lever.

.9 Maximum pressure drop across damper at 4.06 m/s [800 FPM] shall be 45 Pa [0.18" w.g.]

.2 Standard of Acceptance:

.1 Ruskin CBD-6.

2.3 BALANCING DAMPERS

.1 Construction in accordance with SMACNA Duct Standards - Figs. 2-14 and 2-15.

.2 Minimum Requirements:

.1 Rectangular ducts:

.1 Up to 300 mm [12"] deep - single blade (butterfly type).

.2 330 mm [13"] to 400 mm [16"] deep - two opposed blades, mechanically interlocked with pivots at quarter points.

.3 430 mm [17"] deep and over - multiple opposed blades, mechanically interlocked with blades not greater than 200 mm [8"] deep and pivots equally spaced.

.2 Round Ducts:

.1 Single blade (butterfly type).

.3 Material:

.1 Minimum 1.47 mm [16 ga] thick galvanized steel blade on all butterfly dampers.

.2 Minimum 1.47 mm [16 ga] thick galvanized steel blades on multi-blade dampers with rigidly constructed galvanized steel frame (no frame required on single blade dampers).

.3 Minimum 1.14 mm [18 ga] thick stainless-steel blades for fume exhaust ducts.

.4 Bearings:

.1 End bearings on all low-pressure single blade dampers above 300 mm [12"] dia.

.2 Bearings on multiple blade dampers shall be bronze oilite type.

.5 Operating Mechanism:

.1 Lockable quadrant type with end bearing on accessible rectangular ducts up to 400 mm [16"] deep and on accessible round ducts.

.2 Wide pitch screw mechanism type with crank operator on accessible rectangular ducts 430 mm [17"] and over in depth and on inaccessible rectangular and round ducts.

.3 Override limiting stops.

.4 No blade movement in set position.

.6 Concealed Regulators:

.1 Drawing designation: D (CR).

.2 For all drywall ceilings which do not have access panels provide concealed balancing damper regulators embedded in the finished ceiling, mounted behind grilles, on or inside plenum slot diffusers and various types of diffusers.

.3 Concealed damper regulator to be connected to balancing damper by means of flexible Bowden cable and to be installed flush with ceiling.

.4 Coverplate to be held in place with 2 screws and to be easily removed for damper adjustment.

.5 Refer to Mechanical Details.

.6 Standard of Acceptance:

.1 Young Regulator Co. Model No. 270-301.

.2 Provide all necessary hardware including Young Regulator balance damper model 5020-CC, Bowden cable and Young Regulator Model 030-12 wrench.

2.4 DUCT AND PLENUM ACCESS

.1 Locations: Refer to Part 3 (Execution).

.2 Dimensions:

.1 Doors:

.1 500 mm [20"] wide x 1370 mm [54"] high.

.2 Head of door 1780 mm [70"] above floor.

.2 Panels:

.1 380 mm x 500 mm [15"x20"].

.2 Where the far corners of the duct are closer than 500 mm [20"] and the equipment within the duct is closer than 300 mm [12"] the size may be reduced to 400 mm x 300 mm [16"x12"] or 450 mm x 250 mm [18"x10"] elliptical.

.3 Where space will not permit the above dimensions to be attained, they should be matched as closely as possible and where necessary additional access be provided.

.3 Products:

.1 Doors - construct in accordance with SMACNA Duct Standards Fig. 6-12 except for latch type. 40 mm [1-1/2"] thick insulation.

.2 Panels - Nailor Hart, Ventlok, 25 mm [1"] thick insulation.

.3 Gaskets - neoprene or foam rubber.

.4 Hardware:

.1 Panels up to 400 mm x 300 mm [16 "x 12"] - 2 sash locks.

.2 Panels - 380 mm x 500 mm [15 "x 20"] - 4 sash locks.

.3 Doors - piano hinge and Ventlok 310 latches c/w front and inside handles and front door pull.

2.5 DUCT CONNECTORS - THERMAL BREAKS

.1 Provide flexible duct connections to provide thermal breaks in all sheet metal ducts and plenums passing through or terminating at the exterior of the building. Install inside the building.

.2 Minimum Requirements:

.1 Pre-assembled 75 mm [3"] long thermal barrier with 75 mm [3"] long, 0.61 mm [24 ga] galvanized steel duct connectors on each side of the thermal break.

.2 Thermal break - heavy fiber glass fabric with elastomer coating.

.3 Standard of Acceptance: Duro Dyne "Durolon", Ventfabrics "Ventlon".

2.6 DUCT CONNECTORS - VIBRATION ISOLATION

.1 Provide flexible duct connections to provide vibration isolation at all duct and plenum connections to fan and air handling units. See Figure 2-19 SMACNA Duct Standards.

.2 Minimum Requirements:

.1 Pre-assembled 75 mm [3"] minimum long flexible connection with 75 mm [3"] long 0.62 mm [24 ga] galvanized steel duct connectors on each side of the flexible connection. Flexible connector - fiber glass fabric with elastomer coating.

.3 Centrifugal fans with 900 mm [36"] diameter and larger fan wheels, use 150 mm [6"] long flexible connection.

.4 Do not install connectors on perchloric acid fume exhaust systems.

.5 Standard of Acceptance: Duro Dyne "Durolon", Dynair "Hypalon", Ventfabrics "Ventlon".

2.7 DUCTWORK - FLEXIBLE - PLAIN

.1 Provide factory fabricated plain, flexible air ductwork for the following applications:

.1 Connections to air terminals.

.2 Connections to downstream side of mixing boxes / air valves.

.3 Connections to round fire dampers (up to 300 mm [12"] diameter).

.2 Minimum Requirements:

.1 Non-corrosive spiral wire reinforcing with flexible vinyl coated fiberglass cloth membrane.

.2 Suitable for up to 2500 Pa [10" w.g.] positive static pressure and 250 Pa [1" w.g.] negative static pressure.

.3 U.L. or U.L.C. labelled, Class 1, duct connector.

.4 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

.3 Standard of Acceptance: Flexmaster FAB4, Thermaflex SLP10,

2.8 DUCTWORK - FLEXIBLE - INSULATED

.1 Provide factory fabricated insulated flexible ductwork for the following applications:

.1 Connections to downstream side of variable volume and constant volume mixing boxes, where indicated.

.2 Connections to air terminals where indicated.

.2 Minimum Requirements:

.1 Flexible vinyl coated steel helix bonded to inner duct liner. Fibrous glass thermal insulation.

.2 Outer jacket of metalized fire-resistant vapour barrier.

.3 Suitable for up to 500 Pa [2" w.g.] positive static pressure and/or 250 Pa [1" w.g.] negative static pressure.

.4 UL or ULC labelled, Class 1, duct connector.

.5 Acoustically rated.

.3 Standard of Acceptance: Glass-Flex ABL-181, Thermaflex M-KE, Wiremold WK.

2.9 DUCTWORK AND PLENUM SEALERS

.1 Provide duct sealing compounds for use in fabrication of all ductwork and plenum joints.

.2 All ductwork shall be sealed to SMACNA Seal Classification A.

.3 Standard of Acceptance:

.1 Foster 32-14, Hardcast Versa Grip, Hardcast Foil Grip 1402, Robson’s Duct Seal-WB, United Duct Sealer, Trans Continental Multi-Purpose.

.4 Where accessible, apply sealer to inside of joints on ducts and plenums under positive pressure - e.g. on the discharge side of fans.

.5 Apply sealer to outside of joints on ducts and plenums under negative pressure - e.g. on the suction side of fans.

2.10 FIRE DAMPERS

.1 Minimum Requirements:

.1 Fire dampers shall be U.L.C. or Warnock Hersey tested and shall bear the testing agency's label.

.2 Fire dampers shall meet requirements of the applicable codes and authorities having jurisdiction.

.3 All fire dampers shall be “dynamic”; rated to close under airflow.

.4 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire separation.

.5 Fusible link actuated and shall have a spring-closing operator.

.6 Fire dampers in low-pressure ductwork may be multi blade or curtain type.

.7 Fire dampers in medium and high-pressure ductwork shall be curtain type.

.8 Curtain fire dampers shall have blades retained in a recess so free area of connecting ductwork is not reduced.

.9 Fusible links: U.L.C. approved with a melting point of 74°C [165°F] on supply, return and exhaust air systems. Use fusible links with a melting point of 141°C [286°F] on all return and exhaust air systems if used for smoke venting.

2.11 FIRE/SMOKE COMBINATION DAMPERS

.1 Minimum Requirements:

.1 Smoke dampers to be labelled to ULC Standard CAN/ULC S112.1-M90 and UL 555S.

.2 Pivoted blade type.

.3 Auxiliary operating shaft.

.4 Galvanized steel frames, blades, gussets and blade stops.

.5 Stainless steel jamb seals.

.6 Silicone rubber blade seals.

.7 Factory assembled caulked sleeve to required length (Contractor to advise).

.8 U.L.C. approved fusible links with a melting point of 74°C [165°F] on supply, return and exhaust air systems. Use fusible links with a melting points of 141°C [286°F] on all return air and exhaust air systems when used for smoke venting.

.9 For all dampers less than 0.25 sq.m. [2.7 sq.ft.] the damper size shall be the same size as the duct size measured inside the damper frame. Enlarge ducts to accommodate damper frames.

.10 Smoke dampers shall be equipped with two CSA approved end switches linked directly to the damper blade. End switches shall provide positive status indication of full open and full closed blade position. Mount switches in self-contained enclosure and wired outside of duct.

.11 Actuators for smoke dampers shall be supplied with the smoke dampers as a single entity which meets all applicable UL555 and UL555S qualifications for both dampers and actuators. Actuators shall be rated for 177°C [350°F] elevated temperature classification. Actuators shall be mounted so that the supply duct smoke damper fails to the closed position and return/exhaust dampers fail to the open position.

.12 Actuators (unless otherwise noted) shall be 120/1/60. Coordinate with Div. 16.

.2 Standard of Acceptance: Leakage Class II, Ruskin FSD-36; Controlled Air FSD-3V-57.

2.12 FIRE DAMPERS - CEILING

.1 Minimum Requirements:

.1 U.L.C. tested and labelled.

.2 Spring loaded heat retardant blanket or insulated damper blades.

.3 74°C [165°F] fusible links.

.4 Where diffuser/grille neck is smaller than diffuser/grille face area, provide U.L. listed C.K. 2000 thermal blanket over ceiling space side of exposed diffuser/grille.

.5 Install above each diffuser/grille mounted in fire rated ceiling.

.6 Provide transition plates (round to rectangular).

.7 Refer to Mechanical Details in Section 23 06 01.

.2 Standard of Acceptance: Controlled Air CFS/CFSR, Ruskin CFSR, Nailor Hart.

2.13 FIRE DAMPERS - COMBINATION REGISTER DAMPER

.1 Minimum Requirements:

.1 Warnock-Hersey tested and labelled.

.2 Combined opposed blade damper with spring tensioned fusible link.

.3 Fasten to 3.23 mm thick [10 ga] steel sleeve, all welded with integral flange on register side.

.4 Refer to Mechanical Details Section 23 06 01.

.2 Standard of Acceptance: E.H. Price VCS-4, Tuttle & Bailey 90A.

2.14 FIRE STOP FLAPS

.1 Minimum Requirements:

.1 Single damper flap with spring catch.

.2 U.L.C. tested and labelled.

.3 Construct of minimum 1.35 mm [16 ga] thick sheet steel with 1.6 mm [1/16"] thick [asbestos] on unexposed side and corrosion-resistant pins and hinges.

.4 U.L.C. approved fusible links with a maximum melting point of 74°C [165°F].

.5 Arranged so as not to reduce duct free area.

.2 Standard of Acceptance: Ruskin CFSF.

2.15 INSTRUMENT TEST PORTS

.1 Application:

.1 Provide instrument test ports in each plenum access door (unless more than one door serves a plenum compartment).

.2 Locate ports to permit easy reading of instruments.

.2 Minimum Requirements:

.1 1.35 mm [16 ga] thick steel zinc plated after manufacture.

.2 Cam lock handles with neoprene expansion plug and handle chain.

.3 25 mm [1"] minimum inside diameter. Length to suit insulation thickness.

.4 Neoprene mounting gasket.

.3 Standard of Acceptance: Duro Dyne IP1 or IP2.

Part 3 Execution

3.1 BALANCING DAMPERS

.1 Provide balancing dampers at points on low pressure supply, return and exhaust systems where branches are taken from larger duct as required for proper air balancing.

.2 Provide balancing dampers at each run out to a grille or diffuser.

.3 Identify the airflow direction and blade rotation and open and closed position.

.4 On all round ductwork larger than 300 mm [12"] diameter and on externally insulated rectangular ductwork, provide sheet metal bridge to raise quadrant type operators above the insulation thickness (coordinate with Section 23 07 13). Provide an open end bearing where bridges are used. Bridges on uninsulated round ducts shall be at least 25 mm [1"] high.

.5 Where quadrant type operators are used, the lever shall be arranged parallel with the damper blade.

3.2 BACKDRAFT DAMPERS

.1 Install backdraft dampers on all exhaust and relief openings through the building walls and roof on all exhaust fans where control dampers are not called for or indicated.

3.3 CONTROL DAMPERS - AUTOMATIC

.1 Packaged equipment specified to be complete with control dampers, shall include control dampers as normally supplied by the equipment manufacturer unless otherwise noted.

.2 All other automatic control dampers are specified in the Controls Sections.

.3 Under this section be responsible for receipt, handling, storage and installation of control dampers supplied under the Control Sections.

.4 The indicated size of control dampers is the dimension outside the frame. Oversize the ductwork to include the depth of the damper frame if the pressure drop across the damper exceeds 25 Pa [0.1" w.g.].

.5 Control damper frames shall be fitted tightly into ductwork and sealed airtight.

.6 Check that dampers are installed square and true. Ensure that damper end linkages are easily accessible.

.7 Do not install control dampers within the thickness of any wall unless otherwise indicated.

.8 Control dampers on the roof shall be rated for outdoor weather conditions.

3.4 DUCT AND PLENUM ACCESS

.1 Locations: Provide access doors and panels as follows:

- .1 Doors: where shown on the drawings.
- .2 Panels:
  - .1 Every 12 m [40 ft] on all ductwork.
  - .2 At the base of each duct riser.
  - .3 Both sides of equipment blocking the duct e.g.
    - .1 air flow measuring stations
    - .2 coils
  - .4 At or to one side of other equipment in duct e.g
    - .1 backdraft dampers (counterweight side)
    - .2 balance dampers serving multiple outlets/inlets
    - .3 bearings (fans/motors)
    - .4 control dampers
    - .5 control sensors
    - .6 fire dampers (rectangular ducts and round ducts 330 mm [13"] dia. and larger - latch side)
    - .7 heat detectors (upstream from device)
    - .8 smoke dampers (operator side)
    - .9 smoke detectors (upstream from device)
  - .5 Panels need not be provided where access is available through a door or a register mounted on the side of the duct.
  - .6 Kitchen exhaust access requirement specified under "Ductwork - Kitchen Exhaust".
- .3 Patches:
  - .1 Where required for cleaning and where access panels are not specified, e.g. on both sides of turning vanes.
- .4 Flexible duct - on round duct and round fire dampers up to 300 mm [12"] dia.

.2 Seal frames airtight.

.3 Install so as not to interfere with airflow.

.4 Install to provide easiest possible access for service and cleaning.

.5 Do not use sheet metal screws for attaching access panels to ductwork.

.6 Round ducts 330 mm [13"] dia. and larger shall include a short collar for the installation of access panels.

.7 Small rectangular ducts shall be transitioned to a minimum dimension across the duct of 330 mm [13"] for the installation of access panels.

3.5 DUCT CONNECTORS - VIBRATION ISOLATION

.1 Ensure flexible duct connectors do not reduce duct free area on suction side of fans.

3.6 DUCTWORK – FLEXIBLE

.1 Installed lengths shall be limited to 6 times duct diameter but not longer than 1200 mm [4 ft].

.2 Connect to ductwork and diffusers with stainless steel worm drive clamps or Panduit adjustable clamps or Thermaflex duct strap applied over two wraps of duct tape. Use stainless steel clamps on connections to fire dampers.

.3 Minimum centreline radius of flexible ductwork bends shall be 1.5 times the duct diameter, alternatively, sheet metal elbows may be used at branch takeoffs and boot/diffuser connections.

.4 Support with 25 mm x 0.76 mm [1" x 22 ga] galvanized steel straps at a maximum of 600mm [24"]. Straps shall completely encircle duct.

.5 Support clear of ceiling assembly, light fixtures and hot surfaces.

3.7 FIRE DAMPERS

.1 Install in accordance with the SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems.

.2 Fire damper sleeves must not extend more than 75 mm [3"] from wall on each side.

.3 Fire dampers must be installed within wall thickness of fire separation.

.4 Wall openings sized to allow sleeve/damper expansion.

.5 Arrange dampers so that linkages and locking catches are accessible from the access side of fire damper.

.6 Install so as to close in the direction of normal airflow.

.7 Size so that the free area of duct is maintained through the assembly.

.8 Install in galvanized steel sleeve, retained in place with retaining angles on all four sides at each face of wall.

.9 Connect ductwork to damper sleeves using break-away duct joints on all faces.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 QUALITY ASSURANCE

.1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency signifying adherence to codes and standards

Part 2 Products

2.1 GENERAL

.1 For details and performance, refer to separate equipment lists.

2.2 AIR TERMINALS

.1 Grilles, registers and diffusers shall be product of one manufacturer.

.2 Refer to drawings for sizes and air quantities.

.3 Base air outlet application as follows:

Room Type/Usage	NC (max)
Corridors and Public Spaces	35-40
Offices	30-35
Conference/Meeting Rooms	30-35
Consultation Rooms	35-40
Exercise Rooms	40-45

.4 All air terminals must be checked for compatibility with ceiling types. Refer to Architectural reflected ceiling plans.

.5 Ceiling tee-bar modules are in soft conversion metric, [SI metric], measurements unless where specifically noted otherwise.

.6 The manufacturer (other than the design listed) shall match performance data and indicate a specific comparison for each item, with the shop drawing submission.

.7 All ceiling mounted air terminals shall be provided with means for attachment of two seismic security wires at opposite corners of each air terminal.

.8 Provide concealed baffles, where necessary, to direct air away from walls, columns or other obstructions within the radius of air terminal operation.

.9 Provide auxiliary frames for diffusers located in drywall ceilings and grilles mounted in gyroc walls in public areas. In other areas the grilles should be attached to the ductwork, flanged to the outside of the wall opening.

Part 3 Execution

3.1 AIR TERMINALS

.1 Install with cadmium plated screws in countersunk holes where fastenings are visible.

.2 Install ductwork as high as practical, using offsets where required to obtain maximum duct neck lengths for diffusers.

.3 Refer to Architectural Reflected Ceiling plans for exact locations of air terminals.

.4 Paint ductwork behind grilles with matte black paint where duct or insulation surfaces are visible.

.5 Attach registers and grilles to branch ducts with duct necks having minimum length to prevent grille or register damper from protruding into branch duct.

.6 Where air terminals are installed in mechanical grid ceilings, provide at least two 12 ga. galvanized steel wire seismic security bridles per air terminal tied either to the building structure or to ceiling hanger wires. Attach security bridles at opposite corners of each air terminal and in such a manner that the air terminal cannot fall.

.7 Hand over door grilles to the General Contractor for installation.

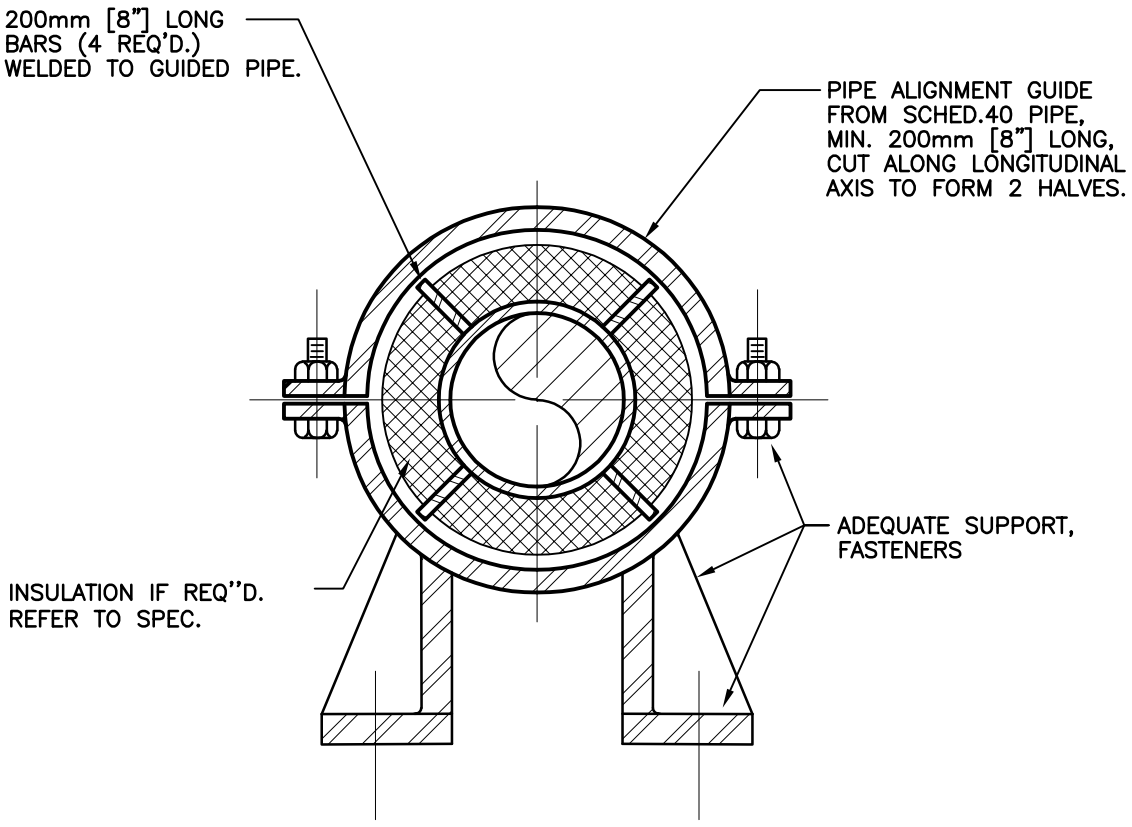
.8 Diffuser, grille, and register cores in air systems shall be removable for cleaning

END OF SECTION

DETAIL NUMBER	DETAIL NAME
MD 02 000	**Pipe Hangers and Supports**
MD 02 001	PIPE GUIDE
MD 02 002	PIPE HANGERS
MD 02 003	PIPE SUPPORT – ROLL HANGERS
MD 02 005	PIPE GUIDE AT FLOOR SLAB
MD 02 006	PIPE ANCHOR AT FLOOR SLAB
MD 02 007	PIPE ANCHOR ON ROOF
MD 07 000	**Pipe Penetrations**
MD 07 001	PIPE PENETRATION THROUGH ROOF
MD 07 002	PIPING PENETRATIONS THROUGH ROOF
MD 07 009	PIPE & DUCT PENETRATION THROUGH NON-RATED WALLS
MD 07 010	PIPE PENETRATION THROUGH FIRE-RATED SEPARATION
MD 08 000	**Equipment Piping Connections**
MD 08 011	EXPANSION LOOP DETAIL
MD 10 000	**Piping to Radiant Ceiling Panel**
MD 10 017	RADIANT CEILING PANEL
MD 10 18	RADIANT CEILING PANEL CONNECTION DETAIL
MD 10 19	LINEAR RADIANT CEILING PANEL CONNECTION DETAIL
MD 09 000	**Piping to Coils**
MD 09 011	DUCT MOUNTED REHEAT COIL INSTALLATION
MD 21 000	**Sheet Metal / Ducting**
MD 21 002	DUCT TAKE-OFF CONNECTION
MD 21 041	FAN / DUCT FLEXIBLE CONNECTION
MD 21 043	GOOSENECK EXHAUST OR INTAKE
MD 22 000	**Duct Penetrations**
MD 22 005	DUCTING THROUGH ROOF
MD 22 008	DUCT PENETRATION THROUGH ROOF

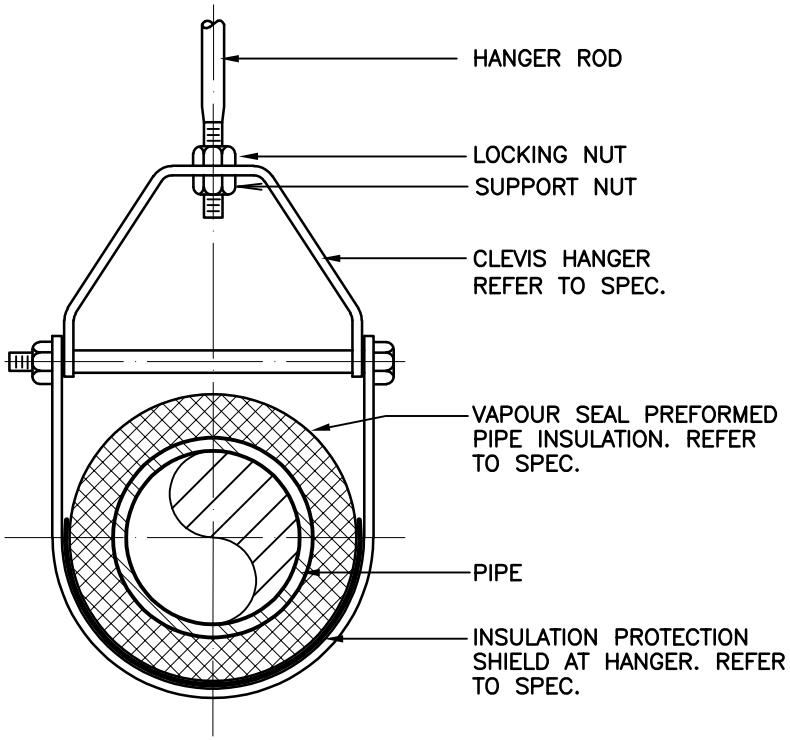
MD 22 012	ROOF CURB CAP
MD 22 013	DUCT PENETRATION THROUGH ROOF
MD 23 000	**Roof Mounted Equipment**
MD 23 010	EQUIPMENT ROOF PADS/PIERS
MD 23 013	EQUIPMENT ROOF CURB
MD 23 016	TYPICAL DUCT/PIPE SUPPORT ON ROOF
MD 23 021	TYPICAL DUCT SUPPORT FROM WALL
MD 28 000	
MD 28 001	FIRE DAMPER (TYPE “B”)
MD 28 003	ACCESS TO FIRE DAMPER (ROUND DUCT UP TO 300 MM [12”])
MD 28 004	CEILING DAMPER / FIRE STOP INSTALLATION
MD 28 006	FIRE DAMPER AND SUPPLY GRILLE INSTALLATION
MD 29 000	**Air Terminal Units**
MD 29 002	AIR VALVE INSTALLATION (RE-HEAT COIL)
MD 30 000	**Air Terminals**
MD 30 002	RETURN/EXHAUST GRILLE WITH PLENUM
MD 30 006	GRILLE MOUNTED ON EXPOSED RECTANGULAR DUCT
MD 30 007	DUCT CONNECTIONS TO AIR TERMINAL UNITS
MD 30 011	SUPPLY AIR DIFFUSER
MD 30 013	EXHAUST/RETURN AIR PLENUM
MD 30 014	REMOTE BALANCING DAMPER
MD 30 015	REMOTE BALANCING DAMPER (FOR DRYWALL CEILINGS)

END OF SECTION

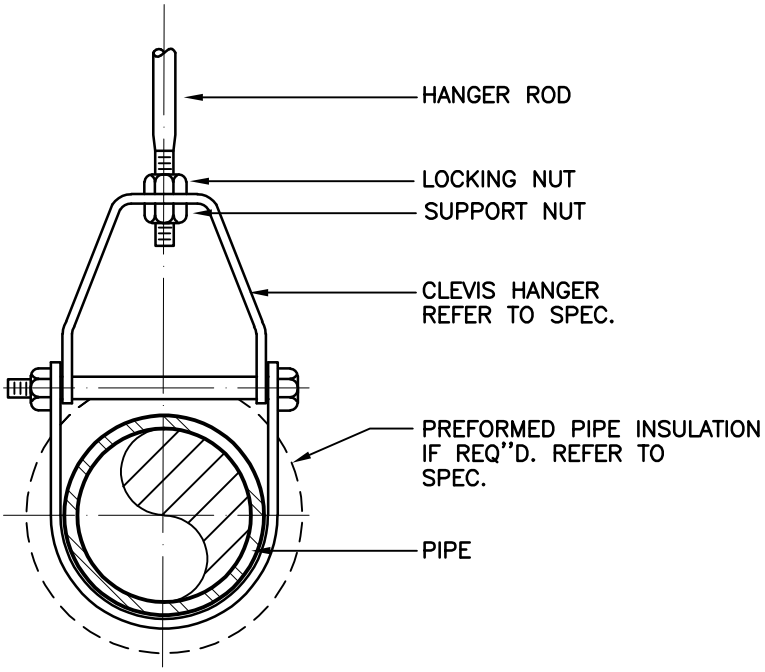

200mm [8"] LONG
BARS (4 REQ'D.)
WELDED TO GUIDED PIPE.
PIPE ALIGNMENT GUIDE
FROM SCHED.40 PIPE,
MIN. 200mm [8"] LONG,
CUT ALONG LONGITUDINAL
AXIS TO FORM 2 HALVES.
ADEQUATE SUPPORT,
FASTENERS
INSULATION IF REQ''D.
REFER TO SPEC.

FOR NPS 2–1/2 PIPE AND LARGER. REFER TO SPEC. FOR INSERTS OR HIGH DENSITY INSULATION AT INSULATION PROTECTION SHIELDS.

FOR COLD PIPING 10°C [50°F] OR LESS.

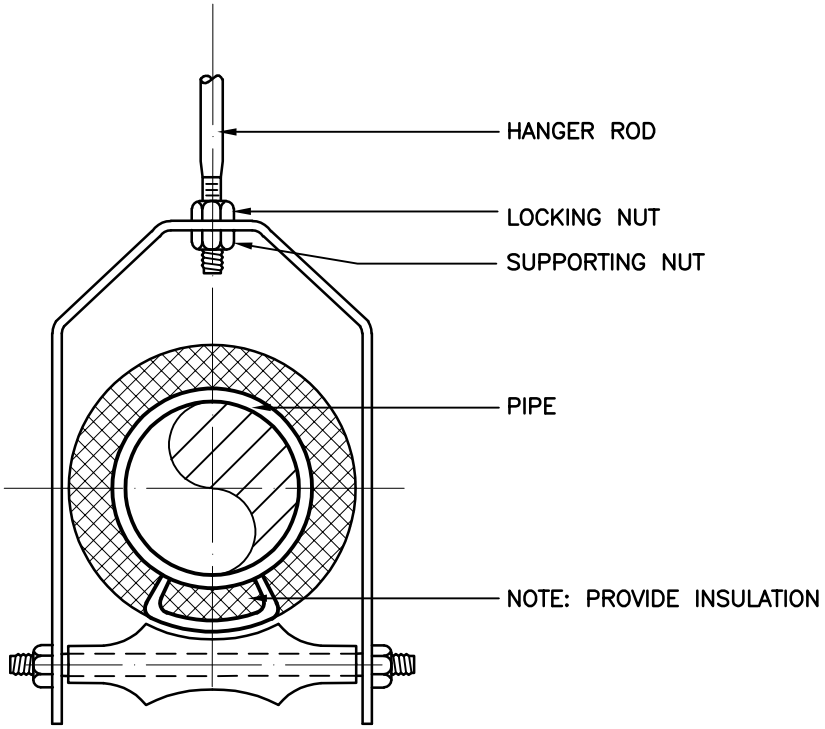


HANGER DETAIL FOR PIPING WITH VAPOUR SEALED INSULATION



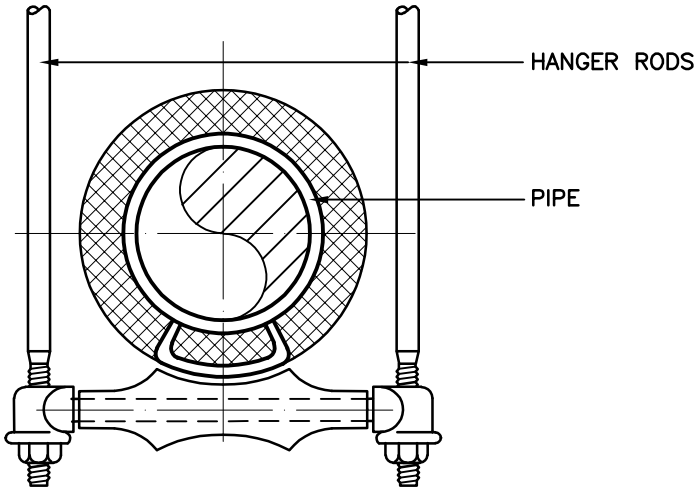
HANGER DETAIL FOR INSULATED HOT PIPING UP TO NPS 3 (75mm) OR ALL SIZES OF BARE PIPE

FOR INSULATED HOT PIPING NPS 4 & 6

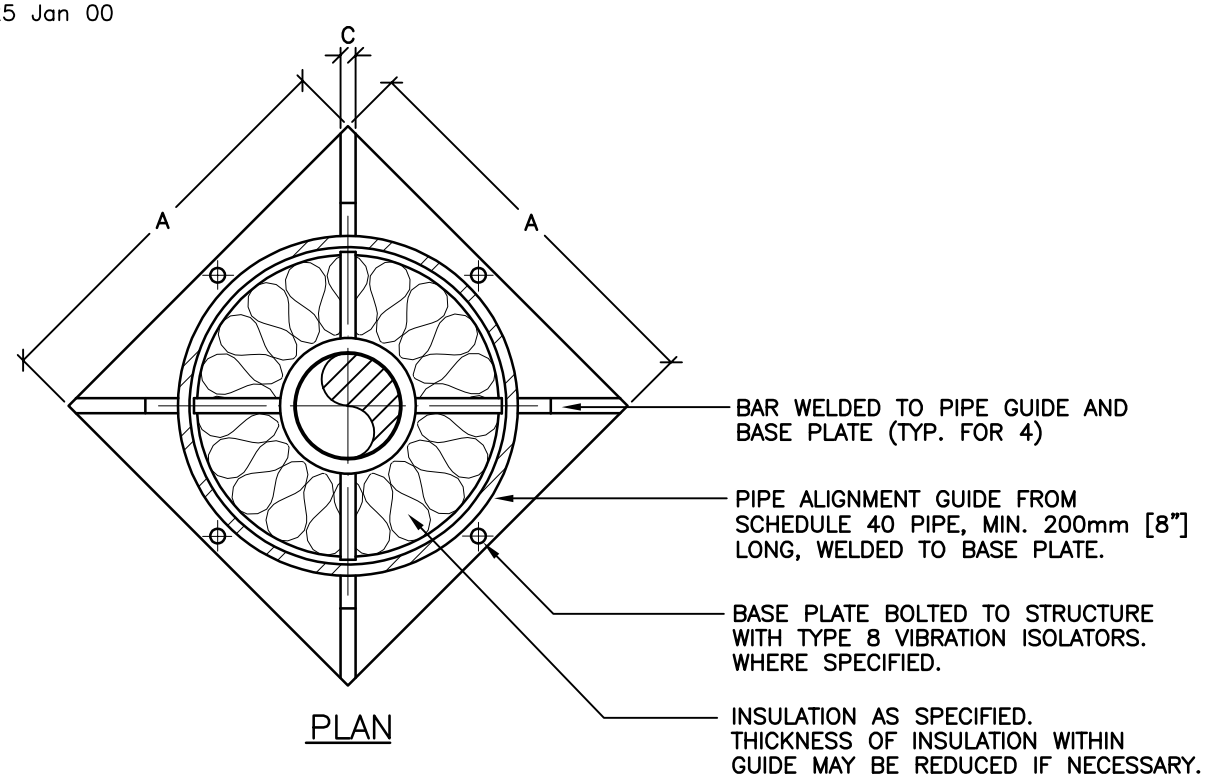


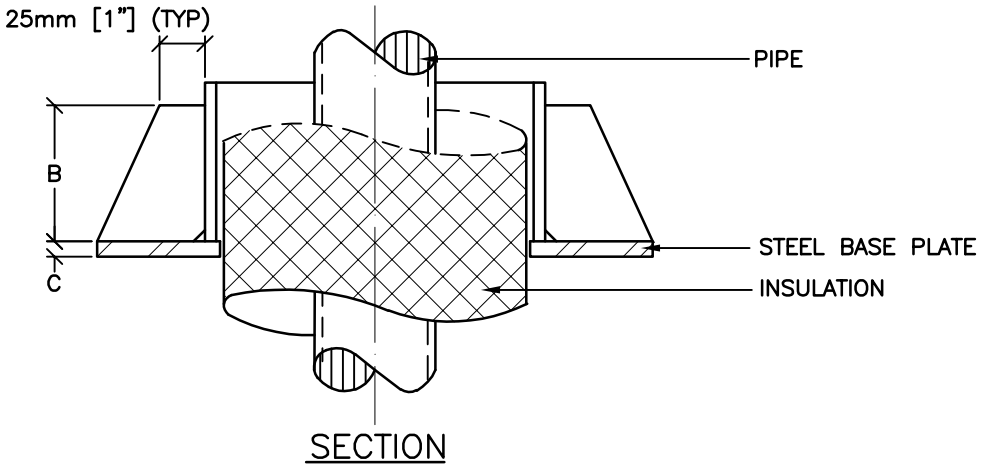
SINGLE ROD HANGER

FOR INSULATED HOT PIPING NPS 8 AND LARGER

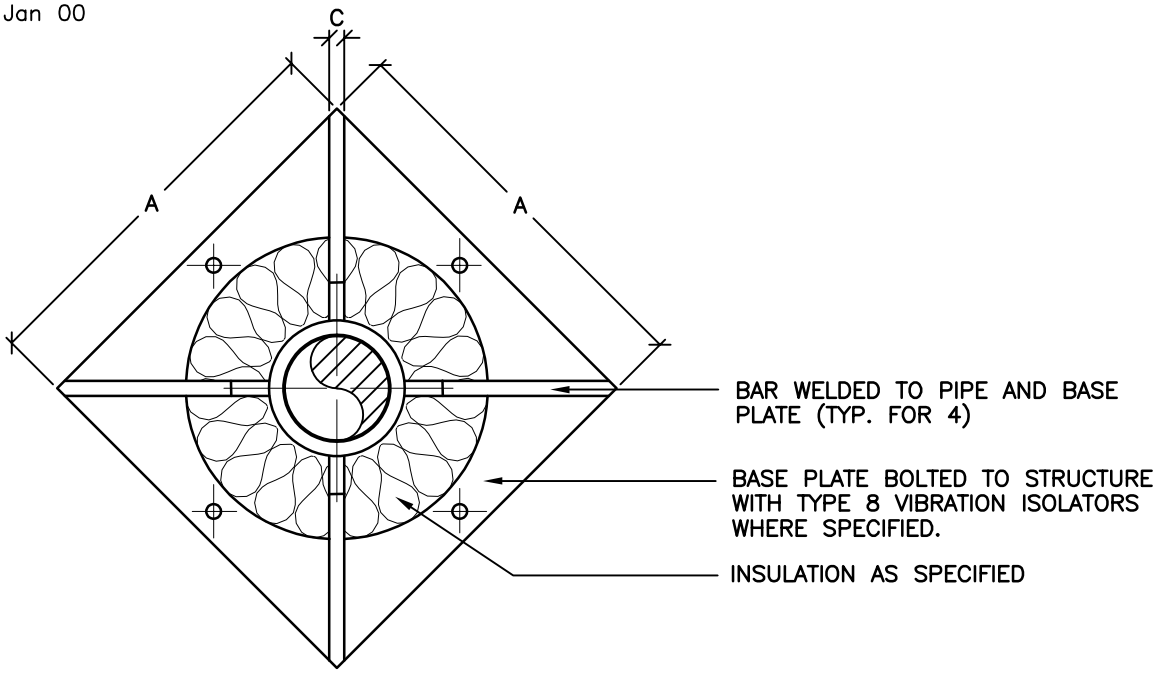


DOUBLE ROD HANGER

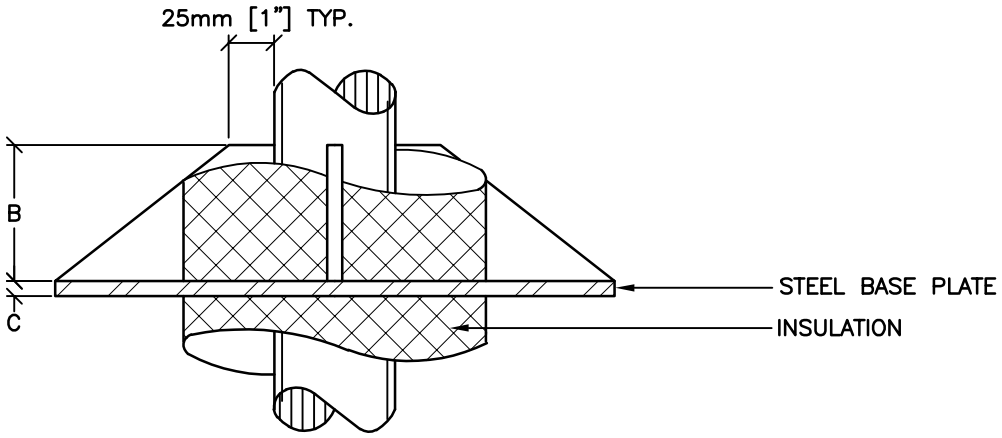




PIPE SIZE	A	B	C
NPS 2	250mm [10"]	100mm [4"]	9.5mm [3/8"]
NPS 2–1/2	400mm [16"]	150mm [6"]	12.5mm [1/2"]
NPS 3	400mm [16"]	175mm [7"]	12.5mm [1/2"]
NPS 4	425mm [17"]	175mm [7"]	12.5mm [1/2"]
NPS 5	475mm [19"]	200mm [8"]	12.5mm [1/2"]
NPS 6	525mm [21"]	200mm [8"]	12.5mm [1/2"]
NPS 8	610mm [24"]	254mm [10"]	19.0mm [3/4"]
NPS 10	711mm [28"]	355mm [14"]	19.0mm [3/4"]



PLAN



SECTION

PIPE SIZE	A	B	C
NPS 2	250mm [10"]	100mm [4"]	9.5mm [3/8"]
NPS 2-1/2	400mm [16"]	150mm [6"]	12.5mm [1/2"]
NPS 3	400mm [16"]	175mm [7"]	12.5mm [1/2"]
NPS 4	425mm [17"]	175mm [7"]	12.5mm [1/2"]
NPS 5	475mm [19"]	200mm [8"]	12.5mm [1/2"]
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NPS 8	610mm [24"]	254mm [10"]	19.0mm [3/4"]
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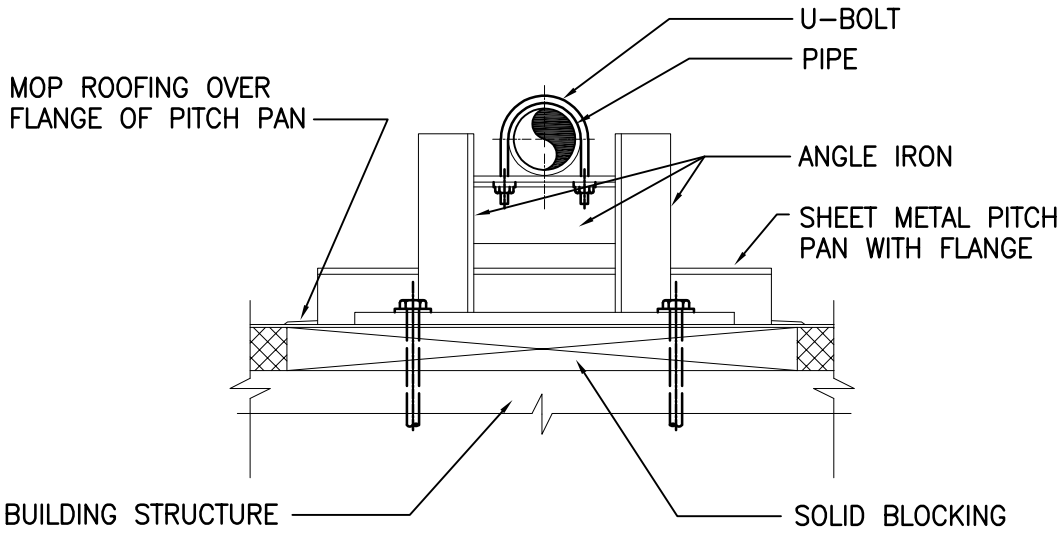
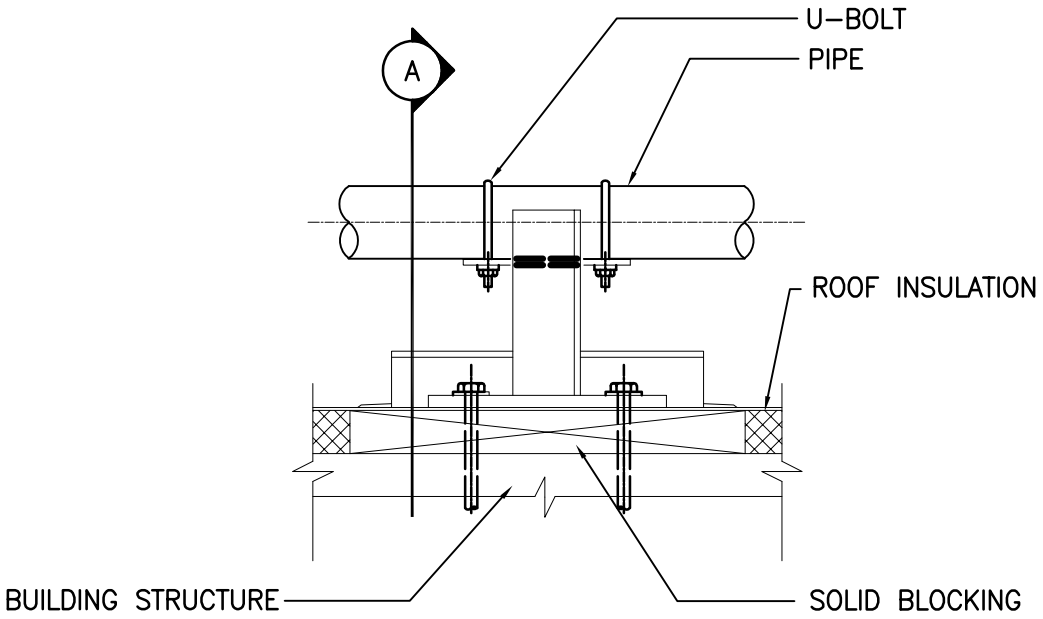
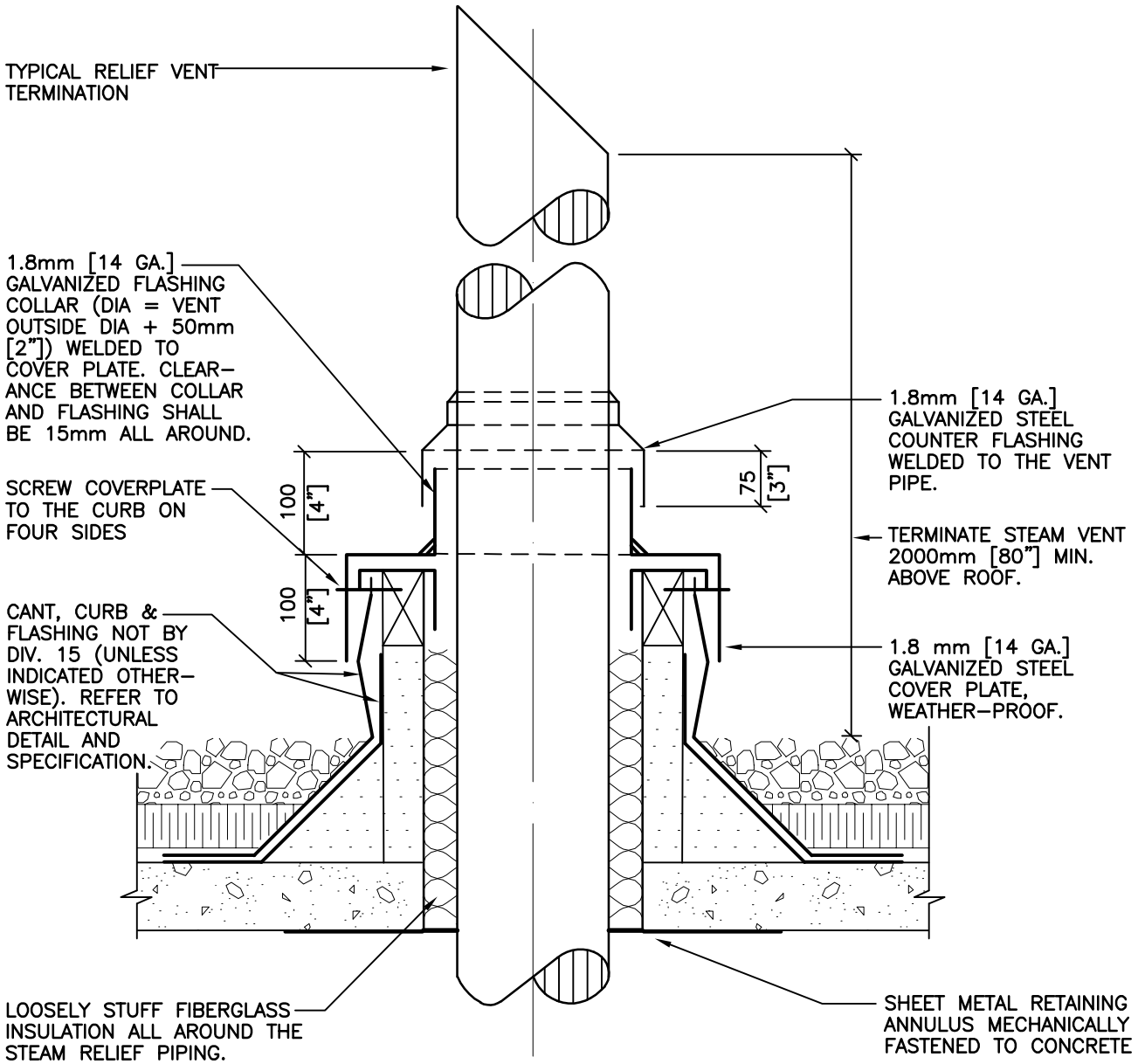
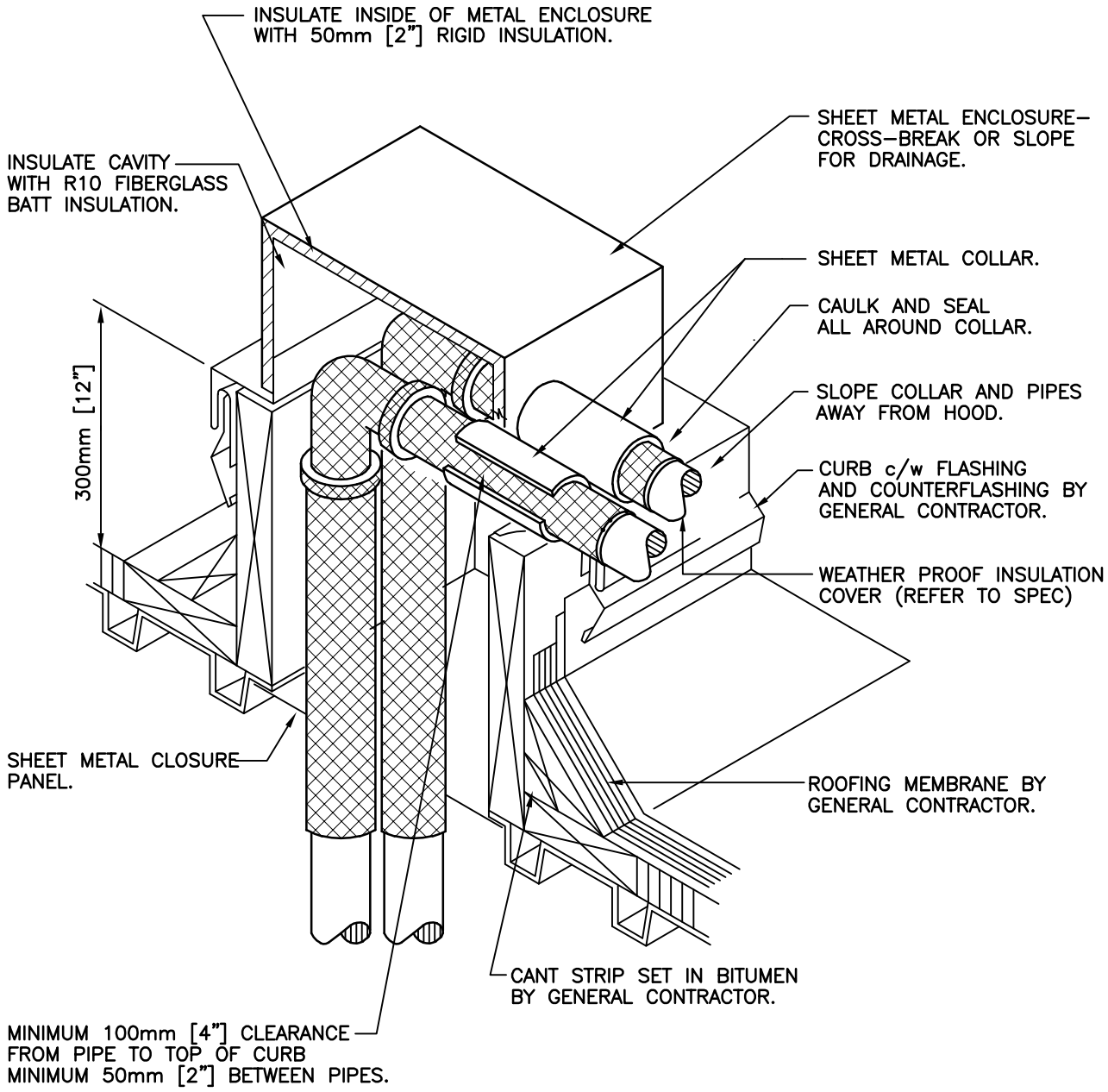

U–BOLT
PIPE
MOP ROOFING OVER FLANGE OF PITCH PAN
ANGLE IRON
SHEET METAL PITCH PAN WITH FLANGE
BUILDING STRUCTURE
SOLID BLOCKING

SECTION A–A

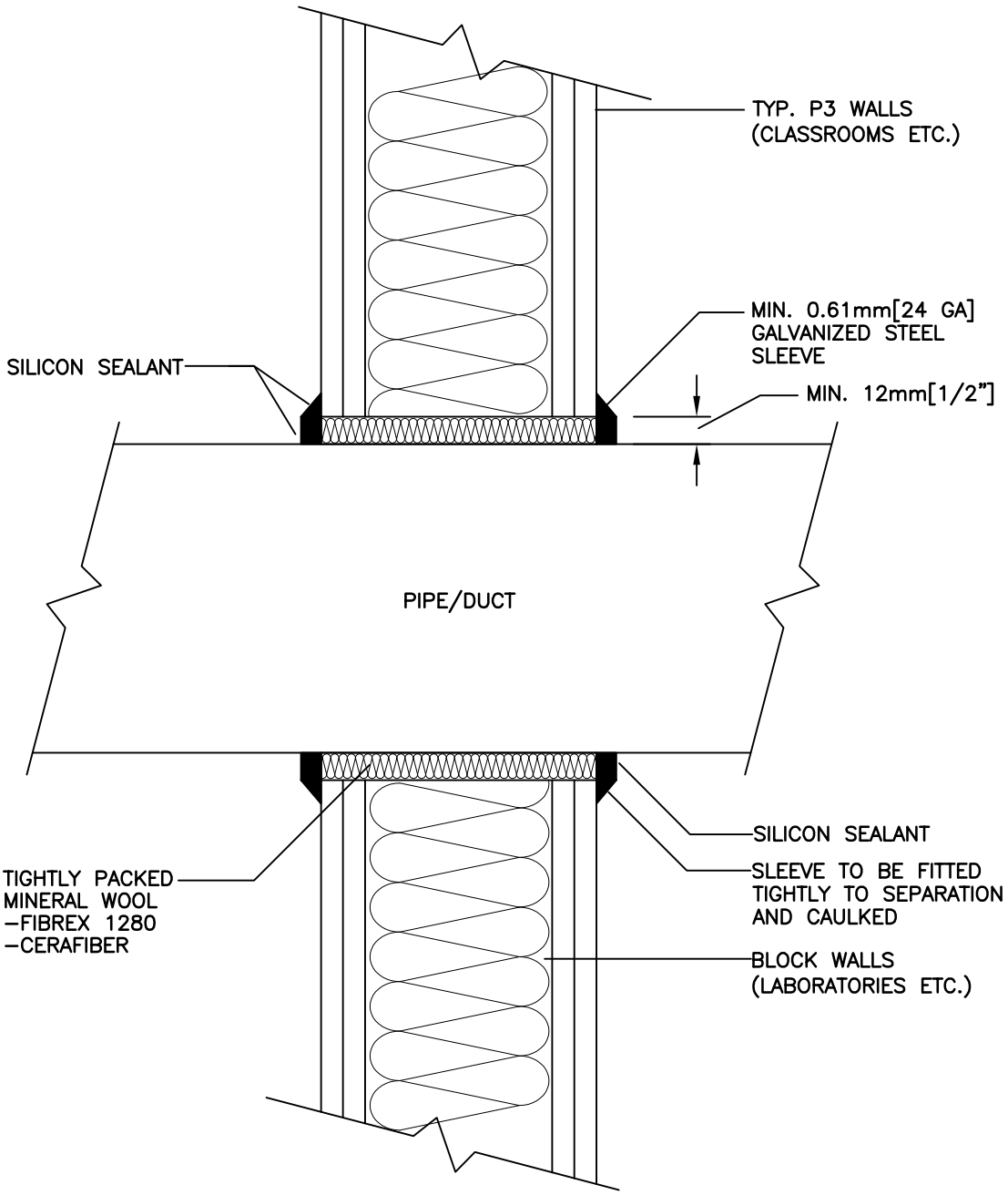

U–BOLT
PIPE
A
ROOF INSULATION
BUILDING STRUCTURE
SOLID BLOCKING


TYPICAL RELIEF VENT TERMINATION
1.8mm [14 GA.] GALVANIZED FLASHING COLLAR (DIA = VENT OUTSIDE DIA + 50mm [2"]) WELDED TO COVER PLATE. CLEAR-ANCE BETWEEN COLLAR AND FLASHING SHALL BE 15mm ALL AROUND.
SCREW COVERPLATE TO THE CURB ON FOUR SIDES
CANT, CURB & FLASHING NOT BY DIV. 15 (UNLESS INDICATED OTHER-WISE). REFER TO ARCHITECTURAL DETAIL AND SPECIFICATION.
LOOSELY STUFF FIBERGLASS INSULATION ALL AROUND THE STEAM RELIEF PIPING.
100 [4"]
100 [4"]
75 [3"]
1.8mm [14 GA.] GALVANIZED STEEL COUNTER FLASHING WELDED TO THE VENT PIPE.
TERMINATE STEAM VENT 2000mm [80"] MIN. ABOVE ROOF.
1.8 mm [14 GA.] GALVANIZED STEEL COVER PLATE, WEATHER-PROOF.
SHEET METAL RETAINING ANNULUS MECHANICALLY FASTENED TO CONCRETE



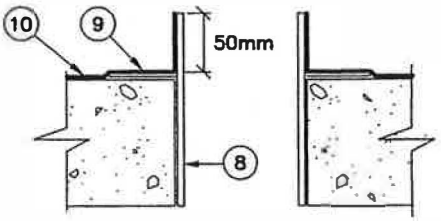
NOTES:

1. ALL WORK BY DIV. 15, UNLESS OTHERWISE NOTED.

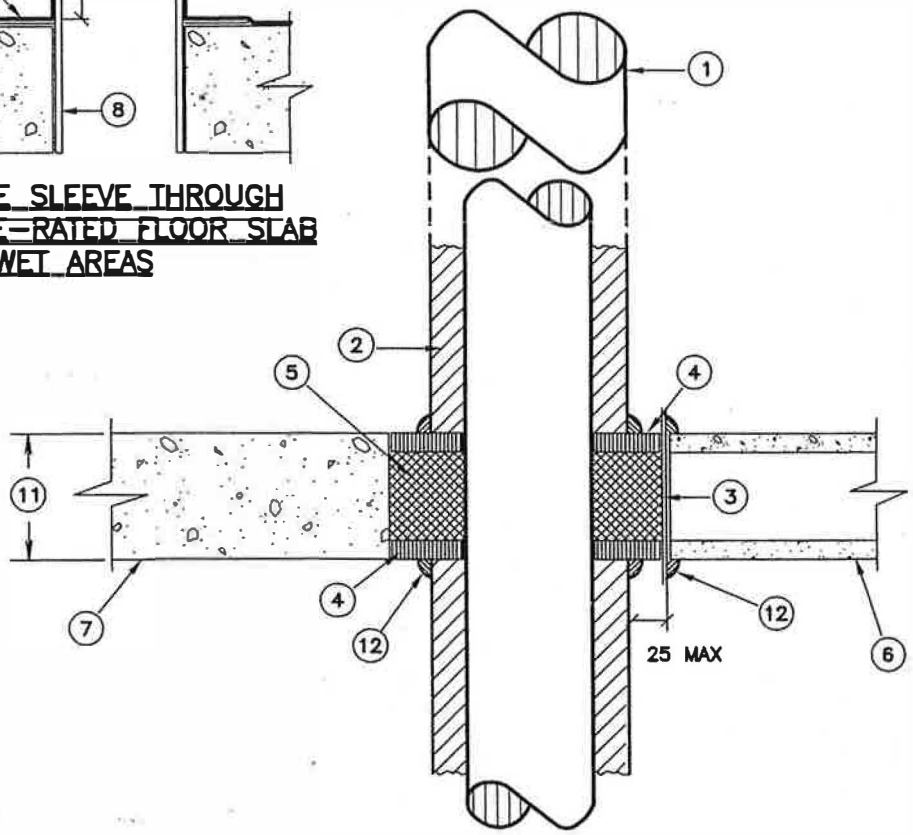


NOTES:

(1) FOR SERVICE PENETRATIONS THRU RATED SEPARATIONS REFER TO SPECIFICATION SECTION 15010–CLAUSE 1.35.



PIPE SLEEVE THROUGH FIRE–RATED FLOOR SLAB IN WET AREAS

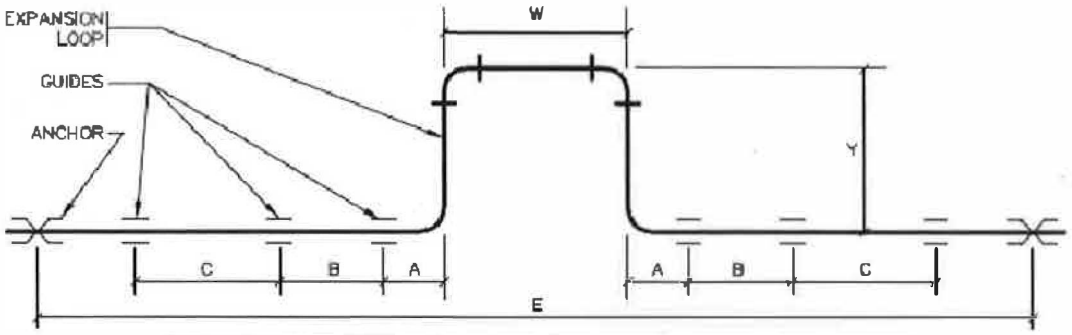


NOTES:

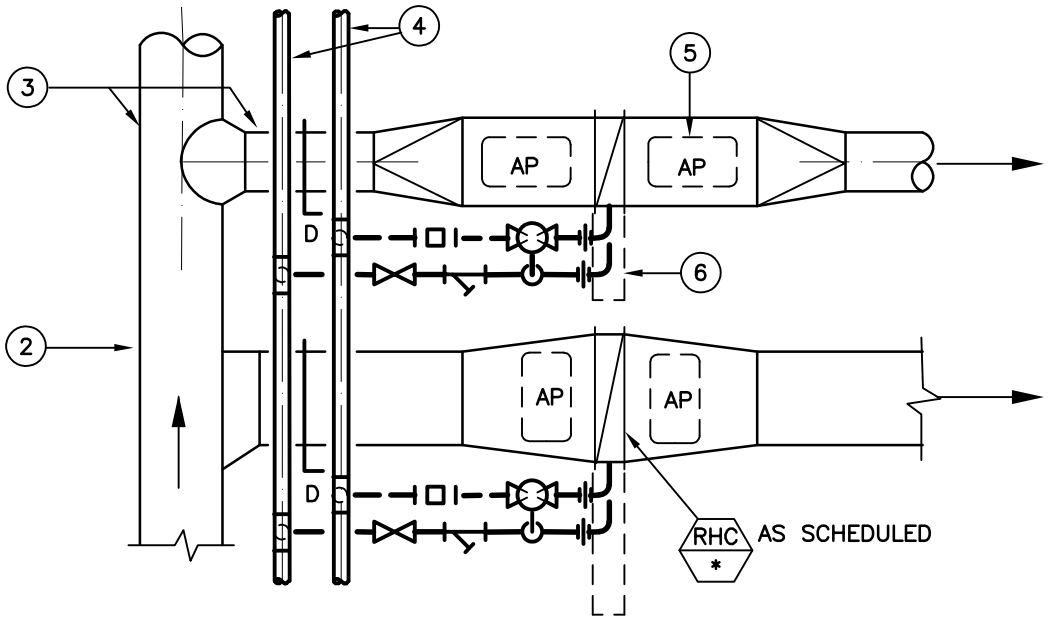
1. UNINSULATED PIPE.
2. INSULATION (AS SPECIFIED). TERMINATE INSULATION AT FIRE STOP.
3. 0.61mm [24 GA] GALVANIZED STEEL SLEEVE (NOT REQ'D. FOR CORE DRILLED CONCRETE OPENINGS). SEE NOTE 8 FOR WET AREAS.
4. MIN. 12mm [1/2"] THICK – U.L.C. APPROVED FIRE STOP SEALANT. SEAL BOTH SIDES (TO MAINTAIN RATING ON GYPROC WALLS; TO RETAIN MINERAL WOOL INSULATION; TO SEAL VAPOUR BARRIER ON COLD PIPES).
5. MINERAL WOOL INSULATION – MANSON "CERAFIBER" OR CARBORUNDUM "FIBERFRAX" TIGHTLY PACKED.
6. FIRE RATED GYPROC WALL.
7. FIRE RATED CONCRETE FLOOR OR WALL.
8. PIPE SLEEVE (SCHED. 40).
9. FLANGE WELDED TO SLEEVE.
10. WATERPROOF MEMBRANE.
11. OVERALL THICKNESS OF MINERAL FIBER PACKING (5) AND FIRE STOP SEALANT (4) TO ENSURE REQUIRED FIRE – RESISTANCE RATING OF SEPARATION.
12. BEAD OF FIRE STOP SEALANT.
13. PIPE INSTALLATION TO ENSURE THAT NO PIPE EXPANSION OCCURS AT FIRE STOP.
14. SUBMIT SHOP DRAWINGS

LOOP SIZING DATA:

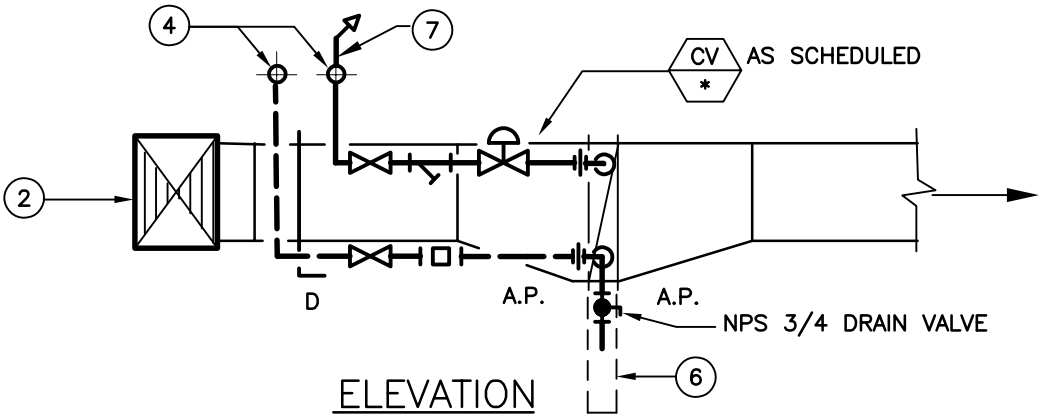
1. USE THESE FORMULAS FOR TEMPERATURE DIFFERENCES NOT EXEEDING 110°C. FOR OTHER CONDITIONS USE THE ASHRAE GUIDE DATA BOOK.
2. LENGTH OF PIPE IN LOOP "L"mm = 2Y + W
3. FOR LENGTH "L" US THE FOLLOWING FORMULAS;
   a. STEEL PIPE $L = 2.67\sqrt{D \times E}$
   b. COPPER PIPE $L = 3.17\sqrt{D \times E}$
4. D = DIAMETER IN mm
5. E = DISTANCE BETWEEN ANCHORS IN mm



ACTUAL DIA. mm	PIPE SIZE mm	MAXIMUM DISTANCE		MAXIMUM SPACING BETWEEN GUIDES
D	NOMINAL	A	B	C
33	25	200	600	3000
42	30	200	600	3000
48	40	200	900	4500
60	50	200	900	4500
73	65	250	1200	6000
89	75	300	1200	6000
114	100	400	1500	9000
168	150	500	3000	10500
219	200	750	3000	13500
273	250	1000	3600	18000
324	300	1200	3600	21000
356	350	1400	3600	21000
406	400	1600	4500	24000
457	450	1800	4500	25500
508	500	2000	6000	27000
610	600	2400	6000	31500



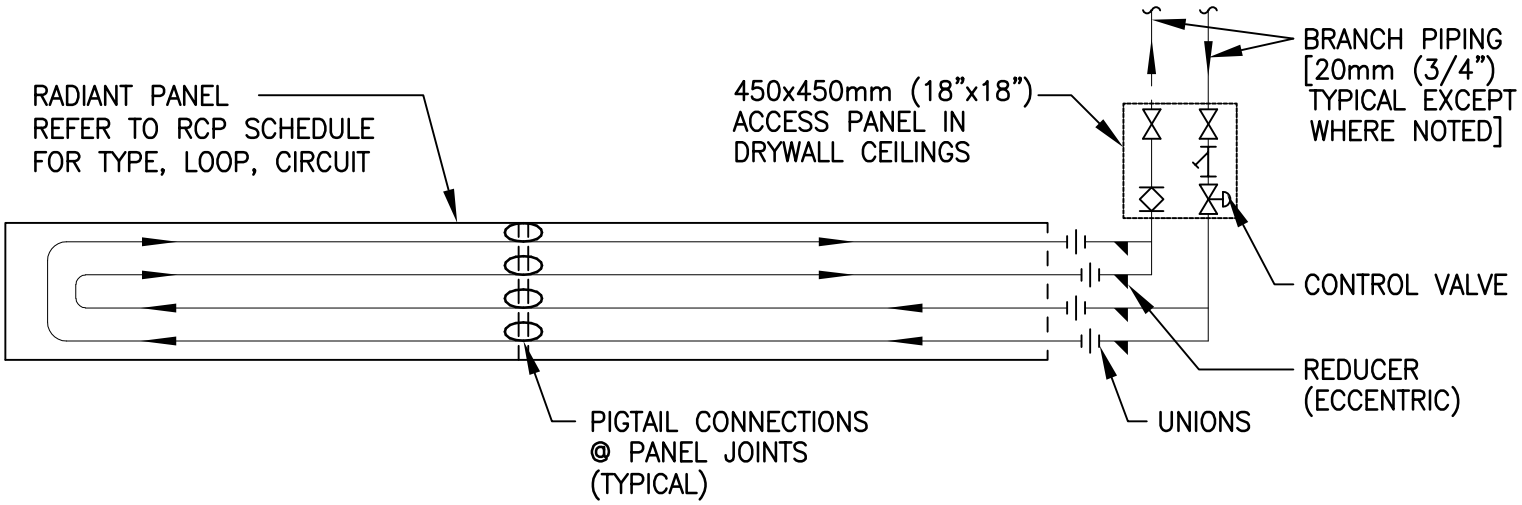
PLAN VIEW



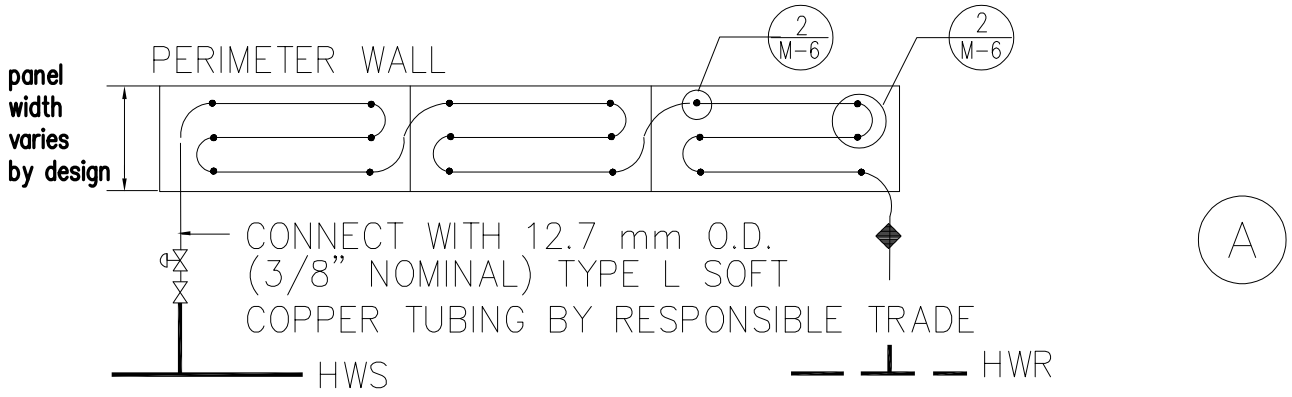
ELEVATION

NOTES:

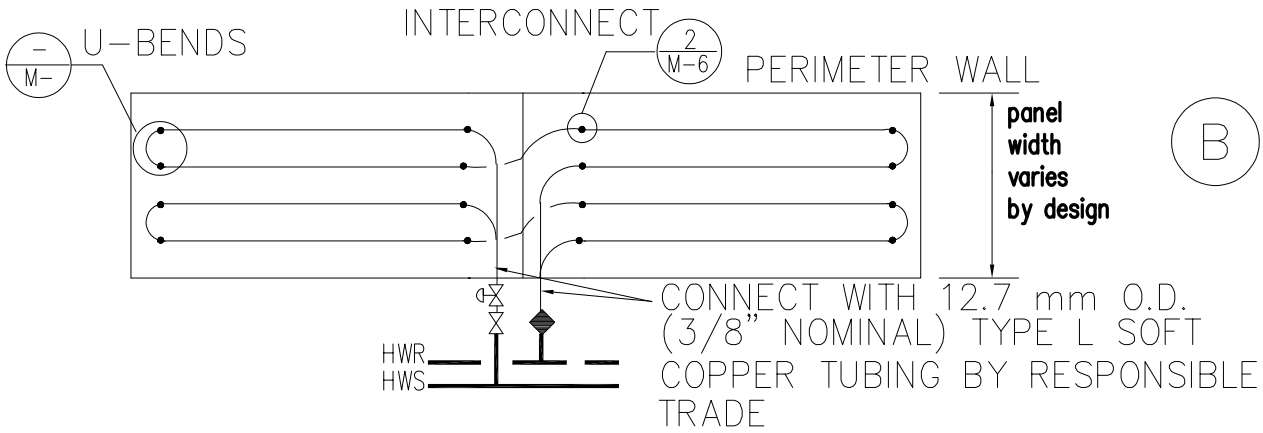
1. SEE MECHANICAL SCHEMATIC FOR PIPING ARRANGEMENT.
2. RECTANGULAR SUPPLY DUCT TYP.
3. ROUND SUPPLY DUCT TYP.
4. HWS & R PIPING.
5. ACCESS PANELS BOTH SIDES OF COIL.
6. CLEARANCE FOR COIL REMOVAL – SIDE OR BOTTOM AS REQ'D.
7. WHERE THE PIPING CONNECTIONS ARE FROM THE TOP OF THE HWS AND HWR MAINS, PROVIDE AUTOMATIC AIR VENT AT THE HIGH POINT ON THE RETURN PIPE FROM THE COIL.


RADIANT PANEL
REFER TO RCP SCHEDULE
FOR TYPE, LOOP, CIRCUIT
450x450mm (18"x18")
ACCESS PANEL IN
DRYWALL CEILINGS
BRANCH PIPING
[20mm (3/4")
TYPICAL EXCEPT
WHERE NOTED]
CONTROL VALVE
REDUCER
(ECCENTRIC)
UNIONS
PIGTAIL CONNECTIONS
@ PANEL JOINTS
(TYPICAL)

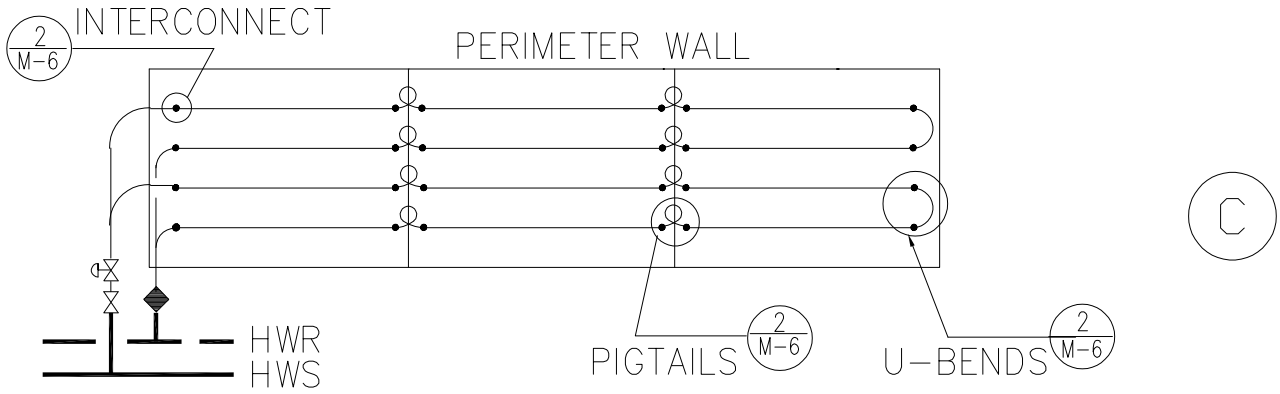
MD 10 018



MULTIPLE PANELS WITH ODD PASS SERPENTINE TUBING



MULTIPLE PANELS WITH EVEN PASS SERPENTINE TUBING

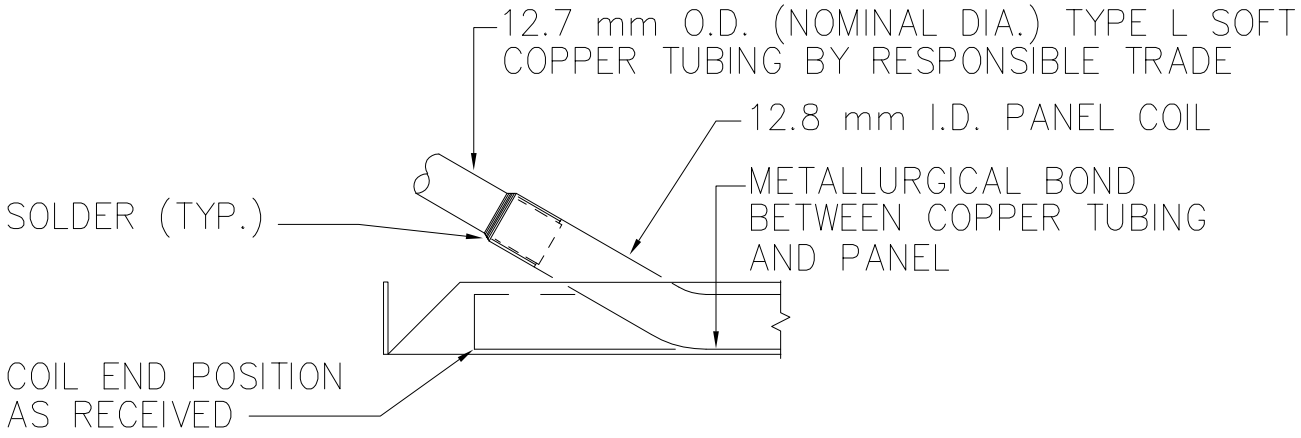


MULTIPLE PANELS WITH EVEN PASS STRAIGHT TUBING

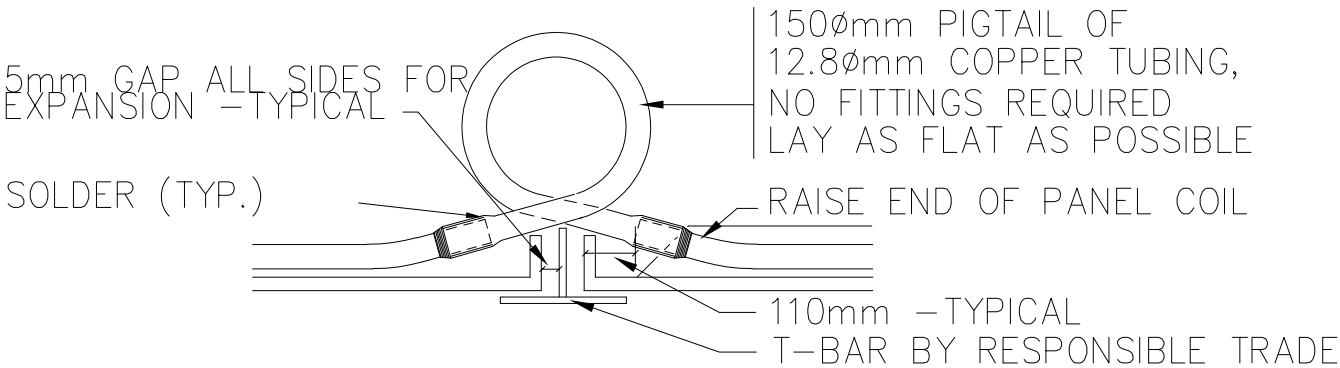
RADIANT PANEL CONNECTION DETAIL

5
M-13

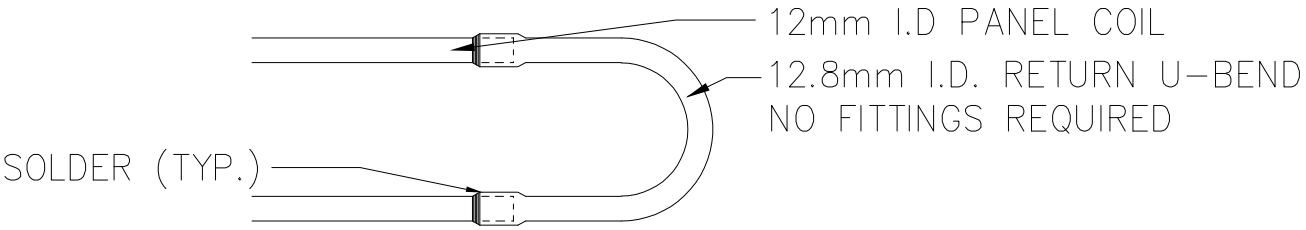
SCALE: N.T.S.



DETAIL OF TYPICAL COIL INTERCONNECT



DETAIL OF TYPICAL PIGTAIL



DETAIL OF TYPICAL U–BEND

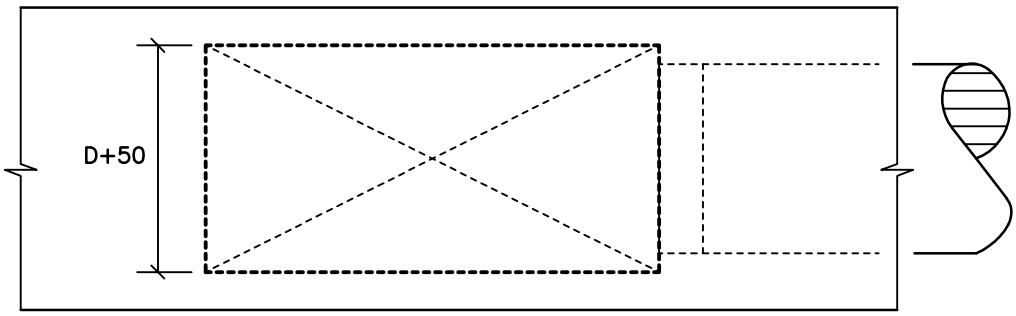
NOTE:

1. PANEL COIL MUST BE RAISED BEFORE INSERTING COPPER TUBING
2. TOOL FOR RAISING END OF COIL AND RESIZING COIL MAY BE OBTAINED FROM SUPPLIER.

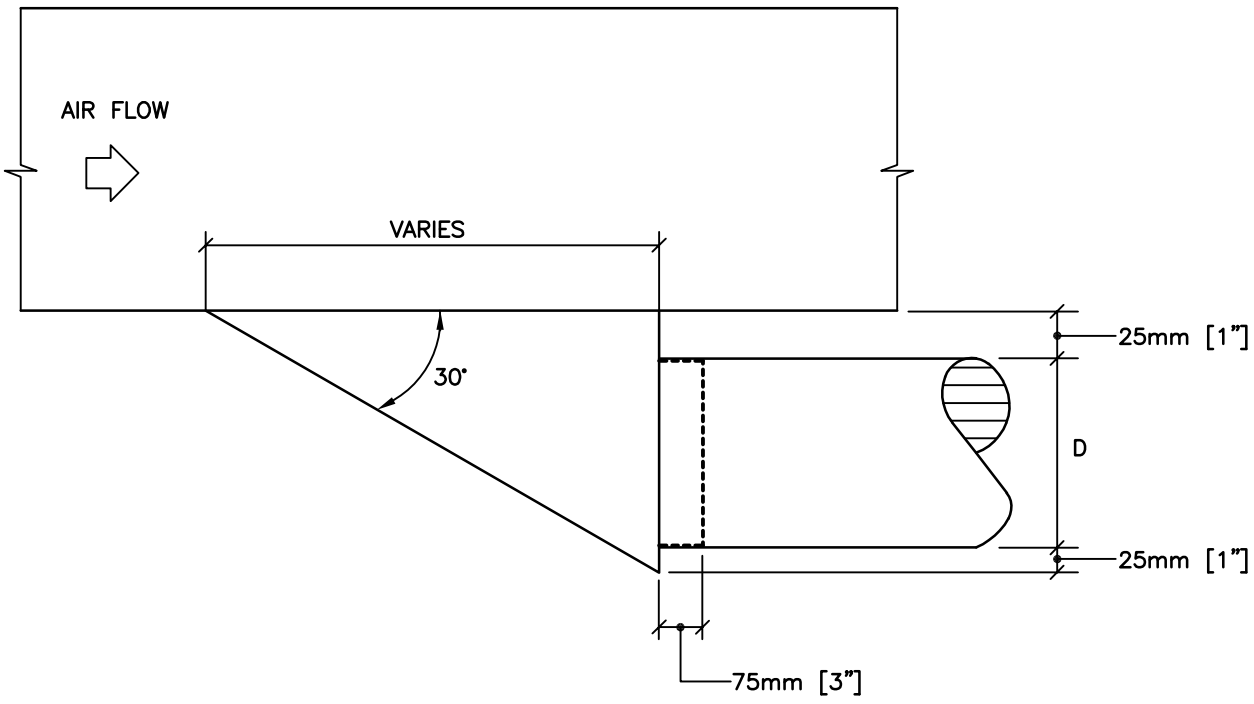
LINEAR RADIANT PANEL CONNECTIONS DETAIL

6
M–13

SCALE: N.T.S.



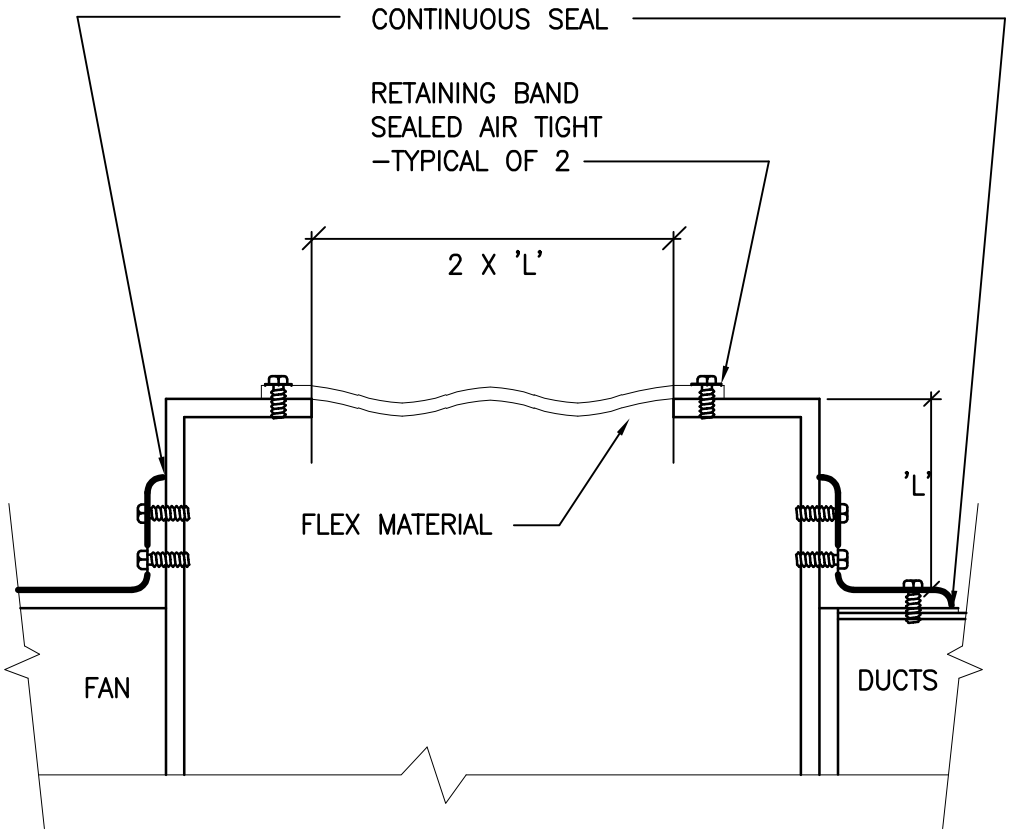
PLAN



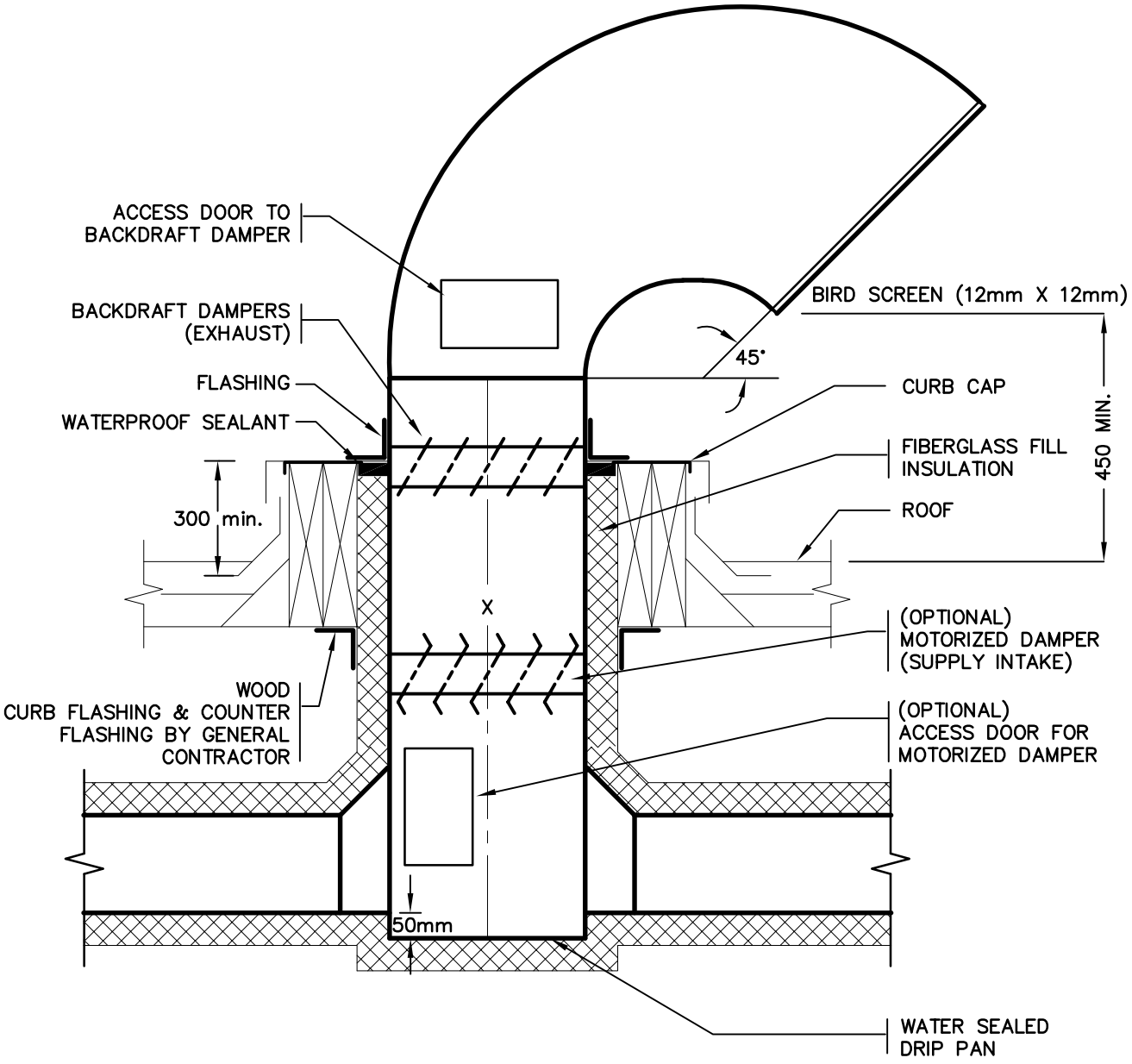
ELEVATION

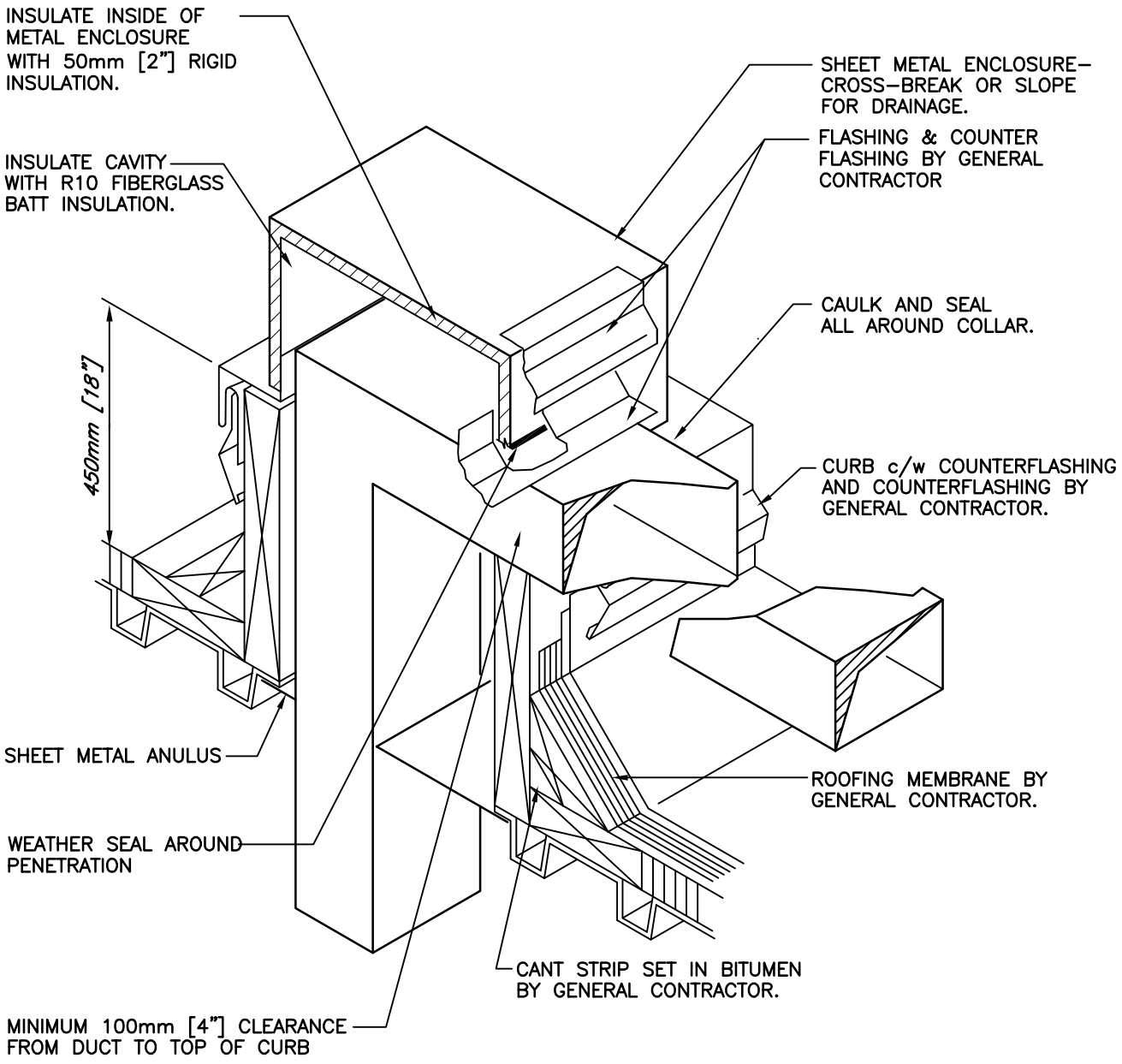
NOTES:

1. D=DIAMETER OF DUCT
2. DUCT TAKE–OFF SHALL BE AS SHOWN UNLESS SHOWN OTHERWISE ON FLOOR PLAN



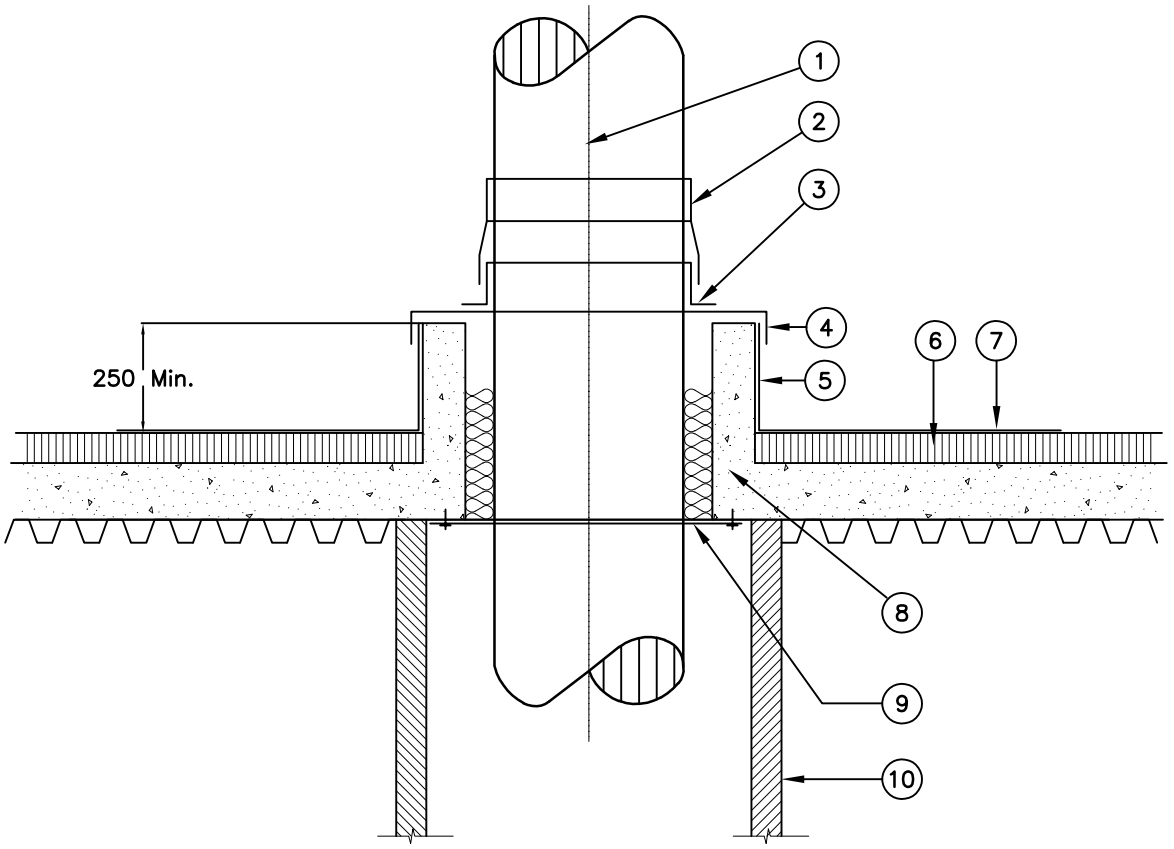
TYPICAL –BOTH SIDES


ACCESS DOOR TO BACKDRAFT DAMPER
BACKDRAFT DAMPERS (EXHAUST)
FLASHING
WATERPROOF SEALANT
300 min.
WOOD CURB FLASHING & COUNTER FLASHING BY GENERAL CONTRACTOR
50mm
X
45°
BIRD SCREEN (12mm X 12mm)
CURB CAP
FIBERGLASS FILL INSULATION
ROOF
450 MIN.
(OPTIONAL) MOTORIZED DAMPER (SUPPLY INTAKE)
(OPTIONAL) ACCESS DOOR FOR MOTORIZED DAMPER
WATER SEALED DRIP PAN



NOTES:

1. ALL WORK BY THIS DIVISION, UNLESS OTHERWISE NOTED.
2. ALL FLASHING BY GENERAL CONTRACTOR



DUCT ROOF PENETRATION DETAIL

N T S

(1) 316L STAINLESS STEEL EXHAUST DUCT INSULATED ABOVE ROOF WITH 50mm THICK FLEXIBLE INSULATION & COVERED WITH ALUM JACKET.

(2) 1.8mm [14 GA] STAINLESS STEEL FLASHING WELDED OR CLAMPED AND SEALED TO EXHAUST DUCT.

(3) STAINLESS STEEL COLLAR WELDED TO CURB CAP. SEE ALSO DETAIL MD–852

(4) STAINLESS STEEL CURB CAP. SEE ALSO DETAIL MD–852

(5) ROOF CURB BY GENERAL CONTRACTOR.

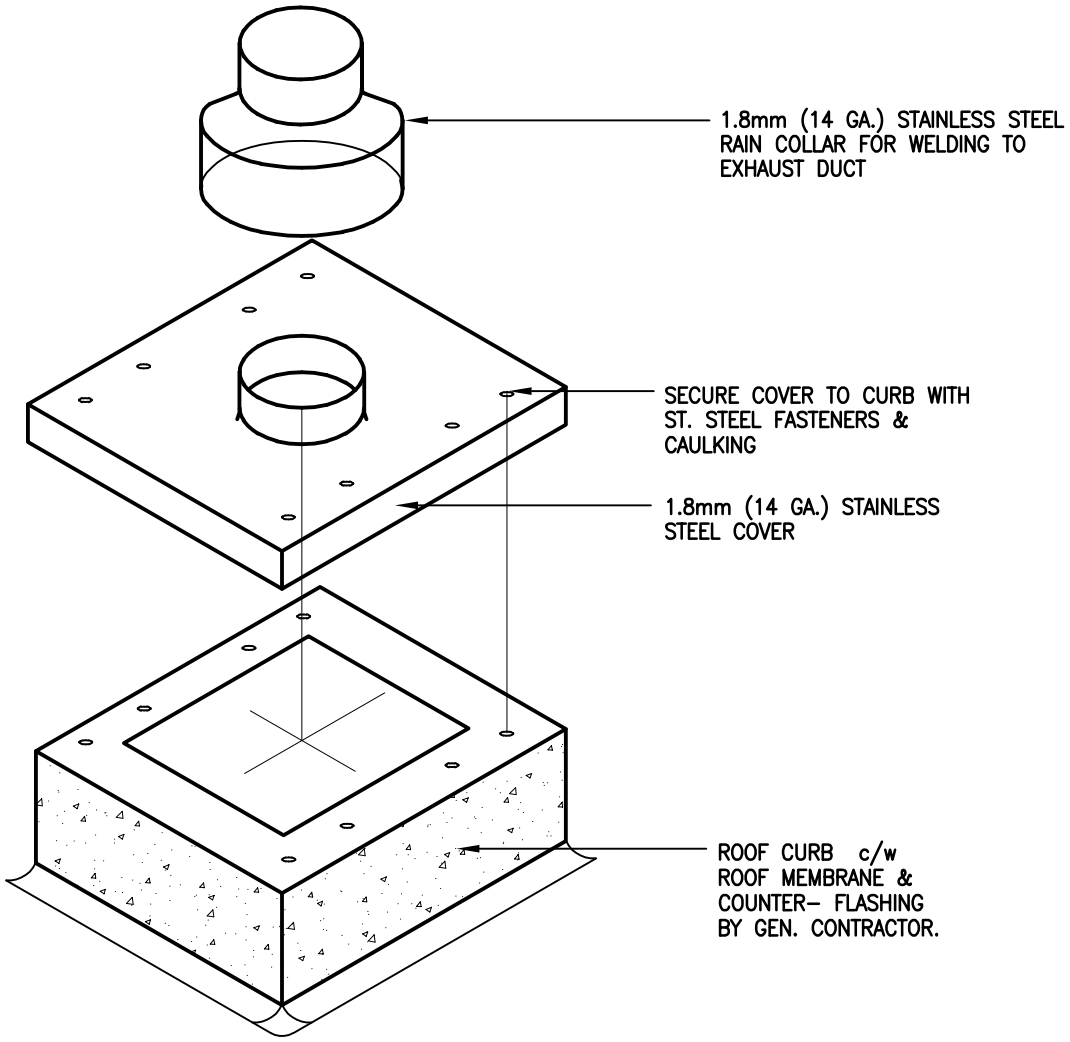
(6) ROOF INSULATION

(7) ROOFING MEMBRANE BY GEN. CONTRACTOR.

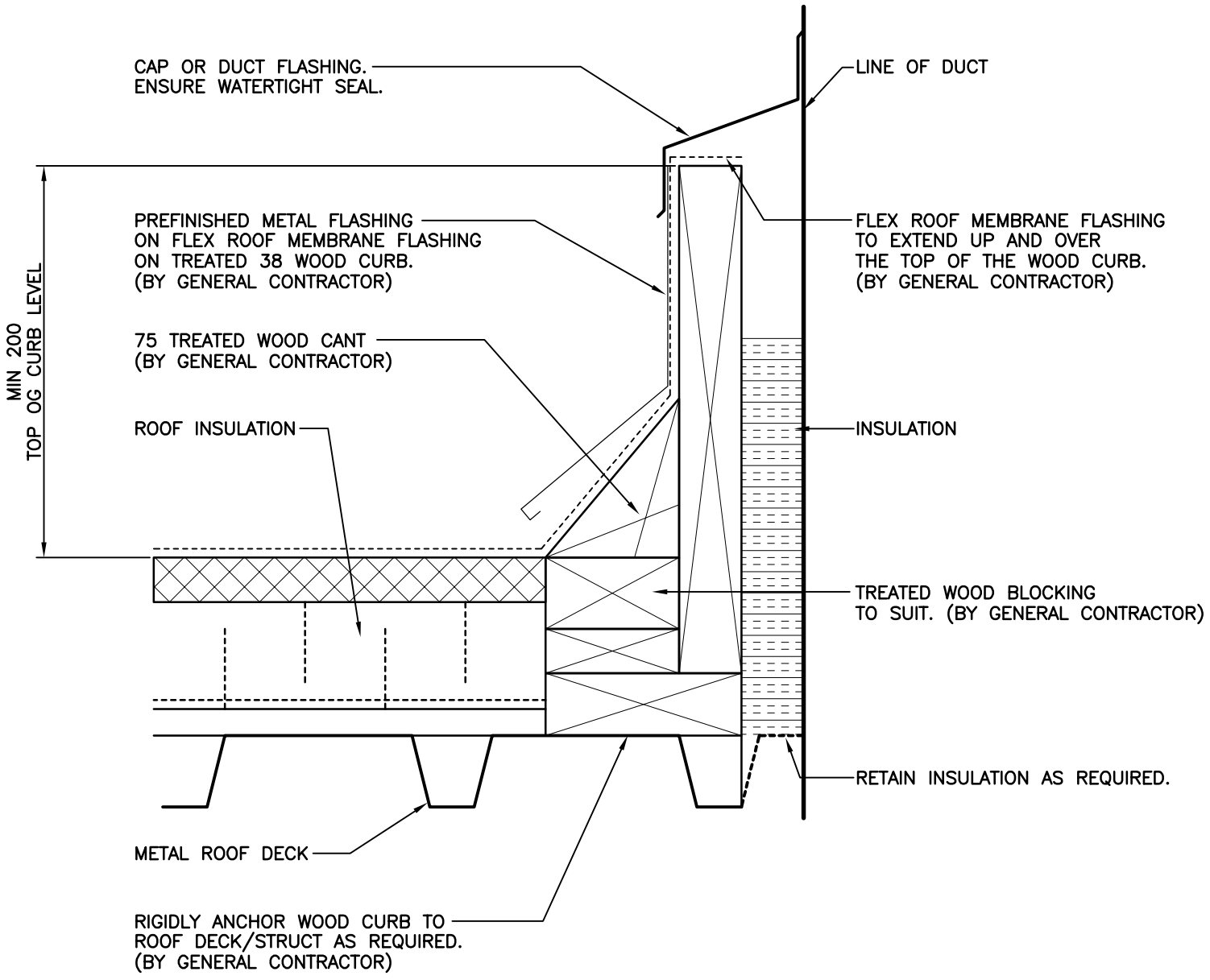
(8) BATT INSULATION LOOSELY PACKED ALL AROUND DUCT

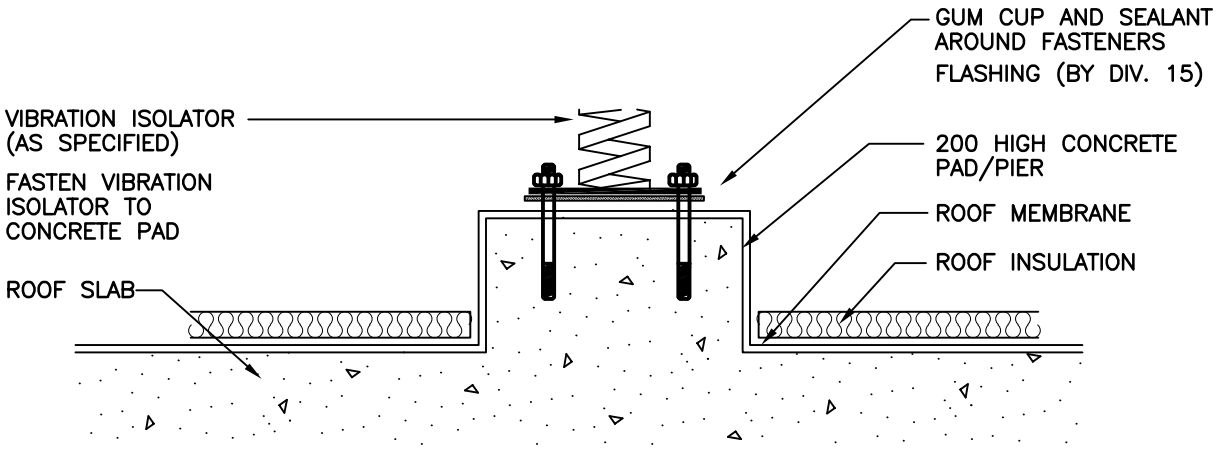
(9) SHEET METAL INSULATION RETENTION ANNULUS FASTENED TO STRUCTURE

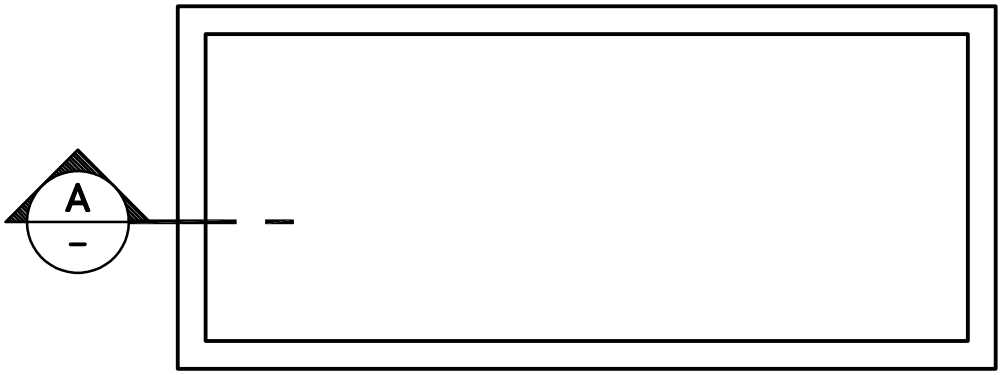
(10) RATED DUCT ENCLOSURE.



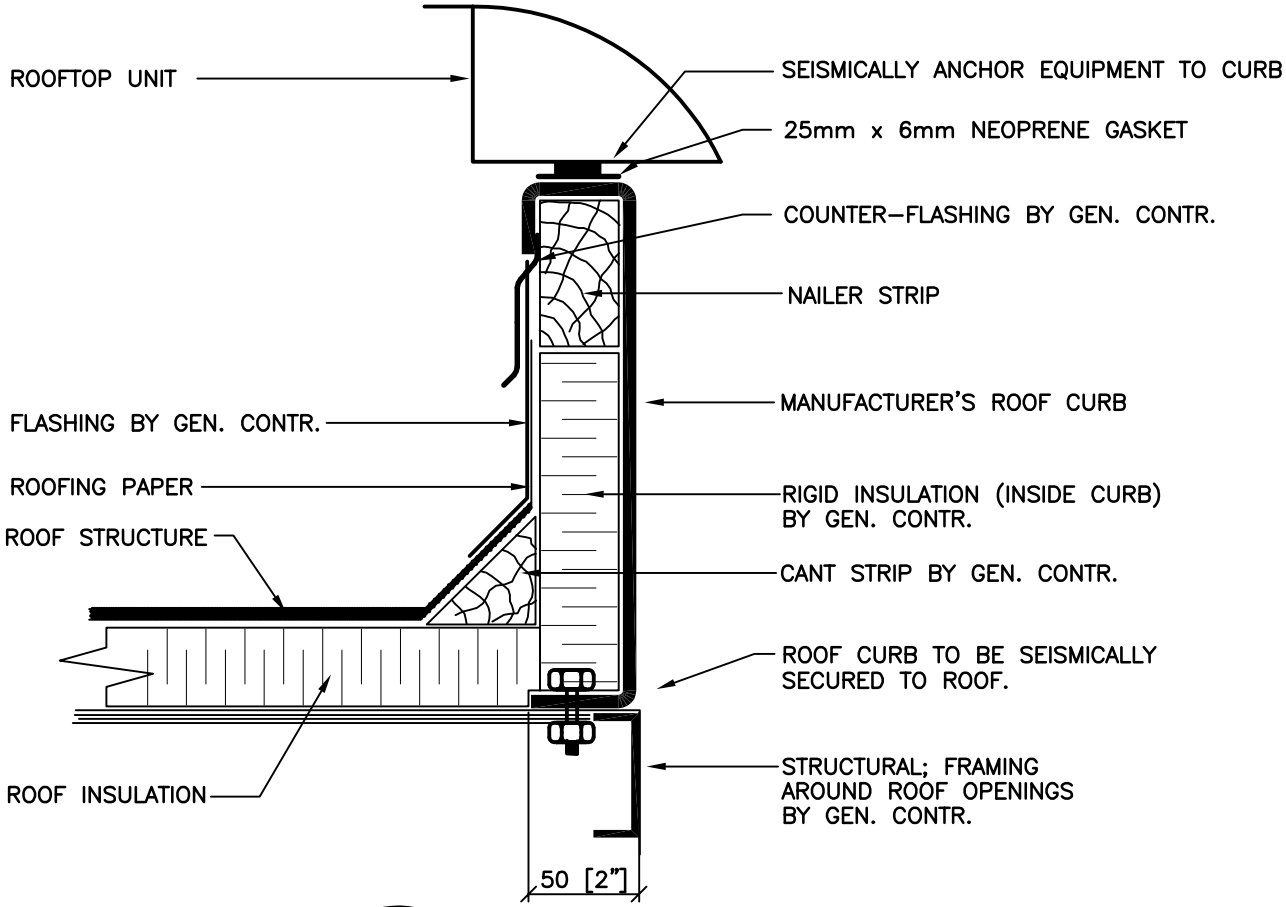
ROOF CURB CAP DETAIL


CAP OR DUCT FLASHING.
ENSURE WATERTIGHT SEAL.
LINE OF DUCT
PREFINISHED METAL FLASHING
ON FLEX ROOF MEMBRANE FLASHING
ON TREATED 38 WOOD CURB.
(BY GENERAL CONTRACTOR)
FLEX ROOF MEMBRANE FLASHING
TO EXTEND UP AND OVER
THE TOP OF THE WOOD CURB.
(BY GENERAL CONTRACTOR)
MIN 200
TOP OG CURB LEVEL
75 TREATED WOOD CANT
(BY GENERAL CONTRACTOR)
ROOF INSULATION
INSULATION
TREATED WOOD BLOCKING
TO SUIT. (BY GENERAL CONTRACTOR)
RETAIN INSULATION AS REQUIRED.
METAL ROOF DECK
RIGIDLY ANCHOR WOOD CURB TO
ROOF DECK/STRUCT AS REQUIRED.
(BY GENERAL CONTRACTOR)


GUM CUP AND SEALANT AROUND FASTENERS
FLASHING (BY DIV. 15)
VIBRATION ISOLATOR (AS SPECIFIED)
FASTEN VIBRATION ISOLATOR TO CONCRETE PAD
200 HIGH CONCRETE PAD/PIER
ROOF MEMBRANE
ROOF INSULATION
ROOF SLAB



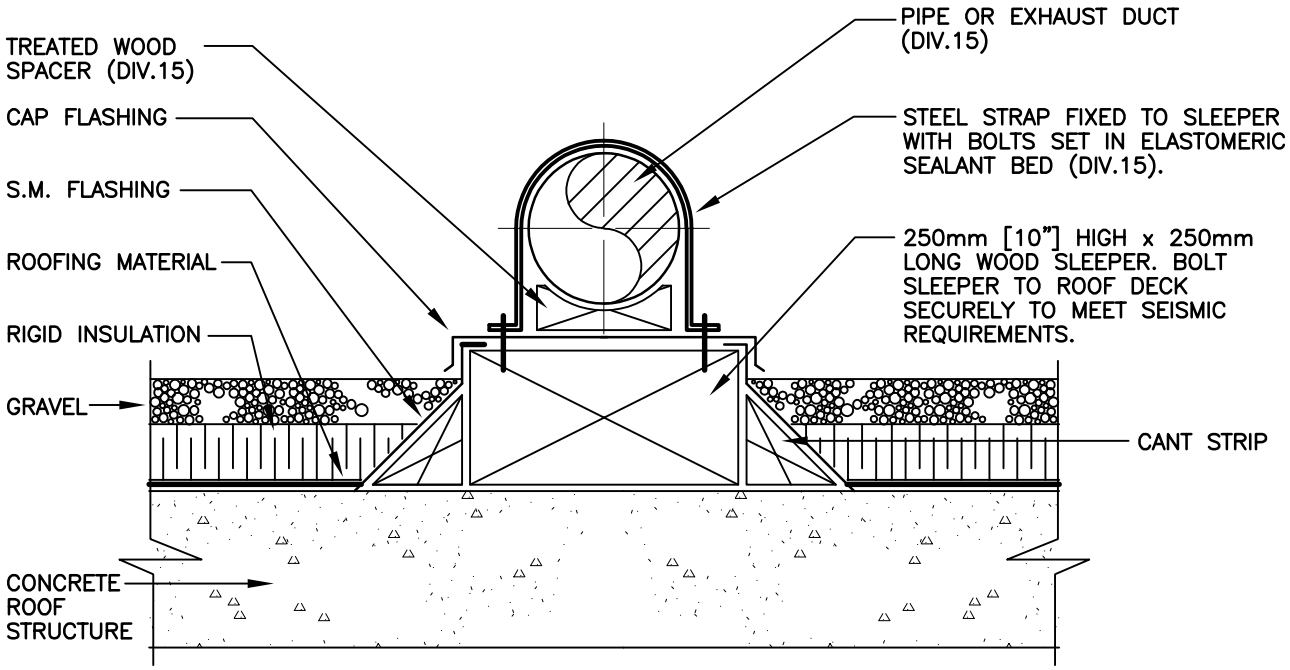
EQUIPMENT ROOF CURB PLAN



A CROSS-SECTION

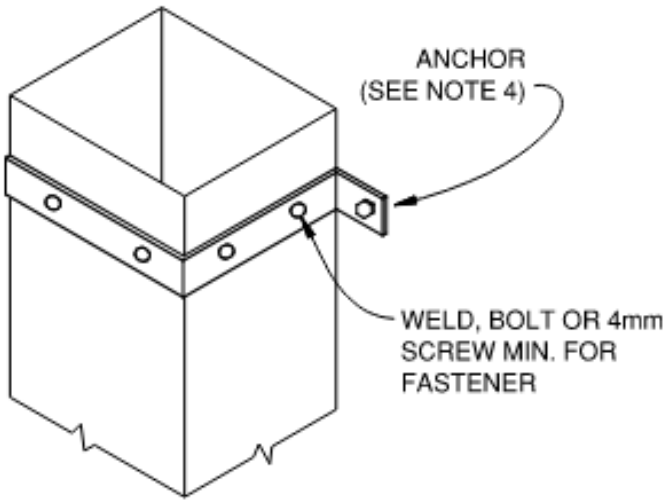
A / —

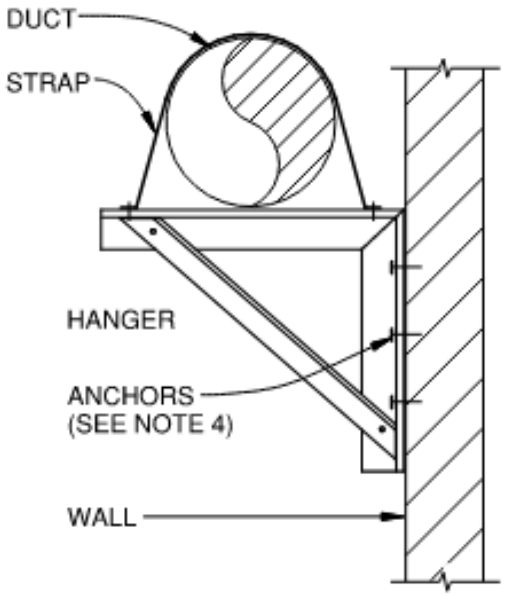
SCALE: N.T.S.

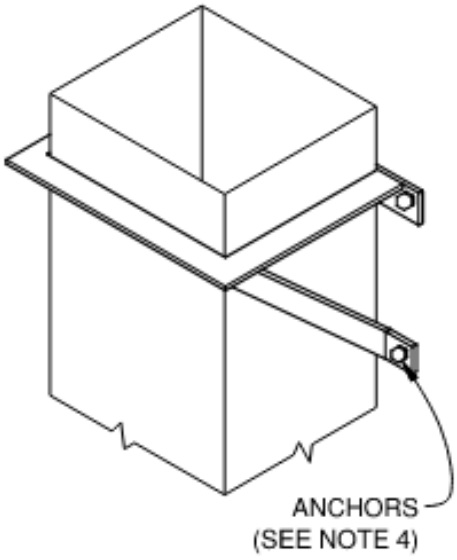


NOTES:

1. UNLESS OTHERWISE NOTED, ALL WORK TO BE DONE BY GENERAL CONTRACTOR.
2. PIPES AND DUCTS SUPPORTED AT 3.0 METERS [10 FT] ON CENTRE.
3. WIDTH OF SLEEPER TO SUIT DUCT OR PIPE SIZE(S).
4. STEEL STRAP (STAINLESS STEEL OR GALVANIZED) TO BE SAME MATERIAL AS DUCT. REFER TO SPECIFICATION FOR DUCT MATERIAL. STEEL STRAPS FOR PIPES TO BE GALVANIZED STEEL.





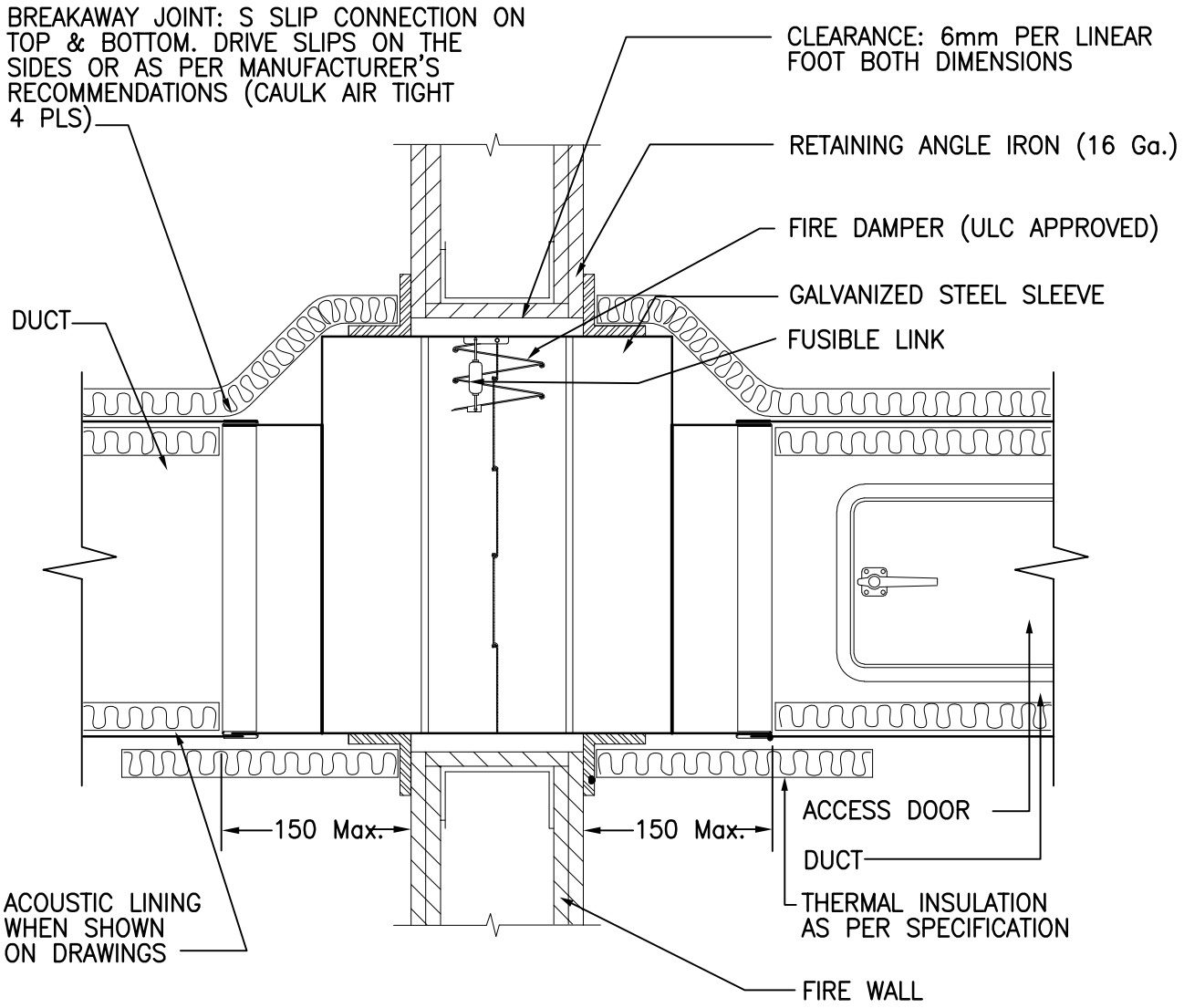


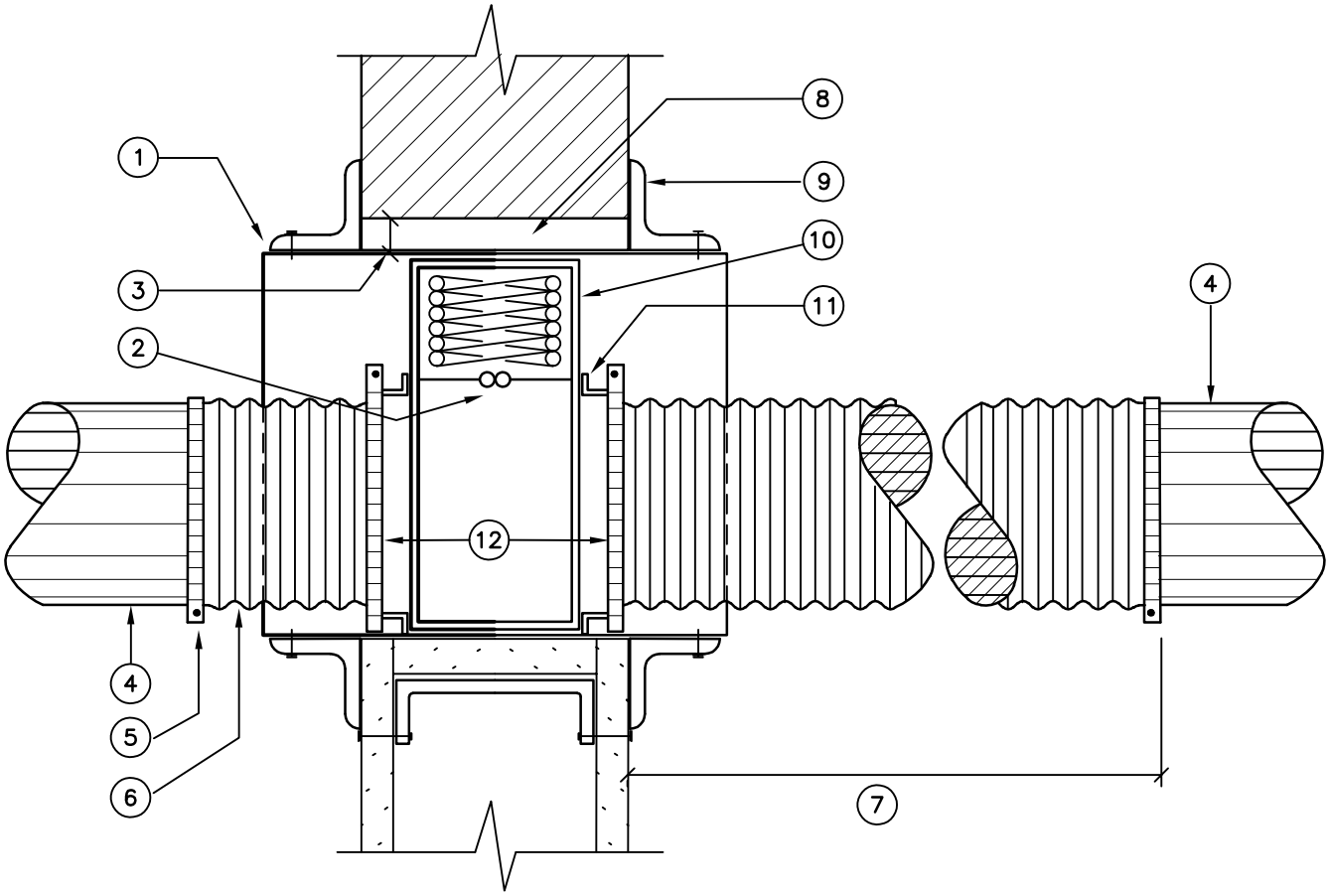
TYPICAL SIZING

DUCT SIZE	ANGLE
UP TO 900x450	25x25x3
1200x750 AND UP	31x31x3

NOTES:

1. BRACKETS ARE SIZED FOR 3600mm OF DUCT MAXIMUM
2. BRACKETS AND STRAPS SHALL BE GALVANIZED STEEL
3. LOCATE DUCTS AGAINST WALL OR MAX OF 50mm AWAY FROM WALL
4. EACH WALL ANCHOR SHALL SATISFY THE FOLLOWING:
   A. TENSILE LOAD = 3/8 X DUCT WEIGHT; SAFETY FACTOR OF 4
   B. SHEAR LOAD = 1/2 X DUCT WEIGHT; SAFETY FACTOR OF 4
5. SECURE WITH APPROVED ANCHORS TO MATCH WALL CONSTRUCTION


BREAKAWAY JOINT: S SLIP CONNECTION ON TOP & BOTTOM. DRIVE SLIPS ON THE SIDES OR AS PER MANUFACTURER'S RECOMMENDATIONS (CAULK AIR TIGHT 4 PLS)
CLEARANCE: 6mm PER LINEAR FOOT BOTH DIMENSIONS
RETAINING ANGLE IRON (16 Ga.)
FIRE DAMPER (ULC APPROVED)
GALVANIZED STEEL SLEEVE
FUSIBLE LINK
DUCT
150 Max.
150 Max.
ACCESS DOOR
DUCT
THERMAL INSULATION AS PER SPECIFICATION
ACOUSTIC LINING WHEN SHOWN ON DRAWINGS
FIRE WALL



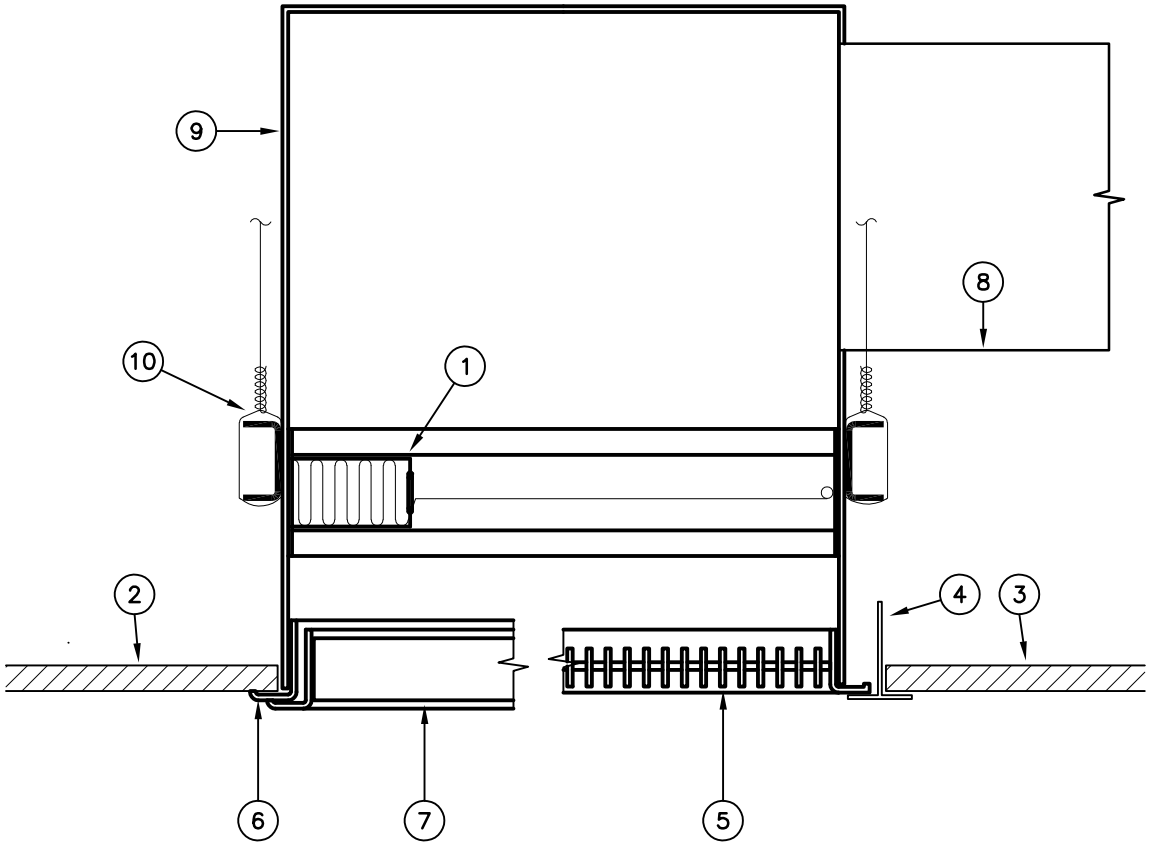
NOTES: (#)

1. GALVANIZED STEEL SLEEVE.
2. FUSIBLE LINK.
3. 12.5mm [1/2"] MAXIMUM CLEARANCE.
4. DUCT.
5. CLAMP CONNECTION ON FLEX.
6. FLEXIBLE CONNECTION.
7. FLEXIBLE DUCT LENGTH – 3 X DIAMETER.
8. OPENING SIZE. SEE STANDARD SMACNA B.C. DETAIL.
9. STEEL RETAINING ANGLES. SEE STANDARD SMACNA B.C. DETAIL.
10. APPROVED TYPE FIRE DAMPER.
11. TO BE AIR TIGHT.
12. BREAK–AWAY JOINTS.

CEILING DAMPER / FIRE STOP INSTALLATION

MD 28 004

REV.



NOTES:

1 U.L.C. LISTED FIRE RATED CEILING DAMPER, WHERE SPECIFIED. INSTALLATION AS PER SMACNA STANDARD DETAILS.

2 CEILING MEMBRANE.

3 CEILING PANEL

4 CEILING TEE

5 T.B. MOUNTING GRILLE WITH REMOVEABLE CORE, AS SPECIFIED.

6 MOUNTING FRAME, AS SPECIFIED.

7 SURFACE MOUNTED GRILLE, AS SPECIFIED.

8 SHEET METAL DUCT. SIZE AS SHOWN ON FLOOR PLANS.

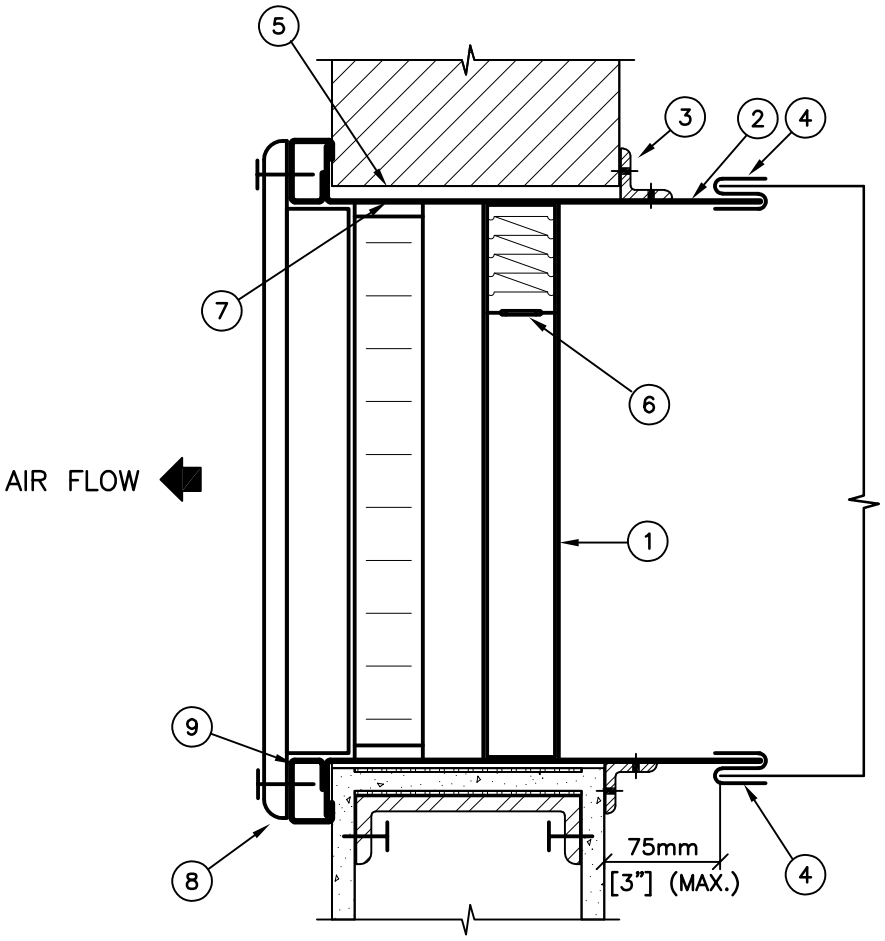
9 SHEET METAL PLENUM.

10 1.47mm [16 Ga.] 40mm [1– 1/2"] STEEL CHANNEL ATTACHED TO DAMPER FRAME AND UPPER "C" – PAN WITH SHEET METAL SCREWS, MIN. OF 2 EACH SIDE, AND NOT OVER 150mm [6"] O.C.

MD 28 006

FIRE DAMPER & SUPPLY GRILLE INSTALLATION

REV.



NOTES:

1 APPROVED SHUTTER TYPE FIRE DAMPER– THINLINE.

2 GALVANIZED STEEL SLEEVE – MATERIAL THICKNESS 3.28mm [10 Ga.]

3 RETAINING ANGLE IRON – SEE SMACNA DETAILS.

4 BREAKAWAY JOINT – USING "S" SLIP CONNECTION ON TOP AND BOTTOM & DRIVE SLIP ON SIDES. CAULK AIRTIGHT.

5 OPENING SIZE – SEE SMACNA DETAILS.

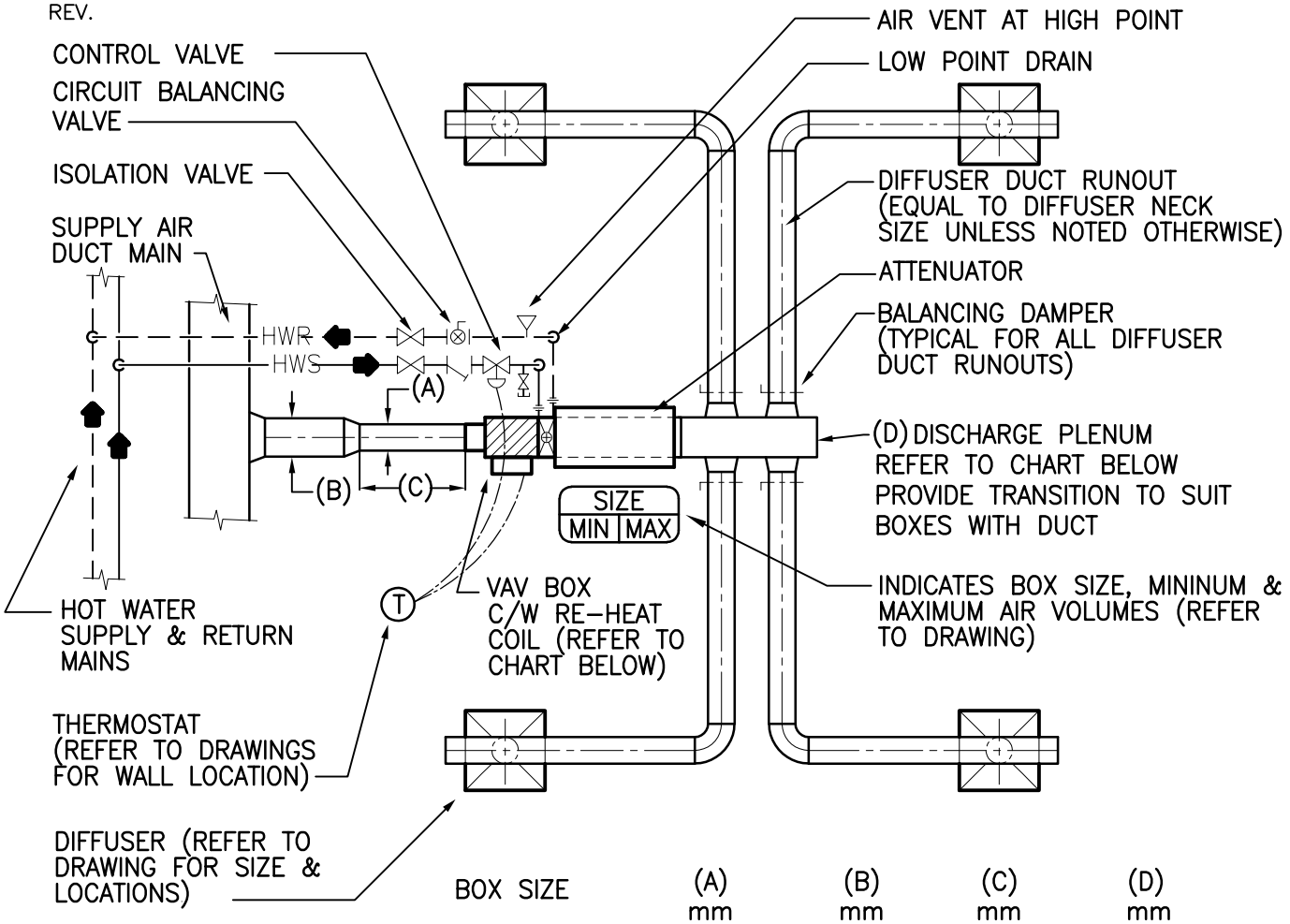
6 FUSIBLE LINK

7 SLEEVE – FLANGED TO FORM RETAINING ANGLE.

8 REGISTER SIZE TO SUITE BOX FRAME – SECURED TO BOX FRAME.

9 EXTENSION BOX FRAME WITH MITRED FINISHED CORNERS – TO RECEIVE SECURING SCREWS FOR REGISTER OR GRILLE. ALTERNATIVE METHODS OF SECURING GRILLES & REGISTER WILL BE CONSIDERED.

REV.



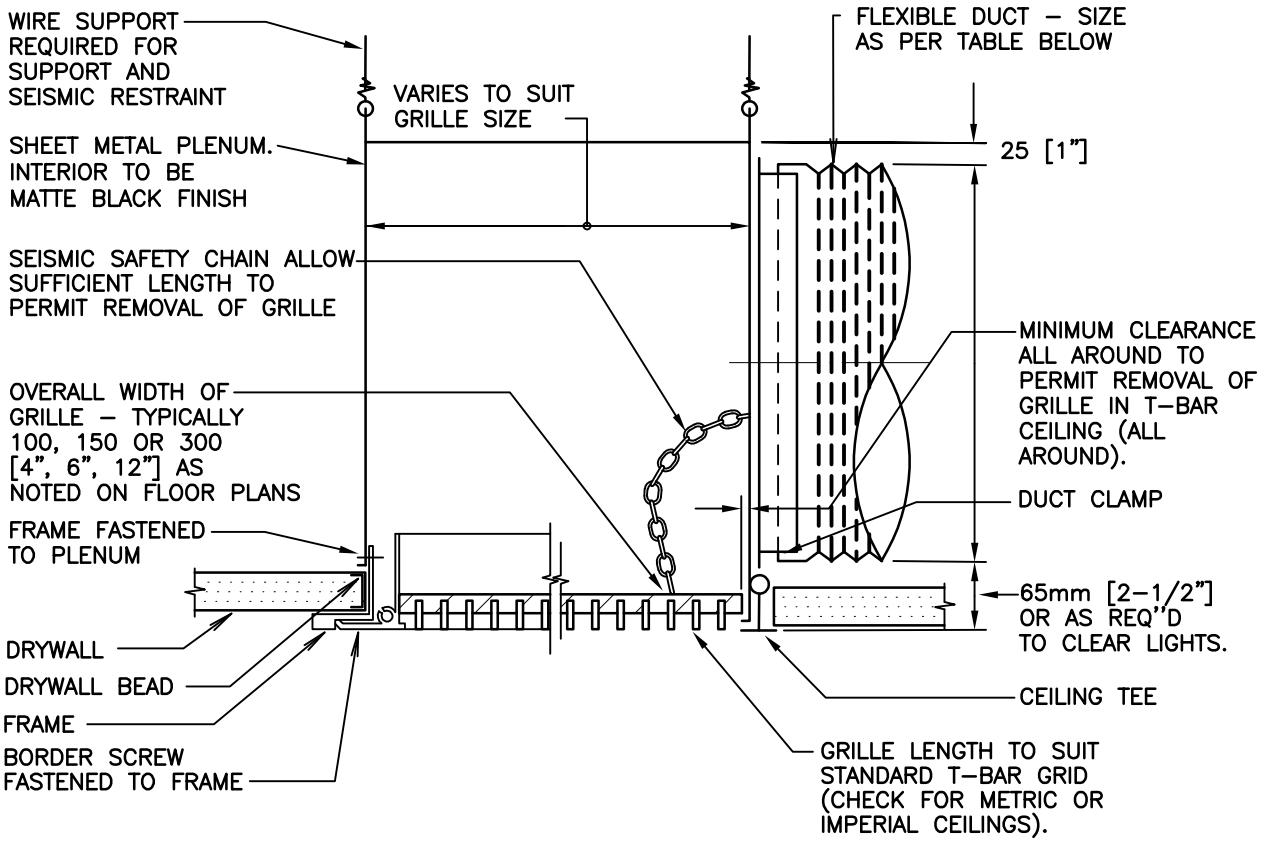
BOX SIZE	(A) mm	(B) mm	(C) mm	(D) mm
4	100~	150~	400	300X200
5	125~	150~	500	300X200
6	150~	200~	600	300X200
7	175~	200~	700	300X250
8	200~	250~	800	300X250
9	225~	250~	900	350X300
10	250~	300~	1000	350X300
12	300~	350~	1200	400X400
14	350~	400~	1400	500X450
16	400~	450~	1600	600X450

NOTES

1. (C) IS THE STRAIGHT LENGTH (Min.) OF DUCT EQUAL TO 4 TIMES THE INLET DIAMETER OF THE BOX.

2. ONE THERMOSTAT PER VAV BOX UNLESS NOTED OTHERWISE. EXACT LOCATION TO BE CONFIMED WITH ARCHITECT PRIOR TO INSTALLATION, REFER TO DRAWINGS.

3. CIRCUIT BALANCING VALVE TO BE SIZED BASED ON FLOW NOT PIPE SIZE.

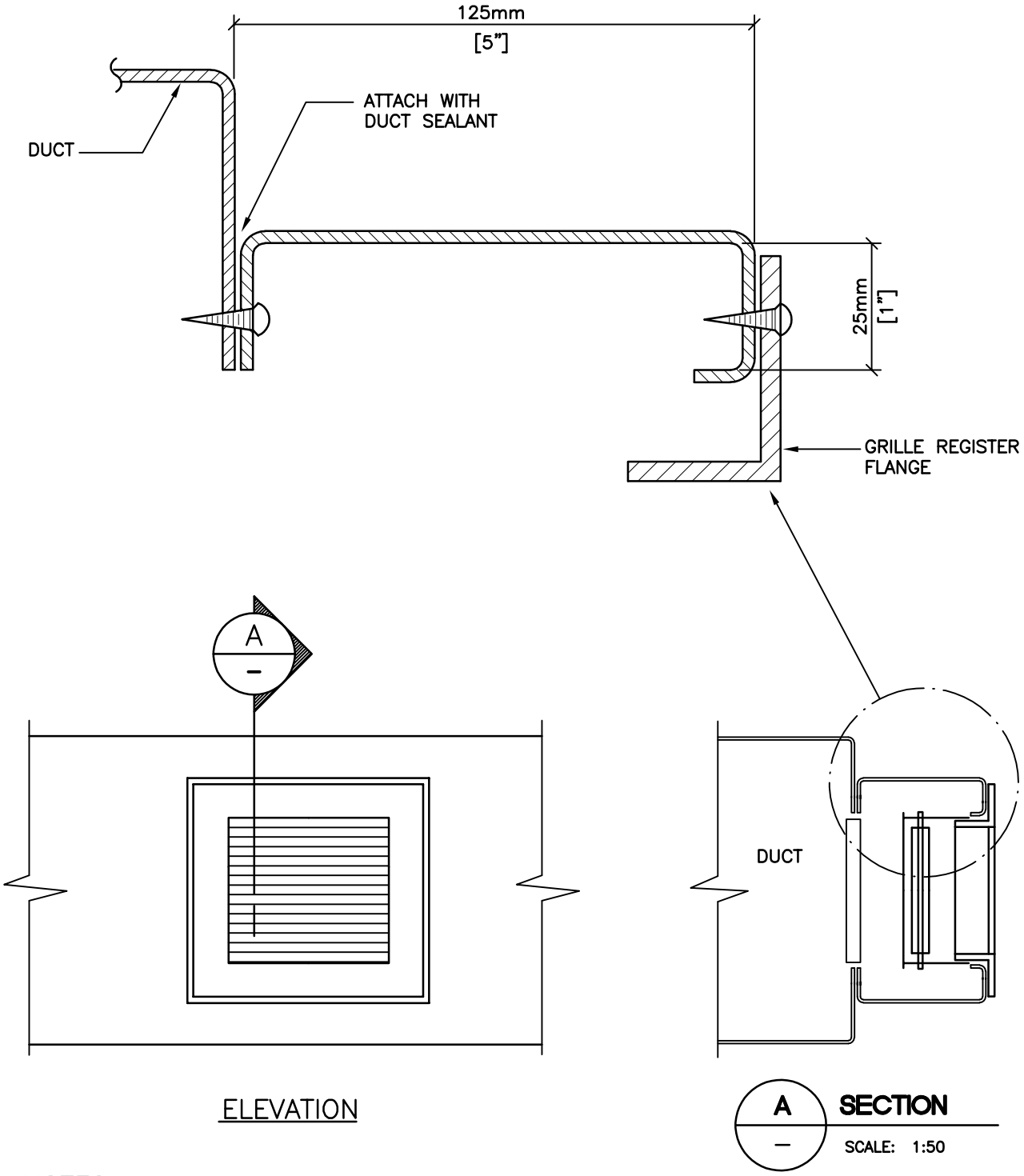


FLEXIBLE CONNECTION SIZE TABLE

GRILLE SIZE	600x100 [24"x4"]	600x150 [24"x6"]	600x300 [24"x12"]	600x450 [24"x18"]
FLEX. CONNEC.	200 [8"] DIA.	250 [10"] DIA.	300 [12"] OVAL	350 [14"] OVAL

NOTE:

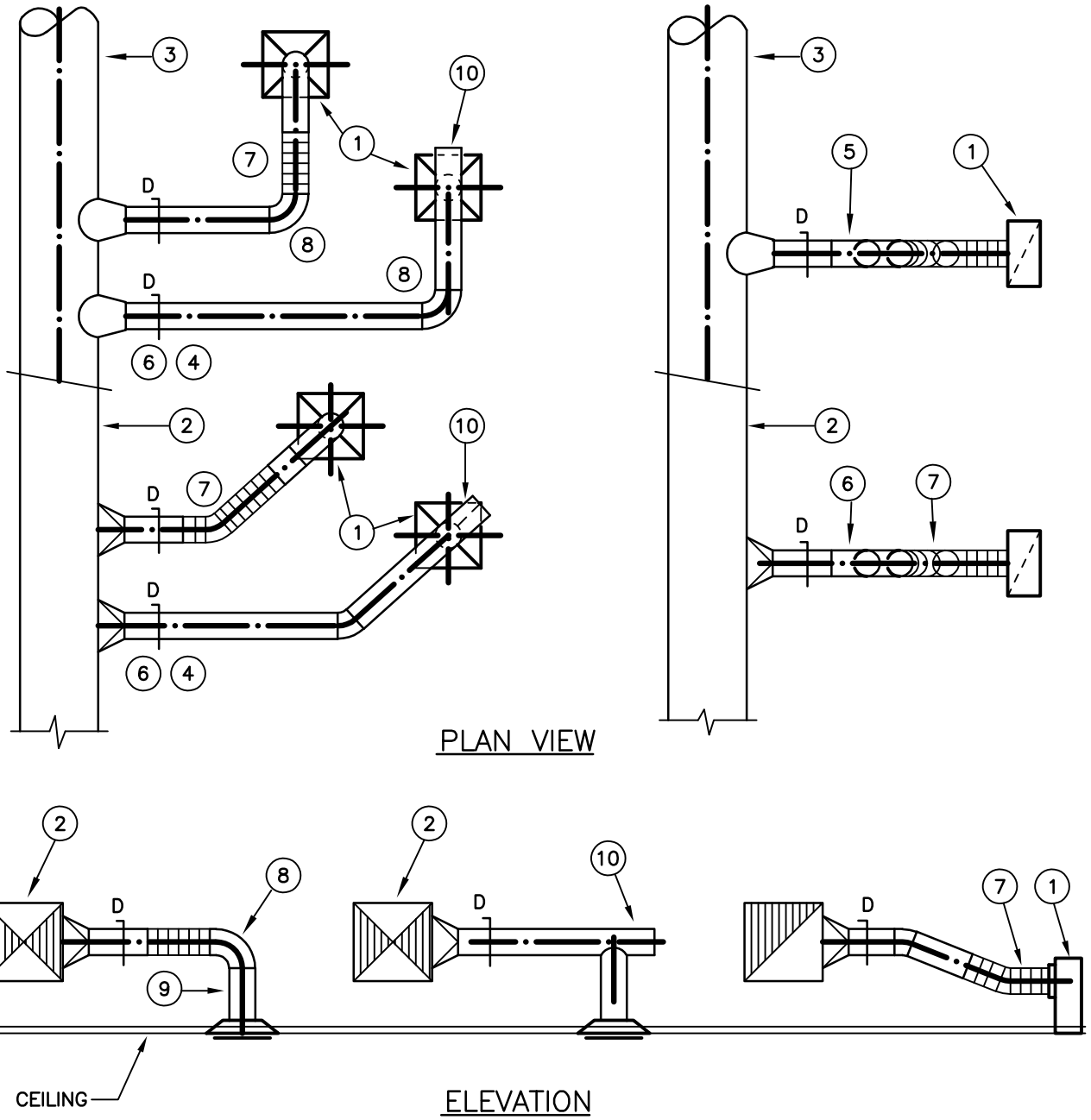
INSTALL BALANCING DAMPER AT DUCT TAKEOFF.



ELEVATION

NOTES:

1. FABRICATE GRILLE MOUNTING FROM 0.91mm [20 GA] GALVANIZED STEEL
2. TYPICAL FOR ROUND OR RECTANGULAR DUCTS



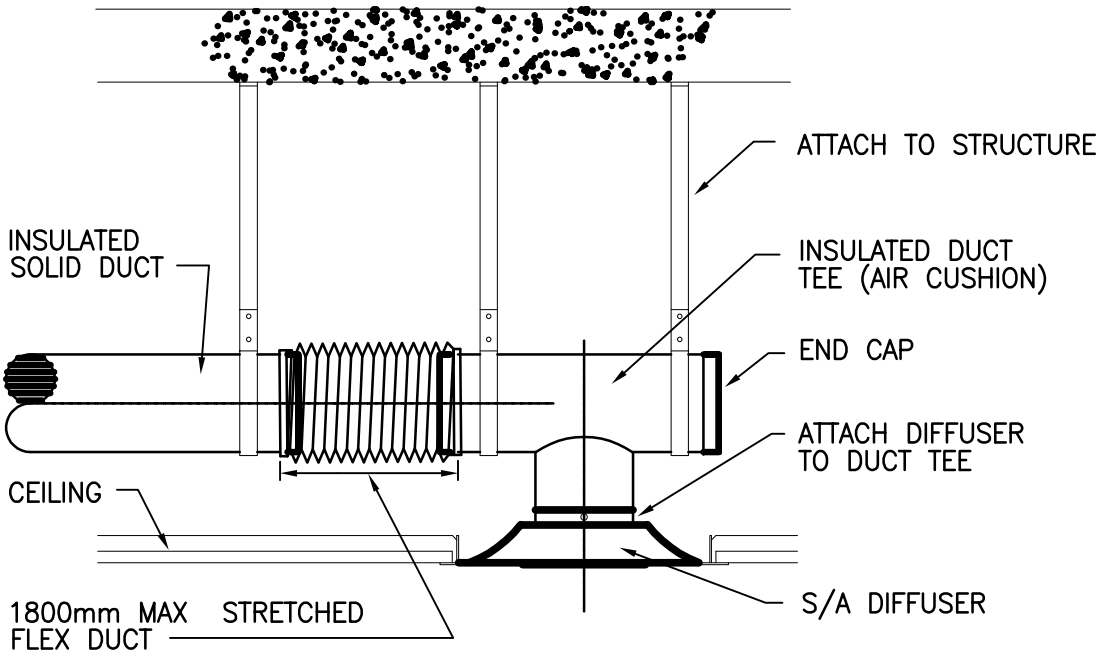
PLAN VIEW

ELEVATION

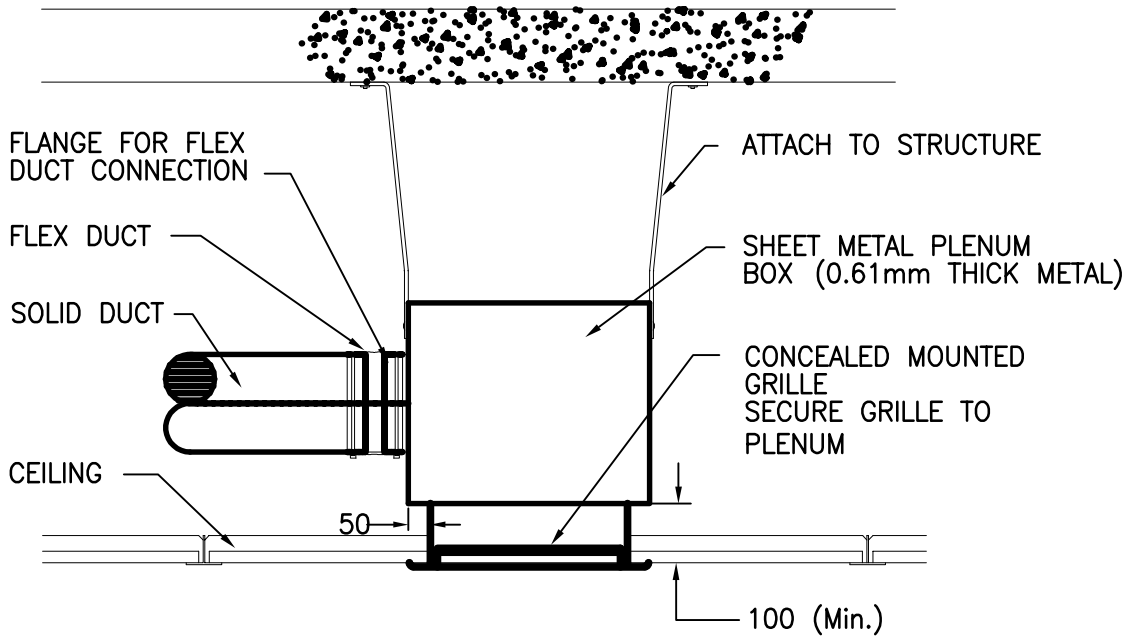
NOTES (#)

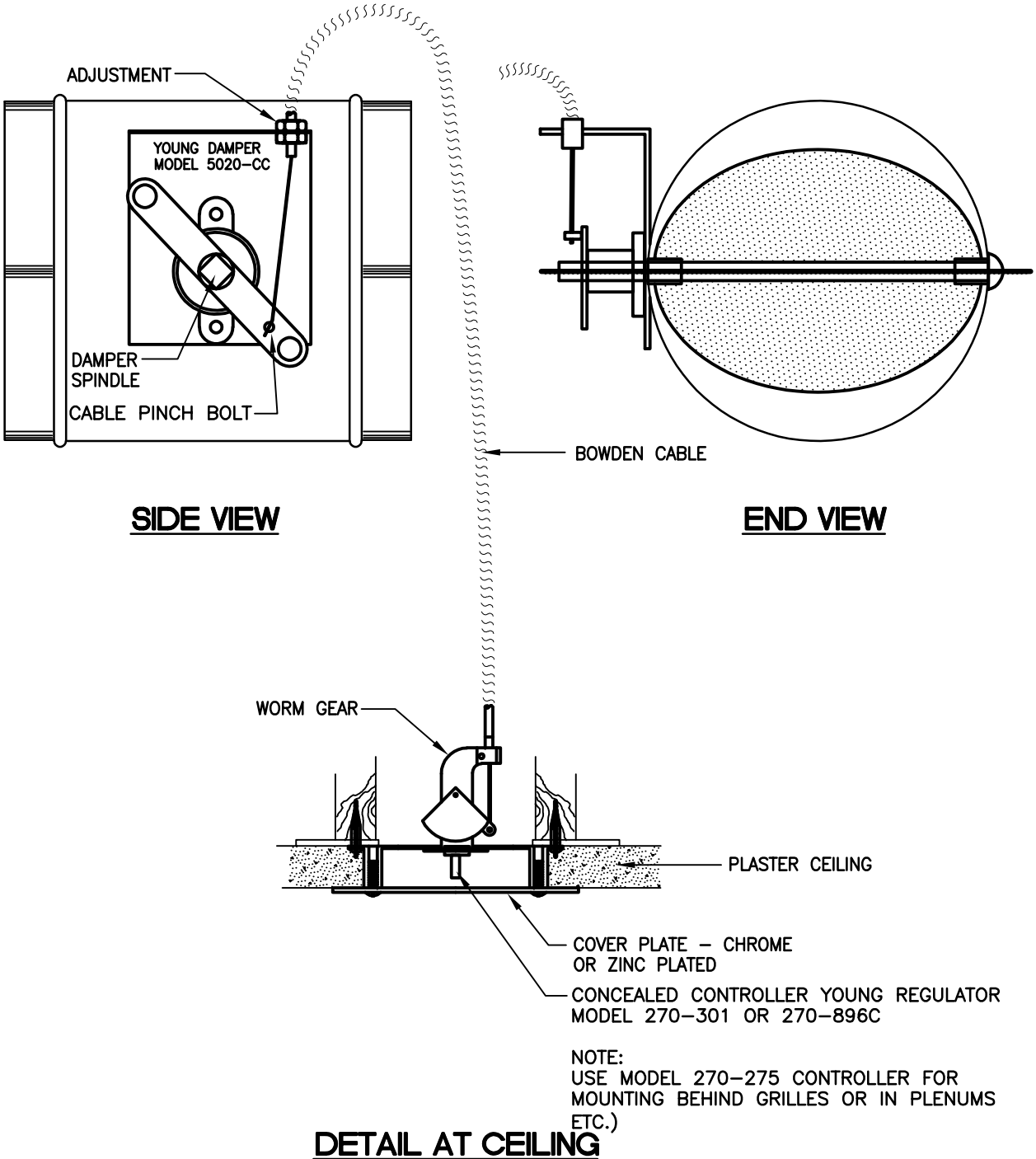
1. AIR TERMINAL UNIT AS SCHEDULED
2. RECTANGULAR DUCT – TYP
3. ROUND DUCT – TYP
4. DUCT SIZE TO MATCH DIFFUSER NECK SIZE
5. DUCT SIZE AS PER DRAWINGS
6. RIGID DUCT
7. FLEX DUCT – MAX. LENGTH AS SPECIFIED
   – MAX. BEND PERMITTED 45 DEG
   USE ALL RIGID DUCT FOR EXPOSED STRUCTURE.
8. RIGID DUCT ELBOW – RADIUS = 1.5 x DIA. MIN.
9. RIGID DUCT MIN. 1 DUCT DIA. LONG FROM ELBOW TO DIFFUSER
10. PROVIDE CUSHION HEAD FOR DIFFUSER WHERE CEILING SPACE IS LIMITED. TRANSITION TO EQUIVALENT RECTANGULAR DUCT AS REQUIRED. CUSHION HEAD LENGTH = 1x DIFFUSER DIAMETER

NOTE: SEISMIC RESTRAINTS AS PER SPECIFICATIONS

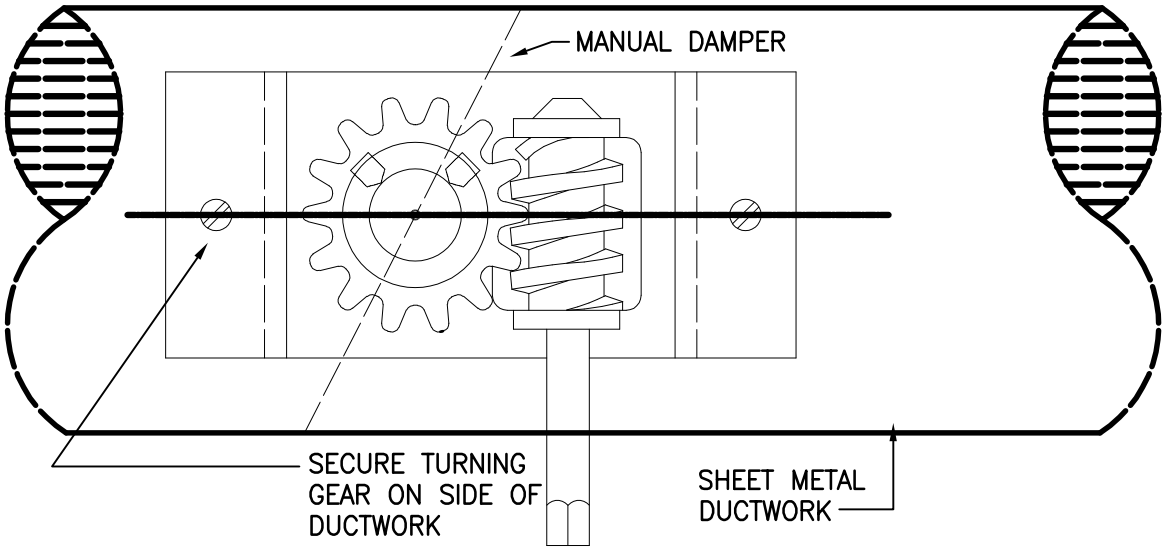


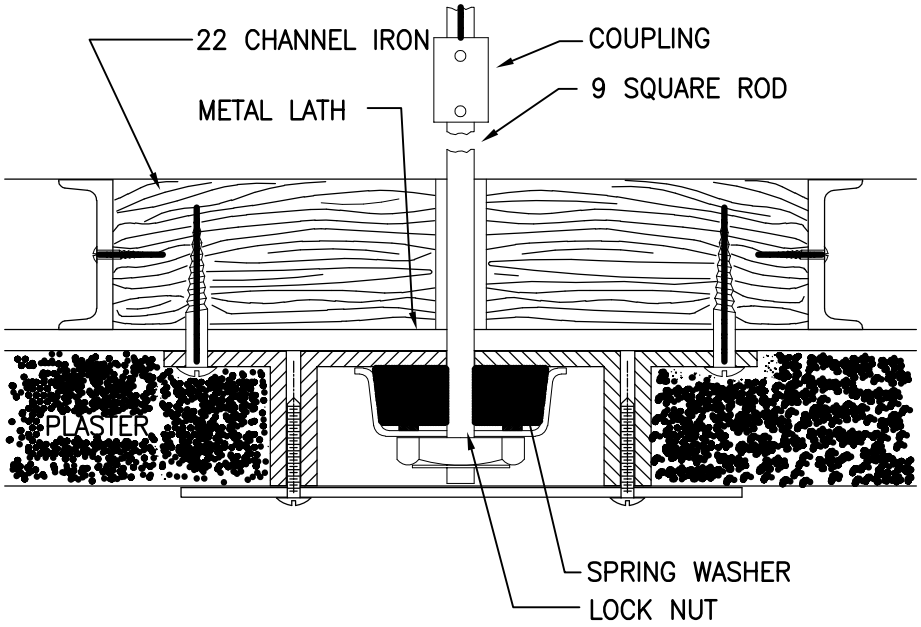
NOTE: SEISMIC RESTRAINTS AS PER SPECIFICATIONS.





DETAIL AT CEILING


MANUAL DAMPER
SECURE TURNING GEAR ON SIDE OF DUCTWORK
SHEET METAL DUCTWORK


22 CHANNEL IRON
COUPLING
9 SQUARE ROD
METAL LATH
PLASTER
SPRING WASHER
LOCK NUT

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
ACCESS DOORS		
Building Surfaces	Acudor, Maxam, Milcor, Mifab	X
ACCESS PANELS		
Ducts	Nailor, Ventlok	X
AIR TERMINALS	Price, Titus	X
BACKDRAFT DAMPERS		
Light Duty	Price CBD, Ruskin B02/A1,	X
Medium Duty	Airolite 625, Penn CBD-6, Ruskin CBD-4,	X
Heavy Duty	Ruskin CBS7	X
CONTROL DAMPERS		
Low Leakage Type	Arrow-Foil PBDAF & OBDAF, Honeywell Moduflow D642 & D643, Johnson Proportion/Aire D-1200 & D-1300, Ruskin CD36, Tamco 1000,	X
Not Low Leakage Type	Honeywell, Johnson, Ruskin CD35,	X
Round	Ruskin DCRS-25,	X
DUCT CONNECTORS FLEXIBLE	Duro Dyne "Durolon", Ventfabrics - "Ventlon", Dynair Hypalon	X
DUCTWORK - SPIRAL	United Sheet Metal, B.C. Ventilating, Spiro-Lok	X
DUCTWORK FLEXIBLE		
Plain	Thermaflex SLP10, Flexmaster FAB4, Wiremold 57	X
Insulated – Acoustic	Thermaflex MKE, Glassflex ABL-181, Wiremold WK	X
Insulated - Thermal	Thermaflex MKC, Micro-Aire JFLX SL, Glassflex D-181, Wiremold WGC	X
EXPANSION JOINTS	Flexonics, Hyspan, Uniroyal, Keflex, Mason, Goodall	X
FANS (Institutional)		
Roof / Wall	Loren Cook, Greenheck, Twin City	X
FAN TERMINAL UNITS	E.H. Price, Tempmaster, Titus	X

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
FILTERS - Fibreglass Free	Viledon, Tridec	X
FILTER GAUGES	Dwyer, Cambridge	X
FIRE DAMPERS		
Folding Shutter Type	Controlled Air, NCA, Ruskin	X
Pivoted Blade Type	Controlled Air, Maxam, Pacwest, Ruskin FD35	X
Ceiling Type	Controlled Air, Kerr Hunt	X
Fire/ Smoke Combination	Controlled Air, Ruskin	X
Register / Fire Damper	E.H. Price VCS-4, Tuttle & Bailey 90A, Airvector	X
HEATERS		
Wall Fin	Eng. Air, Rosemex, Slant / Fin, Trane, Sterling	X
INSULATION - DUCT	Certainteed, Fiberglas, Knauf, Johns-Manville, PPG, Manson	X
INSULATION - PIPING	Certainteed, Fiberglas, Knauf, Johns-Manville, PPG, Manson	X
INSULATION – FIBRE FREE	Armacell AP/Coilflex, K-flex	
PIPE CONNECTORS (FLEXIBLE)	Mason	X
PLENUM - LAYOUT DRAWINGS	Mechanical Contractor	X
PRESSURE GAUGES	Trerice, Marsh/Marshall, Moeller, Weiss, Weksler, Winters	X
SEISMIC ISOLATORS	Mason, USS Snubbers	X
THERMOMETERS	Trerice, Marsh/Marshall, Moeller, Weiss, Weksler, Winters	X
VALVES	Jenkins, Anvil, Crane, Red-White, Toyo, Kitz, Nibco, Apollo	
VIBRATION ISOLATORS	Mason, Korfund, VMC, Vibro-Acoustic	X

NOTE:

.1 The design is based upon the equipment listed in the equipment schedules and/or underlined in the H.V.A.C. Equipment Supplier Schedules.

.2 **X** Denotes required submission.

END OF SECTION

BALANCING:	
	K.D. ENGINEERING CO.
	WESTERN MECHANICAL SERVICES
COMMISSIONING:	
	K.D. ENGINEERING CO.
	WESTERN MECHANICAL SERVICES
OPERATING & MAINTENANCE MANUALS:	
	K.D. ENGINEERING
	WESTERN MECHANICAL SERVICES
CLEANING AGENCIES:	
DUCTWORK	
	POWER SUCTION SERVICES LTD.
	ACE MOBILE POWER SERVICES LTD.
	CLEAN AIR SERVICES CANADA LTD.
	MODERN PURAIR
WATER PIPING	
	BIRD ARCHER
	GRACE DEARBORN
	IPAC CHEMICALS
	PACE CHEMICALS
	SAVOLITE
	KEMTREET
CHEMICAL TREATMENT:	
	BIRD ARCHER
	GRACE DEARBORN INC.
	IPAC CHEMICALS
	PACE CHEMICALS
	SAVOLITE

END OF SECTION

DIVISION 23 TABLE OF CONTENTS

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Division 1 – Commissioning General Requirements and 23 08 00 – Commissioning of Mechanical for additional responsibilities of the BAS contractor

1.2 SCOPE OF WORK

.1 The new control system while being a completely stand-alone system, shall be an expansion of the existing system supplied by Reliable Controls (Houle Controls) Building Automation System.

.2 The new system shall be fully integrated with the existing system (Reliable Controls) and operator interface shall be through the existing operator's workstation located in [workstations (main plant room). In addition, the new system will provide access to Facility & Energy Management Software Use through the Reliable Controls (Houle Controls) RC Webview system. The intent is to centralize the facilities building management operation and collect real-time data about energy use for the facility.

.3 Refer to Section 23 99 60 Mechanical Forms and submit all documentation therein that is applicable to Division 25 Controls and Instrumentation.

.4 The control will be coordinated and provided by the existing Reliable facility controls including the generation of new graphics for all control components.

.5 Acceptable Supplier: Reliable Controls (Houle Controls)

.6 The two louver actuators in existing level 3 Electrical Room to be connected and controlled by BMS system to control the electrical room temperature during free-cooling mode.

1.3 CODES, BYLAWS, STANDARDS AND APPROVALS

.1 Where multiple versions of the same code are published, the most recent version shall be applied, unless noted otherwise by building codes and local by-laws.

1.4 GENERAL

.1 The control system is to be fully microprocessor based [as well as Web Based RC Webview facility and energy management system.]

.2 The controls system is to be complete with all necessary control components and connections to achieve the specified functions and to permit the H.V.A.C. systems to perform properly in the manner described and as hereinafter specified.

.3 The controls contractor shall furnish all materials, including all central computer hardware and software, operator input/output peripherals, standalone DDC panels, automation sensors and controls and wiring. The controls contractor shall be responsible for the design, installation, supervision and labour services, calibration, all software programming, and checkout necessary for a complete and fully operational Building Automation System.

.4 The control system and all controllers and hardware including third party devices shall be BACnet Testing Laboratories (BTL) certified.

.5 The control system is to be set up and adjusted to achieve optimum operation of the H.V.A.C. system. This includes sequencing, timing and readjustment, as required. Modifications to the sequence of operation using points indicated will not be considered as extra to the Contract. These modifications to continue through the construction period, commissioning period and warranty period as required to achieve optimum operation of the mechanical system.

.6 All new outputs shall each have an integral HOA toggle switch.

.7 New controllers shall have a minimum 10% spare points at each location.

.8 Program a trend log and, where appropriate, totalization for each point.

.9 This Section is a performance specification clarified in certain sections to establish minimum standard of equipment, installation or level of control. The specification describes the basic functions required but not all of the installation details or components. This Trade is expected to have sufficient experience to be able to design and estimate the cost of an appropriate control system. Materials and work necessary to achieve a satisfactory result will not be considered extra to the contract.

.10 The contractor shall review all contract documents and visit the site if possible, prior to the closing date of the tender and site confirm the requirements regarding the routing of interconnecting transmission network, etc..

.11 When preparing shop drawings, review the proposed sequences, suggest improvements and review these with the Consultant.

.12 Work with the other parties involved in commissioning, assess how the programming can be modified to improve function, review this with the Consultant and modify the programming as instructed by the Consultant.

.13 The control system shall be a modular, flexible and fully commissioned Direct Digital Control (DDC) System except that controls not scheduled on the points list may be electric. Items identified in the sequence of operation as being under DDC control but which are not included in the points list shall be included in the DDC system.

.14 Control Contractor to connect the new smoke-fire combination dampers to the fire alarm control panel. All wires to run in conduits.

.15 All trend logs need to be setup in Reliable Controls RC Archive to allow long term trending.

1.5 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Division 1 and Division 23.

.2 Shop drawings shall include:

.1 Control centre layouts.

.2 Manufacturer's descriptive technical literature for all equipment and devices.

.3 Interconnection schematics.

.4 Wiring and piping diagrams.

.5 One-line diagram from sensor and control points to Field Interface device and/or standalone DDC panel including all components and cables.

.6 Terminal cabinets, including termination listing.

.7 Written description indicating sequence of operation. Shop drawings will be rejected if the written description is not included with the submission. Sequences should reference English descriptors and labels for each point described.

.8 All input/output points which shall include the following information associated with each point.

.1 Sensing element type and location.

.2 Details of associated field wiring schematics and schedules.

.3 Software and programming details.

.9 Detailed block diagrams of transmission trunk routing and configuration.

.10 Valve and damper schedules indicating size, configuration, capacity and locations. If size varies greater than 10%, obtain approval of Consultant.

.11 Copies of all system graphics complete with system specific point labels.

1.6 OPERATING & MAINTENANCE MANUALS

.1 The maintenance manual data is intended to cover the operation and maintenance of all control systems and equipment installed. Forward three (3) copies of the Controls and Instrumentation section of the operating and maintenance manuals to the Balancing Agency to ensure the binding and format of material are compatible. Ensure sufficient time has been given to the Balancing Agency for the compiling of the complete operating and maintenance manuals by the commissioning deadline. One complete manual shall be furnished prior to the time that system or equipment tests are performed.

.2 The manuals shall include the name, address and telephone number of the control subcontractor installing the systems and a list of emergency numbers for service personnel. The manuals shall have a table of contents and be assembled to conform to the table of contents with the tab sheets placed before instructions covering the subject.

.3 Manuals shall be furnished which provide full and complete coverage of the following subjects:

.1 Operational Requirements: This document shall describe, in concise English terms, all the functional and operational requirements for the system and its functions that have been established. It shall not require knowledge of digital processor programming or electronic techniques or control system theory.

.2 System Operation: Complete guidance and procedures for operation of the system, including required actions at each operator station; operation of computer peripherals; input and output formats and procedures; and emergency, alarm, and failure recovery procedures. Provide step-by-step instructions for system startup, back-up equipment operation, and execution of all system functions and operating modes.

.3 Functional Description: Detailed documentation, in language readily understandable to engineering personnel, of the theory of operation and specific functions of the system. Provide full details of data communications, including data types and formats, data processing and disposition data link components and interfaces and operator test or self-test of data link integrity for all system components and computer peripherals during each system function and operating mode. Hardware and software functions, interfaces, and requirements shall be explicitly detailed for all system components in all system functions and operating modes. Any operating procedures currently implemented or planned for implementation in an automatic mode shall be stated and described.

.4 Software: Documentation of the theory, design, interface requirements, and functions of all software modules and systems for all digital processors. Include test and verification procedures and detailed descriptions of program requirements and capabilities. Provide all data necessary to permit modification, relocation, or other reprogramming and to permit combination of new and existing software modules to respond to changing system functional requirements without disrupting normal control system operation. Include, as a minimum, for all software modules, fully annotated source code listings, error-free object code files ready for loading via a peripheral device, and complete program cross reference, plus any calling requirements, data exchange requirements, necessary subroutine lists, data file requirements, and other information necessary to ensure proper loading, integration, interfacing, and program execution. All DDC panel software shall be provided individually for each DDC panel while a single section shall reference all DDC panel common parameters and functions.

.5 Maintenance: Documentation of all maintenance on all system components including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective units. Include calibration, maintenance, and repair of

all sensors and controls, plus diagnosis and repair or replacement of all system hardware.

.6 Test Procedures and Reports: The test implementation shall be recorded with a description of the test exercise script of events and documented as Test Procedures. A provision for the measurement or observation results, based on the previously published Test Specification, forms the Test Reports. The procedures record and the results of these exercises shall be conveniently bound and documented together.

.4 Refer to Section 23 05 00 for additional requirements.

1.7 WARRANTY

.1 Refer to General Conditions for additional information..

.2 The system including all hardware and software components shall be warranted for a period of one year following the date of final acceptance per department. Any manufacturing defects arising during this warranty period shall be corrected without cost to the Owner.

.3 All applicable software as detailed in this specification shall be updated by the Controls Contractor free of charge during the warranty period. This will ensure that all system software will be the most up-to-date software available from the Controls Contractor. All future patches to the software shall be made available to the Owner.

.4 Repairs required by a total system failure, or the malfunction of any priority portion of the system shall be considered an emergency repair, and shall be performed within eight (8) hours of the report of the failure.

.5 Repairs of a non-emergency nature shall be promptly repaired on the next normal business day.

.6 Provide written assurance that a local service centre will be maintained with a complete stock of replacement parts, and capable of servicing all troubles in the system.

.7 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the General Conditions.

.8 Take note of and provide any extended warranties specified.

1.8 ELECTRICAL COMPONENTS, WIRING AND CONDUIT

.1 By Division 25 Control Systems Contractor:

.1 All control system components to make a complete and operable system, except those supplied as part of packaged equipment controls, but including all auto-sequencing devices and electrical interlocks required to accomplish the sequences specified hereafter. Refer to the electrical equipment schedule, the electrical drawings and the electrical specification, which describes the limits of the extent to the work in Division 26 serving mechanical systems. Materials, equipment, connections and power not provided by Division 26 but required for the Control System shall be provided under this section.

.2 All control circuit transformers (120/1/60 or 24/1/60 and as designated).

.3 All control wiring and metallic conduit for mechanical system controls.

.4 Supply, installation and connection of all electric control items including: damper motors, relays, outside sensors, sub-master control circuits, safety devices, electric thermostats, aquastats, flow switches, wiring to terminal strips, proportional controllers, controllers, etc..

.5 All wiring and conduit from power distribution system to any control devices needing power (including B.M.S components)

.6 Be responsible for coordinating with Division 26.

.7 Electrical work installed under Division 25 shall be to the standards specified under Division 26.

.8 All control wiring shall be in conduits. Refer to division 26 electrical for conduits specifications.

.2 By Division 26 Electrical:

.1 All power wiring and conduit from power distribution system up to and including connection to all motors and starters.

.2 All disconnect switches required (unless specified in schedules as being integral with equipment).

.3 All motor protection switches, stop-start switches, magnetic starters, contactors and hand-off-automatic selector switches except those supplied as part of packaged equipment.

.4 Terminal strips within the motor control centres (MCC) for control connections.

.5 Fire alarm signals.

.3 Note:

.1 All magnetic starters for equipment shall have the following features supplied under this Division:

.1 Hand-off-automatic selector or on-off selector or start-stop buttons in cover with hand-automatic bridge if applicable.

.2 Pilot light,

.3 120-volt coils,

.4 120-volt control transformer and,

.5 Four auxiliary dry contacts for interlocks; two normally open and two normally closed.

.2 The Controls Contractor is responsible for reading Division 26 plans and specifications to determine scope of responsibility and standards.

.4 Wiring:

.1 General:

.1 Run carrier system parallel to building lines.

.2 Support conduit carrier system one meter on centre independent of piping, ductwork and equipment.

.3 Seal all penetrations through fire separations or walls as per code requirements.

.4 Identify all junction box covers with control company label.

.5 Identify with colour bands, all conduits at all junction and pullboxes, at both sides of wall and floors and at not more than 7.5 m [25 ft] intervals along the length. Identification bands to be sprayed on and not less than 100mm [4"] wide. Bands to be [pink] [purple] in colour unless in conflict with Division 26 colours.

.6 Use colour coded conductors.

.7 Adhere to all applicable electrical codes and regulations.

.8 Obtain electrical permit.

.9 For non-CSA equipment where required by electrical code, submit to Inspection Authorities and obtain approval prior to installation of equipment on site.

.10 Refer to Division 26 Electrical for overall wiring requirements.

.11 Wiring shall match electrical wiring requirements to ensure consistent wiring is provided throughout the project.

.12 All control wiring shall be in conduits. Refer to division 26 electrical for conduits specifications.

.2 Carrier System – In stud walls, and all open, exposed areas including mechanical, electrical and equipment rooms:

.1 All wiring for 24 volts or less shall be run in EMT conduit except wiring to all operators and to all sensors subject to vibration shall be run in flexible metallic conduit for the final 900mm (3 feet).

.2 All wiring for over 24 volts shall be run in EMT conduit.

.3 All wiring between the fire alarm panel and the DDC panels. shall be run in EMT conduit.

.4 Provide steel fittings with nylon throats for all conduit connections.

.5 All conduit containing control wiring shall loaded to a maximum of 75% full upon project completion

.6 Wires not in conduit shall be organized using Panduit or similar.

.7 All wiring shall be run in conduit.

.3 Carrier System – Concealed, accessible areas.

.1 Wires not in conduit shall be organized using Panduit or similar.

.2 Class II low voltage BMS open cable, neatly bundled, shall be routed parallel to building lines.

.3 Cable may follow ductwork routing and may be tied to the side or top of the ducting at duct supports, using suitable cable ties. If cabling does not follow ducting, it shall be fixed to the structure, supported at a minimum of every 5m.

.4 Open cable must be rated plenum cable.

.5 All wiring shall be run in conduit.

.4 Wire:

.1 Line voltage power or switched power wiring - #12 gauge copper wire minimum.

.2 Line voltage control wiring - #14 gauge copper wire, length not to exceed 50 meters; #12 gauge copper wire, lengths exceeding 50 meters.

.3 Low voltage – wire as directed by applicable electrical codes and requirements but minimum #20 gauge.

.4 All DDC wiring ran in celling spaces must be strapped every 3 feet, and not run through sharp edges or corners, cables should not be ran crisscross but in a straight organized fashion.

.5 All DDC wiring to have wire tags at both ends.

.6 All wiring shall be run in conduit.

.5 Cable:

.1 Data transmission cable shall be minimum 18-gauge twisted pairs (shielding as per manufacturers recommendations).

.2 All new cabling used for network installation shall be a minimum of CAT6 or as recommended by the equipment manufacturer.

.5 Wiring for B.M.S Life Safety Systems:

.1 Conductors for communications between the front-end CPU and standalone DDC panels and between DDC panels shall be high temperature, 200°C, Teflon FEP insulated and jacketed, shielded twisted cable pairs of minimum 18 gauge

provided by the controls contractor for the distances involved. Wiring shall be fully redundant for separate channels of communication to the CPU via a different route (so as to protect the communication links in the event of a fire in a particular area).

1.9 EQUIPMENT SUPPLIED FOR INSTALLATION UNDER OTHER SECTIONS

.1 The following equipment shall be supplied under this section but installed under the appropriate trade sections of Division :

.1 Automatic control valves.

.2 Temperature sensor wells.

.3 Automatic control dampers.

.4 Pressure tappings.

.5 Static pressure sensors.

.6 Flow switches.

.2 The Controls Subcontractor shall be responsible for arranging, coordinating and supervising the installation of the above devices in a suitable manner and readily accessible location.

1.10 FREEZE PROTECTION

.1 All air supply handling units containing coils shall have a non-recycling, manual reset, electric line voltage freeze protection controller that will stop the system upon sensing 4°C.

.2 The freeze protection controllers shall contain an additional set of dry contacts that will close on freeze detection for remote alarm indication at the [B.M.S.].

.3 The freeze protection contacts shall be connected on the common line after the H.O.A. selector switch.

1.11 ALARMS - GENERAL

.1 No alarm shall be triggered for a device until the device has been started and is in stable operation. Use software time delays to achieve this effect.

.2 Generate an alarm on the B.M.S. if any equipment is not in the intended operating condition or if any analog input is not within the intended operating range.

1.12 IDENTIFICATION

.1 Identify all panels and points with a numbering system consistent throughout the DDC network.

.2 Identify all controls with symbols relating directly to the control diagram. Use plasticized tags, engraved brass, aluminum, metal-photo, or laminated plastic labels and secure them to, or adjacent to the control devices with key chains.

.3 Identify all junction box covers with control company label. Paint junction box covers to match conduit colour coding [pink] [purple].

.4 Identify with colour bands, all conduits at all junction and pull-boxes, at both sides of wall and floors and at not more than 7.5m (25 ft.) intervals along the length. Identification bands to be sprayed on and not less than 100mm (4”) wide.

.5 Use colour coded conductors, white for neutral.

.6 All manual switches, unless they come with standard nameplates, shall be labelled with engraved plastic laminate nameplates to clearly indicate the service. Wording on nameplates shall be subject to approval by the Consultant.

.7 Identify all DDC panels and associated devices with symbols relating directly to the control diagram. Provide plastic labels for each input and output point with the following information:

.1 Point descriptor.

.2 Point type and channel number.

.3 Corresponding DDC panel number.

.8 Mount an input-output legend sheet within each DDC panel. This sheet shall include the name of the points connected to each controller, the end device manufacture, part number, model number and shall describe the I/O range. If an I/O module is remotely located, a separate legend sheet for that module shall be included at both locations.

.9 All Relays shall be labeled and have wire tags.

.10 Motor control centre and motor starters shall be provided with labels identifying that motors are under remote control.

.11 All Equipment above concealed ceiling should be tagged properly. tagged according to UHNBC FM standards. This includes appropriate tags and equipment description.

1.13 SYSTEM COMMISSIONING AND CALIBRATION

.1 Program each standalone DDC panel immediately following installation.

.2 Set up and calibrate all control loops and sensors during the initial start-up of the systems and check, recalibrate and readjust as necessary during the Owner's Demonstration and Instruction period.

.3 Upon completion of the installation, perform all necessary testing and debugging operations satisfactorily.

.4 Perform all modifications and alterations as required to correct any deficiencies noted during these tests.

.5 Check sensor calibration and control system operation during the first heating season and prior to the first cooling season.

.6 Following each visit submit printed graphs of trend logs one week in duration with hourly samples for all analog inputs connected to each DDC panel.

1.14 VERIFICATION OF SYSTEM COMMISSIONING

.1 Preliminary Tests

.1 After installation of each part of the system and completion of mechanical and electrical hook-up, perform tests to confirm correct installation and functioning of equipment.

.2 Notify the Consultant in writing at least seven days before testing is to take place stating the following:

.1 Location and part of system to be tested.

.2 Describe testing procedure and anticipated results.

.3 Provide all necessary testing equipment and personnel.

.4 Provide portable 2-way radios for communications during demonstrations. Provide three units on the same frequency and of sufficient power and quality as to be useful throughout the building.

.5 Perform tests in presence of the Consultant.

.6 Demonstrate the proper operation of each component.

.7 Correct any deficiencies and re-test in the presence of the Consultant, until designated part of the system performs satisfactorily.

.2 Final Operational Acceptance Test

.1 A final operational test of not less than thirty (30) consecutive days, twenty-four (24) hours per day, shall be conducted on the complete and total installed and operational Control System to demonstrate that it is functioning properly in accordance with all requirements of this specification.

.2 The correct operation of all monitored and controlled points shall be demonstrated as well as the operation and capabilities of all sequences, reports, specialized control algorithms, diagnostics, and all other software. If the equipment operates at an average effectiveness level (AEL) of at least 95% during the performance test period of thirty (30) consecutive calendar days, it will be deemed to have met the Acceptable Standard of Performance, and final acceptance of the system shall be made, provided the contractor has satisfied all other requirements of this specification.

.3 The average effectiveness level (AEL) is defined as the ratio between the total thirty-day test period less any system downtime accumulated within that period, and the thirty-day test period.

.4 In the event the required AEL is not reached during the initial thirty (30) consecutive calendar day period, the final operational acceptance test period shall be extended on a day-to-day basis until the required AEL is reached for thirty (30) consecutive calendar days.

.5 Downtime shall result whenever the control system is unable to fulfill all required functions detailed within this specification due to any malfunction of either BMS hardware or software. Any defect of hardware or software shall be corrected when it occurs before the test may be resumed. Downtime created by non-BMS equipment or activities will not be considered as downtime for the AEL calculation.

1.15 MAINTENANCE SERVICE DURING THE WARRANTY PERIOD

.1 The Contractor shall provide all services, materials and equipment necessary for the maintenance of the entire Control System, for a period concurrent with the warranty period. Any necessary material required for the maintenance work shall be provided by the Contractor.

.2 The Controls Contractor shall provide one minor and major inspection per quarter or as required by the manufacturer and two major inspections per year, and all service for the required maintenance.

.3 Major Inspections: these inspections shall include but not be limited to the following:

.1 Work as detailed hereinafter for minor inspections.

.2 Clean all peripheral equipment, CPU, interface panels, multiplexing panels and microprocessor interior and exterior surfaces.

.3 Provide signal, voltage and system isolation checks of all CPU, interface panels, multiplexing panels and peripherals.

.4 Provide mechanical adjustments, new ribbons and necessary maintenance on printers.

.5 Check and/or calibrate each field input/output device.

.6 Run system software diagnostics as required.

.4 Minor Inspections: These inspections shall include but not be limited to the following:

.1 Provide visual and operational checks to all CPU, peripheral equipment, interface panels, multiplexing panels, and field devices.

.2 Change filter and check fan for all CPU's peripheral equipment as required.

.3 Provide complete back up of BMS system.

.4 Regular service calls: these calls shall be performed during regular working hours, 8:00 a.m. to 4:30 p.m. Monday through Friday excluding legal holidays.

.5 Emergency Service:

.1 The Owner will initiate service calls when there is indication that the control system is not functioning properly.

.2 The Contractor shall have qualified control personnel available during the warranty period to provide service to the "critical" control system components whenever required at no additional cost to the Owner.

.3 The Contractor shall furnish the Owner with a telephone number where the service mechanic can be reached at all times. The service mechanic shall be on the job ready to service the control system within the next eight (8) hours, after receiving a request for service and the work shall be performed continuously until the control system is back in reliable operating condition.

.4 Repairs of a non-emergency nature shall be promptly repaired on the next normal business day.

.6 Records and Logs: records and logs shall be kept of each maintenance task.

.7 System Modifications: recommendations for system modification shall be provided in writing to the Consultant. No system modification, including operating parameters and control settings, shall be made without prior approval.

.8 Software: provide implementation of all software maintenance updates. These shall be accomplished as required and full coordination with control system supervisory personnel shall be maintained.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 GENERAL REQUIREMENTS

.1 Provide all remote sensing points and instrumentation as required for the complete operational capability of the Control System. All sensors shall have the accuracies as stated hereinafter. Hysteresis, relaxation time, span, maximum / minimum limits, etc. shall also be accounted for in all application of sensors and controls.

.2 All instruments of a particular category shall be of the same type and manufacture.

.3 All external trim material shall be completely corrosion resistant with all internal parts assembled in watertight, shockproof, vibration proof, heat resistant assembly.

.4 Use standard conduit box termination with screwdriver connector block unless otherwise specifically stated.

.5 Operating conditions 0°C to 60°C with 10-90% RH (non-condensing) unless otherwise specifically stated.

.6 All instruments, transmitter's pressure switches, sensors, are expected to be reachable by ordinary means. All installed devices should incorporate future maintenance in mind. Mounting a device that has pipework in the way or makes it inaccessible is not permitted.

.7 Occupancy sensors, temperature and humidity transmitters (sensors), CO2 detectors, must be verified, an initial calibration should not be required if factory calibrated. Refer to manufactures recommendation as a minimum. If the device is not within specification, it should be noted on the commissioning documents and corrected. If a reoccurrence or drift error occurs within the warranty period, it shall be replaced.

.8 All Sensors Gauges and Transmitters shall be installed to be operated within 75% of their capacity.

Part 2 Products

2.1 ALARM PANELS

.1 Provide alarm panels in the following locations:

.1 .....

.2 Alarm panels shall include:

.1 Test button to verify lights and alarm horn function.

.2 Pilot trouble light(s) and alarm horn to indicate any alarm condition (1 light for each alarm).

.3 Non-disabling silencing button on panel shall silence horn but alarm light(s) shall continue to burn until alarm condition has been corrected and reset button has been reset. On all subsequent alarms received the horn shall sound.

.4 System on-off switch [with key].

.5 Panel to be suitably labelled.

.6 Panel shall include for the following alarms:

.1 4 electrical alarm points.

.2 6 freeze protection alarm points.

.3 1 low control air pressure alarm point.

.4 2 plumbing alarm points.

.5 2 boiler failure alarm points.

.6 2 spare alarm points.

.7 1 heat pump system trouble alarm (wiring from auxiliary contacts in heat pump control panel).

.8 1 freeze high temperature alarm (wire from auxiliary contacts in freezer high temperature alarm package).

2.2 CONTROL AND SMOKE DAMPERS

.1 Minimum Requirements:

.1 Provide control dampers configured as follows:

.1 Modulating; opposed blade dampers.

.2 Mixing; parallel blade dampers.

.3 Two position; parallel blade dampers.

.2 Assemblies - rigid and adequately braced with corner gussets.

.3 Galvanized steel or extruded aluminum frames.

.4 Maximum frame dimensions - 1220 mm [48"] wide and 1220 mm [48"] high, unless otherwise indicated. Multiple sections to have stiffening mullions.

.5 Maximum blade width - 200 mm [8"].

.2 Standard control dampers:

.1 Minimum performance, based on 610x610 [24"x24"] damper size as tested in an independent testing laboratory:

.1 Maximum 87 Pa [0.35"] static pressure drop at 15.2 M/s [3000 fpm] velocity (damper fully open).

.2 Maximum 55 L/s / sq m [10.75 cfm/sq.ft] leakage at 747 Pa [3" wg] (Damper fully closed).

.3 Maximum blade length of 1219mm [48"] suitable for minimum 622 Pa [2.5" wg] and 7.6 M/s [1500 fpm] velocity.

.2 Minimum 1.6mm [16 ga] single skin galvanized steel blades with longitudinal groove reinforcement.

.3 Synthetic sleeve type bearings (no metal to metal contact).

.4 Linkage concealed within the damper frame.

.5 Square or hexagonal axles locked into blades.

.6 Synthetic rubber or PVC coated fabric seals mechanically locked into the blade edge (adhesive or clip-on type seals not acceptable).

.7 Flexible metal compression type or extruded synthetic rubber jamb seals.

.8 Standard of Acceptance: Ruskin CD36.

.3 Low leakage control dampers:

.1 Minimum performance, based on 610x610 [24"x24"] damper size as tested in an independent testing laboratory:

.1 Maximum 62 Pa [0.25"] static pressure drop at 15.2 M/s [3000 fpm] (damper fully open).

.2 Maximum 55 L/s / sq m [10.75 cfm/sq.ft] leakage at 747 Pa [3" wg] (Damper fully closed).

.3 Maximum blade length of 1219mm [48"] suitable for minimum 100 Pa [4" wg] and 15.2 M/s [3000 fpm] velocity.

.2 Minimum 2.0 mm [14 ga] galvanized steel airfoil type or 2.1mm [12 ga] extruded aluminum airfoil type blades.

.3 Synthetic sleeve type bearings (no metal to metal contact).

.4 Linkage concealed within the damper frame.

.5 Square or hexagonal axles locked into blades.

.6 Synthetic rubber blade seals mechanically locked into the blade edge (adhesive or clip-on type seals not acceptable).

.7 Flexible metal compression type or extruded synthetic rubber jamb seals.

.8 Standard of Acceptance: T A Morrison 1000.

.4 Low leakage control dampers (extended temperature range):

.1 Application:

.1 Emergency generator radiator discharge air.

.2 Minimum performance, based on 610x610 [24"x24"] damper size as tested in an independent testing laboratory:

.1 Maximum 0.25" static pressure drop at 3000 fpm.

.2 Maximum 10.75 cfm/sq.ft. Leakage at 3" w.g.

.3 Suitable for –60°C to 150°C [-76°F to 302°F] operating range.

.4 Maximum blade length of 1219mm [48"] suitable for minimum 4" w.g. and 3000 fpm velocity.

.3 Permanently lubricated stainless steel sleeve type bearings.

.4 Linkage concealed within the damper frame.

.5 Square or hexagonal axles locked into blades.

.6 Seals mechanically locked into the blade edge (adhesive or clip-on type seals not acceptable).

.7 Flexible metal, compression-type jamb seals.

.8 Standard of Acceptance: Ruskin CD60.

.5 Smoke control dampers:

.1 Smoke dampers to be labelled to ULC Standard CAN/ULC S112.1-M90 and UL 555S leakage class 1.

.1 Standard of acceptance: Ruskin SD50.

.2 Actuators for smoke dampers shall be supplied with the smoke dampers as a single entity which meets all applicable UL555 and UL555S qualifications for both dampers and actuators. Actuators shall be rated for 177°C [350°F] elevated temperature classification. Actuators shall be mounted so that the damper fails to the closed position (spring return).

.3 Smoke dampers shall be equipped with two position indicator switches linked directly to the damper blade.

.6 Note:

.1 Control dampers integral to air handling and heat recovery units provided and factory installed by the unit supplier (actuators by this Division). All other control and smoke dampers by this Division. Control dampers supplied by the unit manufactures shall follow the above specifications

.2 Instruct the Sheet Metal Trade on damper installation.

.3 Indicated size is outside frame dimension. Increase size of damper and oversize ductwork, to include for depth of the frame, for all dampers with a pressure drop greater than 12 Pa [0.05" w.g.]. Confirm with the Sheet Metal Sub-Contractor before fabrication.

.4 Check that dampers are installed square and true and that blades close tightly against seals and stops.

.5 Blades to be horizontal in vertical mounted dampers. Refer to drawings for orientation of dampers.

.6 Ensure that damper end-linkages are easily accessible (coordinate with the Sheet Metal Sub-Contractor).

.7 Provide an additional drive shaft bearing if the drive shaft is longer than 75 mm [3"].

.8 Do not install dampers within the thickness of any wall unless otherwise indicated (coordinate with the Sheet Metal Sub-Contractor).

.9 Dampers shall be adequate for the maximum system pressure. Refer to the appropriate Section of the specification.

2.3 CONTROL DAMPER ACTUATORS

.1 General:

.1 Provide electric or electronic type damper actuators where indicated or required.

.2 Damper operators shall allow smooth operation of the damper throughout its entire range and assure tight shut-off against system pressure.

.3 Damper actuator shall be easily removed for replacement.

.4 The actuator shall modulate the damper between the fully open and closed position based upon a 0-10 VDC or 4-20 mA control signal. The actuator shall remain in its position until the applied signal changes. In the event of a control signal loss, the actuator shall move to the zero-voltage input position.

.5 The damper shall maintain its shutoff force even if power is lost.

.6 All control dampers shall be supplied by this trade. Refer to equipment schedules.

.7 All damper actuators, including air valve actuators) shall be supplied by this trade for factory installation by unit manufacturer. Damper actuators shall meet the requirements of the unit manufacturer in all cases.

.8 Spring return for "fail-safe" in Normally Open or Normally Closed position where required.

.9 Size actuators to control dampers against maximum pressure or dynamic closing pressure whichever is greater.

.10 Size damper actuators so that they will provide smooth and full travel of the dampers while stroking in both directions.

.11 Where individual dampers are installed, install a separate damper actuator for each damper.

.12 Where multi-section dampers are installed, install a separate damper actuator for each section.

.13 Locate damper actuator so that they are easily accessible for testing and servicing.

.14 Where damper actuator operates outdoor and exhaust air dampers, pretension the damper drive linkage to ensure tight closure.

.15 Where a damper actuator is installed on an insulated surface of a duct or plenum, mount it on a stand-off bracket, so as not to interfere with the continuity of the insulation.

.16 Control contractor to provide low voltage wiring for control dampers.

.2 Electronic Damper Actuators (DME & DTE):

.1 Actuators shall be direct coupled enabling it to be mounted directly to the damper shaft without the need for connecting linkage.

.2 The actuators shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the rotation of the actuator.

.3 Proportional actuators shall accept a 2 to 10 VAC or 4 to 20 mA signal.

.3 Incremental Control Damper Actuator (DMI):

.1 The damper actuator shall modulate the damper between fully open and fully closed based on a 3-wire control signal (24 VAC). The actuator shall remain in position until the signal is applied.

.2 The TUC shall calculate damper position based on the motor speed and duration of control signal. The damper should be driven to a full position and the calculation reset once every 24 hours.

2.4 CONTROL VALVES

.1 All characteristics of control valves shall be suited to the required application. Three-way mixing valves shall be linear for each port giving constant flow, and two-way valves shall have modified linear flow characteristics.

.2 All valves shall be plug type with stainless steel stems and EPT ring pads or teflon packing.

.3 Valve pressure / temperature rating - minimum ANSI Class 125.

.4 Plugs shall be brass with molded composition discs.

.5 Discs (renewable) shall be bronze for media 110°C or less and stainless steel for media above 110°C operating temperature.

.6 Valve bodies for NPS ½ shall be screwed cast brass with integral seat.

.7 Valves NPS ¾ to NPS 2 shall have screened cast brass body and cast brass cage with integral seat.

.8 Valve bodies for NPS 2½ and up shall be cast iron flanged.

.9 All control valves supplied with positive positioning relay shall have a minimum of 27-76 kPa spring range.

.10 Note:

.1 Size control valves according to capacities and pressure drops as indicated in the schedules.

.2 Clearly identify the control valve coefficient (Cv) rating on valve bodies.

.3 All primary building heating valves shall fail open to heating (valves on terminal units may fail either open or to the last operating position). Cooling valves shall fail closed to cooling or to the last operating position. Domestic hot water heating valves shall fail closed to heating.

.4 Control valves to be supplied by this trade for installation by others.

.11 Design: NPS ½ to NPS 2 - Johnson Controls VG7000 series. NPS 2½ and larger - Johnson Controls cast iron flanged globe valves V5252, V5842.

2.5 PRESSURE INDEPENDENT CONTROL VALVES

.1 Pressure Independent Actuated Ball Valves and Cartridge: (12 mm to 50 mm)

.2 See Section 25 99 605 – HVAC – Equipment Manufactures for approved manufacturers.

.3 See Section 23 21 13 – Hydronic Specialties for general valve requirements.

.4 The modulating control valves shall be pressure independent and shall include a Pressure Compensating Cartridge, Actuated Ball Valve, and Manual Isolation Ball in a single valve housing.

.5 Valve housing shall consist of forged brass, rated at no less than 360 psig at 250°F.

.6 Valve ball shall consist of chemically plated nickel brass or stainless steel.

.7 Actuated stem shall be removable/replaceable without removing valve from line.

.8 Manufacturer shall be able to provide ball insert to limit flow to maximum flow rate with ±5% accuracy.

.9 Valve shall have EPDM O-rings behind the seals to allow for a minimum close-off pressure of 100 psi with 35 in-lbs of torque for 1/2" – 3" sizes.

.10 Valve shall have a fixed end or union end connection with factory installed air vent to allow for venting of the coil.

.11 Dual pressure/temperature test valves for verifying the pressure differential across the cartridge and flow limiting ball shall be standard.

.12 Pressure compensating cartridge shall automatically compensate for pressure changes in valve and shall maintain a constant pressure drop across the flow limiting actuated ball. The operating pressure range shall be available with the minimum range requiring 5.8 PSID to actuate the mechanism. Valve internal control mechanism includes a diaphragm and full travel linear coil spring. Valves shall include an accessible/ replaceable cartridge.

.13 A universal mounting plate shall allow installation of actuators meeting the system electrical requirements and valve torque requirements. The actuator and plate can be rotated after mounting.

.14 Valve shall include a 600 WOG manual isolation ball valve.

.15 Identification tags shall be available for all valves; tags shall be indelibly marked with Cv, model number and location; tags shall be 3" x 3" aluminum.

.16 Provide 0-10 VDC control operators for terminal units. Floating point or tri-state operators will not be accepted.

.17 Valve operators shall be easily removable for service or replacement.

.18 Size valve operators to close valves against pump shut off head.

.19 All valve operators shall be suitable for continuous operation.

.20 Valves and actuators shall be suitable for operating conditions encountered and shall provide stable operation throughout the range of operating conditions.

.21 Standard of Acceptance: Griswold PIC-V, Delta Valves, and Belimo.

2.6 CONTROL VALVE ACTUATORS

.1 General:

.1 Valve operators shall allow smooth operation of the valve throughout its entire range and assure tight shut-off against system pressure.

.2 Valve actuator shall be easily removed from the valve body for replacement.

.2 Electric Two Position Valve Actuators (VTE):

.1 Two Position Control Valve Actuators (only to be used where specifically specified):

.3 Incremental Control Valve Actuators (only to be used where specifically specified) (VMI):

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 3-wire control signal (24 VAC). The actuator shall remain in position until the signal is applied.

.2 The valve shall maintain its shutoff force even if power is lost.

.3 The TUC shall calculate valve position based on the motor speed and duration of control signal. The valve shall be driven to a full position and the calculation reset once every 24 hours.

.4 Proportional Control Valve Actuators (VME):

.1 The valve actuator shall modulate the control valve between the fully open and closed position based upon a 0-10 VDC or 4-20 mA control signal. The actuator shall remain in its position until the applied signal changes. In the event of a control signal loss, the actuator shall move to the zero-voltage input position.

.2 The valve shall maintain its shutoff force even if power is lost.

2.7 CONTROL PANELS

.1 General:

.1 Fabricate from prime and enamel coated steel suitable for flush mounting, recess mounting, or free standing with mounting legs, as applicable.

.2 Outdoor panels shall be weatherproof fiberglass type with a breather plug.

.3 All control panel enclosures shall be accessible with 1m clear working distance in front, with no obstructions. Ceiling mounted enclosures shall have accessible T-Bar removable panel and room to place a ladder below.

.4 Panels shall be identified with a panel legend, proper wire tagging, a panel identifier on the outside of the panel, and the panels are to be maximum 75% full when complete to allow room for future expansion.

.5 Panel doors shall be hinged and complete with locks.

.6 Construct so that instruments and gauges are flush mounted.

.7 Provide sub-panel, inside control panel, for mounting control components.

.8 Adhere Lamicoid nameplates on the control panels to clearly identify the service of each device.

.9 All DDC controllers which are networked together must be accompanied with a network map.

.10 Submit shop drawings of control panel for review.

2.8 DIFFERENTIAL PRESSURE TRANSMITTERS (DPT)

.1 Provide differential pressure transmitters having the following minimum specifications:

.1 Internal materials to be suitable for continuous contact with the process material measured including compressed air, water, glycol or steam as applicable.

.2 Output signal of 4 - 20 mA into a maximum of 500-ohm load.

.3 Output variations of less than 0.2% full scale for supply voltage variations of +/- 10%.

.4 Combined non-linearity, repeatability and hysteresis effects not to exceed +/- 1% of full-scale output over entire range.

.5 Integral zero and span adjustment.

.6 Temperature effect of +/- 1.5% full scale/50°C or less.

.7 Output short circuit and open circuit protection.

.8 Over-pressure input protection to a minimum of twice rated input.

2.9 ELECTRONIC AIR FLOW MEASURING STATIONS (FMS)

.1 Air flow measuring stations are to be provided by the Sheet Metal Sub-Contractor c/w 4 – 20 mA electronic pressure transmitter for connection by the controls contractor.

.2 Controls contractor to provide required external power supply to pressure transmitters.

.3 Specify range of air flow to ensure station can read the velocity,

.4 Note the required “straight lengths of ducting required for the station to read the flow accurately

2.10 FREEZE PROTECTION

.1 Freeze protection thermostats shall be manual reset type with 6 m averaging element. Provide multiple thermostats for large duct cross sectional areas.

.2 For liquids, elements shall be rigid bulb type mounted in separable wells.

.3 Freeze protection elements shall be hard wired to the fan starter and also wired to the B.M.S. or alarm system.

2.11 HUMIDITY SENSORS (HS)

.1 Provide humidity sensors as directed with the following minimum specifications:

.1 Range room type 30-80% RH.

.2 Range duct type 20-90% RH.

.3 Operating temperature range of 0°C to 60°C.

.4 Absolute accuracy of +/- 3% RH.

.5 Stainless steel sheath construction complete with integral shroud to enable specified operation in air streams of up to 10 m/sec.

.6 Sensor able to be cleansed of oil vapour, dust or other anticipated air borne contaminants by a simple field method such as solvent or mild detergent solution washing.

.7 Room humidity sensors shall be located at the inlet to an RA grille.

.8 Duct mounted sensors shall be located such that the sensing element is located in the air stream and the transmitter electronics are out of the air stream.

2.12 PRESSURE SWITCHES (PSW)

.1 Provide pressure or differential pressure switches for ranges as indicated.

.2 Pressure sensing elements shall be Bourbon tube, bellows or diaphragm type.

.3 Adjustable setpoint and differential.

.4 Pressure switches shall be snap action type rated at 120 volts, 15 amps AC or 24 volts DC.

.5 Sensor assembly shall operate automatically and reset automatically when condition returns to normal.

.6 Sensor Ratings: sensors shall have the following pressure and accuracy ratings:

.1 Low and medium steam sensors shall be rated at 1030 kPa. Low pressure shall operate from 0 to 207 kPa with an accuracy of plus or minus 3 kPa. Medium pressure shall operate from 0 to 700 kPa and with an accuracy of plus or minus 7.0 kPa.

.2 High pressure steam sensors shall be rated at 2100 kPa, have a full operating range of 0 to 2100 kPa with an accuracy of plus or minus 14 kPa.

.3 Pressure switches for pump operation shall have a range of 20 kPa to 350 kPa and adjustable differential from 1 kPa to 35 kPa.

.4 Pressure switches for fan operation shall have a range of 0 to 1500 Pa and adjustable differential from 10 to 50 Pa.

.5 Sensors on steam lines and high temperature water shall be protected by pigtail siphon installed between the sensor and the fluid line.

.6 All sensors shall have an isolation valve and snubber installed between the sensor and pressure source.

2.13 STATIC PRESSURE TRANSMITTERS (SPT)

.1 Output of 4 - 20 mA linear into maximum of 500-ohm load.

.2 Calibrated span: not greater than twice the static pressure at maximum flow.

.3 Accuracy: +/- 1% of span.

.4 Repeatability: within 0.5% of output.

.5 Linearity: 1.5% of span.

.6 Deadband or Hysteresis: 0.1% of span.

2.14 TEMPERATURE SENSORS

.1 For DDC applications.

.2 General: Temperature sensors shall be thermistor, resistance or thermocouple type, however, thermocouples shall be restricted to temperature range +200°C and above.

.3 The following shall apply to thermistor, resistance or thermocouple temperature sensors as applicable.

.1 RTDs shall be 100 ohm or 1,000 ohms at 0øC (+/- .2 ohm) nickel or platinum element with strain minimizing construction and 3 integral anchored leadwires coefficient of resistivity of 0.000385 ohms/ohm/ deg.C. Thermistors shall be 3,000 or 10,000 ohms.

.2 Sensing element to be hermetically sealed.

.3 Stem and tip construction to be copper or 304 stainless steel as noted.

.4 Sensors to have a time constant response of less than 3 seconds to a temperature change of 10°C.

.5 Sensors shall operate over the following ranges with the accuracies over the noted range of the sensor.

.1 -50°C to +50°C, plus or minus 0.5°C.

.2 0°C to +50°C, plus or minus 0.25°C.

.3 0°C to 25°C, plus or minus 0.1°C.

.4 0°C to 100°C, plus or minus 1°C.

.6 Immersion wells shall be of stainless-steel materials for steam and domestic hot water and brass for other applications. Heat transfer compound to be compatible with sensor.

.4 Temperature sensors shall be of the following types:

.1 Room type (RTS) - suitable for wall mounting, with or without protective guard.

.1 Room temperature sensors in staff areas (non-student, non-public areas) – two-wire type with up/down temperature adjust, no display

.2 Room temperature sensors in student or public areas – no user interface input or display, flat stainless steel plate.

.3 Room temperature sensors shall be mounted 6 inches below any other sensors to prevent false readings due to heat from these sensors.

.2 General purpose duct type (DTS) - suitable for insertion into air ducts at any angle, insertion length shall be suitable for application. Copper sheathed construction.

.3 Spring-loaded thermowell type (ITS) - spring loaded construction with compression fitting for 20 mm NPT well mounting. Lengths shall be suitable for application. Stainless steel sheathed construction.

.4 Averaging duct type (ATS) - continuous filament with immersion length of 6000 mm minimum. Probe to be bent, at field installation time, to a minimum radius of 100 mm at any point along the probe length without degradation in performance. Copper sheathed construction. Or multiple sensors mounted on a cable connected to provide an average temperature reading

.5 Outside air type (OTS) - complete with non-corroding shield designed to minimize solar and wind effects, threaded fitting for mating to 12 mm conduit, probe length of 100 - 150 mm.

Part 3 Execution

3.1 GENERAL

.1 All equipment shall be installed according to manufacturers' published instructions.

.2 Temperature, Humidity Sensors, Thermostats and Humidistats:

.1 All sensors shall be stabilized to such a level as to permit on-the-job installations that will require minimum field adjustments or calibration.

.2 Sensor assemblies shall be readily accessible and adaptable to each type of application in such a manner as to allow for quick, easy replacement and servicing without special tools or skills.

.3 Outdoor installation shall be weatherproof construction in NEMA 4 enclosures. Install space instruments at a height of 1.5 m above the finished floor, unless otherwise indicated.

.4 Install corridor instruments at a height of 2.1 m above the finished floor.

.5 Locate instruments in the same vertical centreline as light switches.

.6 Where instruments are indicated on an outside wall install on a stand-off wall bracket which provides an air space between the instrument and the wall; or on an insulating base (e.g. a cork pad).

.7 Install protective metal guards on instruments in areas where they may be subject to damage (loading areas, gymnasiums, workshops, public corridors and storage areas). Bolt guards, independent of instruments to separate baseplates. Provide backing in wall for securing mounting bases.

.8 Sensors in ducts shall be mounted in locations to sense the correct temperature of the air only, and shall not be located in dead air spaces. The location shall be within the vibration and velocity limits of the sensor. Where an extended surface element is required to properly sense the average temperature it shall be securely mounted within the duct to measure the best average temperatures. Elements shall be thermally isolated from brackets and supports to respond to air temperature only. Sensor element to be supported separately and not connected to coils or filter racks.

.9 Wells shall be installed in the piping at elbows where piping is smaller than the length of the well to effect proper flow across the entire area of the well. Well shall not restrict flow area to less than 70 percent of line-size-pipe normal flow area.

.3 Temperature Transmitters, Humidity Transmitters, Controllers and relays to be installed in NEMA I enclosures.

.1 Panels to be either free standing or wall mounted ANSI 61 polyester powder coated steel cabinets with hinged and key locked front door. Arrange for conduit and tubing entry from top, bottom or either side.

.2 Panels shall be modular multiple panels being used if required for capacity in any particular location.

.3 All panels shall be lockable with same key.

.4 All wiring and tubing within panels to be located in trays or individually clipped to back of panel, and clearly identified.

.4 All field devices to be properly identified.

.5 Mount electrical instruments on standard electrical rough-in boxes fastened to structure.

.6 Testing:

.1 All field devices shall be properly calibrated and tested for performance and accuracy. A report detailing test performed and results to be submitted to the consultant for approval. The consultant will verify results at random. Provide all testing equipment necessary. Provide manpower necessary to assist consultant's verification.

END OF SECTION

TABLE OF CONTENTS

Part 1 General

1.1 DESCRIPTION OF THE PROJECT

.1 BMS contractor shall ensure the existing BMS system and associated wiring and devices essential for operation of the mechanical systems of the building remain protected and operational during construction.

.2 Note: this project involves integration of new controls into the existing BMS system. Unless otherwise noted, the sequence of operation for all the exiting systems that will remain, or removed and reinstalled, shall be reinstated. Test and verify the operation of all the existing equipment (i.e. rooftop exhaust fans) that will be impacted by this project.

1.2 PROJECT SCOPE

.1 Demolition scope:

.1 The demolition of level 1 scope of work area (Fit-Out). Refer to demolition drawings.

.2 Construction – Level 1 Fit-Out scope:

.1 Complete fit-out of the level 1.

.2 New ventilation system (Supply, Return and Exhaust)

.3 New Split system Air conditioning units

Part 2 Products – Refer to Section 25 09 13

Part 3 Execution

3.1 HVAC CONTROL OBJECTIVES:

Temperature Requirements:

.1 The temperature will be monitored and controlled by room temperature sensors (BMS system) and controlled in each space as indicated on the drawings.

Humidity Requirements:

.1 Humidity will be monitored in each space. The humidification level will be controlled at the air handling unit based on feedback from the following equipment

.2 The room Temperature / Humidity Sensors (BMS system) and

Energy:

.1 Provide no more heating than is essential (minimize reheat).

.2 Provide no more cooling than is essential.

.3 Provide temperature, humidity and pressure reset functions for air and water systems to reduce energy consumption.

3.1 ALARM AND SAFETIES

.1 All room temperature, humidity, and pressure sensors shall alarm their high or low alarm condition, as defined in the system database, at the operators Terminal Display Unit (TDU). Alarm points will be taken from dry contacts on the TDU and connected to the existing BMS.

.2 Other temperature and humidity sensors shall alarm their high or low alarm condition, as defined in the system database, at the operators existing workstation (BMS).

.3 An alarm shall be generated at the OWS when any motor status as sensed by a current sensing relay does not match the commanded value for that motor.

.4 A fan alarm is generated at the OWS when any motor status as sensed by a current sensing relay does not match the commanded value for the supply fan VFD.

3.2 MONITORING

.1 The BMS monitors the following conditions and parameters as a minimum:

.1 Fire Devices

.1 All fire / smoke damper positions;
.2 Smoke detection (from fire alarm panel);

.2 Ventilation System:
.1 All motorized mechanical damper positions.
.2 Supply air temperature and humidity.
.3 Duct main static pressure.
.4 Exhaust air temperatures, humidity and CO2 level.

.3 Room Level Controls
.1 Air Supply (l/s).
.2 Air Change Rate - Air Changes per Hour (ACH).
.3 Temperature (oC).
.4 Humidity (where applicable).
.5 Occupancy mode (where applicable).

3.3 HEATING WATER SYSTEM

.1 General Description:
.1 Heating water for the project is produced via the existing boilers located in the penthouse mechanical room.
.2 Existing pumps in the penthouse boiler room distribute primary heating water loop.
.3 New VAV reheat coils and radiant ceiling panels are connected to the existing heating water loop.
.4 New Heating Water Control Valves
.5 New Supply and Return Temperature Sensors
.6 New reheat coil water temperature sensors
.7 Misc. Sensors and Controls for existing Heating water system
.8 Existing Heating water supply temperature sensors
.9 Existing Heating water supply and return temperature sensors
.10 Existing Heating water return temperature sensor

3.4 RE-HEAT CONTROL

.1 General Description: Re-heat Coils in the ceiling are provided for each supply air valve and VAV box.
.2 The re-heat coils and associated valves shall operate in sequence with the supply air valves
.3 Thermostat shall modulate 2-way heating control valves via terminal display unit and room temperature sensors / thermostats.
.4 Components
.1 Re-heat Coils (downstream of supply air valves)
.2 Re-heat 2-way control valves (CV)
.3 End of line bypass
.5 Related Points
.1 Outside air temperature
.2 Heating water modulating control valve
.3 Air valve reheat coil damper and control valve position
.4 Space temperature sensors

.6 Related Systems

.1 Existing AHU and New Air Handling unit AHU-1

.2 Heating water system

.7 Normal Operation

.1 Space temperature / humidity sensor shall modulate re-heat control valve to maintain space temperature at set point.

.2 Where there are space temperature sensors which control air valves, they shall also control the re-heat control valve.

.8 Alarms

.1 If any temperature sensor are reading above or below its intended operating range a BMS alarm shall be initiated.

3.5 RADIANT CEILING PANEL CONTROL:

.1 General Description:

.1 Ceiling mounted radiant heating panels (heating water) are specified in some exterior as indicated on the drawings.

.2 The radiant panels will operate in sequence with the air valves where applicable.

.2 Components

.1 Radiant heating panels with control valves

.3 Related Points

.1 Outside air temperature

.2 BMS Space temperature sensors

.4 Related Systems

.1 Heating water system

.5 Normal Operation

.1 Space temperature sensor shall modulate radiant ceiling panel control valve to maintain space temperature at set point of 22˚C.

.2 Radiant ceiling panels control valve opens to provide heating only when the outdoor temperature is below 18˚C.

.3 Where there are space temperature sensors or duct temperature sensors which control supply air temperature, they shall also control the radiant panel control valve. The radiant panel control valve shall be sequenced on first, followed by the reheat when required.

.4 Where radiant panels are grouped, all applicable panels turn on/off together when in heating mode.

.6 Alarms

.1 If any temperature sensor is reading above or below its intended operating range a BMS alarm shall be initiated.

3.6 SUPPLY AIR VALVE SYSTEM

.1 The VAV system operates 24/7. Reheat to maintain temperature setpoint. Increase air flow for additional cooling as needed.

.2 Refer to section 25 9015

3.7 HEAT TRACE

.1 Refer to specifications 22 05 34 for domestic hot water temperature maintenance (electric heat trace) on pipes.

3.8 TREND LOGGING AND HISTORIAN

.1 Set up trend logs with archiving as required for sustainability documentation, for troubleshooting, energy management and preventive maintenance.

3.9 MEDICAL GAS SYSTEMS

.1 The BMS shall monitor dry contact alarm outputs from the Zone Alarm panel, for the purpose of monitoring and annunciating alarms. Refer to section 22 63 02, clause 2.6 Area Alarms – LCD with Ethernet.

.2 Wiring, and conduits, between the dry contacts and the BMS panels shall be by this contractor.

.3 General Description

.1 The BMS shall monitor medical gas alarm outputs for recording and annunciation at the OWS(s).

.2 Dry contacts are located at the “ZONE” and “MASTER” medical alarm panels, and the medical gas plant equipment.

.4 Related Points

.1 Master alarm panel

.2 Combination zone valve/alarm panel

.3 Stand-alone zone alarm panels

.5 Scope of Work:

.1 Wiring between the dry contacts and the BMS panels shall be by this contractor.

.2 Refer to Medical Gas equipment specifications and drawings for details.

.6 Alarms

.1 Provide alarm for any input point that is reading above or below the normal operating range.

.2 Alarm panel in the corridor outside the Biomed offices.

3.10 MEDICAL FRIDGES AND FREEZERS

.1 General Description

.1 Medical refrigerators and freezers might be equipped with temperature sensors and dry contacts for monitoring and alarm.

.2 Components

.1 Provide connection from the relevant temperature sensors to the BMS.

.2 Locations (confirm with architectural drawings and equipment).

.3 Alarms

.1 If equipment internal temperature sensor reading is above or below its intended operating range a BMS alarm shall be initiated.

.2 Medical fridges and freezers in the Med Room is equipped with temperature sensor and dry contact for monitoring and alarm. Provide connection from the relevant temperature sensor to the BMS. The temperature of the medication room fridge to be maintain between 2°C to 6°C (confirm with FMO). Provide a 15-minute time delay and alarm. Refer to architectural drawings for the location of the fridge inside the Medication room.

3.11 TECHNOLOGY INTERFACE

.1 Include for interface with the following: Lighting, Fire Alarm, occupancy sensors, Electric metering, etc. as outlined in the electrical specification.

3.12 DIVISION 26 ALARMS

.1 Various pieces of electrical equipment are specified complete with BACNet capabilities. Provide connection to the items and provide interface with the building’s DDC system.

.2 Wiring between the dry contacts and the BMS panels shall be by Division 23 contractor.

3.13 PLUMBING SYSTEMS

.1 General Description

.2 Floor drains (FD-1) and hub drains traps equipped with trap primers are specified to be fed from BMS controlled solenoid valves.

.3 Solenoid valves shall cycle on/OFF as per a programmed schedule.

.4 Solenoid valves locations to be coordinated on site.

.5 The BMS shall monitor dry contact alarm outputs provided by the Plumbing Sections for recording and annunciation at the OWS(s).

.6 between the dry contacts and the BMS panels shall be by this contractor.

END OF SECTION

ITEM	ACCEPTABLE PRODUCTS / SUPPLIERS / MANUFACTURERS	SHOP DWG.
CONTROL SYSTEMS	Reliable Controls, Houle Building Controls Automation	X
CONTROL DAMPERS		
Low Leakage Type	Arrow-Foil PBDAF & OBDAF, Honeywell Moduflow D642 & D643, Johnson Proportion/Aire D-1200 & D-1300, Ruskin CD36, Tamco 1000,	X
Not Low Leakage Type	Honeywell, Johnson, Ruskin CD35	X
CONTROL DAMPER ACTUATORS	Belimo	X
CONTROL VALVES		X
CONTROL VALVE ACTUATORS	Belimo	X
		X

NOTE:

.1 The design is based upon the equipment listed in the equipment schedules and/or underlined in the Equipment Supplier Schedules.

.2 **X** Denotes required submission.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS & SUMMARY

.1 The General Conditions, Supplements and Amendments shall govern this Section (read in conjunction with Instructions to Tenderers / Bidders). This section covers items common to all Electrical sections and is intended only to supplement the requirements of Division 01.

.2 Reference to “Electrical Divisions” shall mean all sections of Divisions 26, 27, 28, 33, 34 & 48 in the Master Format or the Canadian Master Specifications.

.3 The word "Provide" shall mean "Supply and Install" the products and services specified. "As Indicated" means that the item(s) specified are shown on the drawings.

.4 Provide materials, equipment and plant, of specified design, performance and quality; and, current models with published certified ratings for which replacement parts are readily available. Provide project management and on-site supervision to undertake administration, meet schedules, ensure timely performance, ensure coordination, and establish orderly completion and delivery of a fully commissioned installation.

.5 The most stringent requirements of this and other electrical sections shall govern.

.6 All work shall be in accordance with the Cardiac Renovation Project Drawings and Specifications and their intent, complete with all necessary components, including those not normally shown or specified, but required for a complete installation.

.7 Provide seismic restraints for all required equipment and wiring systems.

.8 Connect to equipment specified in other Sections and to the equipment supplied and installed by other Contractors or by the Owner. Uncrate equipment, move in place and install complete, start-up and test. Include all field assembly of loosely/separately packaged accessories

.9 "Consultant" shall mean Stantec Consulting Ltd.

1.2 REFERENCES

.1 Install in accordance with CSA C22.1 (latest adopted edition) - except where specified otherwise.

.2 Refer to CSA C22.1 Appendix A “Safety Standards for Electrical Equipment” for applicable codes and the related revisions

.3 Refer to CSA C22.1 Pages xxix - xxxii for related ‘Reference Publications’

.4 Refer to NBCC Table 1.3.1.2 for applicable codes and the related revisions.

.5 Comply with Local Electrical Bulletins and by-laws relating to the Authority having Jurisdiction.

.6 Install overhead and underground systems in accordance with CSA C22.3 No.1 (current adopted edition) - except where specified otherwise.

.7 Preferred Voltage Levels for AC Systems, 0-50,000V in accordance with CAN3-C235 (current adopted edition)

1.3 DEFINITIONS

.1 Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

1.4 DESIGN REQUIREMENTS

.1 Operating voltages: to CAN3-C235- current edition

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

.1 Submittals to be in accordance with Division 01.

.2 Product Data: submit WHMIS MSDS in accordance with Division 01 - Sustainable Requirements and Division 02- Hazardous Materials

.3 Single Line Diagram

.4 Provide revised complete single line electrical diagrams under plexiglass as follows:

.1 Submit PDF for review prior to installing:

.2 Electrical distribution system: locate in main electrical room.

.3 Electrical power generation and distribution systems: locate in power plant rooms.

.5 Fire Alarm Riser:

.6 Provide revised fire alarm riser diagram, plan and zoning of building under plexiglass at fire alarm control panel and annunciator. Submit PDF for review prior to installing.

.7 Shop Drawings:

.8 Submit shop drawings, product data and samples in accordance with Division 01. The submission shall be reviewed, signed and processed as described in Division 01.

.9 Indicate details of construction, dimensions, capacities, weights and electrical performance characteristics of equipment or material.

.10 Where applicable, include wiring, line and schematic diagrams. Include wiring drawings or diagrams showing interconnection with work of other Sections.

.11 Content

.1 Shop drawings submitted title sheet.

.2 Data shall be specific and technical.

.3 Identify each piece of equipment.

.4 Information shall include all scheduled data.

.5 Advertising literature will be rejected.

.6 The project and equipment designations shall be identified on each document.

.7 Information shall be given in S.I. units.

.8 The shop drawings/product data shall include:

.1 Dimensioned construction drawings with plans and sections showing size, arrangement and necessary clearances, with all equipment weights and mounting point loads.

.2 Mounting arrangements.

.3 Detailed drawings of bases, supports and anchor bolts.

.4 Control explanation and internal wiring diagrams for packaged equipment.

.5 A written description of control sequences relating to the schematic diagrams.

.12 Format

.1 PDF

.2 Bill of Quantities for related components, identified by model number, listed on the front cover with item identification numbers.

.13 Coordination

.1 Where electrical equipment requires support or backing by other trades or mechanical connections, the shop drawings shall also be circulated through the other "services" contractor(s) prior to submission to the Consultants.

.14 Keep one [1] copy of shop drawings and product data, on site, available for reference.

.15 Quality Control: in accordance with Division 01 - Quality Control

.1 Provide CSA certified equipment and material. Where CSA certified equipment and/or material is not available, submit such equipment and/or material to the authority having jurisdiction for special approval before delivery to site.

.2 Submit test results of installed electrical systems and instrumentation.

.3 Submit, upon completion of Work, the electrical “load balance” report.

.16 Permits and Fees:

.1 Submit to Electrical Inspection Department, Local Fire Authorities and Supply Authority the necessary number of drawings and specifications for examination and approval prior to commencement of work. Obtain all required permits and pay all fees.

.2 Arrange for inspection of all Work by the authorities having jurisdiction. On completion of the Work, furnish final unconditional certificates of approval by the inspecting authorities.

1.6 QUALITY ASSURANCE

.1 Quality Assurance: in accordance with Division 01 - Quality Control

.2 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices in accordance with authorities having jurisdiction as per the conditions of Provincial and/or Territorial Act respecting manpower vocational training and qualification.

.1 Employees registered in provincial apprentices program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

.2 Permitted activities: determined based on training level attained and demonstration of ability to perform specific duties.

.3 Site Meetings: in accordance with Division 01 - Construction Progress Schedule

.1 Site Meetings: as part of Manufacturer's Field Services: schedule site visits, to review Work, at stages listed below:

.1 At time of initial shop drawing submission to confirm any existing conditions and to coordinate with the project schedule and any cross discipline requirements.

.2 After delivery and storage of products, and when preparatory Work is complete but before installation begins.

.3 During progress of Work at key schedule points as determined.

.4 At commissioning.

.5 Upon completion of Work, after cleaning is carried out.

.4 Health and Safety Requirements: do construction occupational health and safety in accordance with Division 01 - Health and Safety Requirements.

1.7 DELIVERY, STORAGE AND HANDLING

.1 Material Delivery Schedule: provide Consultant with schedule within 4 weeks after award of Contract.

.2 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and/or recycling in accordance with Division 01 Construction/Demolition Waste Management and Disposal.

1.8 RECORD DRAWINGS

.1 The contractor shall keep on complete set of white prints at the site office, including all addendums, change orders, site instructions, clarifications and revisions for the purpose of record drawings. As the work on site proceeds, the contractor shall clearly record in Red Pencil all as-built conditions which deviate from the original contract documents.

.2 Prior to substantial performance, the contractor shall obtain CAD files of all electrical drawings, using AutoCAD (latest version), and use the services of a competent CAD operator to transfer all as-built information, including: Addendums, Change Order, Clarifications, Revisions, Site Instructions and shop drawings. Upon completion, the Contractor shall certify, in writing that the as-built record drawings are complete and that they accurately indicate all electrical and lighting devices, including exposed as well as concealed items.

.3 Contractor to forward letter of certification and as-built CAD drawings to the Consultant for final review. As-built drawings to be submitted in the form of one set of CAD files.

1.9 OPERATION AND MAINTENANCE MANUALS

.1 Within 30 days prior to the substantial performance, the Contractor shall submit a draft copy of the proposed contents of each maintenance manual to the Consultant for review. Once the draft copy is approved, the contractor will supply 4 copies in suitably labelled, hard back, D-ring type commercial binders, each complete with an index and tabbed title sheets for each section.

.2 All maintenance manual data shall be printed on 8½" x 11" heavy bond, indexed, tabbed, punched and bound in the binders. Each manual shall have a title sheet which is labelled "Operation & Maintenance Manual" and lists the Project name, Contractor's & Consultant's names, date submitted, and a Table of Contents for each volume. If a manual exceeds 75mm in thickness, provide additional manuals as required.

.3 Each section of the manual shall contain the following information:

.1 Systems Descriptions. A brief synopsis of each system typed and inserted at the beginning of each section. Include sketched and diagrams where appropriate.

.2 Descriptive and technical data.

.3 Copy of test data. Must supply a copy to the Consultant and to the Client.

.4 Include type and accuracy of instruments used to obtain test data. This must be approved by the Consultant, the Client and manufacturer prior to testing.

.5 Copy of final inspection certificate.

.6 Copy of all warranty certificates.

.7 Set of final reviewed shop drawings.

1.10 SYSTEM START-UP

.1 Refer to Division 01, and as follows.

.2 Instruct Consultant and operating personnel in the operation, care and maintenance of equipment.

.3 Arrange and pay for services of manufacturer's factory service Engineer to supervise start-up of installation, check, adjust, balance and calibrate components, where required in these specifications.

.4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

1.11 OPERATING INSTRUCTIONS

.1 Provide for each system and principal item of equipment as specified in technical sections for use by operation and maintenance personnel.

.2 Operating instructions to include following:

.1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.

.2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.

.3 Safety precautions.

.4 Procedures to be followed in event of equipment failure.

.5 Other items of instruction as recommended by manufacturer of each system or item of equipment.

.3 Print or engrave operating instructions and frame under glass or in approved laminated plastic.

.4 Post instructions where directed.

.5 For operating instructions exposed to weather, provide weather-resistant materials or weatherproof enclosures.

.6 Ensure operating instructions will not fade when exposed to sunlight and are secured to prevent easy removal or peeling.

1.12 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management and Disposal and with the Waste Reduction Work plan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.13 ASBESTOS REMOVAL

.1 Refer to specification Division 01 for procedures, removal and disposal of asbestos.

.2 If during renovations / demolition, asbestos is discovered (or material suspected to be asbestos), all work in that area shall immediately cease and the General Contractor

advised. The General Contractor shall take immediate appropriate action to verify presence of friable asbestos and be responsible for the removal of all friable asbestos.

.3 This division will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

1.14 DRAWINGS AND MEASUREMENTS

.1 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of work and are not detailed installation drawings. Do not scale the drawings. Obtain accurate dimensions from the Architectural and Structural drawings.

.2 Consult the architectural drawings and details for exact locations of fixtures and equipment. Obtain this information from the Consultant where definite locations are not indicated.

.3 Take field measurements, where equipment and material dimensions are dependent upon building dimensions.

.4 Where imperial units have been indicated in brackets [ ] following the requirements in SI units, the conversion is approximate and provided for convenience. The SI units shall govern.

1.15 PROJECT COORDINATION

.1 Check drawings of all trades to verify space and headroom limitations for work to be installed. Coordinate work with all trades and make changes to facilitate a satisfactory installation. Make no deviations to the design intent involving extra cost to the Owner, without the Consultant's written approval.

.2 The drawings indicate the general location and route to be followed by the electrical services. Where details are not shown on the drawings or only shown diagrammatically, the services shall be installed in such a way as to conserve head room and interfere as little as possible with the free use of space through which they pass. Service lines shall run parallel to building lines. All services in the ceiling shall be kept as tight as possible to beams or other limiting members at high level. All electrical services shall be coordinated in elevation to ensure that they are concealed in the ceiling or structural space provided unless detailed otherwise on drawings.

.3 Work out jointly all interference problems on the site and coordinate all work before fabricating, or installing any material or equipment. Where necessary, produce interference/coordination drawings showing exact locations of electrical systems or equipment within service areas, shafts and the ceiling space. Distribute copies of the final interference/coordination drawings to the Architect and Consultant and all affected parties.

.4 Ensure that all materials and equipment fit into the allotted spaces and that all equipment can be properly serviced and replaced, if and when required. Advise the Consultant of space problems before installing any material or equipment. Demonstrate to the Consultant on completion of the work that all equipment installed can be properly, safely serviced and replaced, if and when required.

1.16 PROVISION FOR FUTURE EQUIPMENT AND CONSTRUCTION

.1 Leave clear spaces designated for future equipment or building expansion where indicated. Plan for the installation under this contract and ensure clear accessible, unhindered access to the space is allowed for.

.2 Were contract documents don’t clearly indicate the future expansion requirements, but known services are required, provide written “request for information” to the consultant before making assumptions as to intent.

1.17 SPRINKLER PROOF REQUIREMENTS

.1 All equipment and wiring systems shall be sprinkler proof standard where sprinkler fire protection systems are installed.

.2 In rooms where electrical equipment is installed surface mounted, electrical equipment contained in these rooms to be protected by non-combustible driphoods, shields, and gasketed doors as applicable to inhibit water ingress into electrical equipment. Exposed conduits connected to equipment to utilize watertight connectors. Top entry to be avoided where possible

.3 In particular all unit substations, transformers, switchgear, motor control and panelboard shop drawings shall be certified 'sprinkler proof' design.

1.18 EQUIPMENT RESTRAINT

.1 Related Section: 26 05 05 Seismic Restraint.

.2 It is the entire responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

1.19 REUSED EQUIPMENT

.1 Where existing equipment is being relocated and re-used, check and report on the condition to the Consultant before reinstallation. Protect and carefully store equipment designated for reuse.

1.20 PHASED CONSTRUCTION

.1 See Architectural specifications and drawings for construction phasing. Make all allowances to phase the work in accordance with the project phasing.

.2 All existing services and the existing building must be maintained in operation. Provide and install temporary services as required.

.3 All trades in this Division shall make allowance for the implications of having to totally complete all work in the new addition before proceeding with work in the existing building.

1.21 SEQUENCE OF WORK

.1 Before interrupting major services notify the Owner well in advance and arrange an acceptable schedule for the interruptions.

.2 Before interrupting any services complete all preparatory work as far as reasonably possible and have all necessary materials on site and prefabricated (where practical) and work continuously to keep the length of interruption to a minimum.

.3 Include for the cost of all work that may be required out of regular hours to minimize the period of service interruption when modifying the existing systems.

.4 All trades in this Division shall make allowance for the implications of having to totally complete all work in the new addition before proceeding with work in the existing building.

1.22 BUILDING OPERATION DURING CONSTRUCTION

.1 In order to minimize operational difficulties for the existing building staff, the various trades must cooperate with the owner throughout the entire construction period and particularly ensure that noise is minimized.

.2 Convenient access for the staff and public to the building must be maintained at all times. Minor inconvenience and interruption of services will be tolerated, provided advance notice is given, but the Contractor will be expected to coordinate his work, in consultation with the owner, so the operation of the facility can be maintained as nearly normal as possible.

1.23 EXISTING SERVICES

.1 Protect all existing services encountered. Every effort has been made to show the known existing services. However, the removal of concealing surfaces may reveal other existing services. Work with the Owner's staff to trace the originating source and points served. Obtain instructions from the Consultant when existing services require relocation or modifications, other than those already indicated in the Contract Documents.

.2 Arrange work to avoid shutdowns of existing services. Where shutdowns are unavoidable, obtain the Owner's approval of the timing, and work to minimize any interruptions.

.3 Shutdowns, to permit connections, to be coordinated with the maintenance staff.

.4 In order to maintain existing services in operation, temporary relocations and wiring may be required.

.5 Be responsible for any damages to existing systems by this work.

.6 The interruption of utility services to permit tie-ins shall be arranged through the owner’s representative. Application must be received in writing at least seven (7) calendar days prior to the date required for the shutdown. Service shutdowns shall only be carried out by Physical Plant and will normally be scheduled to occur during evenings or weekends. The Owner reserves the right to withhold permission for a reasonable period with respect to any shutdown, if the shutting-off of a service interferes with essential building operations.

1.24 SALVAGE

.1 All conduit, wiring and equipment which becomes redundant and is no longer required due to the work in this Contract shall be completely removed.

.2 All existing items which need to be removed, and which have a reasonable salvage value, shall be carefully removed and handed over to the Owner. Handing over to the Owner includes moving to Owner's designated storage place on site. These items shall not become the property of the Contractor. Obtain a written receipt from the Owner detailing each of the items handed over.

.3 Remove all redundant material not required by the Owner from the site.

1.25 WARRANTY

.1 Use of installed equipment during construction shall not shorten or alter the warranty period as specified in the Division 01.

.2 Take note of any extended warranties specified.

.3 Furnish a written warranty stating that all work executed under this Division will be free from defects of material and workmanship for a period of one (1) year from the date of substantial performance.

.4 Promptly investigate any electrical or control malfunction, and repair or replace all such defective work and all other damages thereby which becomes defective during the time of the warranty.

1.26 TENDER INQUIRIES

.1 All contractor queries during the tender period shall be made in writing to the consultant. Contractor queries will be collected and suitable addenda will be issued for clarification. No verbal information will be considered valid or issued by the consultant's office during tender. All tender queries may be faxed, mailed or couriered to the consultant's office. No telephone questions will be answered.

1.27 EXAMINATION

.1 Visit the site before preparing the tender and examine all existing conditions. No extra cost will be considered for any misunderstanding of work to be done resulting from failure to visit the site.

.2 Examine the documents for details of work included. Obtain a written clarification in the event of conflict within the specification, between the specification and the drawing, or in the drawing. Obtain written clarification from the Consultant if work affecting the installation is not clear. Where this is not done in advance, allow in the tender sum for providing the more costly alternative.

1.28 RESPONSIBILITIES

.1 Ensure that equipment does not transmit noise and/or vibration to other parts of the building, as a result of poor installation practice.

.2 Where the Contract Documents do not contain sufficient information for the proper selection of equipment for bidding, notify the Consultant during the tendering period. If clarification is not obtainable, allow for the most expensive arrangement. Failure to do this shall not relieve the Contractor of responsibility to provide the intended equipment.

.3 Protect equipment and material from the weather, moisture, dust and physical damage.

.4 Cover equipment openings and open ends of conduit, piping and pullboxes as work progresses. Failure to do so will result in the Trade being required to adequately clean or replace materials and equipment at no extra cost to the Owner.

.5 Protect all existing services encountered. Obtain instructions from the Engineer when existing services require relocation or modification.

.6 Refinish damaged or marred factory finish to factory finish.

.7 The specifications and drawings form an integral part of the Contract Documents. Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, vice versa, shall be considered as properly and sufficiently specified and shall be provided. Misinterpretation of any requirement of either plans or specifications shall not relieve this Contractor of the responsibility of properly completing his trade to the approval of the Consultant.

1.29 STANDARD OF ACCEPTANCE

.1 Standard of Acceptance means that the item named and specified by manufacturer and/or catalogue number forms part of specification and sets standard regarding performance, quality of material and workmanship and when used in conjunction with a referenced standard, shall be deemed to supplement the standard.

.2 Where two or more manufacturers are listed, the manufacturer's name shown first or underlined or shown with a model name and/or number was used in preparing the base design. Tenders may be based on any one of those named, provided that they meet every aspect of the base design and every aspect of the drawings and specifications.

.3 Where other than the first named or the underlined manufacturer or scheduled/specified manufacturer is selected or approved, include for the cost of any resulting work (both under this Division and other Divisions) and any necessary redesign of installation or structure. Submit redesign drawings for review with Shop Drawings. Maintain installation, access and servicing clearances. Equipment/materials shall not exceed the available space limitations. Redesign drawings shall be to scale and of a standard equal to the Project Drawings.

.4 A visible manufacturer's nameplate shall indicate manufacturer's name, model number, serial number, capacity data, electrical characteristics and approval stamps.

1.30 ADDITION OF ACCEPTABLE MANUFACTURERS

.1 Material/products considered to satisfy the specification, but of a manufacturer other than those named may be submitted to the Consultant for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.

.2 Alternate approvals will be given by written addendum only. No other substitution will be permitted after closing of tenders.

.3 Alternate approvals granted before the closing of tenders will be limited to a manufacturer's system and/or series only. This limited approval will not preclude substitute equipment/material from complying with specific features included with equipment/material specified. Determine that the alternate product meets the specification intent before basing a tender on the product

.4 Where alternate equipment/materials are selected, allow for effects on other parts of the work of this Trade and other Trades. Where substantial changes in arrangement are required, submit shop drawings of the proposed changes with Plan and Section views and show effects on work of other Trades. Alternate equipment/materials shall not exceed the available space limitations. Maintain installation, access and servicing clearances. No extra will be allowed due to the use of alternate equipment/materials.

.5 Where two or more items of equipment and/or material, of the same type, are required, provide products of a single manufacturer.

.6 Install and test all equipment and material, in accordance with the detailed recommendations of the manufacturer.

1.31 CASH ALLOWANCES

.1 Coordinate cash allowances with bid documents. Allowances directly affecting this Division include: none.

1.32 PREPARATION OF RECORD DRAWINGS – CASH ALLOWANCE

.1 Refer to Section 01210 for Preparation of Record Drawings – Cash Allowance.

1.33 SEISMIC ENGINEER SERVICES - CASH ALLOWANCE

.1 Refer to Section 01210 for Seismic Engineer Services - Cash Allowance.

1.34 EQUIPMENT LIST

.1 Submit a completed Equipment List, showing the make of equipment and material included in the Tender, including the names of the subtrades, 10 days after the award of the Contract**. Form EF110** in Appendix A shall be used for this purpose.

.2 The equipment list shall be a full list of materials or systems intended for installation.

1.35 PROGRESS CLAIM AND CHANGEORDER BREAKDOWNS

.1 Ten (10) days after the award of contract, submit price breakdowns on photocopies of the Price Breakdown **Form EF112** included in Appendix A.

.2 In particular cases more detail may be necessary to properly assess a change order or progress claims. This additional information could include all suppliers and all sub-contractors when requested by the Consultant. Provide details for each section of the electrical work listed for each separate electrical change order item exceeding $10,000.00.

.3 Mark-up information is required for change orders but is optional on the original tender price.

.4 Progress claims will not be certified nor payment made beyond 90% of the overall Electrical contract until commissioning and verification of the systems are complete. This procedure is to allow for any necessary deficiency holdbacks on items which do not become apparent until the systems are commissioned.

1.36 PROJECT CLOSE-OUT REQUIREMENTS

.1 Refer to detailed specifications in each section for detailed requirements. Also refer to Specification Appendix A Form EF-142 for list of required substantial completion submissions. Record drawings to be submitted to Consultant and all life safety systems must be operational, verified and tested and demonstrated to Consultant prior to issuance of Schedule C.

1.37 SUBSTANTIAL PERFORMANCE REQUIREMENTS

.1 Before the Consultant is requested to make an inspection for substantial performance of the work:

.1 Commission all systems and prove out all components, interlocks and safety devices.

.2 Submit a letter certifying that all work is complete for the intended use, operational, clean and all required submissions have been completed. **Form EF143** in Appendix A should be used for this purpose.

.3 A complete list of incomplete or deficient items shall be provided. If, in the opinion of the Consultant, this list indicates the project is excessively incomplete, a substantial completion inspection will not be performed.

.2 The work will not be considered to be ready for use or substantially complete until the following requirements have been met:

.1 All reported deficiencies have been corrected.

.2 Operating and Maintenance Manuals completed.

.3 "As Built" Record Drawing ready for review.

.4 Systems Commissioning has been completed and has been verified by Consultant.

.5 All demonstrations to the owner have been completed.

.6 All documents required on **Form EF142** in Appendix A have been submitted.

.7 All documentation required for LEED ™ certification has been submitted.

.3 Consultants Letters of Assurance will not be issued until the following requirements have been met:

.1 All items listed in .1 above have been completed or addressed.

.2 Certificate of Penetrations through separations (**Form EF130**).

.3 Provincial or City Electrical Inspection - Certificate of inspection.

.4 Seismic Engineers letter of Assurance and final inspection report.

.5 Certificate of Substantial Performance (**Form EF143**).

.6 Signed off copy of Consultants final inspection report.

.7 Fire alarm verification.

1.38 DEFICIENCY HOLDBACKS AND DEFICIENCY INSPECTIONS

.1 Work under this Division which is still outstanding when substantial performance is certified will be considered deficient and a sum equal to at least twice the estimated cost of completing that work will be held back.

.2 It is expected that outstanding work will be completed in an expeditious manner and the entire holdback sum will be retained until the requirements for Total Performance of Division 26, 27, 28, 33 (electrical) work have been met and verified.

Part 2 Products

2.1 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Division 01 - Sustainable Requirements: Construction

.2 Do verification requirements in accordance with Division 01 Sustainable Requirements: Contractor's Verification.

2.2 MATERIALS AND EQUIPMENT

.1 Provide materials and equipment in accordance with Division 01 and as follows.

.2 Material and equipment to be CSA certified. Where CSA certified material or equipment is not available, obtain special approval from authority having jurisdiction before delivery to site and submit such approval.

.3 Where equipment or materials are specified by technical description only, they are to be of the best commercial quality available for the intended purpose.

.4 Factory assemble control panels and component assemblies.

2.3 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS

.1 Provide all power and control wiring, conduit, wire, fittings, disconnect switches, motor starters, for all mechanical equipment unless otherwise specified.

.2 Ground all motors to conduit system with separate grounding conductor in flexible conduit or bonding conductor in the flexible conduit.

.3 Connections shall be made with watertight flexible conduit with watertight connectors.

.4 Control wiring and conduit standards are specified in the Electrical Divisions. Refer to Mechanical Divisions for scope of work and particular details.

2.4 WARNING SIGNS

.1 Provide warning signs, as specified or to meet the requirements of Inspection Department, Authority having Jurisdiction, Engineer and Architect.

.2 Use decal signs, minimum 175 x 250 mm [7” x 10”] size

2.5 WIRING TERMINATIONS

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.6 EQUIPMENT IDENTIFICATION

.1 Identify all electrical equipment including but not limited to starters, disconnects, remote ballasts and controls with nameplates and labels as follows:

.2 Nameplates:

.1 Lamicoid 3 mm [0.125”] thick plastic engraving sheet, white face, black core, self adhesive unless specified otherwise. Provide white face, red core for all essential distribution equipment.

.2 Nameplate Sizes:

Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

.3 Typical Labelling:

.1 Panelboard & CDP – 5 lines

.1 Line 1 – eg Conditional/Vital – Size 4 lettering

.2 Line 2 – Panel/CDP designation – Size 4 lettering

.3 Line 3 – eg 225A, 120/208V, 3 phase 4W – Size 2 lettering

.4 Line 4 – Feeder: eg 4#3 – 35mm C – Size 2 lettering

.5 Line 5 – Origin eg: Main Elect. Room – Size 2 lettering

.2 Distribution Circuit Breakers – 4 lines

.1 Line 1 – Conditional/Vital – Size 4 lettering

.2 Line 2 – Main Circuit Breaker – Size 4 lettering

.3 Line 3 – Feeder: eg 4#3 – Size 2 lettering

.4 Line 4 – Origin: eg K1 Sub-station – Size 2 lettering

.3 Label colours unless otherwise indicated:

.1 120/208V labels: white letters on black base.

.2 347/600V labels: Black letters on white base.

.3 Standby/Emergency Power: white letters on red base.

.4 Wording on nameplates to be approved prior to manufacture.

.5 Allow for average of twenty-five (25) letters per nameplate.

.6 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.7 Terminal cabinets and pull boxes: indicate system and voltage.

.8 Transformers: indicate capacity, primary and secondary voltages.

.3 Labels:

.1 Identify each outlet, starter, disconnect and all items of fixed equipment with the appropriate panel and circuit number origin by means of a small but good quality vinyl, self-laminating label such as T & B E-Z Code WSL, Dymo Letratag or Brother P-Touch equivalent printable markers. Embossed Dymo or any labels with edges and corners that are prone to lift will be rejected. Confirm location of labels with Consultant before installing. Circuit number to agree with Record Drawings.

.2 In Patient Care areas provide receptacle circuit identification in accordance with CSA-Z32 "Electrical Safety and Essential Electrical Systems in Health Care Facilities". Provide mechanically fastened (with drive rivets, not screws) lamicoid nametags for all receptacles located in Patient Care areas. Nameplates to be located above receptacles in Patient Care areas.

.4 Provide plastic covered panel directory with circuits and areas served typed in, and mounted on inside of door. Directory to conform to Record Drawings.

2.7 WIRING IDENTIFICATION

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

2.8 CONDUIT, CABLE AND PULLBOX IDENTIFICATION

.1 Colour code conduits, metallic sheathed cables, pullboxes and junction boxes.

.2 Code with 25 mm plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor and at 15 m intervals.

.3 Colour coding to be as follows unless otherwise specified:

SYSTEM	MAJOR BAND	MINOR BAND	CHARACTERS
High Voltage	Yellow	Purple	Nominal V
347/600V Normal	Dark Blue		
347/600V Conditional	Dark Blue		
347/600V Emergency	Dark Blue	Red	
347/600V UPS	Dark Blue	Orange	
120/208V Normal	Light Blue		
120/208V Conditional	Light Blue		
120/208V Emergency	Light Blue	Red	
120/208V UPS	Light Blue	Orange	
Ground	Dark Green		GR
Fire Alarm	Red		FA
Emg Voice Paging	Red	Dark Green	EP
Fire Fighters Telephone	Red	Light Green	FFT

SYSTEM	MAJOR BAND	MINOR BAND	CHARACTERS
Computer/Data	Light Green		COM
Telephone	Light Green	Black	TEL
General Intercom	Light Green	Yellow	IC
Low Level Paging	Light Green	White	PA
Commercial TV	Dark Brown		TV
AV/TV Systems	Light Brown		AV/TV
Security Systems	Purple		SEC
Building Alarm	Purple	White	BA
CCTV	Purple	Yellow	CCTV
Door Intercom	Purple	White	DI
Door Lock Release	Purple	Black	ED
Master Clock System	Yellow		CS
BAS (Digital)	White	Green	BCD
BAS (110V)	White	Black	BCH
BAS (LV)	White	Blue	BCL
PLC (Digital)	White	Brown	PLC
Low Voltage Control	White	Yellow	LVC
Health Care:			
Nurses' Call	Orange		NC
Patient Monitoring	Orange	Black	MON
Patient Emergency Call	Orange	Pink	EC
Cardiac Arrest	Orange	Green	CA
Low Voltage Control	White	Yellow	LVC

2.9 FINISHES

.1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside and at least two coats of finish enamel.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.

.3 Clean and prime paint exposed hangers, racks, fastenings to prevent rusting. Finish painting shall be provided by Division 09.

.4 Paint outdoor electrical equipment "equipment green" finish.

.5 .Paint indoor switchgear and distribution enclosures light gray unless otherwise indicated in particular specification sections for specialised or emergency power equipment.

2.10 ACCESS PANELS (DOORS)

.1 Unless otherwise noted, access doors shall be minimum: 450mmx450mm [18"x18"] for body entry; 300mmx300mm [12”x 12”] for hand entry.

.2 Access doors in fire separations of 3/4 hour rating, and higher, and firewalls shall have a compatible fire rating and a ULC label with tamper-proof latch, self closing.

.3 Minimum Requirements:

.1 180 degree door swing, mitred rounded safety corners flush welded, concealed hinges, screwdriver latches, and anchor straps or lugs to suit construction, all steel prime coated.

.2 Plaster or wet wall construction: 14 gauge bonderized steel flush with wall or ceiling type with concealed flange.

.1 Acceptable Product: Acudor PS-5030.

.3 Masonry or drywall construction: 16 gauge for 400 mm [16"] x 400 mm [16"] and smaller, 14 gauge for 450 mm [18"] x 450 mm [18"] and larger bonderized steel face of wall type with exposed flange.

.1 Acceptable Product: Acudor UF-5000.

.4 Tile, ceramic tile, marble, terrazzo, plaster or wet wall construction in washrooms and other special areas: 14 gauge stainless steel flush with wall or ceiling type with concealed flange.

.1 Acceptable Product: Acudor PS-5030 stainless.

.5 Acoustical tile ceiling and similar block materials: 14 gauge bonderized steel recessed ceiling type.

.1 Acceptable Product: Acudor AP-5010 or AT-5020.

.6 Feature wall construction: Recessed wall type that is selected to complement and conform to the architectural module, treatment, or panelling. The size shall conform to adjacent finishes.

.7 Access panels in fire separations and fire walls shall have a compatible fire rating and ULC label. (ie. Acudor Fire Rated FW-5050 or FB-5060).

.4 Standard of Acceptance : Zurn, Wade, Acudor, Can-Aqua, Milcor, Maxam, Van-Met.

2.11 ANCHOR BOLTS AND TEMPLATES

.1 Supply anchor bolts and templates for installation by other Divisions.

2.12 FASTENING TO BUILDING STRUCTURE

.1 General:

.1 Do not use inserts in base material with a compressive strength less than 13.79 MPa [2000 psi] [refer to structural drawings].

.2 All inserts supporting conduit racks shall have a factor of safety of 5. All other inserts shall have a factor of safety of 4.

.2 Types:

.1 Cast-in-place type:

.1 Channel type - Burndy, Canadian Strut, Unistrut, Cantruss or Hilti Channel.

.2 Wedge type galvanized steel concrete insert, Grinnell Fig. 281 for up to

200 mm [8"] pipe size.

.3 Universal type malleable iron body insert, Grinnell Fig. 282 for up to 200 mm [8"] pipe size.

.2 Drilled, mechanical expansion type:

.1 Hilti HSL or UCAN LHL heavy duty anchor for use in concrete with compressive strength not less than 19.6 MPa [2840 psi].

.2 Hilti Kwik-Bolt or UCAN WED stud anchor for concrete. (Do not use in seismic restraint applications).

.3 Hilti HDI or UCAN IPA drop-in anchor for concrete.

.4 Hilti or UCAN Sleeve Anchor (medium and light duty) for concrete and masonry.

.5 Hilti ZBP or UCAN Zamac pin bolt (light duty) for concrete and masonry.

.3 Drilled, adhesive type:

.1 Hilti HVA or UCAN Adhesive Anchor consisting of anchor rod assembly with a capsule containing a two-component adhesive, resin and hardener.

.2 Hilti HY150 consisting of anchor rod with a 2 part adhesive system.

.3 For use in concrete housekeeping bases (in vertical downward position) where the distance to the edge of the concrete base could cause weakness if a mechanical expansion type anchor were used.

.4 Rod assemblies shall extend a minimum of 50 mm [2"] into the concrete slab below the housekeeping bases.

.3 Note:

.1 All drilling for inserts shall be performed using the appropriate tool specifically designed for the particular insert. The diameter and depth of each drilled hole shall be to the exact dimensions as specified by the insert manufacturer.

.2 Refer to manufacturer's recommendations for tightening torques to be applied to inserts.

.3 Where specifically called for, drills shall include a dust vacuum system, Hilti SAV Dust Vacuum System.

2.13 EQUIPMENT SUPPORTS

.1 Provide stands and supports for equipment and materials supplied.

.2 Lay out concrete bases and curbs required under Electrical Divisions. Coordinate with Concrete Divisions.

.3 Concrete bases shall be a minimum of 100 mm [4"] thick, or as noted and shall project at least 150 mm [6"] outside the equipment base, unless otherwise directed. Bases and curbs shall be keyed to the floor and incorporate reinforcing bars and/or steel mesh. Chamfer edges of bases at 45 degrees.

.4 Equipment with bedplates shall have metal wedges placed under the edges of the bedplates to raise them 25mm [1"] above the base after levelling. The wedges shall be left permanently in place. Fill the space between the bedplate and the base with non-shrink grout - Embeco or In-Pakt.

.5 Construct equipment supports of structural steel. Securely brace. Employ only welded

construction. Bolt mounting plates to the structure.

.6 Support ceiling hung equipment with rod hangers and/or structural steel.

2.14 MISCELLANEOUS METAL

.1 Be responsible for all miscellaneous steel work relative to Electrical Divisions of the Specifications, including but not limited to:

.1 Support of equipment .

.2 Hanging, support, anchoring, guiding and relative work as it applies to wiring raceways and electrical equipment.

.3 Earthquake restraint devices - refer also to “Seismic Restraint” sections

.4 Bridle rings - secure to structure or steel supports.

.2 All steel work shall be primed and undercoat painted ready for finish under the related Division.

2.15 MAINTENANCE MATERIALS AND CABINET

.1 Provide maintenance materials in accordance with Division 01 and specified in appropriate Sections.

.2 Refer to Specification Appendix A Electrical **Form EF140** “Items to be handed to the Owner” Obtain the Building Owners representative sign off. Use **Form EF 140** for this purpose.

.3 Provide a finished painted sheet steel “spare equipment cabinet”. Cabinet to have a continuous hinge and complete with shelves and hasp to suit padlock. Minimum size 600 [24”] x 900 [36”] x 200 [8”] deep. Mount on wall in the Electrical Room. Provide a plastic covered typewritten list of spare parts and affix to the inside of the door.

2.16 OPERATION AND MAINTENANCE DATA

.1 Provide operation and maintenance data for incorporation into maintenance manual specified in Division 01 and as follows.

.2 Include in operations and maintenance data:

.1 Details of design elements, construction features, component function and maintenance requirements, to permit effective operation, maintenance, repair, modification, extension and expansion of any portion or feature of installation.

.2 Technical data, product data, supplemented by bulletins, component illustrations, exploded views, technical descriptions of items, and parts lists. Advertising or sales literature not acceptable.

.3 Wiring and schematic diagrams.

.4 Names and addresses of local suppliers for items included in maintenance manuals.

.3 Include in the manual the following major sections:

.1 Title page (in plastic cover).

.2 Comprehensive description of the operation of the systems, including the function of each item of equipment within the system.

.3 Detailed instructions for the normal maintenance of all systems and equipment installed including procedures and frequency of operational checks and service and troubleshooting instructions.

.4 Local source of supply for each item of equipment.

.5 Wiring and control diagrams.

.6 Spare parts list.

.7 Copies of guarantees and certificates.

.8 Manufacturer's maintenance brochures and shop drawings.

.4 The manual information shall be bound in a three “D-ring” hard back reinforced vinyl covered ("bar lock" post type where more than 50mm [2”] rings required) binder c/w index tab separators to divide the different sections. The binder cover shall be black with white lettering. Printing of the binder cover shall be completed before the binder is manufactured and the wording shall be approved by the Consultant before printing.

.5 Submit a draft copy to the Consultant for review thirty (30) days prior to start up of the systems and equipment.

.6 Submit three (3) copies in the final approved form.

2.17 PROJECT RECORD DRAWINGS

.1 Provide project record documents as specified in Division 01 as further called for in this Division.

.2 During the construction period, keep on Site a clean set of drawings marked up to reflect the "As-Built" state, for examination by the Consultant on a regular basis. Include elevations and detailed locations of buried services, empty conduit systems and junction and pull boxes.

.3 At the time of "substantial performance" provide the consultant with a copy of the red-lined “As-Built” drawings for production of record drawings.

Part 3 Execution

3.1 INSTALLATION

.1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.

3.2 NAMEPLATES AND LABELS

.1 Ensure manufacturers nameplates and CSA labels to be visible and legible after equipment is installed.

3.3 CONDUIT AND CABLE INSTALLATION

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit and protruding 50 mm [2”].

.2 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

.3 Install roof jacks where conduit and cables penetrate roofs. Apply sealant after installation.

.4 All cables and conduits to be installed concealed in finished areas.

3.4 LOCATION OF OUTLETS

.1 Do not install outlets back-to-back or in the same stud space in wall; allow minimum 400mm [16”] horizontal clearance between boxes.

.2 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000mm [10”- 0”] and information is given before installation.

.3 Locate light switches on strike side of doors unless otherwise indicated.

.4 Locate light switches on latch side of doors.

.5 Locate disconnect devices in mechanical and elevator machine rooms on latch side of floor.

3.5 MOUNTING HEIGHTS

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not indicated verify before proceeding with installation. Confirm the height of devices in handicapped facilities before installation.

.3 Refer to detail on drawings.

.4 In the absence of a drawing detail or drawing note, use the following:

Device	Height		Comment
Local switches	1200	[48”]	
Wall receptacles/data	450	[18”]	General
Wall receptacles/data	200	[8”]	Above top of continuous baseboard heater
Wall receptacles/data	175	[7”]	Above top of counters or counter splash backs – coordinate with Architectural detail
Wall receptacles/data	900	[36”]	In mechanical rooms
Wall receptacles/data Health Care	450 to 900	[18”] to [36”]	Confirm before installation
Panelboards	2000	[80”]	Panelboards: as required by Code or as indicated.
Wall mtd telephone	1500	[60”]	
Card Readers	1200	[48”]	Confirm before installation
Fire alarm stations	1100	[54”]	ULC S524 requires not less than 1050mm or more than1150mm.
Fire alarm bells/audio	2200	[88”]	ULC S524 requires not less than 1800mm to centre. In any event not closer than 50mm to the ceiling
Fire alarm visual devices	2000	[80”]	ULC S524 requires not more than 2000mm to centre. In any event not closer than 150mm to the ceiling
Fire alarm Annunciator	1800 Top	[72”]	ULC S524 requires not more than 1800mm above finished floor.
End of line resistors	1800	[72”]	
Television outlets			As receptacles –coordinate with equipment location
Wall mounted speakers & clocks	2100	[84”]	Coordinate with equipment location
Door bell	1500	[60”]	Coordinate with location

Device	Height		Comment
pushbuttons			
Emergency Lighting (wall mounted)			150mm below ceiling or 4800mm max.
Nurse call (NC) bed station	1350 to 1500	[54”] to [60”]	Coordinate with Architectural detail and/or bedhead layout
NC emergencystation	1350	[54”]	
NC shower station	1650	[66”]	
NC staff/duty station	1500	[60”]	

3.6 COORDINATION OF PROTECTIVE DEVICES

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to the required values and settings to provide a fully coordinated system.

3.7 FIELD QUALITY CONTROL

.1 Load and Balance:

.1 Measure voltage and phase & neutral currents to panelboards with normal loads (lighting) operating at time of acceptance; adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase and neutral currents to dry-core transformers and motor control centres, operating under normal load,

.3 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.

.2 Conduct and pay for the following tests:

.1 Power generation and distribution system including phasing, voltage, grounding and load balancing.

.2 Circuits originating from branch distribution panels.

.3 Lighting and its control.

.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.

.5 Systems: fire alarm system and communications.

.6 Main ground resistance (at all grounding locations).

.7 Insulation resistance testing:

.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.

.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.3 Provide Consultant with at least one weeks notice prior to testing.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during

and at conclusion of project.

.5 Manufacturer's Field Services:

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports.

.2 Furnish manufacturer's certificate or letter conforming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.3 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.4 Schedule site visits to review Work.

.6 Reports:

.1 Provide written reports in a timely manner upon completion of the testing and load balance. Indicate test hour and date.

3.8 CLEANING

.1 Do final cleaning in accordance with Division 01.

.2 At time of final cleaning, clean lighting reflectors, lenses and other lighting surfaces that have been exposed to construction dust and dirt.

.3 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.4 Clean and prime paint exposed non-galvanised hangers, racks, fastenings to prevent rusting. Coordinate finish painting with Division 09.

3.9 WORKMANSHIP

.1 Workmanship shall be in accordance with well established practice and standards accepted and recognized by the Consultant and the Trade.

.2 The Consultant shall have the right to reject any item of work that does not conform to the Contract Documents and accepted standards of performance, quietness of operation, finish and appearance.

.3 Employ only tradesmen holding valid Provincial Trade Qualification Certificates. Tradesmen shall perform only work that their certificate permits. Certificates shall be available for inspection by the Consultant.

3.10 PROTECTION OF WORK

.1 Protect equipment and materials, stored or in place, from the weather, moisture, dust and physical damage.

.2 Mask machined surfaces. Secure covers over equipment openings and open ends of equipment and conduit, as the installation work progresses.

.3 Equipment having operating parts, bearings or machined surfaces, showing signs of rusting, pitting or physical damage will be rejected.

.4 Refinish damaged or marred factory finish.

3.11 PROTECTION OF ELECTRICAL EQUIPMENT

.1 Protect exposed live equipment during construction for personnel safety.

.2 Shield and mark live parts, e.g. "LIVE 120 VOLTS".

.3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

3.12 CONCEALMENT

.1 Conceal wiring and conduit in partitions, walls, crawlspaces and ceiling spaces, unless otherwise noted.

.2 Do not install wiring and conduit on outside walls or on roofs unless specifically directed.

3.13 SERVICE PENETRATIONS IN RATED FIRE SEPARATIONS

.1 All cabling, wiring, conduits, cable trays, etc. passing through rated fire separations shall be smoke and fire stopped to a ULC or cUL tested assembly system, in accordance with CAN4-S115-95, that meets the requirements of the Building code in effect.

.2 The scope includes new services which pass through existing rated separations and also all existing services which pass through a new rated separation or existing separations whose rating has been upgraded.

.3 Fire resistance rating of installed firestopping assembly shall not be less than fire resistance rating of surrounding assembly indicated on Architectural drawings. Where this is not indicated assume a minimum of one hour for walls and two hours for floors.

.4 Install firestopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions. The Applicator shall be approved, licensed and supervised by the manufacturer in the installation of firestopping and are to follow the requirements of a rated system as detailed above.

.5 Contractors are expected to submit system information detailing firestopping product, backing, penetrant, penetrated assembly, Fire (F) and Temperature (T) rating, and ULC or cUL system number.

.6 Provide fire stopping material and system information in the maintenance manuals and via labels at major penetrations that are likely to be repenetrated.

.7 All penetrations are to be firestopped using EZ Path System (Specified Technologies Inc - STI) only.

.8 Allow openings for 100% capacity of raceway or 200% capacity of J-hooks.

.9 Provide split systems where existing cables are involved.

.10 Provide Firestopping approval certificate in including a Building Code / By-Law Schedule B-1, B-2 & C-B signed by a BC registered Professional Consultant. Submit a letter certifying that all work is complete and in accordance with this specification. Electrical Form EF130 in Section 16991 [26 06 02] should be used for this purpose.

3.14 SERVICE PENETRATIONS IN NON-RATED SEPARATIONS

.1 All cabling, wiring, conduits, cable trays, etc. passing through non-rated fire separations and non-rated walls and floors shall be tightly fitted and sealed on both sides of the separation with caulking or silicon sealant to prevent the passage of smoke and/or transmission of sound.

3.15 CONDUIT SLEEVES

.1 Provide conduit sleeves for all conduit and wiring passing through rated walls and floors. Sleeves to be concentric with conduit or wiring.

.2 Except as otherwise noted conduit sleeves are not required for holes formed or cored in interior concrete walls or floors.

.3 Conduit sleeves shall extend 50 mm [2"] above floors in unfinished areas and wet areas and 6 mm [1/4"] above floors in finished areas.

.4 Conduit sleeves shall extend 25 mm [1"] on each side of walls in unfinished areas and 6 mm [1/4"] in finished areas.

.5 Conduit sleeves shall extend 25mm [1"] beyond exterior face of building. Caulk with flexible caulking compound.

.6 Sleeve Size: 12 mm [1/2"] clearance all around, between sleeve and conduit or wiring.

.7 Paint exterior surfaces of ferrous sleeves with heavy application of rust inhibiting primer.

.8 Packing of Sleeves:

.1 Where sleeves pass through foundation walls and perimeter walls the space between sleeve and conduit shall be caulked with waterproof fire retardant non-hardening mastic.

.2 Pack future-use sleeves with mineral wool insulation and then seal with ULC approved fire stop sealant for rated fire separations.

3.16 ACCESSIBILITY AND ACCESS PANELS

.1 Install all equipment, controls and junction boxes so as to be readily accessible for future modification, adjustment, operation and maintenance as appropriate.

.2 Provide access panels where required in building surfaces. Do not locate access panels in panelled or special finish walls, without prior approval of the Consultant.

.3 Access panels in U.L.C. fire separations and fire walls shall have a compatible fire rating and U.L.C. label. Acquire approval in writing from the local fire authority if required.

.4 Access panels shall be painted with a primer coat if applicable and then with a finish coat, colour and type to the Consultant's approval.

.5 Locate equipment and junction boxes in service areas wherever possible.

3.17 EQUIPMENT INSTALLATION

.1 Provide means of access for servicing equipment.

.2 CSA identification and equipment labels to be clearly visible after installation.

3.18 CUTTING, PATCHING, DIGGING, CANNING , CORING & CONCRETE

.1 Lay out all cutting, patching, digging, canning and coring required to accommodate the electrical services. Coordinate with other Divisions. The performance of actual cutting, patching, digging, canning and coring is specified under other Divisions.

.2 Be responsible for all cutting, patching, digging, canning and coring required to accommodate the electrical services.

.3 Be responsible for correct location and sizing of all openings required under Electrical Divisions, including piped sleeves.

.4 Verify the location of existing and planned service runs and structural components within concrete floor and walls prior to core drilling and/or cutting. Repairs to existing services and structural components damaged as a result of core drilling and cutting is included in this section of the work.

.5 Openings through structural members of the building shall not be made without the approval of the Structural Consultant.

.6 Openings in Concrete:

.1 Be responsible for the layout of all openings in concrete, where openings are not left ready under previous contract.

.2 All openings shall be core drilled or diamond saw cut.

.3 Refer to structural drawings for permissible locations of openings and permissible opening sizes in concrete floors and walls.

.4 Refer to structural drawings for locations of steel reinforcing.

.5 Be responsible for repairing any damage to steel reinforcing.

.7 Openings in building surfaces other than concrete:

.1 Lay out all openings required.

.8 Poured concrete for duct encasements, pole bases, transformer pads and housekeeping pads shall be provided by other Divisions, coordinated and supervised by the Electrical Divisions.

.9 Precast concrete items such as transformer pad bases, pull boxes and light pole bases to be provided and installed by the Electrical Divisions unless otherwise specified.

.10 Excavation and backfilling will be provided by other Divisions. This Division to superintend the work and provide all layouts and parameters.

3.19 PAINTING

.1 Clean exposed bare metal surfaces supplied under the Electrical Divisions removing all dirt, dust, grease and millscale. Apply at least one coat of corrosion resistant primer paint to all supports and equipment fabricated from ferrous metal.

.2 Paint all hangers and exposed sleeves, in exposed areas, with a rust inhibiting primer, as they are installed.

.3 Repaint all marred factory finished equipment supplied under the Electrical Divisions, to match the original factory finish.

.4 Coordinate with Division 09.

End of Section

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification is to be read, coordinated and implemented in conjunction with all other parts of the Contract Documents.

1.2 REGULATORY REQUIREMENTS

.1 Restraints shall meet the requirements of the latest edition of the British Columbia Building Code and amendments.

.2 The Seismic Consulting Engineer should be able to provide a proof of professional insurance and the related practice credentials if requested by the Electrical Consultant. The Seismic Consulting Engineer should be familiar with SMACNA, ECABC & NFPA guidelines as well as BCBC requirements.

.3 The Contractors Seismic Consultant shall submit original signed BC Building Code “Letters of Assurance” “Schedules B and C-B” to the Prime Consultant or Electrical Consultant.

.4 Project to comply with the local bylaw as applicable.

.5 The above requirements shall not restrict or supplant the requirements of any local bylaws, codes, or other certified agencies which may have jurisdiction over all or part of the installation.

1.3 SCOPE

.1 It is the responsibility of equipment manufacturers to design their equipment so that the strength and anchorage of internal components of the equipment exceeds the force level used to restrain and anchor the unit itself to the supporting structure.

.2 Manufacturer's shop drawings to be submitted with seismic information on equipment structure, bracing and internal components and as required by Division 01.

.3 Provide restraint on all equipment and machinery, which is part of the building electrical services and systems, to prevent injury or hazard to persons and equipment in and around the structure. Restrain all such equipment in its normal position in the event of an earthquake.

.4 The total electrical seismic restraint design and field review and inspection will be by a B.C. registered professional structural engineer who specializes in the restraint of building elements. Contractor to allow for coordination, provision of seismic restraints, as well as all costs for the services of the Seismic Restraint Engineer. This engineer, herein referred to as the Seismic Consultant, will provide normal engineering functions as they pertain to seismic restraint of electrical installations.

.5 The Contractor shall be aware of, and comply with, all current seismic restraining requirements and make provision for those that may come into effect during construction of the project. Make proper allowance for such conditions in the tender.

.6 The Seismic Consultant shall provide detailed seismic restraint installation shop drawings to the Contractor. Copies of the shop drawings to be included in the final project manual.

.7 Provide seismic restraints on all equipment, and/or installations or assemblies, which are suspended, pendant, shelf mounted, freestanding and/or bolted to the building structure or support slabs.

.8 The Seismic Consultant shall provide inspections during and after installation. The Contractor shall correct any deficiencies noted without additional cost to the contract.

.9 Include all costs associated with the Seismic installation and certification in the base tender.

1.4 SHOP DRAWINGS & SUBMITTALS

.1 Submit shop drawings of all seismic restraint systems including details of attachment to the structure, either tested in an independent testing laboratory or approved by the seismic consultant.

.2 Submit all the proposed types and locations of inserts or connection points to the building structure or support slabs. Follow the directions and recommendations of the Seismic Consultant.

Part 2 Products

2.1 SLACK CABLE SYSTEMS

.1 Slack cable restraint systems shall be as designed and supplied by Vibra-Sonic Control or equal.

.2 Slack cable restraints shall be provided on suspended and shelf mounted transformers along with associated equipment and assemblies connected to them at the points of vertical support (4 points). The restraint wires shall be oriented at approximately 90o to each other (in plan), and tied back to the ceiling slab or its structure at approximately 45o to the slab or basic structure. The restraints shall be selected for a 1 g earthquake loading, i.e. each wire shall have a working load capacity equal to the weight of the transformer. The anchors in the structure shall be selected for a load equal to the weight of the transformers at a 45o pull.

.3 Slack cable systems to allow normal maintenance of equipment and shall not create additional hazard by their location or configurations. Contractor shall rectify any such installations at no additional cost, all to the satisfaction of the engineer and inspection authority having jurisdiction.

.4 Coordinate requirements of slack cables with suppliers prior to installation.

Part 3 Execution

3.1 GENERAL

.1 All seismic restraints systems shall conform to local authority having jurisdiction and all applicable code requirements.

3.2 CONDUITS

.1 Provide restraint installation information and details on conduit and equipment as indicated below:

.2 Vertical Conduit:

.1 Attachment - Secure vertical conduit at sufficiently close intervals to keep the conduit in alignment and carry the weight of the conduits and wiring. Stacks shall be supported at their bases and, if over 2 stories in height, at each floor by approved metal floor clamps.

.2 At vertical conduit risers, wherever possible, support the weight of the riser, at a point or points above the center of gravity of the riser. Provide lateral guides at

the top and bottom of the riser, and at intermediate points not to exceed 9.2 m [30 ft] o.c.

.3 Riser joints shall be braced or stabilized between floors.

.4 Horizontal Conduits:

.1 Supports - Horizontal conduit shall be supported at sufficiently close intervals to keep it in alignment and prevent sagging.

.2 EMT tubing - tubing shall be supported at approximately 1.2 m [4 ft] intervals for tubing.

.5 Provide transverse bracing at 12.2 m [40 ft] o.c. maximum unless otherwise noted. Provide bracing at all 90o bend assemblies, and pull box locations.

.6 Provide longitudinal bracing at 24.4 m [80 ft] o.c. maximum unless otherwise noted.

.7 Do not brace conduit runs against each other. Use separate support and restraint system.

.8 Support all conduits in accordance with the capability of the pipe to resist seismic load requirements indicated.

.9 Trapeze hangers may be used. Provide flexible conduit connections where conduits pass through building seismic or expansion joints, or where rigidly supported conduits connect to equipment with vibration or seismic isolators.

.10 A conduit system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: wall and a roof; solid concrete wall and a metal deck with lightweight concrete fill.

.11 Provide large enough conduit sleeves through walls or floors to allow for anticipated differential movements with firestopping where required.

.12 It is the responsibility of the contractor to ascertain that an appropriate size restraint device be selected for each individual piece of equipment. Submit details on shop drawings. Review with seismic consultant and submit shop drawings to consultants for their reference.

3.3 FLOOR MOUNTED EQUIPMENT

.1 Bolt all equipment, e.g. transformers, switchgear, generators, motor control centres, free standing panelboards, control panels, capacitor banks, etc. to the structure. Design anchors and bolts for seismic force applied horizontally through the center of gravity to a seismic force of 0.5g. For equipment which may be subject to resonances, use a nominal 1.0 g seismic force.

.2 Provide flexible conduit connections between floor mounted equipment to be restrained and its adjacent associated electrical equipment.

3.4 LIGHT FIXTURES

.1 Light fixtures in suspended ceilings shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by at least two taught cables which are connected to the fixture at diagonal points.

.2 Surface and recessed style fixtures shall be hung independently of the ceiling system. Fixtures shall be secured to concrete or structural deck above by taut cables.

.3 Fixtures which are hung independently of ceiling systems shall have minimum of one seismic cable in addition to the chain or cable used to support the fixture. Seismic restraint cables shall be secured into the concrete or structural deck above.

.4 Cables shall be corrosion resistant and approved for the application.

.5 Fixtures which are rod hung shall have seismic ball alignment fittings at the ceiling and fixture.

End of Section

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 ASBESTOS

.1 Refer to specification Division 01 for procedures, removal and disposal of asbestos.

.2 If during renovations / demolition, asbestos is discovered (or material suspected to be asbestos), all work in that area shall immediately cease and the General Contractor advised. The General Contractor shall take appropriate action without delay to verify presence of friable asbestos and be responsible for the removal of all friable asbestos.

.3 This division will not be entitled to a claim for any delays resulting from the investigation of or removal of asbestos.

1.4 PCB (POLYCHLORINATED BIPHENYLS)

.1 Carefully remove any electrical items containing PCB's (eg light fixture ballasts) from equipment or fixtures to be renovated or demolished. Removed items (containing PCB's) to be catalogued and stored on site in approved labelled storage containers in accordance with regulations.

1.5 SCOPE

.1 The Electrical Division to take note that demolition and renovation will be done on a staged basis in a building that is operational 24 hours a day, seven days a week, year round.

.2 The Electrical Division to also take note of the owner's dust containment requirements as outlined in the architectural and front end specification.

.3 Electrical tender documents do not show all existing luminaires, wiring devices, conduit, boxes or wire. Conduit routing and wire grouping is not known. During demolition, the Electrical trade(s) are to deactivate all existing electrical and communication systems affected in such a manner that complete systems are not deactivated and system circuits affected in party wall partitions to be reactivated immediately on a temporary or permanent basis as site conditions dictate.

.4 This construction is typically sequenced or phased where demolition is required in a 24 hour operation building. Work in one area or phase to not affect work in subsequent or previous areas or phases. Areas outside the particular area of renovation are to be kept operational at all times unless permission has been received from the building owners representative to shut down a particular service.

.5 Services needed for the first and subsequent areas or phases of construction must be provided in the earlier activity. Existing services to be removed that must remain operational in previous or subsequent areas or phases are not to be removed until new or temporary services have been provided. Any discrepancies appearing on the drawings or in this specification are to be brought to the attention of the Consultant who will provide instruction.

.6 Where devices are not shown on the new plans in walls that are not being removed, such devices are to be reinstated and remain unless they affect the “Patient Care” area grounding in which case they must be removed.

1.6 SCHEDULING

.1 Refer to Prime Consultant divisions.

1.7 EXAMINATION

.1 Refer to Prime Consultant divisions.

1.8 PHASING

.1 Refer to Prime Consultant divisions.

1.9 PROTECTION

.1 Refer to Prime Consultant divisions.

Part 2 Products

2.1 STANDARDS

.1 Refer to applicable material standards in other specification sections and/or as detailed on drawings.

Part 3 Execution

3.1 DEMOLITION

.1 Demolition to be carried out in strict conformance to provincial, local and municipal authorities and Part 8 of the B.C. Building Code latest adopted edition.

.2 All redundant electrical components in the areas of demolition excluding those specifically identified in the following clauses shall become the property of the Electrical Division and shall be removed from site.

.3 The following existing electrical components to be disconnected by the Electrical Trade(s), cleaned and suitably packaged where applicable, and turned over to the Owner at designated location established on site. If the Owner refuses these items they become property of the Electrical Division and are to be removed from site

.1 All fluorescent luminaires complete with lamps and ballasts.

.2 Fire alarm components.

.3 Call system and components.

.4 Security devices.

.5 Speakers.

.6 Clocks.

3.2 DISRUPTION TO OPERATIONS

.1 Contractor to issue a scheduled shutdown time and coordinate installation of the new equipment as appropriate. All equipment installed and modified requires testing before startup.

.2 Contractor to provide temporary connections to all required equipment for temporary power during the installation of any new equipment.

3.3 REUSE OF EXISTING COMPONENTS

.1 Existing components may be reused only where so specifically indicated on the drawings or in the specifications, however in all cases all wiring shall be new and no splicing shall be permitted at any location.

3.4 DISTRIBUTION OF CIRCUITS

.1 Circuit: power, voice/data, fire alarm, control etc. which are disrupted during demolition and are essential, to be made good immediately. The Electrical Trade(s) to identify these circuits to the Consultant. Specific tasks involving the demolition of essential circuits will require that the contractor to obtain permission from the Owner before proceeding.

3.5 ABANDONED CONDUIT, WIRE AND EXISTING CIRCUITS

.1 All abandoned conduit and wire to be removed and disposed of by the Electrical Divisions.

.2 Remove all accessible (eg. Surface) wiring and cables back to source.

.3 Remove abandoned outlets and raceway, even if in or behind drywall, where they are located behind millwork or in locations unsuitable for reuse i.e. not at standard heights for switches or outlets.

.4 All remaining circuits to be rerouted as required and suitably secured to the building structure.

.5 Any cabling, including voice/data wiring, presently resting on any suspended ceiling system to be removed as part of the renovation process and shall be neatly bundled, protected and permanently secured to building structure. No cabling is permitted to rest on the ceiling system.

3.6 EXCAVATION AND CUTTING DAMAGE

.1 Circuits disrupted by floor cutting or drilling (ie. buried cables) to be brought to the attention of the consultant. Obvious systems disturbed because due care and attention was not followed, shall be repaired immediately at no additional cost to owner.

3.7 FIRE ALARM SYSTEM

.1 Construction/demolition activities in existing building may require that certain fire alarm devices are protected from construction dust, damage etc. Coordinate with the Owners representative as required to protect components of the fire alarm system to prevent nuisance operation and alarms.

.2 Provide, install and test temporary heat detectors in the area of construction where the construction area is not protected by an active supervised fire protection sprinkler system. The “construction” detectors to be removed and discarded at the end of the project.

.3 Provide temporary replacement of smoke detectors with heat detectors including interim programming and testing and final re-verification where deemed necessary to minimize false alarms and to ensure other occupants of the building are protected.

.4 Maintain existing fire alarm system in areas under construction where practical. Relocate, rewire and provide interim connections as required while installing the new system to replace the existing. Provide temporary fire alarm devices and audible signals to suit any temporary EXITing provisions.

.5 Contractor to check in with Physical Plant at the start and end of each working day to confirm the fire alarm status in the area of work. Arrange for the related fire alarm zone card or area to be deactivated either to suit the progress of the work and/or where dust will be present on a day to day basis. Bag and protect fire detectors in dusty areas during construction. Remove any bagging at the end of the work day. Any existing detectors subject to construction dust to be immediately vacuumed and marked to be replaced at the end of the project. Any fire alarm devices subject to moisture to be replaced immediately.

.6 The fire alarm system is to be fully functional in the area of construction when the contractor is neither on site nor after the contractors normal work hours. (ie overnight, holidays, weekends)

End of Section

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Division 27 & 28 for particular Communications, Electronic Safety & Security wiring systems and types.

.3 Refer to “Patient Care Wiring” Section 26 05 23H for additional requirements in Health Care Facilities.

1.2 TERMS OF REFERENCE

.1 Typically use insulated 98% conductivity copper conductor wiring enclosed in EMT (steel) conduit for the general wiring systems unless otherwise indicated. Refer to “Site Services” Section for allowable site conduits as an alternative to steel.

.2 Aluminium conductors only permitted where indicated on drawings and then typically only for feeder conductors larger than 3/0 AWG. All conductor sizes indicated on drawings are based on copper conductors unless otherwise noted.

.3 Teck cable may only be used where specifically indicated on the drawings or in the specifications. Where permitted, Teck wiring up to 750 system volts to be PVC jacketed armoured cable, multi-copper conductor type Teck90 1000 volt having a PVC jacket with FT-6 flame spread rating.

.4 Flexible armoured cabling (BX) shall not be used for the general wiring system other than final drops to recessed light fixtures in concealed locations.

.5 Cabling indicated to be 2-Hour Fire-Rated shall be Vitalink 2-hour rated cable compliant to CAN/ULC-S139 and CSA 38-95. Cabling shall be low smoke halogen free.

.6 Provide all control wiring except HVAC controls as specified in Mechanical Divisions.

.7 Refer to Equipment Schedule(s) for detailed responsibilities.

.8 Non-metallic sheathed wiring is not to be used on this project.

1.3 PRODUCT DATA

.1 Provide product data in accordance with Division 01

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management And Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

Part 2 Products

2.1 WIRING & CABLES – GENERAL

.1 Conductors: stranded for 10 AWG and larger. Minimum size #12 AWG.

.2 Insulation to be 600 volt RW90XLPE (X link) for the general building wiring in conduit.

.3 Use RWU90XLPE for underground installations.

.4 Site services sub-circuits, including site lighting, to be minimum #10 AWG for power and #12 for controls. Increase wiring size for lengthy and/or loaded circuits so that system will not exceed the maximum voltage drop as recommended by the Canadian Electrical Code CSA 22.1.

.5 Main feeders to be conduit and copper insulated wiring unless otherwise noted on drawings. Provide ground wiring for all conduits in or below slabs. Increase conduit size as required.

.6 Armoured (BX) cable may only be utilized for recessed tee bar luminaire drops from ceiling mounted outlet boxes. "Tite Bite" connectors and their counterparts of other manufacturers shall not be used. Use anti-short connectors. Cable from luminaire to luminaire is discouraged. Allow nominally 900mm [3'] extra cable looped and supported in the ceiling space to permit fixture relocations of one tile space.

.7 TBS90 #14 AWG stranded shall be used in all switchgear assemblies. Current transformer secondary wiring shall be #12 AWG stranded. Current transformer leads shall incorporate ring type tongues for termination purposes

.8 Conductors to be colour-coded. Conductors No.10 gauge and smaller shall have colour impregnated into insulation at time of manufacture. Conductors size No.8 gauge and larger may be colour-coded with adhesive colour coding tape, but only black insulated conductors shall be employed in this case, except for neutrals which shall be white wherever possible. Where colour-coding tape is utilized, it shall be applied for a minimum of 50 mm at terminations, junctions and pullboxes and condulet fittings. Conductors not to be painted.

2.2 TECK 90 CABLE

.1 Cable: to CAN/CSA-C22.2 No. 131.

.2 Conductors: copper and sized as indicated.

.3 Insulation: Chemically cross-linked thermosetting polyethylene rated type RW90XLPE,600V

.4 Inner jacket: polyvinyl chloride material.

.5 Armour: flat galvanized steel.

.6 Overall covering: PVC jacket with FT-4 flame spread rating. PVC flame retardant jacket over armour meeting requirements of Vertical Tray Fire Test of CSA C22.2 No. 0.3 with maximum flame travel of 1.2 m.

.7 Fastenings:

.1 One (1) hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.

.2 Channel type supports for two (2) or more cables.

.3 Threaded rods: 6 mm dia. to support suspended channels.

.8 Connectors: Watertight approved for TECK cable

2.3 TWO HOUR FIRE RATED CABLE ASSEMBLIES.

.1 Cabling indicated to be 2-Hour Fire-Rated shall be Vitalink 2-hour rated cable compliant to CAN/ULC-S139 and CSA 38-95. Cabling shall be low smoke halogen free.

2.4 ARMOURED CABLE (*BX*)

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90 600 V rated.

.3 Armour: interlocking type fabricated from galvanized steel.

.4 Anti-short connectors.

2.5 ALUMINUM SHEATHED CABLE

.1 Conductors: insulated copper , size as indicated.

.2 Insulation: type RA90 rated 600 V.

.3 Sheath: aluminum applied to form continuous smooth or corrugated seamless sheath.

.4 Outer jacket of PVC applied over sheath for direct burial and wet locations.

.5 Fastenings for aluminum sheathed cable:

.1 One hole aluminum straps to secure surface cables 25 mm and smaller. Two hole steel straps for cables larger than 25 mm. Use aluminum strap only with single conductor cable.

.2 Channel type supports for two or more cables.

.3 Threaded rods: 6 mm dia. to support suspended channels.

2.6 NON-METALLIC SHEATHED CABLE

.1 Non-metallic sheathed copper cable type: NMD-90 size as indicated.

2.7 LOW VOLTAGE CONTROL CABLES

.1 Type LVT: soft annealed copper conductors, with thermoplastic insulation, outer covering of thermoplastic jacket. Minimum size #18 AWG.

.2 Unless otherwise specified wiring to be multicore individually identified and colour coded with grey sheath enclosed in conduit or (EMT).

2.8 WIRE & BOX CONNECTORS

.1 Pressure type wire connector current carrying parts to be copper and sized to fit conductors used.

.2 Fixture type splicing connector current carrying parts to be copper sized to fit conductors 10 AWG or less.

.3 Bushing stud connectors to EEMAC 1Y-2 and suitable for stranded copper conductors

.4 Clamps or connectors for armoured cable, flexible conduit, as required.

Part 3 Execution

3.1 INSTALLATION

.1 Install all cables and wiring.

.2 Conductor length for parallel feeders to be identical. Provide permanent plastic nametag indicating load fed.

.3 Group Teck, Armoured, MI & Sheathed cables on channels wherever possible.

.4 Lace or clip groups of feeder conductors at all distribution centres, pullboxes, and termination points.

.5 Wiring in walls should typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls should be avoided unless indicated.

.6 All grounding conductors and straps to be copper. All bonding conductors to have green insulation jacket.

.7 Colour coding to be strictly in accordance with Section 16010 [26 05 00].

.8 Provide sleeves where cables enter or exit cast concrete or masonry.

.9 Power wiring up to and including No.6 gauge shall be spliced with nylon-insulated expandable spring-type connectors. Large conductors shall be spliced using split-bolt or other compression type connectors wrapped with cambric tape then PVC tape.

.10 Wires shall be sized for 2% maximum voltage drop to farthest outlet on a loaded circuit. Increase home run cable size to meet these requirements.

.11 All branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.

.12 Install all control cables in conduit.

.13 Provide numbered wire collars for all control wiring. Numbers to correspond to control drawing legend. Obtain wiring diagram for control wiring of other Divisions.

3.2 VOLTAGE REGULATION

.1 The drawings are diagrammatic and indicate the general routing of conduit runs and not exact routing, either horizontally or vertically.

.2 Branch circuit conductor sizes shall be #12 AWG or larger based on the Canadian Electrical Code CSA 22.1 Section 8, which allows a maximum 3% voltage drop for branch circuits.

3.3 WIRE & BOX CONNECTORS

.1 Remove insulation carefully from ends of conductors and:

.1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65

.2 Install fixture type connectors and tighten. Replace insulating cap.

.3 Install bushing stud connectors in accordance with EEMAC 1Y-2

End of Section

Part 1 General

1.1 Related Work

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 Regulatory Requirements

.1 All branch circuit wiring for receptacles and permanently wired equipment in defined “Patient Care Areas” are to be installed in accordance with Section 24 of the Canadian Electrical Code "Patient Care Areas" and CSA-Z32. “Electrical Safety and Essential Electrical Systems in Health Care Facilities”.

.2 This Division to retain an approved Independent Testing Agency to carry out voltage regulation and grounding tests as described in CSA-Z32. This Division to include all associated testing and reporting costs. This Division is responsible for the upgrading and/or replacement of any wiring and conduit necessary to provide unconditional satisfactory test results.

.3 Provide ten (10) working days notice to Consultant ahead of testing.

1.3 Area Classification

.1 CSA-Z32 list “Patient Care Areas” into three broad classifications. Examples include, but are not limited to:

.1 **Basic Care** where body contact between a patient and medical equipment is neither frequent or usual:

.1 Patient Examination Rooms.
.2 Patient Rooms within Long Term Care Facility
.3 Patient Rooms in General, Specialty, or Rehabilitation Hospitals where body contact between a patient and medical equipment is neither frequent or usual.

.2 **Intermediate Care** where body contact between a patient and medical equipment is frequent or normal:

.1 Wards, Treatment and Examination Areas located in General, Specialty or Rehabilitation Hospitals
.2 Renal Dialysis Units
.3 Non-invasive Procedure Rooms
.4 Patient Preparation Areas
.5 Physiotherapy Departments
.6 Ultrasound Suites
.7 Dental and Chiropractic Clinics
.8 Physicians Offices
.9 Patient Bedrooms and Holding rooms

.3 **Critical Care** is defined as a Patient Care area that is an anaesthetizing location or in which cardiac contact between patient and medical equipment is frequent or normal:

.1 Angiographic Laboratories
.2 Cardiac Catheterization Laboratories
.3 Cardiac Care units
.4 Emergency Trauma Rooms
.5 Intensive Care Units
.6 Intensive Care Neonatal Units
.7 Operating Rooms.
.8 Burn Units

.2 "Patient Care Areas" requiring more stringent CEC (Canadian Electrical Code) Section 24 compliance include Intermediate Care and Critical Care but can also include Basic Care in a Hospital or Clinic setting. If not indicated, determine the area classifications prior to the rough-in. Sometimes a long term facility has dedicated areas, or a small number of beds, dedicated to "treatment" and may have such items as medical gas etc. These areas require a higher standard of "Patient Care" wiring.

Part 2 PRODUCTS

2.1 Related Sections

.1 Refer to related specification sections for wiring products.

2.2 Wiring & Cables

.1 Unless otherwise specified all Patient Care areas to be wired using insulated 98% conductivity copper conductors enclosed in EMT (steel).

.2 Where Teck cables with uninsulated bonding conductors are indicated to be acceptable in certain Patient Care areas in this project, ensure that the bonding conductors does not contact the metal sheath of the Teck cable and the bare conductor is covered in green insulating tape or sleeving at the termination points to comply with the Canadian Electrical Code 24-104.

.3 All bonding conductors and straps to be copper. All bonding conductors to have green insulation jacket minimum size #12AWG or larger as table Canadian Electrical Code Table 16.

2.3 Medical Service Columns & Bedhead Flatwall

.1 Typically the Medical Service Columns & Bedhead Flatwall are provided by other than the Electrical Division(s) and arrive on site at the project finishing stage. Coordinate all electrical and communications requirements and the detailed electrical rough-in requirements at the shop drawing stage. Consider other services coordination and clearances.

.2 Unless otherwise specified, the Electrical Divisions are to provide all coverplates and wiring and associated bonding (without internal splices) and provide and install and test the actual receptacles, switches and communication devices in the Medical Services Columns and Bedhead Flatwall.

.3 The Medical Services Column and Bedhead Flatwall manufacturer will provide the required internal electrical raceways, pull boxes, back boxes/mounting and the barriers. Coordinate all requirements including confirmation of the internal raceway sizing, barriers and coverplates.

.4 The Medical Services Column and Bedhead Flatwall manufacturer will provide a main grounding post at the service entrance location(s) of the assembly and provide any medical gas and metal finishes bonding within the assembly back to the grounding post.

Part 3 EXECUTION

3.1 Installation

.1 All “Patient Care” branch circuit wiring for receptacles and permanently wired equipment in intermediate and critical care areas to be 2-wire circuits only. This includes discharge lighting or other harmonic rich loads, i.e. common neutrals not allowed. Common neutrals may be used in certain basic care areas. Refer to Canadian Electrical Code, Section 24, Patient Care Areas and CSA Z32. Neutrals may be shared where circuits for multiple outlet surface raceways are shown connected to multiple poles, but only where neutral conductor is upsized relative to phase conductors.

.2 Install all control and communication cables in conduit.

.3 Contractor to make allowance for grounding any existing service panel with a supplementary bond conductor if the existing insulated bond has not been confirmed.

.4 This Division to repair, replace or make good at no additional contract cost any patient care branch circuit that exceeds a 3% voltage drop when tested.

3.2 Equipotential Ground Systems

.1 Equipotential grounding systems relate to Patient Care areas that are required to be solidly bonded to a common ground source in order to minimize voltage rise between any two points in the sphere of the Patient as defined in Section 24 of the Canadian Electrical Code.

.2 Where indicated, or in all “Patient Care Areas”, provide a room reference grounding (RRG) junction box or cabinet, typically mounted above an accessible ceiling and in the immediate vicinity of the area served.

.3 All related power circuits to be routed thru a metal RRG junction box complete with a hinged lid and a barrier to segregate Essential and Non Essential (Vital and Normal) power sources. Provide a common copper ground bus though the barrier to facilitate the connection of the bonding conductors on each side of the barrier. Provide a terminal for each bonding conductor and identify function. Provide #6 AWG insulated bonding conductor from the equipotential ground bus to the system panelboard(s) Install a #6 bonding conductor with the circuit conductors in a home run conduit.

.4 Provide at least one #12 AWG bonding conductor run with the circuit conductors from the equipotential ground bus to the U-ground terminal of each duplex receptacle associated with the circuit conductors. Bonding conductor size to be minimum #12 or upsized to the same size as the phase conductors. Provide one #12 AWG bonding conductor for each circuit, unless two patient care areas are serviced from three two wire circuits in which case two bonding conductors, (one for each patient care area receptacles) is acceptable. In any event bonding conductors to be installed in conduit.

.5 Provide separate insulated bonding conductors from the equipotential bus to electrical conductive surfaces in the patient care area which could be or become energized at some potential above the ground reference. Typical equipment and services requiring bonding in this manner are listed, but not limited to:

.1 Luminaires and switches
.2 Electrical cabinets and film illuminators
.3 Monitoring equipment and mounting brackets
.4 Low tension and communications systems outlet boxes
.5 Medical gas piping.
.6 HVAC diffusers and grilles if within the “Patient Contact” area.

3.3 Voltage Regulation

.1 The drawings indicate the general routing of conduit runs and not exact routing, either horizontally or vertically.

.2 Branch circuit conductor sizes shall be #12 AWG or larger based on routing of conduit and run lengths as shown on the drawings, and in order to comply with Canadian Electrical Code, Part I, which allows a maximum 3% voltage drop for branch circuits.

.3 All voltage drop calculations to be based on Canadian Electrical Code, Part I, and utilizing a current of 80% of the circuit protective device specified.

.4 When exact run lengths are determined for all branch circuits, and prior to installation of the conductors, ensure that the maximum voltage drop (based on 80% of circuit protective device) does not exceed 3%. Increase wire size from #12 AWG, if necessary, to ensure that the 3% voltage drop is not exceeded. Electrical Contractor to submit a report to consultant and confirm the length of installed conduit runs that serve patient care room receptacles from applicable panelboard and the size of conductors installed, if the distance of conduit is greater than 20 metres [65’].

.5 This Division Independent Testing Agent is to carry out voltage regulation, and ground equi-potential, tests as specified in Tests related to CSA-Z32. Tests are to include all the receptacles in Patient Treatment, Diagnostic, or Sleeping rooms even if not within the defined area around the current location of the bed. Test shall HIGHLIGHT all voltage drops above 3%, or any other marginal pass or fail results. This Division shall be given the opportunity to attempt a correction prior to the testing agency leaving the site and the testing agency is to retest the items that did not clearly pass on the first attempt. Devices that were retested are to be noted. This Division will be responsible for replacement of any wiring and conduit necessary to provide the voltage regulation specified above.

.6 Reference conductor length schedule for 15A circuits (for 20A circuits prorate accordingly):

	Maximum Length of Run	
Conductor	120V	347V
#12 AWG	20 m [65’]	65 m [210’]
#10 AWG	30 m [100’]	100 m [330’]
#8 AWG	55 m [180’]	170 m [555’]
#6 AWG	95 m [310’]	270 m [885’]

End of Section

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Section 26 05 23 “Patient Care Wiring” includes Equipotential Grounding for Patient Care.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 REFERENCE STANDARDS

.1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)

.2 Transformer grounding shall comply with CSA C22.2 No.41.

.3 All grounding conductors to be stranded soft annealed copper unless otherwise noted.

.4 Install complete grounding and bonding system in accordance with Canadian Electrical Code and local inspection authority requirements.

1.4 TESTING REQUIREMENTS

.1 Provide “Fall of Potential” tests and the corresponding “Touch & Step” calculations for high voltage installations.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions. Measure ground grid resistance.

.3 Any third party testing agency costs for the testing and reporting shall be included in the Electrical Division base tender and shall be carried out by a pre-approved testing agency.

1.5 ADDITIONAL SCOPE

.1 Refer to drawings for extent of grounding in addition to code requirements.

Part 2 Products

2.1 MATERIALS

.1 Grounding equipment to: CSA C22.2 No.41.

2.2 EQUIPMENT

.1 Clamps for grounding of conductor, size as required.

.2 Rod electrodes: Existing

.3 System and circuit, equipment, grounding conductors, bare stranded copper, soft annealed, sized as indicated. Insulation where specified or required to be green.

.4 Ground bus: Existing

.5 Non-corroding accessories necessary for grounding system, type, size material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Pressure wire connectors.

2.3 STANDARDS OF ACCEPTANCE

.1 Acceptable manufacturers:

.1 Burndy Corp.
.2 Erico Inc
.3 Cadweld.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Extend existing grounding system to create a complete permanent, continuous grounding system including, electrodes, conductors, connectors, accessories.

.2 Provide ground wire in EMT conduits installed in grade or below slabs.

.3 Install connectors in accordance with manufacturer's instructions.

.4 Protect exposed grounding conductors from mechanical injury.

.5 Use mechanical connectors for grounding connections to equipment provided with lugs.

.6 Soldered joints not permitted.

.7 Install bonding wire for flexible conduit, connected at both end to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit. Provide a ground conductor in all flexible conduit and secure to system grounding lugs at both the equipment and source.

.8 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.

.9 Install separate ground conductor to each outdoor lighting standard.

.10 Connect building structural steel and metal siding to ground by welding copper to steel.

.11 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.12 Bond single conductor, metallic armoured cables to cabinet at supply end and provide non-metallic entry plate at load end.

.13 Provide a bonding conductor appropriately sized within each raceway routed within the building.

.14 All bonding and grounding connections to be compression type unless noted otherwise.

.15 Bond bonding bus of switchboard to the grounding grid with a #3/0 copper conductor.

.16 Ground the secondary winding of potential and current transformers.

.17 All components shall be securely and adequately bonded and where required to accomplish this, bonding jumpers, grounding studs and bushings shall be used.

.18 Ensure that all raceways, terminal panels, etc. for fire alarm, etc. are securely and adequately bonded and provide grounding conductor to main ground bus where called for or when required.

.19 All interior metallic gas piping which may become energized to be made electrically continuous and to be bonded in accordance with requirements of Canadian Electrical Code.

.20 Bond all low tension equipment with #6 AWG bonding conductor.

.21 Bond all structural steel, all concrete reinforcing steel and all metal systems with a #2 copper bonding conductor. Connect to closest ground bus or bonding point.

.22 All metallic conduits longer than 1m in length, containing a single grounding or bonding conductor, shall be bonded as per the Canadian Electrical Code.

3.2 BUILDING SERVICES BONDING

.1 GAS PIPE GROUNDING - All interior metallic gas piping which may become energized to be made electrically continuous and to be bonded in accordance with requirements of Canadian Electrical Code.

3.3 EQUIPMENT GROUNDING OR BONDING

.1 Install grounding or bonding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, UPS, control panels, building steel work, generators, elevators, distribution panels and outdoor lighting.

.2 Provide a grounding conductor from the secondary of every distribution transformer to the grounding system. Ground conductor to be sized and installed in accordance with Canadian Electrical Code.

.3 Provide grounding conductor(s) from all major switchgear to solidly ground the secondary system. This includes equipment located in the main electrical room as well as each sub-electrical room. Grounding conductors to be sized to Canadian Electrical Code and switchgear manufacturer's requirements.

3.4 MECHANICAL EQUIPMENT GROUNDING

.1 Provide a #2 ground conductor from the mechanical room ground bus to each MCC.

.2 Provide a #6 ground conductor from the mechanical room ground bus to each VFD

.3 Ground wires to be installed in all conduit serving motor feeder circuits and to extend to ground screws on junction and outlet boxes for bonding.

3.5 SYSTEMS GROUNDING

.1 Install home run a #6 AWG insulated bonding conductor in conduit from the main ground bus to the:

.1 Main Fire Alarm panel

.2 Main Security panel.

.3 Sound and Communication systems head end.

.4 RF Television system

.5 Nurse Call head end

.6 Uninterruptable Power Supply (UPS) system(s)

.7 Each Flammable Storage Cabinet (to nearest ground point).

3.6 DATA & VOICE GROUNDING

.1 Install home run insulated ground conductor in conduit from the building main ground bus as follows:

.1 #2 AWG to a ground bus in the main data equipment room.

.2 #2 AWG to a ground bus in the main telephone equipment room.

.3 #2 AWG to a ground bus in each telephone backboard in equipment rooms/closets.

.2 Unless otherwise solidly bonded, bond all data and telephone incoming and outgoing steel conduits with insulated 1#12 AWG from the nearest “Communication” ground bus.

.3 Provide telephone grounding system in accordance with telephone company's requirements.

3.7 CABLE TRAY BONDING

.1 Install 1#6 to each cable tray from nearest ground bus.

.2 Install 1#6 bare copper ground, unless shown otherwise, for full length of tray bonded to tray at 15m [50’] intervals and to ground bus at each termination point as specified.

3.8 FIELD QUALITY CONTROL

.1 Perform tests in accordance with Section 26 05 00.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions.

.3 Measure ground grid resistance with earth test megohmmeter and install additional ground rods and conductors as required until resistance to ground complies with Code requirements and is less than 1Ω.

.4 Carry out all tests required by the Electrical Inspection Authority and provide all required reports and copied to the Consultant. Include all associated costs.

.5 Ensure test results are satisfactory before energizing the electrical system.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data for cabinets in accordance with Section 26 05 00

Part 2 Products

2.1 SPLITTERS

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs, connection bars to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 JUNCTION AND PULL BOXES

.1 Welded steel construction with screw-on flat covers for surface mounting.

.2 Covers with 25 mm [1”] minimum extension all around, for flush-mounted pull and junction boxes.

2.3 CABINETS

.1 Type E: sheet steel, hinged door and return flange overlapping sides, handle and catch, for surface mountings.

.2 Type T: sheet steel cabinet, with full length hinged door, latch, lock, 2 keys, containing 19 mm G1S fir plywood backboard for surface or flush mounting as appropriate.

.3 Include filtered vents and/or fan-cooling when enclosed equipment is heat producing.

2.4 FINISHES

.1 Apply finishes in accordance with Section 26 05 00.

Part 3 Execution

3.1 SPLITTER INSTALLATION

.1 Install splitters as indicated and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 JUNCTION, PULL BOXES AND CABINETS INSTALLATION

.1 Install pull boxes in inconspicuous but accessible spaces.

.2 Only main junction and pull boxes are indicated. Provide pull boxes so as not to exceed 30 m of conduit run between pull boxes.

.3 Provide pull boxes and junction boxes in locations shown on the drawings and as required to suit job conditions.

.4 Locate pull boxes and junction boxes above removable ceilings, in electrical rooms, utility rooms or storage areas.

.5 Junction boxes, when used, to be installed in areas that are accessible through luminaire openings, and/or access panels.

.6 Where pull boxes are flush mounted, provide overlapping covers with flush head cover retaining screws, prime coated and painted to match wall or ceiling finish.

.7 Where cast corrosion resistant boxes are used, covers to be of matching type and gasketed.

.8 For special (not 100mm [4”] square or octagonal) pull boxes and/or junction boxes, paint identification for the system and provide lamicoid nametags to box covers with a size 2 nameplate 5mm [0.25”] lettering identifying system.

.9 Interior of all pull boxes and junction boxes for each system to be spray painted with colour as specified in Section 26 05 00

.10 All pull boxes, junction boxes and cabinets to be supported directly from building structure using one or a combination of galvanized screws, galvanized bolts, galvanized rods, and approved box clip.

.11 Support of pull boxes, junction boxes by conduit fittings or wire is not acceptable.

3.3 CABINETS INSTALLATION

.1 Mount cabinets with top not higher than 2 m [6’] above finished floor.

.2 Cabinets shall be flush mounted in finished areas where depth can be accommodated in the walls. Provide flush trim to suit.

.3 Provide fit up in Type T cabinets as indicated.

3.4 IDENTIFICATION

.1 Install size 2 identification labels indicating system name, voltage and phase in accordance with Section 26 05 00

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management And Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 REFERENCES

.1 All conduits and accessories to be manufactured and certified by the related CSA standard.

1.4 SCOPE

.1 Drawings do not show all conduits. Those shown are in diagrammatic form only.

.2 Conceal all conduits where possible in finished areas. Conduits may be surface mounted either only where indicated or in service areas accessible only to authorized personnel.

.3 If a finished area is concrete (existing) or concealment is not practical, obtain ruling from Consultant where exposed wiremold may be substituted.

.4 Note particular requirements for routing of conduits where detailed.

.5 Provide polypropylene pull cord in all “empty” conduits.

Part 2 Products

2.1 CONDUITS

.1 Rigid metal conduit: to CSA C22.2 No.45 Galvanized Steel.

.2 Electrical Metallic Tubing (EMT): to CSA C22.2 No.83.

2.2 CONDUIT FASTENINGS

.1 One hole steel straps to secure surface conduits 41mm [1.5”] and smaller. Use two hole steel straps to conduits larger than 41mm [1.5”].

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits.

.4 10mm [3/8”] threaded rods to support suspended channels.

2.3 CONDUIT FITTINGS

.1 Fittings manufactured for use with conduits specified. Coating same as conduit.

.2 Provide factory "ells" where 90 degree bends are required for 27mm [1”] and larger conduits.

.3 EMT couplings and connectors shall be steel, or Regal Die-cast zinc alloy. Couplings used on conduit containing fire-rated cable shall be steel. Regular die-cast alloy fittings and couplings are not acceptable. Provide plastic bushings (insulated throat) for all connectors unless there is no chance of burrs. Provide water-tight connectors in damp or wet locations and for surface equipment (e.g. Panelboards, MCC's, etc) in rooms that are fire sprinkler protected.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

.1 Weatherproof expansion fittings with internal bonding assembly suitable linear expansion.

.2 Water-tight expansion fittings: with integral bonding jumper, suitable for linear expansion and 21mm [3/4"] deflection in all directions.

.3 Weatherproof expansion fittings for linear expansion at entry to panel as required.

2.5 RIGID P.V.C. CONDUIT

.1 Conduit: rigid non-metallic conduit of unplasticized polyvinyl chloride as manufactured C.G.E. "Sceptre" or equal.

.2 Fittings: threaded male or female solvent weld connectors and solvent weld couplings, as supplied by conduit manufacturer.

.3 Solvent: as recommended by conduit manufacturer.

2.6 CABLE TRAY

.1 Refer to specification section 26 05 36 Cable Trays.

2.7 SURFACE RACEWAYS

.1 Removable cover finished painted steel surface raceways.

.2 Internal barriered to provide physical separation between power and communication cabling.

.3 Colour to be as indicated on the drawings or where not indicated confirm with Consultant before ordering.

.4 All raceway fittings to be accessories available from the manufacturer.

.5 Standard of acceptance:

.1 Wiremold 3000 (39mm x 70mm), 4000 (44mm x 121mm), or 6000 (90mm x 121mm), as indicated on the drawings or as required for wiring capacity.

.2 Approved equal

.6 All product to be from the same manufacturer.

2.8 OUTLET AND CONDUIT BOXES IN GENERAL

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm [4"] square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped. Do not use sectional boxes.

.4 Blank cover plates for boxes without wiring devices.

.5 347V outlet boxes for 347V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

.7 Bushing and connectors with nylon insulated throats.

.8 Knock-out fillers to prevent entry of foreign materials.

.9 Conduit outlet bodies for conduit up to 35 mm[1.25”]. Use pull boxes for larger conduits.

.10 Double locknuts and insulated bushings on sheet metal boxes.

2.9 SHEET STEEL OUTLET BOXES

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm [3" x 2" x 1.5"] or as indicated. Larger 102 mm square x 54mm deep [4”x 2”] outlet boxes (No. 52151 or 52171) to be used when more than one conduit enters one side. Provide extension and plaster rings as required.

.2 For larger boxes use GSB solid type as required.

.3 Boxes for surface mounted switches, receptacles, communications, telephone to be 100mm square No. 52151 or 52171 with Taylor 8300 series covers.

.4 Lighting fixture outlets: 102 mm [4”] square outlet boxes (No 52151, 52171 or 72171) or octagonal outlet boxes (No 54151 or 54171).

.5 102 mm [4”] square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster and/or tile walls.

2.10 MASONRY BOXES

.1 Electro-galvanized steel masonry single and multi gang type MDB boxes for devices flush mounted in exposed block walls.

2.11 CONCRETE BOXES

.1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.12 FLOOR BOXES

.1 Concrete tight electro-galvanized sheet steel floor boxes with adjustable finishing rings to suit floor finish with faceplate. Device mounting plate to accommodate short or long ear receptacles. Minimum depth: 28 mm [1.1”] for receptacles; 73 mm [2.9”] for communication equipment.

.2 Adjustable, watertight, concrete tight, cast floor boxes with openings drilled and tapped for 16 mm [0.5”] and 21 mm [0.75”] conduit. Minimum size: 73 mm [2.9”] deep

2.13 SURFACE CONDUIT BOXES

.1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacles.

Part 3 Execution

3.1 CONDUIT - GENERAL

.1 Generally use electrical metallic tubing (EMT) in the building interior and in above grade slabs except where subject to mechanical injury or where otherwise indicated.

.2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass. Set out the work and coordinate with other services prior to installation. Maintain access to junction and pull boxes.

.3 Where practical conceal conduits.

.4 Any conduit exposed in finished areas to be free of unnecessary labels and trade marks.

.5 All conduit ends to be reamed to ensure a smooth interior finish that will not damage the insulation of the wiring.

.6 Ensure grounding continuity in all conduit systems.

.7 Surface conduits are acceptable in mechanical and electrical service rooms and in unfinished areas or where indicated.

.8 Use rigid galvanized steel (RGS) threaded conduit where the installation is subject to mechanical injury. In any event, use RGS conduit for surface installations up to 1.5m [5'] above the finished floor.

.9 Field threads on rigid conduit shall be sufficient length to draw conduits ends together.

.10 Unless otherwise noted and where practical, all conduits to be routed through the ceiling space rather than in, or below, slabs or floor structures to facilitate future changes.

.11 Conduits in walls should typically drop (or loop) vertically from above to better facilitate future renovations. Generally conduits from below and horizontal conduits in walls and concrete structures should be avoided unless indicated.

.12 All branch circuit conduit, home-runs and communication/data conduits to be minimum 21 mm [3/4"] diameter unless otherwise indicated.

.13 Generally use Rigid PVC conduits in or below ground level slab unless otherwise noted. Transition to RGS conduit in exposed locations: eg where conduits emerge from ground level slab.

.14 Conduits are not permitted in terrazo or concrete toppings.

.15 Cap turned up conduits to prevent the entrance of dirt of moisture during construction.

.16 Locate conduits more than 75mm [3"] parallel to steam or hot water lines with a minimum of 25mm [1"] at crossovers.

.17 Bend conduits cold, so that conduit at any point is not flattened more than 1/10th of its original diameter. Conduits bent more than this or kinked to be replaced.

.18 Provide polypropylene pull cord in empty conduits to facilitate pulling wiring in future.

.19 Where conduits become blocked, the use of corrosive agents is prohibited. Remove and replace blocked section.

.20 Damaged conduits to be repaired or replaced.

.21 Dry conduits out thoroughly before installing wiring. Swab out conduit and thoroughly clean internally before wires and cables are pulled.

.22 Conduits shall not pass through structural members except as indicated.

.23 Conduit sizes indicated on drawings are minimum only. Increase sizes as required to suit alternative wiring types or to comply with Code.

.24 Conduits and ducts crossing building expansion joints shall have approved conduit expansion fittings to suit the type of conduit used.

.25 Seal conduits with approved sealant where conduits are run between heated and unheated areas.

.26 Seal openings with approved sealant where conduits, cables, or cable trays pierce fire separations.

.27 Where conduits pass through walls, they shall be grouped and installed through openings. After all conduits are installed, wall openings shall be closed with material compatible with the wall construction and/or to meet any fire separation integrity.

.28 Where drawings show conduit designations, these conduits shall be identified at each point of termination with Thomas & Betts "Ty-Rap" No. TY532M labels.

.29 Use "Condulet" fittings for power and telephone type conduit terminations in lieu of standard boxes where box support is not provided.

.30 Provide necessary roof jacks or flashing where conduits pass through roof or watertight membranes. Apply approved sealant to maintain membrane integrity.

.31 Use flexible metal conduit for connection to recessed incandescent fixtures without a prewired outlet box and connection to recessed fluorescent fixtures.

.32 Use liquid tight flexible metal conduit for connection to motors, and other vibrating equipment and transformers.

.33 Use explosion proof flexible connection for connection to explosion proof motors.

.34 Install conduit-sealing fittings in hazardous areas, isolation rooms and clean rooms. Fill with compound.

3.2 SURFACE CONDUITS

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with minimum 1.5m [5’] clearance.

.3 Conduits to be run in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended and/or surface channels.

.5 Surface conduits will not be accepted in finished areas unless detailed.

3.3 SPARE CONDUITS

.1 Provide spare conduits as indicated.

.2 Provide 2x27 mm [1”] spare conduits up to ceiling space and 2x27 mm [1”] spare conduits down to ceiling space below from each flush panel. Terminate the conduits in 150x150x100 mm [6”x6”x4”] junction boxes in ceiling spaces or in case of an exposed concrete slab, terminate each conduit in a flush concrete box. Provide coverplates for all junction boxes.

3.4 CABLE TRAY INSTALLATION

.1 Use ventilated cable tray for Voice/Data service cable down drops in the Communication Rooms

.2 Support suspended cable tray from trapeze style hangers with hangers spaced as recommended by the manufacturer based on a maximum load capacity for the tray. Support trays at all corners, offsets and tee fittings

.3 Where shown and appropriate, support cable tray from wall using a cantilever support arrangement. Cable trays may be supported using wall mounted support on masonry walls or from the building steel only.

.4 Cable tray location and mounting heights to be coordinated on site with other trades to provide minimum headroom and serviceability. Verify drawing details to allow for all services run in ceiling spaces. Provide vertical and horizontal offsets as required to suit job site conditions.

.5 Cable tray sections shall be joined by approved connector plates and rust-resistant (plated) hardware. Torque all hardware as per manufacturer's recommendations.

.6 Cables shall be secured in place in tray with tie wraps where in horizontal runs and with cable clamps in vertical runs. Low tension cabling shall be secured to tray by use of Velcro style straps. Support cables routed vertically through a service riser with a basket type wire grip equal to Hubbell Kellems grip for power cables and data cables including fiber optic cables.

.7 Bond all tray continuously with #6 AWG bond wire installed within all cable trays and connected to each length of tray by a ground clamp. Connect bonding conductor to building ground system at one or both ends

.8 Provide pulleys and rollers to install cables.

.9 Where cable tray passes through fire separations install fire pillows as required to maintain proper fire rating.

3.5 SURFACE RACEWAYS

.1 Where practical provide regularly spaced device outlets and factory pre-cut raceway covers and cover plates. Field install outlets where factory installation is not possible due to delivery issues or irregularly spaced outlet requirement. In this event covers may be field cut with proprietary factory cover shear equipment with sharp blades.

.2 Raceways shall be free of burrs inside and out.

.3 Covers to be matching colour, smooth, free of burrs and parallel with no gaps.

.4 Preserve and organize the space within the wireway to facilitate multiple wiring runs and future additions. In finished areas and where practical, conduit to feed the surface raceway from a box recessed behind and via grommeted openings to the back of the surface raceway. Maintain pullbox access as required by the Canadian Electrical Code.

.5 Where a PAC pole is noted on drawings for power and data, use Legrand 30TP Series or better.

3.6 BOXES INSTALLATION

.1 Support boxes independently of connecting conduits.

.2 Ceiling outlet boxes to be provided for each surface mounted fixture or row of fixtures installed in other than T bar ceilings with removable tiles.

.3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material. Remove upon completion of work.

.4 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm [0.25”] of opening.

.5 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers not to be used.

.6 All outlet boxes to be flush mounted in all areas, excluding mechanical rooms, electrical rooms, and above removable ceilings.

.7 Adjust position of outlets in finished masonry walls to suit masonry course lines. Coordinate cutting of masonry walls to achieve neat openings for all boxes. All cutting of masonry work for installation of electrical fittings to be done using rotary cutting equipment.

.8 No sectional or handy boxes to be installed.

.9 Provide vapour barrier wrap or boots behind outlets mounted in exterior walls. Maintain integrity of the vapour barrier and insulation to prevent condensation through boxes.

.10 Coordinate location and mounting heights of outlets above counters, benches, splash-backs and with respect to heating units and plumbing fixtures. Coordinate with architectural details.

.11 Outlets installed back to back in party stud walls to be off-set by one stud space.

.12 Refer to wiring device and communication specification sections and to architectural layouts for mounting heights of outlet boxes.

.13 Back-boxes for all communications systems equipment to be provided in accordance with specific manufacturer's recommendations and as specified in the communications sections of these specifications.

.14 Separate outlets located immediately alongside one another to be mounted at exactly the same height above finished floor. Similarly, outlets mounted on a wall in the same general location at varying heights to be on the same vertical centre-line unless otherwise noted.

.15 Where outlet boxes penetrate through a fire separation, ensure that the boxes are externally tightly fitted with an approved non-combustible material to prevent passage of smoke or flame in the event of a fire.

End of Section

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CAN/CSA C22.1 No.126.1, Metal Cable Tray Systems.

.2 CAN/CSA C22.1 No.126.2, Non Metallic Cable Tray Systems.

.2 .National Electrical Manufacturers Association (NEMA)

.1 NEMA FG 1, Fibreglass and Cable Tray Systems.

.2 NEMA VE 1, Metal Cable Tray Systems.

.3 NEMA VE 2, Cable Tray Installation Guidelines.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Division 01 - Submittal Procedures.

.2 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.

.3 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.

.4 Identify types of cable trays used.

.5 Show actual cable tray installation details and suspension system.

Part 2 Products

2.1 CABLE TRAY (COMMUNICATION ROOM)

.1 A Flex or basket type cable tray shall be provided above equipment cabinets and around the perimeter of the room and shall be attached to the Communications cable tray infrastructure.

.2 The tray shall be mounted @ 2.7M AFF unless otherwise noted.

.3 Wall mounted tray brackets shall be bolted through any plywood backboards to the wall.

2.2 CABLE TRAY (INTERIOR PATHWAYS)

.1 All ventilated tray to be steel or aluminum, complete with angles, offsets, corners, saddles, tees, etc. as indicated and required to suit the installation. Radii on fittings shall be 300mm minimum.

.2 All steel non-painted tray shall be hot dip galvanized after fabrication to CSA G164-1965 ASTM designation A386.

.3 All tray shall have 45 degree corners at all vertical and horizontal corners, tees and width change locations.

.4 Cable tray to have a minimum cable loading depth of 114mm [4.5”]. Cable tray width to be a minimum of 305mm [12”] wide for communications, or as indicated on drawings

.5 Suspended tray supports to be trapeze style hangers of minimum 40mm [1.5”] square “Unistrut” supported from 9.5mm [3/8”] threaded rod hangers from preset or afterset concrete inserts or direct steel support.

.6 Barriers where specified, to be continuous metal dividers for entire length of the tray.

.7 Fire Barrier Pillows to be self contained intumescent firestop product for use in through-penetration firestops. Product to achieve up to three (3) hours fire rating in accordance with ASTM E 814 tests.

2.3 CABLE TROUGH

.1 Cabletroughs and fittings: to NEMA FG 1/VE 1 and CAN/CSA C22.1 No. 126.1/2.

.2 Ladder Ventilated & Non Ventilated wire mesh type, Class A C1 to CAN/CSA C22.2 No.126.1/2.

.3 Solid covers for complete cabletrough system including fittings.

.4 Barriers where different voltage systems are in same cabletrough.

.5 Ground cable trays with bare copper conductor attached to each tray section in accordance with CEC requirements.

.6 Provide fire stop material at firewall penetrations.

2.4 SUPPORTS

.1 Provide splices, supports for a continuously grounded system as required.

2.5 STANDARD OF ACCEPTANCE

.1 Code Manufacuring

.2 Wespac

.3 Mono Systems

.4 Wiremold

.5 Approved equivalent

Part 3 Execution

3.1 GENERAL INSTALLATION – POWER & COMMUNICATIONS

.1 Cable trays are usually installed in the false ceiling space of hallways and located to keep conduit lengths to a minimum.

.2 Provide cable tray in approximate location and general routing as shown on drawings.

.3 Provide dropouts when cables exiting all horizontal cable trays.

.4 Support suspended cable tray from trapeze style hangers with hangers spaced as recommended by the manufacturer based on a maximum load capacity for the tray. Support trays at all corners, offsets and tee fittings

.5 Where shown and appropriate, support cable tray from wall using a cantilever support arrangement. Cable trays may be supported using wall mounted support on masonry walls or from the building steel only.

.6 Generally Cable Trays shall be separated at a minimum 450mm from the adjacent wall unless otherwise indicated.

.7 Cable tray location and mounting heights to be coordinated on site with other trades to provide minimum headroom and serviceability. Verify drawing details to allow for all services run in ceiling spaces. Provide vertical and horizontal offsets as required to suit job site conditions.

.8 Cable tray sections shall be joined by approved connector plates and rust-resistant (plated) hardware. Torque all hardware as per manufacturer's recommendations.

.9 Unless otherwise indicated, bond all cable tray with a minimum #6 AWG copper bonding conductor installed continuously within the full length of all cable trays. Securely connect the bond wire to the tray at each end and at a minimum of 15m [50’] intervals. Connect bonding conductor to the building ground system at one or both ends.

.10 Provide pulleys and rollers to install cables.

.11 Install ventilated type tray in corridors and as vertical risers. Where cable trays pass through solid walls and floors, trays shall be solid type with cover and shall extend a minimum of 450 mm on each side of the wall or floor.

.12 Where cable tray passes through fire separations install fire pillows as required to maintain proper fire rating.

.13 Cable tray may require installation of risers, bend, etc. to adjust tray up or down as well as sideways for the tray routing to fit within limits of space available, and to clear other services, ducts, pipes etc. along the route. Routing maybe adjusted somewhat as necessary to enable installation of services under other trades. These field adjustments are to be done at no extra cost to the Owner.

.14 Where tray runs change elevation, trays shall overlay each other when manufactured waterfall assemblies can not be used. To prevent cables stress install drop-outs on the top tray when overlap method is to be used. Further, tray sections shall be coupled together to provide some rigidity. This coupling maybe made by using a short length of tray and adjustable elbows or may be coupled by means of common support rods at the tray overlap.

.15 Sharp metal edges in cable trays which could cut the cable shall be smoothed and the cable dressed away from these edges. Manufacturer surface imperfections shall be touched up with a cold galvanizing coating before installing cable.

.16 There shall be no wiring joints or splices within the cable tray.

3.2 INSTALLATION - COMMUNICATIONS

.1 Use ventilated cable tray for Voice/Data service cable down drops in the Communication Rooms.

.2 Cables shall be secured in place in tray with tie wraps where in horizontal runs and with cable clamps in vertical runs. Low tension cabling shall be secured to tray by use of Velcro style straps. Support cables routed vertically through a service riser with a basket type wire grip equal to Hubbell Kellems grip for power cables and data cables including fiber optic cables.

.3 The “communications” cable tray system is for extra-low voltage cabling only. There shall be no cables within the tray that has a voltage exceeding 30V.

.4 Power distribution conduits shall not be located within 200mm [8”] of the cable tray.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Section 26 05 00 Common Work Results

.3 Section 26 27 26 Wiring Devices

.4 Section 26 24 16 Panelboards – Breaker Type

1.2 SYSTEM DESCRIPTION

.1 The facility shall have a stand-alone lighting control system interfaced to the central Building Management Control System (BMCS). Refer to system overview drawing for wiring diagram.

.2 Lighting control system shall the following components:

.1 Room controllers

.2 Low Voltage Wall Switches

.3 Photocell Sensors

.4 Daylight Sensors

.5 Occupancy Sensors

.6 Interfaces with BMCS

1.3 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings & product data in accordance with Section 26 05 00.

.2 Retain the equipment supplier's representative to assist with the review of the equipment application at the shop drawing stage.

.3 Provide custom schematic shop drawings of the complete systems and devices specified in this section.

Part 2 Products

2.1 LOW VOLTAGE CONTROL - GENERAL

.1 Provide low voltage control for lighting and other systems as shown on plans and specified herein.

.2 Do not connect the secondaries of the control transformers in parallel or connect one side of the secondaries in common. All control transformers to be connected to the same phase.

.3 Standard of Acceptance:

.1 Reliable Control

.1 Mach ProView MPV-L-ER

.2 Mach ProLight, MPL-8XX+Relay RE-WR6161K-84

.2 Pre approved product

2.2 LOW VOLTAGE WALL SWITCHES

.1 Wall switches shall be flush mounted with associated hardware to fit into standard wall boxes. Switches shall be single push operation, with internal solid state circuit that continuously monitors the condition of the associated lighting control load relay and connecting wires. Key operated or secure switches as noted on drawings. Key shall be removable in either the ‘enabled’ or ‘disabled’ state.

.2 Each switch shall be clearly identified with a printed switch label. The label shall indicate the switch function, or area served, as indicated in Lighting Control Schedule. Labels shall be held in place with removable clear plastic cap and shall be field replaceable. Submit label schedule as part of the shop drawing submittal.

.3 Individual switches shall each contain a green "off" LED and a red "on" LED, thus continuously indicating the status of the associated lighting control load relay.

.4 Switches shall have color coded captive screw terminals.

.5 Provide wiring as recommended by the system manufacturer. Typically wiring will be stranded multi-conductor and jacketed.

.6 Switch plates shall be stainless steel or as otherwise indicated.

.7 Provide interfaces as required to group relays to common switches.

.8 Provide master switches in gang arrangements as required.

.9 Standard of Acceptance:

.1 Reliable Space Sensor Temperature, SST3-L-O-S/W

.2 Pre approved product

2.3 OCCUPANCY SENSORS – CEILING MOUNTED

.1 Occupancy sensors shall be capable of detecting presence in the floor area to be controlled using dual technology: passive infrared (PIR) and microphonics. Upon sensing motion using PIR technology, the sensor signals ON, activates the sound detector and starts an internal timer. Timer will be continually reset whenever motion is seen or sound is detected.

.2 Provide a bypass switch (or pin) to defeat automatic function that shall be visible from the floor when installed. Function selection: on/off switching or off-only switching.

.3 Sensors shall have the ability to directly control up to four low voltage relays directly and have the ability to connect low voltage wall switches in parallel to each relay for occupant override.

.4 LED status indicator.

.5 Low profile recessed design not protrude more than 25mm down from the ceiling.

.6 Multi-directional 360 degree detection.

.7 Time delay range from 30 seconds to 20 minutes.

.8 PIR lens capable of being rotated or swivelled.

.9 Unit assembly shall have one set of normally open and one set of normally closed auxiliary contacts.

2.4 POWER PACKS:

.1 Power Packs shall be self contained transformer relay module complete with snap-in nipple for installation in a typical electrical box knockout.

.2 Unit shall have dry contacts capable of switching line voltage (120V or 347V) relays controlling up to 20 Amp ballast load or 13 Amp incandescent or 13 Amp fluorescent ballast load.

.3 Unit shall provide 24 volt DC @ 150 mA output capable for controlling a minimum of three (3) occupancy sensors plus remote slave packs as required.

.4 Unit shall be capable of parallel wiring without regard to primary AC phasing.

.5 Unit shall be CSA approved.

.6 Provide addressable Power Pack as required to suit system.

2.5 WIRING

.1 Provide all control wiring as required and recommended by the manufacturer.

.2 The removal of any addressable device shall have no effect on the communication between other devices and the relay panels in the rest of the lighting control network.

Part 3 Execution

3.1 INSTALLATION

.1 Provide and install all equipment including all components needed to make the system work in the intended manner.

.2 Confirm control wiring individual conductor sizes with equipment manufacturer prior to installation.

.3 Retain the equipment supplier’s representative to assist with the proper device placement at the rough-in stage.

.4 Confirm control wiring individual conductor sizes with equipment manufacturer prior to installation.

3.2 INSPECTION

.1 Coordinate controls and interfaces to other Divisions including the BMCS.

3.3 COMMISSIONING

.1 Check and confirm that all control devices and sensors work in the intended manner.

.2 Retain the equipment supplier’s representative to review the coverage patterns and finally adjust sensor settings after the move in and furniture installation. Provide a Suppliers sign off letter and a schedule indicating the set points of all devices.

End of Section

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Section 26 09 24 “Lighting Controls” includes low voltage relays assemblies that are to be factory installed and prewired, within adjoined matching panel tubs and trims that are part of this section. Refer to section 26 09 24 for scope and extent.

1.2 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 26 05 00.

.2 Shop drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

.3 Shop drawings to include matching tub and trim details for factory installed low voltage relay cabinets where specified.

1.4 PLANT ASSEMBLY

.1 Install circuit breakers in panelboards before shipment from plant.

.2 Install and prewire low voltage relays assemblies where indicated.

.3 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.

.4 All panelboards to be of a common manufacturer.

1.5 FINISH

.1 Apply finishes in accordance with Section 26 05 00.

.2 Panel finish in electrical and equipment rooms and closets to be standard ASA Grey baked enamel for normal power service and Blue for emergency power service. Confirm with Consultant prior to shop finishing panels.

.3 Panels in finished and/or public areas to be either as clause .2 above or prepared to accept painting to closely match surroundings as directed by the Architect. In the later instance, the final paint coat to be done by Divison 09 but coordinated by the Electrical Division in particular for protection and masking of locks and sensitive parts. Confirm with Consultant prior to paint finishing panels.

Part 2 Products

2.1 PANELBOARDS, DOORS AND TRIMS

.1 Panelboards: to CSA C22.2 No. 29 and product of one manufacturer.

.2 Bus and breakers rated for 10 KA symmetrical, minimum, interrupting capacity or as indicated.

.3 Tin plated aluminum bus with full size neutral.

.4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number.

.5 Mains, number of circuits and number and size of branch circuit breakers as indicated.

.6 Provide all necessary connectors and mounting hardware in every space to facilitate installation of future breakers. Provide blank fillers for all spaces.

.7 Concealed hinges and concealed trim mounting screws, hinged locking door with flush catch.

.8 Panelboards to have flush doors. (Gasketed where required).

.9 Provide two keys for each panelboard and key similar voltage panelboards alike.

.10 Panel tubs to be typically 600mm [20”] wide.

.11 Provide "sprinkler-proof" design in areas where sprinkler fire protection is installed. In any event, all surface mounted enclosures to be complete with sprinkler drip cover.

.12 Provide door within door trims where indicated to facilitate ease of service maintenance Each tub trim cover to be hinged and self supporting and to swing out to expose breaker cable terminations and wireways. Hinged trim shall be secured with cover screws on opening side by concealed machine screws. Hinged breaker cover shall be recessed into the hinged overall tub cover. Breaker cover shall have latch type closures. Submit details on shop drawings prior to manufacturing.

2.2 CUSTOM BUILT PANELBOARD ASSEMBLIES

.1 Relay section(s) on side(s) of panels as indicated or required for installation of low voltage remote control switching components. Coordinate with lighting controls equipment supplier

.2 Double stack panels as indicated.

.3 Contactors in mains as indicated.

.4 Feed through lugs as indicated.

.5 Provide Isolated ground bus as indicated. Isolated ground bus to be similar to neutral.

2.3 BREAKERS

.1 All breakers to be bolt on type, moulded case, non adjustable and non interchangeable trip, single, two and three pole, 120/208(240)V or 347/600V and with trip free position separate from "On" or "Off" positions.

.2 Two and three pole breakers to have common simultaneous trip and able to be located in any circuit position within the panelboard. Minimum interrupting rating of breakers to be as follows:

.1 347/600V panelboards - 14,000 Amps at 347 volts.

.2 120/208V panelboards - 10,000 Amps at 250 volts.

.3 Main breaker to be separately mounted at top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.

.4 Provide circuit breakers with indicated trip ratings as shown in the panelboard schedules.

.5 Provide at least 10% spare 15 Amp single pole breakers whether indicated or not.

.6 Provide GFI type breakers as indicated.

.7 Provide Lock-on devices as indicated and in any event for Fire Alarm circuits, Security equipment circuits, EXIT sign circuits and Emergency Battery equipment circuits.

2.4 PANELBOARD IDENTIFICATION

.1 Provide equipment identification in accordance with Section 26 05 00.

.2 Nameplate for each panelboard size 5 (2 line) engraved as indicated and include panel designation and voltage/phase.

.3 Complete circuit directory with typewritten card(s) located in slide-in plastic pocket(s) fixed to the back of the related door. Directory card to indicate the panel designation, mains size, voltage/phase and the location and load controlled of each circuit. Include a “letter sized” paper copy of each directory in the project maintenance manual.

.4 Provide a plasticized typewritten information card fixed to the back of the each panel door. Information card to indicate the panel designation and location, feeder type and size and locations of any controlling contactors and feeder pullboxes. Include a “letter sized” paper copy of each information card in the project maintenance manual.

2.5 STANDARD OF ACCEPTANCE

.1 Cutler Hammer Type PRL Door within door trim.

.2 Schneider, Type NQOD Door within door trim.

Part 3 Execution

3.1 INSTALLATION

.1 Locate panelboards as indicated and mount securely, plumb true and square, to adjoining surfaces.

.2 Panelboards located in service rooms, mechanical rooms, and electrical rooms to be mounted on unistrut supports.

.3 Mount panelboards to height given in Section 26 05 00 or as indicated.

.4 Connect loads to circuits as indicated.

.5 Connect neutral conductors to common neutral bus with respective neutral identified.

.6 Install 4x27mm [1”] empty conduits (or equivalent) from each flush mounted panelboard single tub to ceiling space above and 2x27mm [1”] empty conduits (or equivalent) from each flush mounted panelboard single tub down to ceiling or space below where space exists. Refer also to Section 26 05 32 Conduit, Tray, Wireways Boxes Fittings.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE OF WORK

.1 In general the HVAC and the Plumbing/Fire Protection motors and drives will be respectively provided under the Mechanical Division and Plumbing/Fire Protection Divisions;. Refer to the related division of the specifications and drawings for exact locations and requirements.

.2 Provide the following components:

.1 All disconnect switches required.

.2 All starters, contactors, control transformers, except where supplied by the Mechanical or Plumbing/Fire Protection Divisions as noted in the equipment schedule.

.3 Thermostats, solenoid valves, pressure switches, aquastats, flow switches, timeclocks are generally provided by the Mechanical or Plumbing Divisions except as noted in the equipment schedule(s).

.4 Refer to equipment schedule(s) for details of motor controls and devices.

.5 Provide all power wiring from power distribution centre, through starter and control equipment to the motors.

.6 Conduit, wire and connections for all HVAC low voltage control wiring shall be the responsibility of Mechanical Division unless otherwise specified.

.7 Provide, connect and verify all Fire Alarm control wiring and devices.

1.3 CONTROLS - GENERAL

.1 Mechanical and Plumbing Divisions differ both in regard to the particulars of drives, motors, etc. specified. The Mechanical Division typically includes a major section on controls whereas the Plumbing Division typically includes more package equipment requiring power service connection only. Because of these variations the demarcation point between the work of the Electrical Division and the Mechanical and Plumbing Divisions typically differ.

.2 Generally for drives, equipment, etc. detailed in the Mechanical Division, the work of the Electrical Division finishes with the supply of a standard terminal block array for each starter. All further wiring, relays, timers, etc., together with control consoles, are provided under the Mechanical Division.

.3 Generally for the package equipment, drives and special controls detailed in the Plumbing Division, the work of the Electrical Division typically includes the provision of all wiring, devices, etc to complete each system and left ready for commissioning, set up, etc. by the Plumbing Division.

1.4 ELECTRICAL DIVISION RESPONSIBILITIES FOR MECHANICAL DIVISIONS

.1 Provide a ten point terminal block for each starter or contactor.

.2 Provide interwiring between starters or contacts and terminal blocks. Starter to be entirely factory-wired.

.3 Terminals to be as follows:

.1 120 V line from control transformer.

.2 Terminals for remote 3 wire stop/start.

.3 HOA or other control.

.4 120V neutral.

.5 Normally open dry contact.

.6 Common.

.7 Normally closed dry contact.

.8 Normally open dry contact.

.9 Common.

.10 Normally closed dry contact.

.4 Except where otherwise indicated, the work of the Electrical Division shall not extend beyond the control terminal blocks. The Mechanical Division shall provide all conduit, wire, wiring connections and components such as relays, timers, etc. as required to provide the interlocking functions and controls as outlined in the specifications. If the standard terminals supplied by the Electrical Division require supplementation in any way, e.g. by supplying additional N.O. or N.C. contacts, these facilities are included in the Mechanical Division Mech Div scope.

.5 Mechanical Division shall provide the mechanical control consoles complete with pilot controls, indicating lights, etc., as outlined in the specifications.

.6 When an item provided under the Mechanical Division is factory supplied with a starter or contactor and it is necessary to alter or add to the control wiring in order to achieve the method of operation specified in the Mechanical Division, this work shall be included in Mechanical Division.

.7 When control items such as thermostats, float controllers, etc., are connected to power wiring in series with the item being powered (e.g. unit heater motor, fractional HP fans, etc.) the supply and installation of the controller devices are included in Mechanical Division. Power wiring to and from the controllers is included in the Electrical Division. Install line voltage thermostats for single phase motors provided by the Mechanical Division where specifically indicated on the drawings and/or the “Equipment Schedule” of this specification.

.8 When the electrical characteristics of a controlled item exceed the capacity of a specified controller, provision of a contactor and the required wiring shall be included in the Mechanical Division.

1.5 ELECTRICAL DIVISION RESPONSIBILITIES FOR PLUMBING DIVISIONS

.1 When a drive, motor, etc. provided under the Plumbing Divisions is factory supplied with a starter, contactor, alternator, pressure switch, etc., the wiring and installation of these items and controls shall be included in the Electrical Division.

.2 The ten point terminal blocks similar to those specified under the Mechanical Division controls are not mandatory for the Plumbing Division equipment.

.3 The Electrical Division shall provide stop/start or HOA controls as specified for each item except where these stations are factory supplied with equipment.

.4 The Electrical Division shall leave each system fully functional and requiring only minor final adjustments (such as pressure or vacuum settings) by the Plumbing Divisions.

Part 2 Products

2.1 MATERIALS

.1 Refer to appropriate section of the Electrical Division(s).

2.2 CONTROL RELAYS

.1 Control relays to be rated minimum 10 A, 300V, with contacts as required and 120 V control coil unless otherwise noted. Relays to be typically mounted in CEMA1 enclosures located in control terminal cabinets and/or MCC.

.2 Provide required fire alarm relays and auxiliary contacts in motor control centres or at the related equipment cabinets to provide activation and deactivation of mechanical fan units as specified in the Mechanical Division.

.3 Relays for Fire Alarm shutdown system control to be approved for Fire Alarm use and powered from the Fire Alarm panel. Fire Alarm relay enclosures to be finished in red and identified “FIRE ALARM RELAY”

.4 Time delay relays to incorporate time delay feature to delay either opening or closing as specified. Time period to be adjustable from 0 to 5 minutes unless otherwise specified.

Part 3 Execution

3.1 INSTALLATION

.1 Provide all labour and materials required to complete power wiring for HVAC, Plumbing and Fire Protection equipment as called for in the project specifications and/or shown on the drawings.

.2 Provide all 1 phase and 3 phase motor protection switches, combination starters and disconnects contactors and relays as required for mechanical equipment unless otherwise specifically noted in these specifications or on the drawings.

.3 Terminate all line voltage wiring to the designated equipment terminals.

.4 Obtain a full set of HVAC control shop drawings and have a full understanding of the scope before commencing installation and including any fire alarm interface.

.5 Verify the recommended overcurrent protection and rating of Mechanical and Plumbing and Fire Protection equipment and equipment supplied by the Owner. Change feeder overcurrent protection as required to comply with equipment recommendations. Notify the Consultant of all revisions.

3.2 FIELD QUALITY CONTROL

.1 Cooperate with Mechanical Consultant and Contractor and check out the operation of all motor controls with all HVAC systems fully operational. Record all electrical loads. Replace any defective or wrongly sized starter overloads, heaters, fuses or circuit breakers.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00.

1.3 RELATED SECTIONS

.1 Section 26 09 24 Lighting Controls (Occupancy Sensors, Low Voltage Switching Devices, etc).

1.4 REFERENCES

.1 Canadian Standards Association (CSA International)

.1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.

.2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).

.3 CSA-C22.2 No.55, Special Use Switches.

.4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

1.5 LABORATORY SUPPLEMENT

.1 Use “Hospital Grade” devices in all Laboratory areas unless otherwise noted.

.2 Use “Heavy Duty Specification Grade” devices in all other areas.

Part 2 Products

2.1 SWITCHES

.1 Heavy duty specification grade.

.2 20 A, 120 V or 347 V, single pole, double pole, three-way, four-way switches as indicated.

.3 Manually-operated general purpose ac switches as indicated and with following features:

.1 Terminal holes approved for No.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.

.5 White toggle (red toggle for emergency power circuits).

.4 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rating capacity of motor loads.

.5 Switches of one manufacturer throughout project.

.6 Standard of acceptance:

.1 Hubbell HBL.1221 20A series

.2 Leviton 1221-20A 120V series – 18221 347V

.3 Pass & Seymour PS20AC1 120V series – PS37201(3)0 347V

2.2 RECEPTACLES – GENERAL

.1 Heavy duty specification grade.

.2 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 White nylon molded housing (red for emergency power circuits)

.2 Suitable for No.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 non riveted grounding contacts.

.3 Use shuttered safety receptacles in Day Care or similar children play areas or as indicated.

.4 Receptacles of one manufacturer throughout project.

.5 Standard of acceptance:

.1 Hubbell 5252 heavy duty, construction series

.2 Leviton 5262 series

.3 Pass & Seymour 5262 series

2.3 RECEPTACLES – PARTICULAR APPLICATION

.1 Allow a maximum connection of six general use receptacles to one 15 amp circuit.

.2 Utilize NEMA 5-20R 15/20Amp style duplex receptacles for printers / and provide 20A rated dedicated circuits for each printer / copier unless special receptacle type configuration is required to suit the selected equipment.

.3 Utilize NEMA 5-20R 15/20Amp style receptacles for housekeeping spaced a maximum of 15 metres apart staggered along alternate sides of the corridor. Provide 20A rated dedicated circuits for each area, to a maximum of 6 receptacles per circuit.

.4 Ground Fault Interrupter type to be 15 Amp, 125 volt duplex receptacles to be 2 pole, 3 wire hospital grade, white face, parallel blade, U ground, impact resistant nylon face, complete with breaker and reset button. Equal to:

.1 Hubbell GF8200A series

.2 Leviton 7599HG series

.3 Pass & Seymour HG1595 series (Décor)

.5 In the Campus Communications Hub (CCH) use L21-30R Industrial grade twist lock receptacles, two (2) per server cabinet and equipment rack are to be mounted on the underside the cable runner facing down above the vertical PDU location.

.6 All other single outlet and special purpose receptacles to be similar to the grade and series indicated above. Confirm ampacity, voltage and pin configuration prior to installation.

2.4 COVER PLATES

.1 Utilize thermoplastic nylon cover plates for receptacles and switches.

.2 In patient areas provide tamperproof fasteners, minimum two per cover plate, and install cover in a bed of tamperproof sealant.

.3 Grouped receptacles and switches will have a single cover plate for the whole group.

Part 3 Execution

3.1 INSTALLATION GENERAL

.1 Mount wiring devices to height specified in Section 26 05 00 or as indicated.

.2 Upper edge of plates located on separate outlets immediately alongside one another to be at exactly the same height above finished floor.

.3 All plates to be installed parallel or perpendicular to building lines.

3.2 INSTALLATION PARTICULAR

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.2 Receptacles:

.1 Install all receptacles in the vertical plane unless otherwise noted.

.2 Generally install the 5-15/20R U ground pin down unless otherwise noted. Neutral up when receptacle in mounted horizontal.

.3 Install receptacles vertically in gang type outlet box when more than one receptacle is required in one location.

.4 Where split receptacles has one portion switched, mount vertically and switch the upper portion.

.5 Surge suppression duplex receptacles to be provided for all communication and computer terminal equipment backboards and cabinets including fire alarm, telephone, public address, door security, nurse call, central dictation, RF television, security television, etc. Provide dedicated neutral conductors for each surge suppression receptacle.

.6 Ground fault interrupter duplex receptacles to be used, adjacent sinks or water sources.

.3 Cover plates:

.1 Protect cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00.

Part 2 Products

2.1 DISCONNECT EQUIPMENT

.1 “Heavy Duty” class, enclosed manual air break switches in non-hazardous locations: to CSA C22.2 No.4

.2 Fuseholder assemblies to CSA C22.2 No.39.

.3 Fusible and non-fusible disconnect switch in CSA enclosure.

.4 Provision for padlocking in off switch position.

.5 Fuses as indicated. Allow for Class J or L for general circuits, Class RK5 for transformer, motor or other high inrush current circuits

.6 Fuseholders in each switch suitable without adaptors, for type of fuse as indicated.

.7 Quick-make, quick-break action.

.8 ON-OFF switch position indication on switch enclosure cover.

.9 Weatherproof as required.

2.2 CONTACTOR EQUIPMENT

.1 Contactors: to CSA C22.2 No.14.

.2 Half size contactors not accepted.

.3 Electrically operated, electrically or mechanically held, multi-pole full voltage type.

.4 Contactors to have 120V operating (and unlatching) coils unless otherwise noted.

.5 Controlled by pilot devices as indicated and rated for type of load controlled.

.6 Breaker or Fused switch combination contactor as indicated.

.7 Complete with 1 normally open and 1 normally closed auxiliary contacts unless indicated otherwise.

.8 Provide CEMA enclosure as required for location unless indicated otherwise.

2.3 EQUIPMENT IDENTIFICATION

.1 Indicate name of load controlled on size 4 name plates to Section 26 05 00.

2.4 STANDARD OF ACCEPTANCE

.1 Cutler Hammer – Heavy Duty

.2 Schneider - Heavy Duty

.3 Siemens - Heavy Duty

Part 3 Execution

3.1 DISCONNECT INSTALLATION

.1 Install disconnect switches complete with fuses where indicated or required.

.2 All disconnect switches for elevator machine rooms shall be fused in accordance with the equipment suppliers' requirements.

.3 Provide an auxiliary switch with dry contacts on all elevator disconnects and as required by the Elevator Code. Review elevator shop drawings to confirm any additional requirements.

.4 Provide and locate safety disconnect switches to isolate individual items of equipment in accordance with Canadian Electrical Code CSA 22.1 whether indicated on not on the contract drawings.

3.2 MOTOR PLUG/RECEPTACLE AND QUICK DISCONNECTS

.1 Motor quick disconnects do not negate the requirement for a switched safety disconnect as specified in this Division. A separate disconnect is still required unless the Consultant has given a special pre-approved circumstance.

3.3 CONTACTOR INSTALLATION

.1 Install contactors and connect auxiliary control devices.

.2 Pilot lights to be illuminated when contactor is closed.

.3 Control wire to be minimum #14 AWG. Remote control wiring to be 5A fuse protected and the wiring shall be upsized to limit voltage drop to no more than 2%.

.4 Control circuits shall fail safe leaving the contactor in the open position if the power fails or where automatic reset could be a safety or operational concern. Provide a control circuit seal-in contact for all momentary contact control devices unless otherwise indicated.

.5 The contactor shall not automatically reset after a power failure unless otherwise indicated or for such items as automatic freeze protection, snow melting, light control etc.

.6 Electrically held contactors to be located in service rooms where practical.

End of Section

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REFERENCES

.1 CAN/CSA C22.1-09, Canadian Electrical Code, Part I.

.2 CAN/CSA C22.2 No.9.0, General Requirements for Luminaires.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.4 ADDITION OF ACCEPTABLE MANUFACTURERS

.1 Refer to Section 26 05 00 and as noted below.

.2 Material/products considered to satisfy the specification, but of a manufacturer other than those named may be submitted to the Consultant for consideration not later than five (5) working days prior to closing of tender or of bid depository subtrade tender whichever is earlier.

.3 Alternate approvals will be given by written addendum only. No other substitution will be permitted after closing of tenders.

.4 Alternate approvals granted before the closing of tenders will be limited to a manufacturer's system and/or series only. This limited approval will not preclude substitute equipment/material from complying with specific features included with equipment/material specified. Determine that the alternate product meets the specification intent before basing a tender on the product

1.5 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 26 05 00.

.2 Submit complete photometric and heat dissipation data prepared by independent testing laboratory for proposed luminaires.

.3 Photometric data to include VCP Table and spacing criterion.

1.6 INTENT

.1 Provide lighting fixtures and accessories for all outlets as listed in the Fixture Schedule and as shown on drawings.

.2 Lighting fixtures shall be structurally well designed and constructed, using new parts and materials of the highest commercial grade available.

.3 Ground all lighting equipment to grounding system.

.4 Verify all ceiling types and finishes before ordering fixtures and provide fixtures suitable for mounting in or on ceilings being installed in each area, as specified. Where fixture

types specified are not suitable for ceiling being installed, obtain written instructions from the Consultant before ordering fixtures.

.5 Fixtures of the same or similar type shall be supplied by the same manufacturer.

Part 2 Products

.1 Refer to luminaire schedule for all lighting products.

Part 3 Execution

3.1 INSTALLATION AND SUPPORTS

.1 Provide complete and proper support for all fixtures, fixture hangers, etc., including headers in ceiling space, where required, for proper support of outlet boxes and fixture hanger assemblies.

.2 Support fixtures as shown on the drawings, level, plumb and true with the structure and other equipment in a horizontal or vertical position as intended. Wall or side bracket mounted fixture housings shall be rigidly installed and adjusted to give a neat flush fit to the surface on which it is mounted.

.3 All hangers, supports, fastenings or accessory fittings shall be protected against corrosion. Care shall be taken during the installation to assure that insulation and corrosion protection is not damaged.

.4 Self aligning seismically rated ball joint hangers shall be used for rod suspended fixtures. Ceiling canopies or hood assemblies intended to cover the suspension attachments shall be installed to fit tightly to the ceiling without restricting the alignment of the hanger. Support fixtures by hangers and mounting arrangements which will not cause the fixture frame, housing, sides or lens frame to be distorted; or prevent complete alignment of several fixtures in a row.

.5 The suspension length of all ceiling mounted suspended types of lighting fixtures as listed in the Fixture Schedule shall be the overall length from the ceiling to the lowest point of the fixture body, reflector or glassware in its hanging position.

.6 Metal inserts, expansion bolts or toggle bolts in concrete slabs for stems which do not carry wiring must be accurately located in relation to the outlet boxes, to allow perfect alignment and spacing of suspension stems.

.7 Where fixtures are surface mounted on the underside of an inverted tee bar ceiling, the fixture shall be supported either directly from the building structure by means of rod hangers and inserts or by means of metal angle headers, supported from the tee bar framing structure above the tile. Fixtures shall be supported from the quarter points.

.8 Wiring from outlet boxes to fluorescent fixtures and wiring through fluorescent fixture channels shall be rated for 90 degrees C.

.9 Connection to incandescent fixtures shall be by means of approved fixture type wiring.

.10 All recessed fixtures to be installed so that they are removable from below to gain access to outlet box or prewired fixture box. Connect all recessed fixtures to boxes with flexible conduit and approved fixture wire. Provide approved drywall enclosures in insulated ceilings. Volume of enclosure to comply with Electrical Code.

.11 Install fixture lenses as late as possible to protect from dirt and dust. Remove and clean or replace lenses to the satisfaction of the Consultant.

.12 Where ballasts are to be remotely located, they shall be racked together and labelled with size 3 lamicoid. Label shall bear the ballast number which has a corresponding location on an adjacent floor plan reference drawing. Labels and floor plans shall be provided by electrical contractor. Floor plans shall measure 280mm x 430mm (11"x17") and shall be framed and laminated.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 REFERENCES

.1 Canadian Standards Association:

.1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

.2 CSA C860, Performance of Internally-Lighted Exit Signs.

.2 BC Building Code, Part 3, Section 3.4.5

1.3 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00.

Part 2 Products

2.1 SCHEDULE

.1 Refer to drawings for location and types. Provide directional arrows as indicated.

.2 To match existing self-powered, AimLite RPSTUMWHT-BAT

2.2 EXIT SIGNS GENERAL

.1 Green Pictogram Style

.2 Universal mounting.

.3 Wall, end, or ceiling mounted as shown on drawings.

.4 Single or double-faced as indicated

.5 Light Emitting Diode (LED) light source for 120 volt operation.

.6 Provide 12VDC standby lamps/system and connection points to accommodate standby power from an external 12VDC source.

.7 Faceplate and housing to have no visible unused knockouts.

.8 Provide weatherproof exit signs for all exterior installations.

.9 CSA 860-01 approved.

2.3 SPARE EXIT SIGN MATERIAL

.1 Refer to Appendix A Electrical Form EF140 for Spare Material hand over requirements to Owner.

.2 Provide 3 spare Exit Signs (lights)

.3 Include in base tender to install the “spare” Exit Signs in locations as directed by the Consultant. Include for the installation and up to 30m {100’} of wiring for each spare Exit Sign. The unused Exit Signs to be handed over as spare material.

Part 3 Execution

3.1 INSTALLATION

.1 Install Exit Signs as indicated.

.2 Connect Exit Signs to dedicated circuits and breakers as required by the Canadian Electrical Code.

.3 Provide circuit breaker locks for Exit Sign circuits.

.4 Power to exit lights to be sourced from emergency power were available.

.5 Provide at least one Exit Sign circuit for each floor level except as noted.

.6 All Exit Sign wiring to be installed in separate conduit and boxes.

.7 All conductors to be minimum #12 AWG with RW90 X-link insulation.

.8 Provide Exit Sign 12VDC standby lighting and separate connection points where standby emergency lighting battery packs are used for the emergency lighting. For remote connections low voltage cable sizing refer to the battery systems specification section.

.9 Support Exit Signs from ceiling tile in tee bar installation locations so as to provide a flush/neat installation and minimize tile lift.

.10 Provide approved support hardware to the tee bar rail assembly to minimize tile stress and provide independent seismic cable(s) restraint from building structure.

.11 Wall mounted exit lights to be mounted 2290mm [7’ 6”] to underside or as detailed.

.12 Ceiling mounted exit lights in all service spaces to be suspended to 2290mm [7’ 6”] to the underside.

3.2 FINAL ACCEPTANCE

.1 Position exit lights to optimize viewing angles and to avoid line of site obstructions.

.2 Attend the building occupancy review with the Authority Having Jurisdiction and adjust any locations as required.

.3 Install any additional exit signs as requested in accordance with “Spare Exit Sign Material” clause noted above.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Refer to Section 26 05 00 Common Work Results.

.3 Complete and operational telecommunications system as required by the drawings and as herein specified.

.4 Provide all labour, materials, tools, and equipment required for the complete installation of work called for in all sections of the contract documents.

1.2 REFERENCES

.1 Canadian Electrical Code latest adopted edition.

.2 British Columbia Building Code latest adopted edition.

.3 ANSI/TIA Standards:

.1 ANSI/TIA 568-D.1-2015 Generic Telecommunications Cabling for Customer Premises Standard.

.2 ANSI/TIA 568-0-D-2015 Commercial building Telecommunications Cabling Standard.

.3 ANSI/TIA 568-C.2-2009 Commercial Building Telecommunications Cabling Standard – Balanced Twisted Pair Cabling Components.

.4 ANSI/TIA 568-C.3-2008 Optical Fiber Cabling Components Standard.

.5 ANSI.TIA 569-D-2015 Commercial Building Standard for Telecommunications Pathways and Spaces.

.6 ANSI/ITA 606-B-2011 Administration Standard for Commercial Telecommunications Infrastructure.

.7 ANSI/TIA 758-B-2012 Customer Owned Outside Plant Telecommunications Cabling Standard.

.8 ANSI/TIA 1179-2010 Health Care Telecommunications Cabling Standard.

.9 ANSI/TIA 942-A-2012 Telecommunications Infrastructure Standard for Data Centers.

.10 ANSI/TIA-TSB-162-A-2013 Telecommunications Cabling Guidelines for Wireless Access Points.

.4 BICSI latest technical manuals:

.1 ANSI/BICSI 002-2014, Data Centers Design and Implementation Best Practices.

.2 ANSI.BICSI 003-2014, Building Information Modeling (BIM) Practices for Information Technology Systems

.3 ANSI/BICSI 004-2012, Information Technology Systems Design and Implementation Best Practices for Healthcare Institutions and Facilities

.4 ANSI/BICSI 005-2013, Electronic Safety and Security (ESS) System Design and Implementation Best Practices

.5 ANSI/BICSI 006-2015 Distributed Antenna System (DAS) Design and Implementation Best Practices

.6 ANSI/NECA/BICSI 568-2006, Standard for Installing Commercial Building Telecommunications Cabling

.5 CSA 2318.7-95 Commissioning of Communications Systems in Health Care Facilities.

.6 IEEE 802.3 series of Ethernet Standards.

.7 IEEE 802.11 series of Wireless Standards.

.8 Conform to current safety and security standards, codes, and practices in effect at NH including, but not limited to:

.1 Workers Compensations Act – Part 3 – Occupational Health & Safety.

.2 BC Electrical Safety Act.

.9 IMIT Communications Infrastructure Standards Version 1.5.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 - Construction/Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.4 SPECIFICATIONS AND DRAWINGS

.1 The General Conditions, Supplementary Conditions and Division 01 are part of this specification and shall apply to this Division.

.2 The intent of the specifications and drawings are to include all labour, products and services necessary for complete work, tested and ready for operation.

.3 Symbols used to represent various telecommunications devices often occupy more space on the drawing than the actual device does when installed. In such instances, do not scale locations of devices from telecommunications symbols. Install these devices with primary regard for usage of wall space, convenience of operation and grouping of devices.

.4 These specifications and the drawings and specifications of all other divisions shall be considered as an integral part of the accompanying drawings. Any item or subject omitted from either the specifications or the drawings but which is mentioned or reasonably specified in and by the others shall be considered as properly and sufficiently specified and shall be provided.

.5 Provide all minor items and work not shown or specified but which are reasonably necessary to complete the work.

1.5 SUBMITTALS

.1 Prior to delivery of any products to job site and sufficiently in advance of requirements to allow ample time to checking, submit shop drawings for review as specified in Division 01. Submit shop drawings for all equipment as required in each section of this specification.

.2 Prior to submitting the shop drawings to the Consultant, the contractor shall review the shop drawings to determine that the equipment complies with the requirements of the specifications and drawings.

.3 The term “shop drawing” means drawings, diagrams, illustrations, schedules, performance characteristics, brochures and other data which are to be provided by the contractor to illustrate details of a portion of the work.

.4 Manufacturer of products shall conform to revised shop drawings.

.5 Keep a complete set of shop drawings at job site during construction.

1.6 RECORD DRAWINGS

.1 The contractor shall keep on complete set of white prints at the site office, including all addendums, change orders, site instructions, clarifications and revisions for the purpose of record drawings. As the work on site proceeds, the contractor shall clearly record in Red Pencil all as-built conditions which deviate from the original contract documents. Record drawings to include cable runs (complete with number of cables and ID number) and locations of all telecommunications equipment.

.2 Prior to substantial performance, the contractor shall obtain CAD files of all telecommunications drawings, using AutoCAD (latest version), and use the services of a competent CAD operator to transfer all as-built information, including: Addendums, Change Order, Clarifications, Revisions, Site Instructions and shop drawings. Upon completion, the Contractor shall certify, in writing that the as-built record drawings are complete and that they accurately indicate all communications services and communications pathway related with communications, including exposed as well as concealed items.

.3 Contractor to forward letter of certification and as-built CAD drawings to the Consultant for final review. As-built drawings to be submitted in the form of one set of CAD files.

1.7 OPERATION AND MAINTENANCE MANUALS

.1 Within 30 days prior to substantial performance, the Contractor shall submit a draft copy of the proposed contents of each maintenance manual to the Consultant for review. Once the draft copy is approved, the contractor will supply 4 copies in suitably labelled, hard back, D-ring type commercial binders, each complete with an index and tabbed title sheets for each section.

.2 All maintenance manual data shall be printed on 8½" x 11" heavy bond, indexed, tabbed, punched and bound in the binders. Each manual shall have a title sheet which is labelled "Operation & Maintenance Manual" and lists the Project name, Contractor's & Consultant's names, date submitted, and a Table of Contents for each volume. If a manual exceeds 75mm in thickness, provide additional manuals as required.

.3 Each section of the manual shall contain the following information:

.1 Systems Descriptions. A brief synopsis of each system typed and inserted at the beginning of each section. Include sketched and diagrams where appropriate.

.2 Descriptive and technical data.

.3 Copy of test data. Must supply a copy to the Consultant and to the Client.

.4 Include type and accuracy of instruments used to obtain test data. This must be approved by the Consultant, the Client and manufacturer prior to testing.

.5 Copy of final inspection certificate.

.6 Copy of all warranty certificates.

.7 Set of final reviewed shop drawings.

1.8 QUALITY ASSURANCE

.1 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29.06 Health and Safety Requirements.

1.9 PRODUCT HANDLING

.1 Use all means necessary to protect the products of this Division before, during and after installation and to protect products and installed work of all other trades.

.2 Immediately make good any damage by repair or replacement at no additional cost to the Owner and to the approval of the Consultant.

.3 Remove advertising labels from all equipment. Do not remove identification or certification labels.

1.10 LABOUR

.1 The communications contractor must comply with all job-site requirements for the duration of the project.

.2 The communications contractor agrees to use only trade person who are fully trained, qualified and experienced on the installation, termination and testing of the structured cabling solution. The communications contractor must be an approved installer of the specific structured cabling solution.

Part 2 Products

2.1 SELECTED PRODUCTS & EQUIVALENTS

.1 Products and materials provided shall be new and free from all defects. Defective products or materials will be rejected, regardless of previous inspections. The contractor shall be responsible to remove and replace defective products at their expense, and shall be responsible for any resulting delays and associated expenses which result from defective products being rejected. Related materials shall be of the same manufacturer throughout the project.

.2 Products and materials referred to in the specifications by trade names, manufacturer's name and catalogue reference are those which shall be used as the basis for the Tender.

2.2 QUALITY OF PRODUCTS

.1 All products provided shall CSA approved, Canadian Underwriters' Laboratory approved where applicable, and new unless otherwise specified.

.2 If products specified are not CSA approved, obtain special approval fro the local regulatory authority. Pay all applicable charges levied and make all modifications required for approval.

.3 Products provided, if not specified, shall be new, of a quality best suited to the purpose required and their use subject to approval by the Consultant.

2.3 UNIFORMITY OF MANUFACTURE

.1 Unless otherwise specifically called for in the specifications, uniformly of manufacture shall be maintained for similar products throughout the work.

2.4 USE OF PRODUCTS DURING CONSTRUCTION

.1 Any equipment used for temporary or construction purposed shall be approved by the Construction Manager and in accordance with the General Conditions, "Use of Premises." Clean and restore to "as new" condition all equipment prior to the time of substantial completion.

.2 The warranty period shall begin when the date of substantial performance of work on each tranche.

Part 3 Execution

3.1 COORDINATION WITH OTHER DIVISIONS

.1 Examine the specifications and drawings of all divisions and become fully familiar with their work. Coordinate work with all trades and make changes to facilitate a satisfactory installation.

.2 Lay out the work and equipment with due regard to architectural, structural, mechanical, electrical and A/V features. Architectural and structural drawings take precedence over the telecommunications drawings regarding locations of wall, door, equipment and location and heights of outlets.

.3 Coordinate with all Divisions installing and services, and ensure that there are no conflicts.

.4 Install anchors, bolts, pipe sleeves, hanger inserts, etc. in ample time to prevent delays.

3.2 LOCATION OF OUTLETS

.1 Telecommunications drawings are, unless otherwise indicated, drawn to scale and approximate distances and dimensions may be obtained by scaling. Figured dimensions shall govern over scaled dimensions. Where exact dimensions and details are required, refer to Architectural, Interior Design and Structural drawings.

.2 Unless otherwise specified or shown, install products in accordance with recommendations and ratings of manufacturers.

3.3 SEPARATION OF SERVICES

.1 Maintain separation between electrical wiring system and building piping, ductwork, etc. so that wiring system is isolated (except at approved connections to such systems) to prevent galvanic corrosion.

.2 In particular, contact between dissimilar metals, such as copper and aluminum, in damp or wet locations is not permitted.

.3 Do not support wiring from pipes, ductwork, etc. Hangers for suspended ceilings may be used for the support of wiring only when approval is obtained from the Owner and the ceiling installer, and approved clips or hangers are used.

3.4 EQUIPMENT IDENTIFICATION

.1 Colour code exposed conduits (including conduits above t-bar ceilings), junction and pull boxes and metallic sheathed cables with paint or plastic tape (27mm wide band) at 15 metre intervals.

3.5 MOUNTING HEIGHTS

.1 Refer to section 26 05 00 Common Work Results for general mounting heights specification.

.2 Refer to all architectural drawings for telecommunications outlet mounting heights direction and requirements.

3.6 SEALING OF WALL AND FLOOR OPENINGS

.1 All conduit and cable entries through outside walls of building, through partition walls separating electrical rooms from other areas, through fire separations, and through floors above grade shall be sealed to prevent passage of moisture, dust, gases, flame, or to maintain pressurization.

.2 Openings shall be sealed when all wiring entries shown on the drawings have been completed.

.3 Sealing material shall be fire resistant and shall not contain any compounds which will chemically affect the wiring jacket or insulating material. Cable penetrations through fire separations to be sealed with approved firestopping material.

3.7 SLEEVES

.1 Vertical floor separation shall extend 102mm above finished floor level.

.2 The space between the sleeve and the conduit shall be filled with approved permanently resilient, non-flammable and weatherproof silicone base compound and ensure that the seal in compatible with the floor and ceiling finishes.

.3 Located and position sleeves exactly prior to construction of walls and floors.

.4 Failure to comply with the above requirements shall be remedied at this Division's expense.

End of Section

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SCOPE

.1 The Contractor will supply, furnish, and install all material, labour, apparatus, tools, equipment and services required for construction and put into regular operation the complete structured cabling system as shown on the associated drawings, described in the specifications, and any attached appendices. System to be complete with all data/voice outlets, patch panels, equipment racks, cable management systems, 110 punch-down blocks, wire and cable to form a complete system.

1.3 APPLICABLE STANDARDS

.1 The cabling system described in this specification is derived in part from the recommendations made in industry standard documents. The documents below are incorporated by reference.

.1 This Technical Specification and Associated Drawings

.2 ANSI/TIA/EIA-568-B Commercial Building Telecommunications Cabling Standard – April, 2001

.3 ANSI/TIA/EIA-569-B Commercial Building Standard for Telecommunications Pathways and Spaces - February, 2004

.4 ANSI/TIA/EIA-606-A Administration Standard for the Telecommunications Infrastructure of Commercial Buildings – May, 2002

.5 ANSI/J-STD-607-A Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications - October, 2002

.6 Building Industries Consulting Services, International (BICSI) Telecommunications Distribution Methods Manual (TDMM) – 11th (or latest edition), 2006

.7 National Fire Protection Agency (NFPA) - 70, National Electrical Code NEC) - 2002

.2 If a conflict exists between applicable documents, then the order in the list above shall dictate the order of precedence in resolving conflicts. This order of precedence shall be maintained unless a lesser order document has been adopted as code by a local, provincial or federal entity, and is therefore enforceable as law by a local, provincial or federal inspection agency.

.3 If this document and any of the documents listed above are in conflict, then the more stringent requirement shall apply. All documents listed are believed to be the most current releases of the documents; the vendor is responsible to determine and adhere to the most recent release when developing the proposal for installation.

1.4 Submittals

.1 Submittals as outlined herein and contain all items within one complete submission. Refer to Section 26 05 00 (Common Work Results) for submission details and the following:

.1 Shop Drawings

.1 Product data (including cut sheets and catalogue information)

.2 Samples required by the Contract Documents

.3 All above submittals must be forwarded promptly and in such sequence as to cause no delay in the work or in the activities of the other trades.

.4 Submitted shop drawings shall be signed by the Contractor, imprinted with the date submitted, and shall bear the Contractor's legitimate Company name.

.5 By submitting shop drawings, product data, and samples, the Contractor signifies that he, or she has carefully reviewed and verified materials, quantities, field measurements, and related field construction criteria. It also signifies the Contractor has checked, coordinated, and verified that all information contained with shop drawings, product data, and samples conforms to the requirements of the Work and of the Contract Documents.

.6 The Contractor shall perform no portion of the Work requiring submittal and review of shop drawings, product data, or samples until the Consultant has returned an approved submittal.

.7 The Contractor shall submit shop drawings, product data, and samples to the Consultant as a complete set in paper format within fifteen (15) days subsequent to Award of Contract and prior to start of Work.

.8 The Contractor shall make reproductions as required for his or her own use and distribution to subcontractors.

.9 The Contractor shall highlight relevant products on the shop drawings.

.10 The Consultant shall not accept illegible submittals.

.11 Prior to the start of installation, the Contractor shall submit (6) sets of the following shop drawings and construction documents to the Consulting Engineer for approval:

.1 Manufacturer specification sheets.

.2 Plan view drawings illustrating the layout of all Electrical, and Communication components and equipment in each Communication room.

.3 Elevation drawings of all walls of each Communication room, clearly showing the layout of all termination hardware, grounding & bonding components, equipment cabinets, Communications equipment, power receptacles, lighting fixtures, cable tray, conduit, entry ducts, etc.

.4 Vertical and horizontal cable topology, riser duct, and horizontal cable count diagrams.

.5 System block diagrams depicting the interconnection between Communication rooms, system components, sub-systems and equipment cabinet layouts.

.6 Communication Bonding & Grounding System.

.7 Fire-stop design, identifying all locations to be firestopped, complete with documentation, a list of all firestopping materials to be used, and firestop systems to be installed.

.8 Cabling installation schedule based on overall construction schedule for the project.

.9 Manufacturer specification sheets.

.2 As-Built Drawings:

.1 The installation contractor will be provided with 2 sets of drawings at the start of the project. One set will be designated for as the central location to document all as-built information as it occurs throughout the project. The central set will be maintained by the Contractor's Foreman on a daily basis, and will be available to the Technical representative upon request during the course of the project. Anticipated variations from the build-to drawings may be for such things as cable routing and actual outlet placement. No variations will be allowed to the planned termination positions of horizontal cables, and grounding conductors unless approved in writing by the Owner.

.2 The Contractor shall provide the central drawing set to the owner at the conclusion of the project. The marked up drawing set will accurately depict the as-built status of the system including termination locations, cable routing, and all administration labelling for the cabling system. In addition, a narrative will be provided that describes any areas of difficulty encountered during the installation that could potentially cause problems to the communications system.

1.5 Spare Parts And Maintenance Materials

.1 The contractor shall furnish an hourly rate with the proposal submittal, which shall be valid for a period of one year from the date of acceptance. This rate will be used when cabling support is required to affect moves, adds, and changes to the system (MACs). MACs shall not void the Contractor's nor manufacturer's warranty.

1.6 General Requirements

.1 System to be complete with all necessary components to provide functions required whether or not each and every item is necessarily mentioned. All components to be production proven models. Custom designed units will only be considered for those items that are not currently available on commercial market. System to be supplied and installed by an established communications contracting firm that is approved by Owner.

.2 Neither the drawings nor the specifications shall be used alone. Work omitted from the drawings but mentioned or reasonably implied in the specifications, or vice versa, shall be considered as properly and sufficiently specified and shall be provided.

.3 Misinterpretation of any requirements on drawings, or specifications shall not relieve the Contractor of his, or her responsibility of properly completing the Contract.

.4 Where conflict exists between drawings and specifications the Contractor shall, make allowance for provision of the component, system, or installation process in a manner which will provide the highest monetary cost components, systems, or installation process.

.5 Drawings are generally diagrammatic and are intended to indicate the scope and general arrangement of the Work. The Contractor shall obtain information from the Consultant where exact locations are not indicated.

.6 The Contractor shall not scale the drawings, but rather take field measurements in existing buildings particularly where equipment and material dimensions are dependent on building dimensions.

.7 The Consultant has the option of changing the location of Electrical and Communication outlets to within 2 m of designed location prior to rough-in stage at no extra cost.

.8 All wiring for systems to be PVC insulated, unshielded, twisted pair. All wiring to be installed in conduit and tray system unless otherwise specified.

.9 All conduit, pullboxes, junction boxes and terminal panels are to be installed to provide a complete conduit system for the Telephone/Data cabling system. All communication/data conduits to be minimum 27 mm [1 inch] diameter unless otherwise indicated. Horizontal pathway conduits may have no more than two 90 degree bends and are may be no longer than 30.5m [100 feet] in distance without a pullbox.

.10 The system shall be certified, by a Contractor designated and trained by the manufacturer of being capable to do so and shall provide written confirmation of this fact. Proof of certification must be provided prior to commencement of work.

.11 All data runs are to terminate on a universal patch panel system which will permit assignment from the data hardware by the use of labelled patch cords. All voice runs are to terminate on a universal patch panel system which will permit assignment from the voice hardware by the use of labelled patch cords.

.12 All horizontal cable and associated jacks, connectors, patch panels, and faceplates will be Category 6A and manufactured by Panduit. Specialized device runs or incidental voice lines requiring alternative design will be specified in accompanying documentation. Each communication outlet will have a minimum of two permanent links as defined in EIA/TIA 658-C, unless specified otherwise.

.13 The cabling system must meet the performance requirements outlined in EIA/TIA 568-C in addition to all other standard CAT 6A performance requirements and provide a 25 year system performance certification from a single channel source manufacturer. Multi or mixed vendor solutions will NOT be considered.

1.7 Training

.1 System installer to conduct training program for designated maintenance and operating personnel. This program to include but not be limited to the following:

.1 Operation: designated personnel to be trained to accomplish and understand all aspects of system operation.

.2 Maintenance: designated personnel to be trained to perform routine maintenance on the system.

.3 Training period schedule to be established by Owner. Training periods to take place after building completion and prior to system use.

Part 2 Products

2.1 MANUFACTURER

.1 Panduit.

2.2 HORIZONTAL CABLING

.1 Category 6A Non-plenum Data Cable

.1 Approved cable will be the latest Panduit, GigaSPEED Category 6A, 23 AWG, TX6A Vari-MaTriX CMR UTP yellow, PUR6AV04YL-G. (YELLOW)

.2 Category 6A Plenum Data Cable

.1 Horizontal cabling shall be Panduit, Category 6A, 23 AWG, 4-pair UTP, UL/NEC/CSA CMP or CSA equal rated, with a yellow plenum-rated PVC jacket. Individual conductors shall be 100% FEP insulated. CMP rated in plenum spaces.

.2 All horizontal cable and associated jacks, connectors, patch panels and faceplates will be Category 6A and manufactured by Panduit.

.3 The installed system shall utilize a cable no larger than 0.275” O.D. while supporting IEEE proposed Type 4 PoE performance (100W) over the full

channel length.

.4 The installed system shall utilize a cable design supportive of heat dissipation such that no more than 9.5C of temperature rise occurs inside a 100-cable bundle as PSE power reaches 90W over 100 meters.

.5 Cable: Cat 6A, 23AWG, TX6A Vari-MaTriX CMP UTP yellow, PUP6AHD04YL-G.(YELLOW)

.6 Obtain approval of color of cable jacket and other accessories from Northern Health authority prior to ordering.

.2 Cable jacketing shall be lead-free. Cable shall meet the performance requirements as outlined in EIA/TIA 658-C in addition to all other standard Category 6A performance requirements.

2.3 TELECOMMUNICATION OUTLETS

.1 Telecommunications Outlets

.1 Each outlet location will be a minimum of two (2) Category 6A cables.

.2 The outlet plates, unless otherwise noted, shall be 2-port, mounted to single gang boxes, box eliminators, surface mount boxes, and/or floor monuments (3rd party) as required.

.2 Modular Jack and Faceplate

.1 All modular jacks shall be wired to the T568A wiring pattern.

.2 Modular jacks shall be terminated using IDC connections colour coded for both T568A and T568B wiring.

.3 Modular jacks shall be UL Listed under file number E81956 or CSA equivalent.

.4 Category 6A modular (data) jacks shall be unkeyed 4-pair and shall meet the performance requirements outlined in EIA/TIA 658-C in addition to all other standard Category 6A performance requirements.

.5 Outlets shall use white, 2-port, single gang, flush faceplates constructed of ABS moulding compound and be 4.53” X 2.77” X .60” in size.

.6 Each faceplate shall contain two (2) Category 6A jacks

.7 Each port shall be individually labelled above the port with white machine printed label tape, applied horizontally, to indicate its function.

.8 The faceplates shall be mounted to in-wall single gang boxes.

.9 Panduit CAT6A jacks, NK6X88M

.10 Panduit faceplate, NK2FWHY (WHITE)

.3 Wireless Connection Outlet

.1 Provide two (2) Category 6A cables.

.2 Provide 5m slack cable for each cable, at the outlet box, coiled neatly, suspended in the ceiling space with proper support and cable management. Coil radius must be within acceptable bend radius for the cable as per EIA/TIA 658-C.

.3 Support cables with Velcro wraps or equivalent. Tie-wraps are not to be used. Use surface-mount box within the ceiling space.

2.4 WIRING CLOSET HARDWARE

.1 RACK Communications Room

.1 Free standing 2133.6mm (84") high rack units, gang-able

.2 Shall be equipped with 2 sets rails

.3 Must provide 482.6mm (19") rack mount capability for rack mountable components.

.4 Must provide 1955.8mm (77") of vertical mounting space. (44U)

.5 Must have threaded mounting holes (EIA) front and rear.

.6 Shall be black in colour.

.2 Horizontal Data Cross-Connect

.1 The horizontal cross-connect for data circuits shall consist of patch cords from the horizontal Category 6A termination panels to the network equipment within the same or adjacent racks. The horizontal data cross-connect shall be contained in suitably sized 19" racks.

.2 All equipment racks shall be augmented with horizontal and vertical management hardware, both front and rear, to properly dress horizontal cables and patch cords.

.3 Patch panels shall be 1.75 inches high (1U) and provide 24 modular jack ports, terminated to T568A.

.4 Patch panels shall terminate the building cabling on 110-style insulation displacement connectors.

.5 Patch panels shall comply with the performance characteristics outlined in EIA/TIA 658-C in addition to all other standard Category 6A requirements.

.6 Patch panels must be UL Listed under file number E81956 or CSA equivalent.

2.5 PATCH CABLES

.1 Workstation

.1 Patch cords used at the telecommunication rack shall be Category 6A, 4-pair assemblies with a yellow jacket. Patch cords shall be factory-assembled by the manufacturer of the cabling system. The workstation patch cords shall be provided by the Information Systems Department. The phone cords shall be provided by the Information Systems Department.

.2 In the telecommunications room, patch cord as required per site conditions shall be provided by the contractor to cross-connect between the data patch panels and network equipment. One patch cord per user outlet is provided. The total quantity of telecommunications room end patch-cords required is to be equally divided between three assembly lengths.

.2 Cables: Panduit Cat6A TX6A UTP, UTP6AX15YL (Yellow)

Part 3 Execution

3.1 INSTALLATION

.1 Outlet Installations

.1 Cables shall be coiled in the ceiling prior to entering the wall and in surface mount boxes if adequate space is present to house the cable coil without exceeding the manufacturer's bend radius.

.2 No more than 12” of slack shall be stored in an in-wall box, modular furniture raceway, or insulated walls. Excess slack may be neatly coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

.3 Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer’s recommendations and/or best industry practices.

.4 Pair untwist at the termination shall not exceed one-half an inch for Category 6A connecting hardware.

.5 Bend radius of the UTP cable in the termination area shall not be less than 4 times the outside diameter of the cable as per the TIA/EIA 568-B standard.

.6 The cable jacket shall be maintained as close as possible to the termination point.

.7 Voice jacks, unless otherwise noted in drawings, shall be located in the bottom position(s) of each faceplate. Voice jacks in horizontally oriented faceplates shall occupy the right-most position(s). Modem jacks shall be considered the last voice jack in the sequence.

.8 Blank data jacks shall occupy the top position(s) on the faceplate.

.9 Data jacks shall occupy the top position(s) on the faceplate. Data jacks in horizontally oriented faceplates shall occupy the left-most position(s).

.10 Provide minimum 4 ports for future use.

.2 Horizontal Cabling Installation

.1 Cable shall be installed in accordance with manufacturer’s recommendations and best industry practices and shall not exceed 80m form the patch panel in the rack to the outlet.

.2 Cable raceways shall not be filled greater than the CSA/NEC maximum fill for the particular raceway type.

.3 Cables shall be installed in continuous lengths from origin to destination (no splices) unless specifically addressed in this document.

.4 Consolidation points are not permitted except by written authority.

.5 The cable’s minimum bend radius and maximum pulling tension shall not be exceeded.

.6 When a cable enters or exits a junction or pull box or other such enclosure the appropriate connector, grommet, or bushing shall be used.

.7 If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of four-foot intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

.8 Horizontal distribution cables shall be bundled in groups of no greater than 40 cables. Cable bundle quantities in excess of 40 cables may cause deformation of the bottom cables within the bundle.

.9 Cable shall be installed above fire-sprinkler and systems and shall not be attached to the system or any ancillary equipment or hardware.

.10 The cabling system and support hardware shall be installed so that it does not

obscure any valves, fire alarm conduit, boxes, or other control devices.

.11 Cables shall not be attached to ceiling grid or lighting support wires. Where light supports for drop cable legs are required, the contractor shall install clips to support the cabling.

.12 Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the contractor prior to final acceptance at no cost to the Owner.

.13 Cables shall be identified by a self-adhesive label.

.14 4-pair UTP cable shall be installed so that there are no bends less than four times the cables outside diameter (4 X cable O.D.) at any point in the run as outlined in EIA/TIA 658-C.

.15 Pulling tension on 4-pair UTP cables shall not exceed 25-pounds for a single cable or cable bundle as outlined in EIA/TIA 658-C.

.16 Cables will not pass through anymore than two 90 degree angles from end to end as outlined in EIA/TIA 658-C.

.17 If cable needs to go through a wall and an existing pathway does not exist, the created pathway must use electrical conduit as a sleeve with EMT connectors with nylon throats at each end of the conduit. Poking a hole in the wall and running the cable through is not acceptable. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system

.18 If cable is to be terminated in an open office location with modular furniture and termination within a wall is not a viable option then the cables are to terminate within pac poles, not the modular furniture.

.3 Copper Termination

.1 Cables shall be dressed and terminated in accordance with the recommendations made in the TIA/EIA-568-B document, manufacturer's recommendations and/or best industry practices.

.2 Pair untwist at the termination shall not exceed one-half an inch for Category 6A connecting hardware.

.3 Maximum bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

.4 Cables shall be neatly bundled and dressed to their respective panels or blocks. Each panel or block shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

.5 The cable jacket shall be maintained as close as possible to the termination point.

.6 Each cable shall be clearly labelled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labelled within the bundle, where the label is obscured from view shall not be acceptable.

.4 Closet Layout Installation

.1 The telecommunication room shall house racks, cable termination fields and required cable routing hardware.

.2 Racks shall be placed in a manner that will allow a minimum of 3 feet of

clearance from the front and rear mounting surfaces and on one side.

.3 If one mounting rail of the rack is placed against a wall, the mounting rail shall be no closer than 6" to the wall to allow room for vertical management. Where there is more than one rack, the racks shall be ganged with double wide vertical management hardware to provide inter-bay management.

.4 Ganged rack frames will be placed in a manner that allows a minimum of 3 feet of clearance from the front and rear mounting surfaces and on one side of the ganged assembly.

.5 In all closets the racks shall be on the opposite side of the room from the voice termination fields.

.6 Conduits a minimum of 4" in diameter shall be used in all closets.

.7 Contractor shall provide required ladder, wire tray, waterfalls and wall mount management rings to properly support and dress cables from conduits to racks and frames.

.5 Rack Installations

.1 Racks shall be installed in the following manner:

.1 Racks shall be securely attached to the concrete floor using 3/8" hardware or as required by local seismic codes.

.2 All racks shall be grounded to the telecommunications ground bus bar.

.3 Rack mount screws (#12-24) not used for installing hardware shall be bagged and left with the rack upon completion of the installation.

.6 Labeling:

.1 All documentation and labelling must follow the TIA/EIA 606A Standard. Specifically, all labels must be machine-printed. They must be smudge-resistant and water-resistant. Laser printed labels are acceptable. Ink-jet printed labels may be used provided some mechanical protection is used (such as cellophane tape or a plastic strip). For labels on faceplates, patch panels, walls, or equipment, a device such as the Brother P-Touch labeller is acceptable. For labels identifying cable, the labels must be wrapped around the cable within 30 cm of the cable termination and must be protected with a plastic coating. Laser-printed labels may be printed on sheets such as Panduit PLL-12-Y3 self-laminating sheets or equivalent. Also, a device such as the Panduit LS3E can be used to print self-laminating labels as needed.

.2 In addition to other labels, network equipment must be labelled to identify the equipment within the room. Hubs will be labelled top-to-bottom, left-to-right, starting at "Hub 1". For labelling purposes, the term "hub" refers to switches and terminal servers as well.

.3 Horizontal cables are labelled sequentially from each communications room. Patch panels will be labelled in a left-to-right, top-to-bottom fashion. With all new builds the cables must be terminated in a logical fashion so that all data drops from a room or area in the building are sequentially located on the patch panel(s). In order to identify the installer of the horizontal cable, the label on the cable also includes the company's initials or logo where possible. Self-laminating labels must be wrapped around the ends of horizontal cable runs 10 cm from the end of the sheath, with the communications room and closet and the wire number marked on it. For example, a cable coming from patch panel B, location 17, in TR A1A would have this label at both ends XX A1A-B17. (XX being the

company's initial or logo)

.4 The colour coding for jacks to identify system usage is as follows: Orange - PACS Diagnostic Imaging; Green - Wireless Connection Outlet (POE enabled); Black- Data Applications; White-Voice Applications; Purple - Dictation; Yellow-Nurse Call; Red - Patient Monitoring

.5 Patch cables used at the workstation or within a communications room or closet do not need to be labelled.

.7 Grounding and Bonding

.1 All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the TC or ER shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression connectors. Where metallic panels attached to the rack do not have sufficient metal to metal contact to provide an adequate path to ground, they shall be bonded to the rack using a minimum #14 AWG copper conductor. The copper conductor size shall be upgraded based on the largest power conductor feeding any rack mount equipment. The conductor shall be continuous; attaching all isolated components in a daisy chain fashion from top to bottom and bonded to the rack using an appropriate compression connector. All wires used for telecommunications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap of green tape. All cables and bus bars shall be identified and labelled in accordance with the System Documentation Section of this specification.

.2 The TBB shall adhere to the recommendations of the TIA/EIA-607 standard, and shall be installed in accordance with best industry practices. Installation and termination of the main bonding conductor to the building service entrance ground, at a minimum, shall be performed by a licensed electrical contractor.

.8 Firestop Systems

.1 A firestop system is comprised of: the item or items penetrating the fire rated structure; the opening in the structure and the materials and assembly of the materials used to seal the penetrated structure. Firestop systems comprise an effective block for fire, heat, vapour and pressurized water stream. All penetrations through fire rated building structures (walls and floors) shall be sealed with an appropriate firestop system. This requirement applies to through penetrations (complete penetration) and membrane penetrations (through one side of a hollow fire rated structure). Any penetrating items i.e., riser slots and sleeves, cables, conduit, cable tray, and raceways, etc., shall be properly fire stopped.

.2 Firestop systems shall be CSA/ULC Classified and shall be approved by a qualified Professional Engineer (P. Eng), licensed in the Yukon.

.3 All firestop systems shall be installed in accordance with the manufacturer's recommendations and shall be completely installed and available for inspection by the local inspection authorities prior to cabling system acceptance.

3.2 ACCEPTANCE

.1 A Technical Representative will make periodic inspection of the project in progress. One inspection will be performed at the conclusion of cable pulling, prior to closing of the false ceiling, to inspect the method of cable routing and support, and the fire stopping of penetrations. A second inspection will be performed at completion of cable termination to validate that cables were dressed and terminated in accordance with TIA/EIA 568-B

specifications for jacket removal and pair untwist, compliance with manufacturer's minimum bend radius, and that cable ends are dressed neatly and orderly.

.2 Upon completion of the project, the Technical Representative will perform a final inspection of the installed cabling system with the Contractor's Project Foreman. The final inspection will be performed to validate that all horizontal cables were installed as defined in the drawing package, and that the installation meets the aesthetic expectations of the Owner.

.3 Upon receipt of the test documentation, the Owner reserves the right to perform spot testing of a representative sample of the cabling system to validate test results provided in the test document. Owner testing will use the same method employed by the contractor, and minor variations will be allowed to account for differences in test equipment. If any significant discrepancies are found, the Contractor will be notified for resolution.

.4 During the three week period between final inspection and delivery of the test and as-built documentation, the Owner will activate the cabling system. The Owner will validate operation of the cabling system during this period.

.5 Completion of the installation; in-progress and final inspections; receipt of the test and as-built documentation; receipt of the installation permit number with an accompanying summary of the work performed within three weeks of completion and successful performance of the system for a two week period will constitute acceptance of the system and/or written approval by the Consultant.

3.3 WARRANTY AND SERVICES

.1 The contractor shall provide a system warranty covering the installed cabling system against defects in workmanship, components, and performance, and follow-on support after project completion.

.2 The contractor shall warrant the cabling system against defects in workmanship for a period of one year from the date of system acceptance. The warranty shall cover all labour and materials necessary to correct a failed portion of the system and to demonstrate performance within the original installation specifications after repairs are accomplished. This warranty shall be provided at no additional cost to the Owner.

.3 The contractor shall facilitate a 25 year performance warranty between the manufacturer and the Owner. The performance warranty shall warrant the installed 250 MHz horizontal CAT 6A copper cabling system. Copper links shall be warranted against the link performance minimum expected results defined in TIA/EIA-568-B.

3.4 TESTING

.1 Test documentation shall be provided electronically in PDF format to the Information Systems Department within three weeks after the completion of the project. The test document should not exceed 8-1/2" x 11" There shall be only one cable test result per page, and the document must include the cable designation that matches the machine printed label that can be found within 10cm of each cable end. Test documentation must include site code.

.2 The test equipment by name, manufacturer, model number and last calibration date will also be provided at the end of the document. Unless a more frequent calibration cycle is specified by the manufacturer, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test.

.3 When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be provided electronically in PDF format to the Information Systems Department.

END OF SECTION

1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

.2 Arrange for a coordination meeting between Divisions 28, 27, 26, 08, consultants, the owner and the general contractor before ordering any equipment for the access control system.

.3 Division 27 shall provide multi-conductor cable from the card readers and other devices at the door locations as required per existing access control systems located in comm room.

.4 Division 28 shall provide all access card readers, monitoring and asset monitoring power supplies as/if specified in other sections. This work shall include for all components, including wire, necessary to interface these systems to the portal system for device management, as required to meet the functionality requirement defined for security and building code compliance.

.5 System integration enclosures with lid shall be provided by Division 26 except where specifically stated that the enclosure is listed to be provided by Division 8, Section 08 71 00. Coordination is required to insure compatibility.

.6 Division 26 shall provide all 120Vac connections to related electrified products at the portal system including for power openers where specified.

.7 Division 26 shall provide all conduits to the power controller, power supply and system integration points as required per site conditions and existing system. Coordinate with Access Control System Contractor.

.8 Division 26 shall position all enclosures with consultation to ensure that all enclosures provided are vertically mounted in accessible locations for future service. Under no circumstances are these enclosures to be mounted in the inverted position. All conduit (EMT) shall be provided with the actual wire required by this specification or an industry standard pull string for the use of Section 08.

.9 Division 26 shall not include for installation and pulling of hook-up wire provided by Section 08 between the portal devices and the portal system integration points. All low volt wire supply and installation between the power controller and /or the power supply shall be the responsibility of Division 26.

1.2 PRODUCT DATA

.1 Submit product data in accordance with Section 26 05 00.

1.3 SCOPE

.1 Tie the new access control doors to the existing access control system in the hospital. Systems shall include card readers, door contacts, request to exit device, electronic locking hardware, power supplies, cable, and miscellaneous components as required for a fully operational system and as listed in Sections 08 71 00. Provide an additional I/O card as required to the existing panel.

1.4 SHOP DRAWINGS

.1 Provide complete shop drawings which include the following:

.1 Include a complete system one-line, block diagram.

.2 Include a statement of the system sequence of operation.

.3 Include full schematic wiring information on these drawings for all devices. Wiring information shall include cable type, conductor routings, quantities, and connection details at device.

.2 Product Data: Provide complete product data that includes the following:

.1 Manufacturer's technical data for all material and equipment at the system and sub system level to be provided as part of the system

1.5 OPERATING MANUALS

.1 Manuals: Final copies of the manuals shall be delivered within 30 days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system.

.2 The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. The manuals shall consist of the following:

.1 Functional Design Manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included.

.2 Hardware Manual: The manual shall describe all equipment furnished including:

.1 General description and specifications

.2 System layout drawings and schematics

.3 Alignment and calibration procedures

.4 Manufacturers repair parts list indicating sources of supply

.3 Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:

.1 Definition of terms and functions

.2 System use and application software

.3 Initialization, start up, and shut down

.4 Reports generation

.5 Details on forms customization and field parameters

.4 Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

.5 As-Built Drawings: During system installation, the Contractor shall maintain a separate hard copy set of drawings, elementary diagrams, and wiring diagrams of the SMS to be used for record drawings. This set shall be accurately kept up to date by the Contractor with all changes and additions to the SMS. Copies of the final as-built drawings shall be provided to the end user in PDF and DXF format.

1.6 GENERAL REQUIREMENTS

.1 Systems shall be complete with all necessary components to provide functions required whether or not each and every item is necessarily mentioned. All components to be production proven models. Custom designed units will only be considered for those items that are not currently available on commercial market. System to be supplied and installed by an established security contracting firm that is in good standing with the Owner and qualified by the SMS vendor to perform this work.

.2 Selection of system shall be made on the basis of quality and suitability of equipment, service facilities available, experience, capabilities, and past performance of the contracting firm.

.3 Division 26 to be responsible for supply and installation of all conduit, wire, device boxes and terminal panels where required and as described above.

.4 All wiring for systems to be PVC insulated, shielded, twisted pair, multi conductor or coaxial, as called for or as required. All wiring for systems to be plenum rated where required. System wiring to be terminated by Security Contractor.

.5 Selection of type of cable to be at discretion of system installer but the system, when complete, must perform to the complete satisfaction of the Consultant and must be free of all interference from cross-talk, hum, switch and relay noise, etc. All wiring to be terminated on terminal strips or blocks, and to be neatly installed, laced and tagged where required. All terminals in terminal panels and junction boxes to be made with solderless connectors to terminal blocks with a separate terminal for each conductor.

.6 The contractor shall be fully trained and factory certified on the access control systems as required by this document.

1.7 WARRANTY

.1 System installer to include with his base tender price a guarantee stating:

.1 A full warranty will be provided for a period of one (1) year.

.2 Service to be provided on system within 24 hours of call origination during the warranty period.

.3 During warranty period system installer at his expense to repair and replace all such defective work and other work to new system damaged thereby which fails or becomes defective during term of warranty, provided that such failure is not caused by improper usage or physical damage.

.4 Warranty date to commence from date of Final Acceptance of this work.

2 Products

2.1 PROXIMITY CARD READER

.1 Reader is to utilize proximity technology, as required per existing system.

.2 Mounted on mullions or single-gang electrical boxes.

.3 LED for visual feedback, Piezo for audio feedback

.4 Compatible with existing access control systems.

.5 Industry standard Wiegand (26 to 56 bit) output.

.6 All card readers shall be provided with sealed single gang boxes for wall mounting.

2.2 PROXIMITY CARDS

.1 No direct contact, no battery, capable of an infinite number of reads, maintenance free operation.

.2 Provide 20 HID ISOprox ll 125kHZ, 26 bits proximity cards under this contract that compatible with Kantech card readers.

2.3 SECURITY WIRING

.1 All wiring and cable installed and connected to any piece of equipment which forms part of the security system to be electrically supervised and shall indicate a fault or tampering (open, ground) and provide a unique display of circuit trouble in the system on the display screen.

.2 Conduit must be used for security cabling within the secured space. Cable tray may be utilized to run security wiring outside of secured spaces.

.3 Unless otherwise specified, security systems do not require conduit – except in exposed or exterior locations. However all wiring used must comply with the Canadian Electrical Code Part I and if run in return air plenums shall be rated for this use or shall be in conduit.

.4 All security control panels shall be located in a secure, accessible location within the protected space (i.e. – panels and equipment shall not be mounted in electrical or data rooms that are not within the protected space).

.5 All cable and equipment supplied, and all installation methods used, shall be as specified by the equipment manufacturer.

.6 All systems shall be wired using cable acceptable to the authority having jurisdiction for the building.

.7 A proposed wiring layout shall be submitted for approval before start of work.

.8 No splices shall be permitted in the wiring except where a connection is made to a device. All connections shall be made using “B” clips, stakons or approved equivalent (no marrettes).

.9 All wiring shall be concealed unless otherwise authorized by the Owner and/or Consultant.

.10 All cables shall be permanently identified and listed on as-built drawings as follows:

.1 Cable number

.2 Source

.3 Destination

.11 Electrical panel circuit number shall be clearly identified on all system panels.

.12 All work shall be installed in a neat and workmanlike manner. The contractor is responsible for clean up and disposal of all garbage and debris caused as a result of their work. There are no extras for removal work.

3 Execution

3.1 INSTALLATION

.1 Any authorized dealer as approved by the owner can install the system. ONLY BMS can make final connections to protect the enterprise server/database and do initial programming.

.2 For each automatic door, supply and install a 120 volt emergency power circuit to controller and circuit as required.

.3 For each automatic door, supply and install a disconnect switch in EEMAC Type 1 enclosure and make connection.

.4 Ensure proper operation of all automatic doors with card readers.

.5 From each electrically locked door, provide connection to fire alarm control panel to de-energize doors upon signal from fire alarm system.

3.2 TESTS AND ADJUSTMENTS

.1 Upon completion of system installation, tests to be conducted by the system installer to determine system conformity to the requirements of the specification. Tests to be conducted in presence of owner and/or his representative who may suspend or discontinue tests at any time performance is considered unsatisfactory. Resumption of testing to cover the previously untested elements and any completed elements at the

discretion of the Owner.

.2 All equipment or wiring provided by system installer which tests prove to be defective or operating improperly to be corrected or replaced promptly at no additional cost to the Owner.

3.3 TRAINING

.1 System installer to conduct training program for designated maintenance and operating personnel. This program to include but not be limited to the following:

.1 Operation: designated personnel to be trained to accomplish and understand all aspects of system operation.

.2 Maintenance: designated personnel to be trained to perform routine maintenance on the system.

.3 Training period schedule to be established by Owner. Training periods to take place after building completion and prior to system use.

.4 Contractor shall provide the Owner with a training attendance sign-off sheet. This sheet shall identify the site, time and date as well as a listing of all those in attendance.

END OF SECTION

Part 1 General

1.1 RELATED WORK

.1 This Section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

1.2 SUSTAINABLE REQUIREMENTS

.1 Materials and products in accordance with Division 01 Sustainable Requirements: Construction.

.2 Do verification requirements in accordance with Division 01 Sustainable Requirements: Contractor's Verification.

1.3 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Division 01 – Construction / Demolition Waste Management and Disposal and with the Waste Reduction Workplan.

.2 Avoid using landfill waste disposal procedures when recycling facilities are available.

.3 Place materials defined as hazardous or toxic waste in designated containers.

1.4 REGULATORY REQUIREMENTS

.1 The fire alarm system to be designed and installed to meet the following standards:

.1 C.S.A. Standard C22.1, Canadian Electrical Code, Part 1

.2 The National Canadian Building Code.

.3 NFPA 72 National Fire Alarm Code.

.4 CAN/ULC S524: Standard for Installation of Fire Alarm System.

.5 CAN/ULC S537: Standard for Verification of Fire Alarm System.

.6 CAN/ULC S525/S526/S527/S528/S529/S530/S531/ Equipment Standards.

.7 CSA-B44. Safety Code for Elevators & Escalators.

.2 Installation subject to approval of consultant and fire marshal for final acceptance.

1.5 STANDARD OF ACCEPTANCE

.1 The equipment supplier and/or testing agency have not been selected for this section of the specification. Pre-approved alternative suppliers will be accepted providing conformance to the base products specified.

.2 Pre-approved suppliers are listed in “Part 2 PRODUCTS” of this section.

.3 Additional suppliers must be preapproved in accordance with section 16010 [26 05 00] ‘Standard of Acceptance’ and “Addition of Acceptable Manufactures’

.4 All products included must be capable of being verified as a complete system under full warranty by the contractor.

.5 Supply and install a complete system as the scope of this section.

.6 The existing main fire alarm system manufacturer is Simplex – 4100U system.

1.6 SYSTEM

.1 Equipment to be ULC approved.

.2 System to be electrically supervised as required by ULC and specified herein.

.3 System operation shall not require personnel with special computer operation skills. User operating language to be based on English type commands.

.4 The system shall be completely addressable and shall use speakers and horns with minimum 3 channel audio, bells and/or chimes for signalling devices, visual signal appliances, two stage alarming devices and remote monitor and control modules to interface with conventional monitor or alarm devices on the floor areas such as sprinkler tamper switches, and flow switches.

.5 The system to be for 24 volt DC operation from a rectified 120 volt AC power supply. The system to incorporate a 3 channel voice evacuation system with the ability for zone paging of individual areas or floors via speakers and selector switches located at the fire command centre and main entrance graphic.

.6 Fire Alarm System to be fully addressable, zoned, non-coded, two stages, annunciated, microprocessor based, employing multiplexing for data acquisition, utilizing end devices, distribution and control. System shall be complete with all necessary hardware, software and memory, specifically tailored for this installation.

1.7 SHOP DRAWINGS AND PRODUCT DATA

.1 Submit shop drawings and product data in accordance with Section 16010 [26 05 00].and as outlined herein. All shop drawings items to be within one complete submission.

.2 Shop drawings to include a complete material list with manufacturer, style, model number and quantity. Cable type and size to be included in material list. Provide battery information and ampere\hour sizing calculation based on the actual equipment load. Include the calculated load in the various system operation modes.

.3 Shop drawings to include manufacturer's specification sheets with photographic depiction of all system components. Specification and descriptive data to include dimension, weight, appearance, connection provisions, materials, metal gauges and operating specification, characteristics, features and controls.

.4 Shop drawings to include the following diagrams:

.1 Equipment panel elevations for each panel or panel group. Elevations to indicate component layouts, cable routing and terminal blocks.

.2 Detail drawings of all control panels and annunciator panels indicating material, finish component models, housing requirements and mounting details.

.3 Complete engineering drawings of all custom made components indicating all materials, gauges, finishes and wiring diagrams.

.4 Complete system block diagrams indicating all components, interconnection and cabling in accordance with ULC S524 requirements. Provide an input/output sequence of operation matrix.

.5 Complete equivalent to a "*Microsoft 'Excel'™*"spreadsheet indicating the proposed Audio messaging and LCD text messaging and shut down schedule. Refer to example format on drawings.

.6 Complete detailed system circuit and riser diagrams indicating:

.1 Alarm devices,

.2 Alphanumeric annunciators,

.3 Auxiliary interconnections,

.4 Component layout,

.5 Identification schedules,

.6 Zone wiring designations,

.7 Panel interconnect wiring,

.8 Detailed wiring connections and wire designations.

.7 Complete wiring diagram showing terminal identification, cable type and cable designation.

.5 No material or equipment to be delivered to the jobsite prior to final review of shop drawings unless otherwise specified and documented in writing by the Consultant.

.6 Provide factory data sheets for the following:

.1 Main panel, annunciator panels, and control units, indicating:

.2 All materials,

.3 Finishes,

.4 Layouts,

.5 Proposed labelling.

.7 All system devices indicating:

.1 Typical wiring connections,

.2 Installation instructions,

.3 Control settings,

.4 Component limitations.

.8 Riser diagrams and detail drawings to be prepared in Autocad to professional standards. Provide hard copies with the shop drawing submittals.

.9 Provide device device samples when requested by the Consultant.

1.8 OPERATING MANUALS

.1 Refer to Section 26 05 00.

1.9 WARRANTY/SERVICE

.1 System installer to include with his base tender price a guarantee stating:

.1 Service to be provided on system within 24 hours of call origination during the warranty period.

.2 Full warranty on new system to be provided for a period of 12 months.

.3 During warranty period the system installer at his expense shall repair and replace all such defective work and other work to the new system damaged thereby which fails or becomes defective during the term of the warranty, provided that such failure is not caused by improper usage or physical damage.

.4 Should the system installer fail to comply with Sub-item 1.1, work will be performed by others at the contractor's expense.

.5 Warranty date to commence from date of final acceptance of this work.

1.10 TRAINING

.1 The Fire Alarm system supplier to conduct "Factory Level" training programs for designated maintenance and operating personnel. Training to be carried out at the project site. Program to include but not be limited to the following:

.1 Operation: designated personnel to be trained to accomplish and understand all aspects of system operation.

.2 Maintenance: designated personnel to be trained to perform routine maintenance on the system.

.2 Training period schedule to be confirmed with the Consultant. Training periods to take place after the system final verification.

.3 Allow for two separate all day training seminars/workshops for a maximum of 5 people. The training days will not necessarily be concurrent so as to suit the Owners shift schedule.

.4 Provide a formal training agenda and issue certificates to attendees upon completion.

.5 Provide maintenance manuals and record drawings as part of training materials.

1.11 TESTS AND ADJUSTMENTS

.1 Upon completion of system installation, tests to be conducted by the system installer to determine system conformity to requirements of the specification. Tests to be conducted in presence of the Owners representative and Consultant who may suspend or discontinue tests at any time performance is considered unsatisfactory. Resumption of testing to cover the previously untested elements and any completed elements at the discretion of the Consultant.

.2 All equipment or wiring provided by system installer which tests prove to be defective or operating improperly to be corrected or replaced promptly at no additional cost to the Owner.

1.12 SYSTEM SUPERVISION

.1 Fire alarm pull stations, detectors, sprinkler (fire protection) circuits, pre-action sprinkler circuits, and annunciation network lines to be fully supervised utilizing a "Class B loop".

.2 Communication lines between CPU, field transponder panels and fire command centre to be fully supervised utilizing Class A loop.

.3 Complete system to be supervised against failure of operating power, open circuits, and ground. Supervision to be maintained on all circuits even in the event of a power failure, when the system is on battery standby. Any of the above shall cause trouble buzzer to sound at the main control panel and at the fire command centre and also light a common trouble lamp in the same panels. Trouble on system to produce a tone distinct from the tone of the alarm signals.

.4 System to incorporate a silencing switch in the main control panel and at the fire command centre, which when operated, silences the trouble bell but causes the trouble lamp to remain illuminated until the trouble is cleared and the system returned to normal. Upon return to normal, trouble signal lamp shall be automatically reset to normal.

1.13 SOURCE OF SUPPLY

.1 Complete fire alarm system shall be supplied by a single manufacturer unless otherwise noted.

1.14 COORDINATION

.1 Coordinate installation of fire alarm system with:

.1 Mechanical equipment controls.

.2 Sprinkler flow and gate valve installation.

.3 Building Management system.

.4 Other related work such as door hardware.

.2 Coordinate with the above noted work as required to provide a complete, integrated, functional system.

1.15 SYSTEM COMMUNICATIONS

.1 Communications loop from the main CPU to all field panels and annunciation panels to be a true peer to peer network using a Class A loop and fire resistive wiring. Typically a minimum of one hour rated unless otherwise noted or as required to suit the particular application.

.2 Each node or point shall have the ability to fully operate independently including all voice messaging if the network communication is lost. An open, short or ground on any one loop shall not degrade the network functionality.

.3 Communication to be carried on multiplexed digital data link between main CPU and field panels and transponders.

.4 Any remote graphics workstation to be connected either as radial or true class A network to suit the different vendor systems. Remote graphics workstations are considered a peripheral device.

1.16 SYSTEM WALK TEST

.1 System to be able to have one person walk test feature with fully digitized alarm and trouble messages in English language that can either sound over the speakers or be silent and logged at the panel and later printed out. The one person walk test feature shall be zoned in the zones indicated and when a zone is put into the walk test the other areas will still be

in alarm monitoring operation. Any alarm from the areas not in a walk test mode will override the area in walk test mode and operate all alarm sequences.

1.17 LABELLING – DEVICES AND PULLBOXES

.1 Provide a 'Brother' style commercial quality label on each fire alarm device. Label to be clearly visible from the ground and contain the address information to correspond to the walk test voice or page.

.2 Provide a red lamicoid label on all fire alarm equipment boxes such as isolators, relays, terminal blocks etc and wiring pull boxes. Lamicoid to be a minimum size 25mm x 50mm [1" x 2"] with clear white lettering indicating function, circuit address etc.

1.18 SYSTEM MAINTENANCE AND TESTING FACILITY

.1 Provide required hardware/software such that ancillary, signal and monitoring station systems can be temporarily disabled by site personnel to enable testing of system. A trouble signal shall be present during testing, but system ULC approval will be unaffected.

1.19 FIRE PLAN

.1 Provide the fire alarm system portion of the "Building Fire Plan". Update and provide input for any existing plan.

Part 2 Products

2.1 FIRE ALARM CONTROL PANEL

.1 Existing Simplex system. Exact model to be confirmed on site.

2.2 ADDRESSABLE MONITOR MODULES

.1 Addressable monitor elements to meet or exceed the following technical requirements:

.1 Compatible with main fire alarm system.

.2 Field programmed.

.3 Individually identifiable.

.4 Supervised.

.5 Supervises normally open contact devices on supervised slave line. Supervision in Class B format with end-of-line resistor.

.6 Operating Voltage: 24 volts.

.7 Slave Line Resistance: 50 ohms maximum.

.8 Ambient Temperature: 0°C - 40°C.

.9 Ambient Humidity: 0 - 93%.

.10 Complete with lamicoid identification on cover identifying address and device monitored.

2.3 ADDRESSABLE CONTROL MODULES

.1 Addressable control elements to meet or exceed the following technical requirements:

.1 Compatible with main fire alarm system.

.2 Field programmed.

.3 Individually identifiable.

.4 Supervised.

.5 May be operated by any one or group of identifiable devices.

.6 May be operated from control centre or automatically by system.

.7 Contact rating: 0.5 amperes 120 volts AC, 2 amperes at 24 volt DC, with one (1) set of Type C contacts.

.8 Ambient Temperature: 0°C - 40°C.

.9 Ambient Humidity: 0 - 93%.

.10 Complete with lamicoid identification on cover identifying address and device controlled.

2.4 ADDRESSABLE DETECTOR BASES

.1 Addressable detector bases to meet or exceed following technical requirements:

.1 Compatible with main fire alarm system.

.2 Field programmable.

.3 Supervised, including removal of specified plug-in detector devices.

.4 Designed to accept ionization, photo-electric smoke detectors and electronic heat detectors.

.5 Designed for remote LED output and base mounted LED.

.6 Operation on system data loop.

.7 Ambient temperature 0 to 90°C.

.8 Ambient humidity: 0 - 93%.

.9 Provide space for future relay in patient care locations (nurse call interface).

.2 Provide a dry contact module in the base of all detectors in patient care rooms under the supervision of a Nurses station. The dry contacts will be used by the (existing or future) Nurse Call systems for signaling.

2.5 ADDRESSABLE MANUAL FIRE ALARM STATIONS

.1 Manual Fire Alarm Stations: to ULC-S528 and as follows:

.1 Type: Addressable.

.2 Construction: Metal or Lexan.

.3 Square pattern, pull lever type

.4 Mounting: Flush in all finished areas (surface acceptable in Equipment Rooms).

.5 Features: Glass rod.

.6 Operation:

.1 First Stage: Manual lever.

.2 Second State: Key operated.

.7 Ambient temperature: 0°C to 40°C.

.8 Ambient humidity: 0 - 93%

.9 Provide weatherproof design in exterior locations.

.2 Replace existing “Pull Station” back boxes to provide a flush installation as required.

.3 Mount manual stations in recesses in walls in gymnasiums and activity rooms so that front of station is flush with wall line. Maintain 50mm [2"] clear space around manual stations and recess for reset mechanism. Provide necessary recess in wall. Frame around opening as required to provide a neat and finished appearance.

2.6 THERMAL DETECTORS

.1 Thermal Detectors: Addressable to ULC-S530 and as follows:

.1 Construction: metal.

.2 Mounting: Addressable base and plug-in head.

.3 Contacts: rated at 3 A from 6 to 125 V AC, 1 A from 6 to 28 V DC.

.2 Ambient temperature 0°C to 40°C.

.3 Ambient Humidity - 10% to 95% R.H.

.4 Operation:

.1 Projecting centre disk shall indicate when alarmed.

.2 Fixed Temperature Type: Resettable, shall operate at 58°C.

.3 Fixed Temperature Type: Non-Resettable shall operate at 88°C.

.5 Thermal detectors to operate on the dual themistor principle.

.6 Built-in LED for alarm indication.

.7 Shielded electronics to limit noise interference.

2.7 MULTISENSOR PRODUCTS-OF-COMBUSTION DETECTORS (SMOKE DETECTORS)

.1 Multisensor technology utilizing photo-electronic and heat sensors complete with addressable base shall be provided in all areas except electrical rooms where ionization type detectors are to be utilized. Units to be unaffected by changes in environmental temperature, humidity and pressure. Surface mounted, screw connection separate field wiring base, indicator lamp, provision for remote mounting, design and function based on dual chamber principle.

.2 POC sensors shall communicate actual chamber values to system control panel. Sensors shall not have a self contained sensitivity setting, sensitivity setting to be determined at control panel. In all areas initially, alarm set point will be set at 1% obscurity during evening hours, and 3.7% obscurity during daytime hours.

.3 The control panel shall be programmed to automatically compensate for environmental changes at the remote sensors. Even if the smoke detector chamber is contaminated with dust, or other particles, the control panel will still alarm at the prescribed alarm set point. The POC shall report ambient conditions to the control panel.

.4 The POC sensor shall be stable even withstanding air-gusts up to 10 m/sec velocity. The detector shall have a 30 mesh insect screen and have a completely sealed back to prevent entry of dust, moisture and air turbulence. The electronics of the unit shall be totally shielded to protect against false alarms due to EMI and RFI. The detector head shall be easily disassembled to facilitate cleaning. All wiring to the smoke detector shall be wired to the base only, thus when removing the head for maintenance or cleaning no wiring is disturbed. The detector head shall contain an LED which shall glow continuously to indicate alarm, or a sensor trouble condition. The detector head shall contain a locking screw to prevent unauthorized removal of the head from the base.

.5 Ceiling units to be attractive design, easy to clean, chamber accessible without special tools, chamber to be provided with anti-static protection, overall tapered geometry with no flare-outs to collect dust. Chamber port open 360°.

.6 Where units are mounted in the ceiling space, provide remote pilot lamp complete with lamicoid identification.

.7 Provide terminals and output for individual annunciation as required.

.8 Duct mounting POC detectors to be complete with addressable module, duct casting, sampling tubes for installation in air systems and pilot lamp. Duct detectors to be complete with remote alarm LED as well as remote keyed test switches on a single gang plate located near the duct detector at an accessible location.

.9 Detectors to meet ULC-S529.

.10 Provide 2 spare smoke detectors and bases. Allow for 20m [60’] of wiring, installation and verification. Locate as directed on site. Any spare material not used to be handed over to Owner.

2.8 FIRE ALARM SPEAKERS (CEILING TYPE)

.1 Speakers to be flush ceiling mounted complete with backbox, line matching transformer, round baffles finished to match ceilings. Provide matching surface mounting boxes in unfinished areas and service rooms.

.2 Assemblies to be complete with channel mounting rails and hold-down clips for connection to ceiling tee bar in tee bar ceilings.

.3 Provide independent support wiring to the building structure in tee bar ceiling installations.

.4 Speakers to be 200mm [8”] in diameter, rating of 11 watts, frequency range from 40 - 11,000 Hz. Magnet weight of not less than 168 grams. Axial sensitivity of not less than 95 dB at 1m [40”] with 1 watt input from 100 to 10,000 Hz ±1 dB.

.5 Speaker transformer to be equipped with ½,1, 2, and 4 watt taps and primary input winding rated at 70V. Confirm voltage rating with any existing equipment and Owners preference. Insertion loss not greater than 1 dB at 4 watts from 50 to 10,000 Hz.

.6 Speaker assemblies to be complete with DC blocking capacitors.

.7 Provide 3 additional speakers c/w 30m (100 feet) of wiring for each. Make allowances to install as determined during audibility commissioning. Any additional speakers not installed to be handed over as spare material.

2.9 FIRE ALARM SPEAKERS (HORN TYPE)

.1 Horn type speakers to be used in all higher ambient noise areas such as service rooms, service areas, stairwells, kitchen, laundry, etc.

.2 Speaker horns to be surface wall, column or ceiling mounted for single or dual (bi-directional) operation.

.3 Speakers to be a re-entrant horn type complete with matching line transformer, output taps for 2, 7.5 and 15 watts.

.4 Units to have a frequency response of 400 to 4000 Hz, rated output of not less than 98 dBA (SPL) at 1000 Hz with 2 watts input at 1m [40”].

.5 Exterior horn type loudspeakers to be weatherproof with matching weatherproof surface mounted backbox.

.6 Tap all horns at 3.5 watts and adjust to suit site conditions

2.10 PIEZOELECTRIC HORNS:

.1 Provide 24V.DC. piezoelectric horns in locations as shown on the drawings.

.2 Surface mount (vertically) on flush mounted outlet boxes. Use manufacturer's recommended outlet boxes and/or adapter plates.

2.11 VISUAL SIGNAL APPLIANCES (STROBE LIGHTS)

.1 Visual signal appliances: to ULC S527 and as follows:

.1 Voltage: 24V DC.

.2 Mounting: designed for ceiling or wall mounted on flush boxes in finished areas. Provide matching red surface mounting boxes in unfinished areas and service rooms

.3 Construction:

.1 High intensity Xenon flasher.

.2 Rated Candela - 15.

.3 Pyramid shaped.

.4 Polycarbonate lens with red print reading "FIRE".

.4 Connect visual signal appliances to dedicated supervised output circuit(s) in the fire alarm control panel and synchronize at minimum 20 flashes per minute.

2.12 DOOR HOLDERS

.1 Provide electromagnetic hold-open devices for smoke control doors where indicated.

.2 Door holders to be complete with all necessary mounting hardware and accessories. Provide flush mounting boxes in finished areas and matching surface boxes in unfinished areas or as required to suit the application. Provide solid backing for all mounting boxes.

.3 Provide the following features:

.1 Rated for 120V AC. continuous service.

.2 Power source for hold-open devices in nearest essential electrical panelboard or as indicated. Install breakers as required and label clearly. Group hold-open devices on dedicated circuits on a floor by floor basis or to suit layout.

.3 De-energize hold-open devices during an alarm condition, using appropriate alarm operated relay contacts in the fire alarm panel. Do not use relays energized by a bell circuit. Provide dual voltage relays as required.

.4 Provide two types of hold-open devices as required:

.1 Two-piece electromagnetic type.

.2 Combination door release/door closer device.

.5 Select type of device as indicated or to suit individual locations

.6 Standard of Acceptance

.1 Two-piece devices:

.1 Simplex FM 990 series.

.2 Combination devices:

.1 Firemark FM 5630 series complete with correct hardware to suit push or pull application.

.2 Pre approved product

2.13 MAGNETIC LOCKS, SECURITY SYSTEMS AND DOORHOLDERS

.1 Interface Magnetic Locks and Security release systems to the Fire Alarm System.

.2 Interface Smoke Control Doorholders to the Fire Alarm System.

.3 Coordinate with door hardware.

2.14 COMBINATION MOTORIZED FIRE/SMOKE DAMPERS

.1 Coordinate and connect Motorized Fire/Smoke Damper systems.

2.15 MECHANICAL SYSTEM CONTROL

.1 Provide control of mechanical system air handling equipment during an alarm condition, as indicated on the drawings and specified under the Mechanical Division.

.2 Provide the following:

.1 BMS interface to send the Fire Alarm status and commands as indicated.

.2 All wiring, connections, relay modules, etc. as required.

.3 Dual voltage relays as required.

.4 Separate relay for each system as indicated in motor schedule.

.5 Minimum one set of Form "C" contacts for each system accessed via clearly labeled terminal strip located adjacent to MCC or starter. Provide general purpose enclosure or use spare (barriered) section of MCC.

.6 Fan shutdown shall be achieved by wiring fan starter control circuit through appropriate alarm operated contacts located in the fire alarm panel. Use interposing relays and do not run 120V or higher motor feeder voltages through fire alarm system cabinets.

2.16 SPRINKLER SYSTEM CONNECTIONS

.1 Connect all sprinkler (fire protection) system pressure, flow, and tamper switches. Coordinate with the Fire Protection Division for exact device locations, grouping and zoning.

.2 Provide the following zoning to monitor the sprinkler (fire protection) system:

.1 Separate alarm zone for each floor area.

.2 Separate alarm zone for each wet or dry system alarm switch.

.3 Separate trouble zone for each wet or dry system low pressure alarm.

.4 Separate trouble indication for each tamper protected gate valve. Only where gate valves are located in immediate proximity may they be grouped together as one trouble alarm.

.5 Provide separate address for each device even though they may be grouped or loop fed.

2.17 END-OF-LINE DEVICES

.1 Provide end-of-line devices wall mounted in separate boxes at 1800mm [72”] above the finished floor level in accordance with ULC S524.

.2 Flush mount devices in finished areas.

.3 Provide finished stainless steel or anodized aluminum coverplates.

.4 Provide permanent lamicoid labels on plates to indicate the related circuits.

.5 Clearly locate and identify the end-of-line devices on record drawings.

2.18 ISOLATORS

.1 Addressable loop isolators shall be provided in each circuit per zone area, and for each stairway such that a fault on any device in that zone shall not affect any other zone.

.2 Short circuit isolation shall be installed per floor and for every 25 devices within the floor where Class A loops are utilized.

2.19 SYSTEM POWER SUPPLIES

.1 Power Supply to ULC S527 and as follows:

.1 Rectifier and Battery Charger:

.1 Designed to automatically maintain battery bank fully charged.

.2 Sized to recharge batteries in 24 hours minimum.

.3 Designed to operate system when batteries are disconnected.

.4 Temperature compensated.

.5 Provide battery connection supervision.

.2 Battery Bank: Gel-cell type.

.3 Capacity: Designed to operate system under supervisory load condition for 24 hours and then have sufficient power to provide 30 minutes of continuous voice and visual communication without recharging.

.4 Mounting integral with each panel or as detailed.

2.20 WIRE AND CABLE

.1 Conductors: Copper, to CSA C22.2 and as follows:

.1 Refer to riser drawing for particular wiring specifications and as follows:

.2 Conductor Insulation: Minimum rating 300 volts. Single conductor RW90XLPE (X-link).

.3 Multi-conductor cables 105°C with outer PVC jacket, colour coded, FAS rated.

.4 Conductor sizes as follows:

.1 Minimum conductor size for alarm initiating circuits shall be #18 AWG.

.2 Minimum conductor size for signal circuits shall be #16 AWG.

.3 Minimum conductor size for AC circuits shall be #12 AWG.

.4 Minimum conductor size for visual signal appliance circuits shall be #14 AWG.

.5 Size all fire alarm wiring for maximum 3% voltage drop at maximum load at last device in run.

.5 Main data risers and loops between fire separations to be approved fire rated cables either Mineral Insulated or equal to 'Vitalink' (RW90 cables with "RHW" silicon coated insulation) cabling installed in EMT in accordance with the manufacturers rated system requirements.

.6 Selection of the type of cable to be at discretion of fire alarm installer but the system shall meet all code requirements, when complete. All wiring to be terminated in terminal panels, junction boxes, etc. on suitable identified terminal strips or blocks, and to be neatly installed, laced and tagged where required. All terminals in terminal panels and junction boxes to be made with solderless connectors to terminal blocks with separate terminal for each conductor.

.7 All wiring to be tag identified at the points of connection.

.8 Provide a ground conductor with all system wiring and bond all metal parts including device boxes.

Part 3 Execution

3.1 INSTALLATION

.1 System installation shall conform to the latest adopted CAN/ULC-S524 Standard for the Installation of Fire Alarm Systems.

.2 Mount all end-of-line resistors immediately beyond the last device in separate backbox.

.3 Flush mount all field control and monitor modules in separate backboxes in ceiling or wall. Do not conceal modules in ceiling spaces unless indicated.

.4 External AC Power Supply:

.1 Provide dedicated 120V power supply to the Fire Alarm Control panels and remote equipment.

.2 Clearly label function with a red lamicoid "FIRE ALARM"

.5 Central station Tie-In:

.1 Provide 21mm [3/4"] conduit and 4#18 conductors to the central station tie-in demarcation point. Confirm requirements.

3.2 AUTOMATIC DETECTORS

.1 Locate automatic smoke and thermal detectors in locations as shown indicated and in accordance with CAN/ULC-S524.

.2 Generally, locate ceiling mounted detectors centrally in rooms and corridors unless lights and/or mechanical devices interfere. Coordinate with other trades before proceeding.

.3 Provide flush mounted devices in finished areas unless wiring is surface mounted in which case surface mounted devices shall be provided. Provide mounting base for surface mounted detectors

.4 Maintain minimum 450mm [18"] clear to mechanical air diffusers and registers.

.5 Typically maintain minimum 450mm [18"] clear in all directions around detectors. Note that the CAN/ULC-S524 has exceptions for narrow spaces and minor ceiling obstructions not exceeding 100mm [6”] projections down from ceiling.

.6 Mount detectors out of line of direct heat and minimum 3m [10'-0"] from unit heaters.

.7 Mount smoke detectors associated with smoke control doors, on the ceiling on either side of the doors; typically 1200mm [4'-0"] from door. Do not mount detectors closer than 900mm [3'-0"] or farther than 1500mm [5'-0"] from the doors.

.8 Mount detectors shown in crawl spaces which have solid type joists or beams at the level of the underside of the joist or beam.

.9 Install duct smoke detectors on the supply air side, and downstream of any filters of air handling units deemed to be shut down in a related fire alarm event.

3.3 WIRING

.1 Make conductor terminations on fixed terminal strips with separate terminal for each conductor. No loose wiring connections allowed.

.2 Fire alarm wiring splices to be minimal. Line splices are not acceptable.

.3 Neatly install wiring clamped with nylon cable straps or laced with jute cord.

.4 Number identify all wiring terminations and terminal strips as indicated on shop drawings.

.5 Attach wiring diagram to inside of panel doors.

.6 All cables crossing fire zones to be protected by 1-hour fire rating.

.7 Provide separate fire alarm zone (and indicated at the graphic annunciators) for each duct mounted products-of-combustion detector for mechanical pressurization and recirculation units.

.8 Coordinate duct detector location and accessibility. Provide remote LED’s for locations not readily viewable by maintenance personnel.

.9 Visual signal appliances to be wired independent from audible devices on the system.

.10 All backboxes in exposed installations to be as provided by system manufacturer.

3.4 CONNECTION OF MISCELLANEOUS SYSTEMS

.1 Provide outputs for control of the following auxiliary equipment.

.1 Door hardware:

.2 Security release/interface.

.3 Pressurization, supply and return air fan control.

.4 Smoke control: switch 120 volt emergency power circuit through dual voltage relays.

3.5 PROGRAMMING

.1 Provide a list of all devices and the related LCD messaging and Audio readouts for review by Consultant and Owner: Submit as part of shop drawings.

.2 This contract to include up to three (3) software re-programs for all the equipment installed under this Contract.

3.6 PROTECTION OF COMPLETED WORK

.1 Protect equipment in areas of construction to prevent the entry of dust, paint and any other foreign matter into the devices or panels.

3.7 SYSTEM INSPECTION

.1 Carry out a complete inspection and test of system on completion of the installation to ensure the following:

.1 System is complete and functional in accordance with the contract documents and regulatory requirements.

.2 System in installed in accordance with the manufacturer's recommendations.

.3 Fire suppression detection devices are connected into the system and are functioning.

.4 Smoke control equipment has been installed, connected and functioning.

.5 All auxiliary equipment has been connected and functioning.

.6 On completion of inspection deliver three (3) final sets of maintenance and operating instructions manuals to the Consultant.

3.8 PERFORMANCE VERIFICATION

.1 The Electrical Division Contractor shall be responsible for directing performance verification of the fire alarm system in accordance with the latest CAN-S537, Standard for Verification of Fire Alarm System Installations.

.2 Provide interim partial verifications to suit the progress of the work and any staged occupancy. All new work to be tested and verified directly following the installation.

.3 Submit all verification reports to the Consultant. Provide an unconditional Appendix C and written test reports from the equipment manufacturer showing that the ENTIRE system has been tested, verified and commissioned by him in accordance with the latest edition of ULC S-537 "Standard for Verification of Fire Alarm System Installations" and that the Fire Alarm system complies with all points of the specifications. Include the verification worksheets identifying every device and its status (i.e. smoke detector - room xx, verified for operation and supervision).

.4 The qualified Fire Alarm verification agency shall be independent of the installing company.

.5 Prior to requesting the final performance verification ensure that fire alarm system is fully operable and that subsequent work to be performed on system will not invalidate examinations and tests performed during verification procedure.

.6 The Electrical Division Contractor and fire alarm system manufacturer's representative shall be present at all times during the verification procedure and shall undertake the following:

.1 Provide all required testing equipment and tools.

.2 Disassemble and reassemble system components.

.3 Disconnect and reconnect wiring.

.4 Perform required field adjustments.

.5 Repair defective work and replace defective components.

.6 Perform all other work on the system required by verification procedure.

.7 Provide four portable communication devices during entire verification.

.7 Include all costs for fire alarm system verifications, including the Fire Alarm System Manufacturer's representative's costs. Take into account that the system may have to be commissioned and verified after normal working hours.

.8 Provide a minimum of ten workings days written notice ahead of the verification process to the Owners Representatives and the Consultant.

3.9 FIRE DEPARTMENT DEMONSTRATION

.1 Arrange, attend and carry out a Fire Department demonstration of the completed system after the final unconditional verification.

.2 Activate alarms and demonstrate all controls as requested.

3.10 SPARE MATERIAL

.1 In addition to all required devices indicated on the drawings and specified above, provide the following spare components:

.1 2 monitor modules

.2 2 control modules

.3 2 breakglass stations

.4 2 Multisensor POC (smoke detectors)

.5 2 Heat detectors

.6 2 addressable bases

.7 2 speakers

END OF SECTION

TABLE OF CONTENTS

1.1 EF 100 Check List – Submissions to Consultant

ITEM	CHECKED BY	DATE
5 WORKING DAYS BEFORE CLOSE OF SUBTRADE TENDER – Request for addition of acceptable manufacturers		
10 DAYS AFTER AWARD OF THE CONTRACT – List of equipment suppliers and subtrades (EF 110) – Detailed price breakdown (EF 112)		
A.S.A.P. – Shop drawings and Product Samples (EF 111)		
WITH EACH APPLICATION FOR PROGRESS PAYMENT – Price breakdown (EF 112)		
PRIOR TO DEMONSTRATION OF SYSTEMS – Demonstration agenda		
DEMONSTRATION OF SYSTEMS – Checklists for sign off of Demonstrations (EF 141)		
10 DAYS PRIOR TO SUBSTANTIAL PERFORMANCE – Submission of items listed on Form EF-142		
WHEN REQUESTING REVIEW OF OUTSTANDING WORK – Checklist of work remaining (EF 144) – Certificate of total completion (EF 145)		

1.2 EF 110 Equipment/Sub-Trade List

ITEM	COMPANY/SUPPLIER
Switchgear and Distribution	
Transformers	
Motor Control	
Wiring Devices	
Luminaries	
Voice Data Equipment/System	
Voice Data Sub-trade	
Fire Alarm System	
Fire Alarm Verification Agency	
Security System Equipment	
Security Sub-trade	
Seismic Engineer	
Testing and Commission Agency	
Other	
Other	
Other	

Modify/Add to suit project and equipment responsibility splits

1.3 EF 111 Check List –Shop drawings and Product and Samples

		REVIEW	
ITEM	**DATE SUBMITTED**	**ACTION**	**DATE**
Switchgear and Distribution			
Transformers			
Motor Control			
Generator Equipment			
Wiring Devices			
Luminaires (list groups)			
EXIT Signs and Emergency Lighting			
Voice/Data system			
Fire Alarm System			
Security System			

NOTES:

.1 Modify list to suit project.

.2 Submit samples where indicated to the consultant for review prior to installation.

1.4 EF 112 Progress Claim Summary – Division26, 27, 28, 33

PROJECT: **CLAIM NO:** _____

FOR MONTH OF: _____

ITEM		PRICE	WORK TO DATE		PREVIOUS WORK		THIS MONTH	
		$	%	$	%	$	%	$
Base Contract:								
General Conditions								
Mobilization (not to exceed 2%)								
Demolition								
Site Work & Utility	Mat Lab.							
Conduit, Boxes & Wire	Mat Lab.							
Distribution	Mat Lab.							
Motor Control	Mat Lab.							
Generator Equipment	Mat Lab.							
Wiring Devices & Plates	Mat Lab.							
Lighting	Mat Lab.							
Voice/Data Systems	Mat Lab.							
Fire Alarm System	Mat Lab.							
Security Systems	Mat Lab.							
O & M								
Testing &								
Other								
Cash Allowances								
Total Base Contract								
Change Order								
Total Change Orders								
Total Contract:								
Amount due less 10% mechanics lien holdback								

Submit this form as called for on **EF 100** for tender price breakdown and for each progress claim

1.5 EF 120 Check List –Colour Coding

Obtain sign off from Building Owners representative prior to colour coding systems.

Project Identification:

	SYSTEM	MAJOR BAND	MINOR BAND	CHARACTERS
1	120/208 volt Non Essential	*Light Blue*		
2	347/600 volt Non Essential	*Dark Blue*		
3	120/208 volt Essential	*Light Blue*	*Black*	
4	347/600 volt Essential	*Dark Blue*	*White*	
5	277/480 volt	*Gold*		
6	Up to 5 kV			
7	Up to 25 kV	*Yellow*	*Purple*	*Nominal Voltage*
8	Fire Alarm	*Red*		*FA*
9	Television	*Dark Brown*		*TV*
10	AV or RF	*Light Brown*		*AV/TV*
11	Clock System	*Yellow*		*CS*
12	Communications	*White*		*COM*
13	Nurse Call/Cardiac Arrest/Emerg Call	*Orange*		*NC/CA/EC*
14	Security/Personal Alarm	*Dark Green*		*SEC/PA*
15	Central Intercom	*Purple*	*Green*	*IC*
16	Other			

Prepared By _____

Owners Sign Off _____ DATE _____

1.6 EF 130 Certificate of Penetrations Through Separations

Project Identification: _____

I hereby declare that I _____

am an employee/a principal of _____

have personally witnessed that all electrical service penetrations through fire separations (rated & non-rated) and sound separations in the following areas have been properly sealed in accordance with the specified requirements.

SIGNED _____ DATE _____

AREA	SIGNED	DATE
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		
Level:		

NOTES:

.1 This certificate shall be submitted to the Consultant prior to Substantial Performance.

1.7 EF 131 Certificate of Seismic Restraint Installation

Project Identification: _____

I hereby declare that I _____

am an employee/a principal of _____

Certify that the seismic restraint of all electrical equipment and wiring system installation meets the requirements of the B.C. Building Code as it relates to seismic restraint and the Schedules B, B1 & CB have been submitted and signed and to the Consultant.

SIGNED _____ DATE _____

NOTES:

.1 This certificate shall be submitted to the Consultant prior to Substantial Performance

1.8 EF 132 Certificate of Acoustic and Vibration Isolation

Project Identification: _____

I hereby declare that I _____

am an employee/a principal of _____

Certify that the vibration isolation installation for the Electrical Equipment has been satisfactorily completed.

SIGNED _____ DATE _____

NOTES:

.1 This certificate shall be submitted to the Consultant prior to Substantial Performance

1.9 EF 140 Check List & Record – Items to be Handed to Owner

ITEM	QUANTITY	RECEIVED	DATE

NOTES:

.1 Copies of this form shall be submitted to the consultant and the owner with all items signed off prior to substantial performance.

Prepared By _____

Owners Sign Off _____ DATE _____

1.10 EF 141 Check List – Owners Demonstration

	CONTRACTOR		OWNER	
SYSTEM/ITEM	**SIGNED**	**DATE**	**SIGNED**	**DATE**
Switchgear Operation				
Motor Control Operation				
Emergency Power Systems				
Lighting System Controls				
Fire Alarm Systems				
Security Systems				
Data/Voice Systems				
Nurse Call Systems				
Electric Interlocks				
Location of Control Devices				
Access to Equipment				
Review of Maintenance Manual				
Points of required Maintenance				

NOTES:

.1 Contractor shall submit copies of this form with each appropriate item signed and dated by the person having overall charge of commissioning prior to substantial performance. (See **EF 143**).

.2 Owners representative shall sign off each item during or after the demonstration.

.3 Contractor to strike out items where they do not apply to the systems being demonstrated.

.4 Interlocks and controls to be demonstrated by following the descriptions and diagrams in the contract documents and proving that all controls function as required.

.5 Where multiple identical controls are installed the Owners representative may elect to only witness sample items, but the person having charge of commissioning is expected to have checked them all.

1.11 EF 142 Check List – Substantial Performance Submissions - Electrical

SECTION	ITEM	DATE	STATUS
260500	Final Electrical Inspector Certificate		
260500	Fire Stop Penetration Certificate. (**EF-130**)		
260500	Acoustic & Vibration Isolation Certificate. (**EF-132**)		
260500	Items handed to Owner Checklist (**EF 140**)		
260500	Identification		
260500	Record Drawings		
260500	Operating & Maintenance Manuals		
260505	Seismic Engineer Report and Schedules (**EF131**)		
260523	Patient Care Testing		
263210	Generator Test and Start-up Report		
261110	Co-ordination Study Report		
260924	Lighting Controls Commissioning		
270000	Voice/Data Verification		
270000	Nurse Call Verification		
280000	Access Control Commissioning		
280000	Security System Commissioning		
283100	Fire Alarm Verification Report and Appendix C (FA)		
	Contractors Letter of Guarantee		
	Demonstration to Operating Staff agenda		
	Demonstrations Checklists (**EF 141**)		
	Substantial Performance Certificate (**EF143**)		
	Checklist of work remaining after Substantial (**EF 144**).		

NOTES:

.1 This list is provided as a checklist and may not include all Substantial Performance requirements.

1.12 EF 143 Certificate of Substantial Performance - Electrical

I hereby certify that I _____
am an employee / a principal /an agent

of _____

and have personally witnessed the following with regard to the electrical systems work specified for the above project and that to the best of my knowledge except as noted on **EF 144** (attached);

- The installation is complete and as specified.
- The systems have been commissioned and operate satisfactorily.
- Every control sequence and every control performs as specified.
- The systems are clean.
- All of the required submissions have been made to the consultant.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be completed and submitted to the consultant prior to substantial performance.

.2 If it is apparent that the systems or their operation are seriously deficient then all reasonable costs and consultant time charges relating to any subsequent site reviews shall be deducted from the contract sum.

1.13 EF 144 Check List – Work Remaining After Substantial Performance

		COMPLETION		
ITEM NO.	**DESCRIPTION**	**CLAIMED BY**	**DATE**	**VERIFIED DATE**

NOTES:

.1 This form must be filled in and submitted to the Consultant prior to substantial performance.

.2 Any discovered outstanding items will be added to the list by the Consultant. Copies of the complete list will be circulated to the Owner, the Architect and the Contractor.

.3 The Contractor may include estimated values against the outstanding work but determination of the actual amounts to be held will be made by the Consultant.

.4 The Contractor shall sign off each item as it is completed and submit the list monthly to the Consultant. When all items are signed off the completed list shall be submitted with the certificate of total performance **EF 145**.

1.14 EF 145 Certificate of Total Performance – Electrical

I hereby certify that I _____
am an employee / a principal / an agent

of _____

and have personally witnessed that each item of outstanding work on the checklist and record of work remaining after substantial completion EF 144 (attached) has been satisfactorily completed and I hereby certify that the Electrical systems work specified on the above project is complete.

SIGNED _____ DATE _____

NOTES:

.1 This certificate must be completed and submitted to the Consultant when requesting total performance.

.2 If it is apparent during the final review that the systems or their operation are seriously deficient then all reasonable costs and consultant time charges relating to any subsequent site reviews shall be deducted from the contract sum.

End of Section

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TO: Jay Dupras
Northern Health
UHN Cardiac Diagnostic Department

2024-09-02

RE: UHN Cardiac Diagnostic Department – Stress Test Room (355)

The minimum shielding requirements for your Stress Test Room (355) are noted on the charts and drawings on the following pages. These requirements incorporate distances, occupancy levels of the adjacent rooms and spaces, maximum x-ray tube potential, exam workloads, and any other variables as provided and noted.

Where a barrier encompasses an entrance (designated E1, E2, etc. on the drawing), the entrance will require a door with the same shielding capabilities as the surrounding barrier.

Where a barrier encompasses a window (designated W1, W2, etc. on the drawing) which is typically used to separate the exposure control position from the exam room, then the window will need to be constructed of Pb-glass or sufficient plate glass, with the same shielding capabilities as the surrounding barrier.

For all barriers/walls, the shielding needs to extend from the floor to a height of 2.17 meters (7 feet) above the floor for each barrier (including the door).

There is no requirement for shielding in the ceiling of this room.
There is no requirement for shielding in the floor of this room.

A summary table describing the requirements for shielding using Pb and other materials is provided on the next page. Detailed shielding calculations for each barrier are also presented in the table and drawing on the following pages.

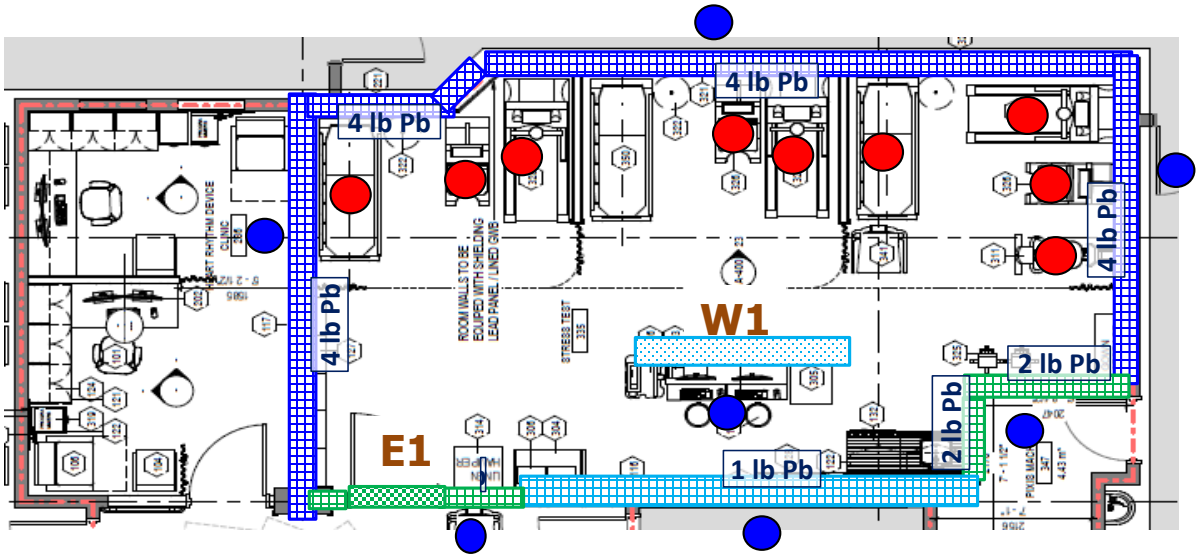
Should you have any questions regarding this report, please do not hesitate to contact our office, and we will be happy to assist you.

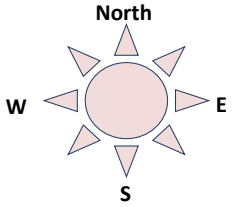
Sincerely,

Devin Baillie, PhD, MCCPM

Filipow Associates *info@filipow.ca*

UHN Cardiac Diagnostic Department - Stress Test Room (355) - MINIMUM Shielding Installation Diagram





E1 is an entrance that requires **2 lb Pb**

W1 is a window that requires **0.2 mm Pb** equivalent shielding.

N.B.: Diagram depicts **minimum** shielding requirements (you can always

- Radiation source (patient positions)
- Calculation Reference Points

	1 lb rolled Pb	2 lb rolled Pb	3 lb rolled Pb	4 lb rolled Pb	5 lb rolled Pb	6 lb rolled Pb	8 lb rolled Pb
Barrier							
Door							
Window							

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Detail - UHN Cardiac Diagnostic Department - Stress Test Room (355)

Maximum Number of Patients per Week: 60

Calculation Point	Occupancy	Design Goal (mGy/week)	Occupancy Corrected Design Goal (mGy/week)	Unshielded Dose (mGy/week)	Dose after Shielding (mGy/week)
Heart Rhythm Device Clinic	1	0.001	0.001	0.0270	0.0007
N Corridor	0.2	0.001	0.005	0.0362	0.0010
E Corridor	0.2	0.001	0.005	0.0268	0.0007
Pyxis	0.05	0.001	0.02	0.0031	0.0005
Mechanical Room	0.05	0.001	0.02	0.0017	0.0007
W Corridor	0.2	0.001	0.005	0.0039	0.0006
Control Console	1	0.02	0.02	0.0317	0.0126

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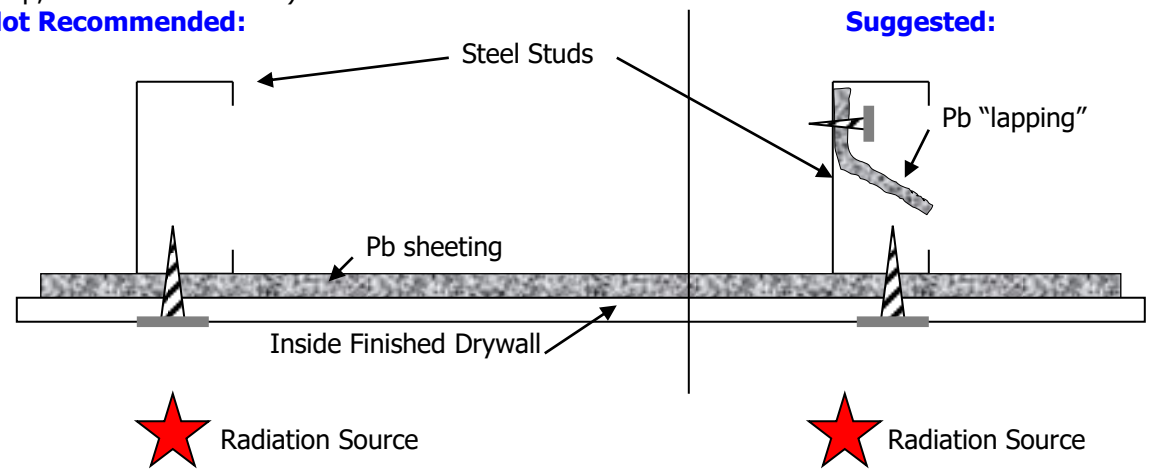
Considerations during Pb shielding installation (Proper Techniques):

A: All Pb sheeting installed must be rolled, and not forged.

B: All Pb in walls must cover from floor level to 7 feet height (2.13 meters)

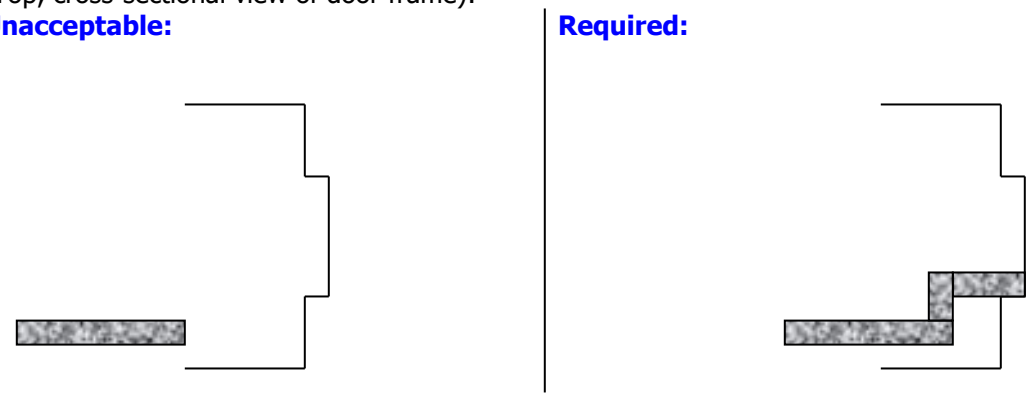
C: Drywall: Inside all studs or I-channels, run a "lapping" strip where drywall screw penetrations will occur (or run a Pb "lap" the entire length inside the stud), as shown below.

(Top, cross-sectional view)



D: Door Jambs. Extend Pb to completely abut interior of all door jambs, including sides and top.

(Top, cross-sectional view of door frame):



E: Astragals. There must be a Pb lined astragal to cover the gap between double door openings.

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F: **Window Jambs.** Extend Pb to completely abut interior of all window jambs, including sides and top. Similar to diagram above for door frame.

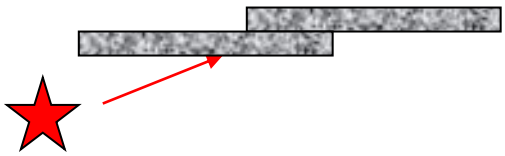
G: **Pb Overlap – Flat walls.** The Pb overlap should be arranged taking into consideration the location of the radiation source (x-ray tube, patient). The Pb overlap **should** be **2 cm**, and **must** be **> 1 cm**.

(Top, cross-sectional view)

Not Recommended:

Radiation Source

Suggested:

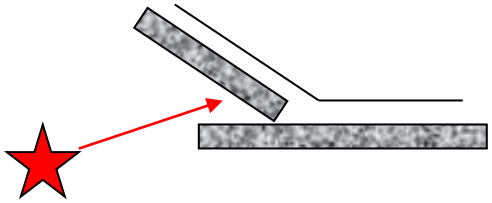


Radiation Source

H: **Pb Overlap - Angles.** The Pb overlap should to be arranged taking into consideration the location of the radiation source (x-ray tube, patient). The Pb overlap **should** be **2 cm**, and **must** be **> 1 cm**.

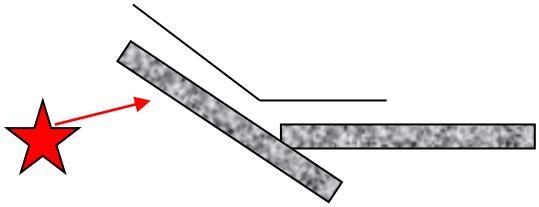
(Top, cross-sectional view)

Not Recommended:



Radiation Source

Suggested:



Radiation Source

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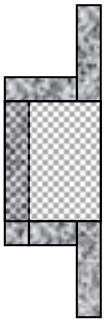
I: **Power, Data port penetration of Pb:**
Be generous with power box Pb lapping.

(Top, cross-sectional view):

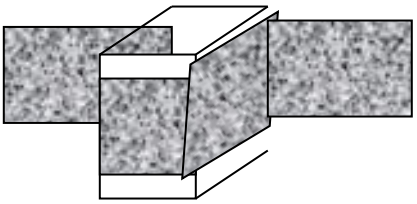
Unacceptable

Required:

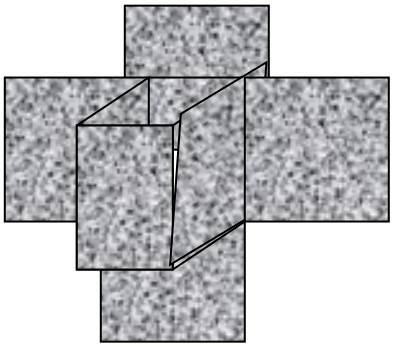


(back view):

Unacceptable



Required:



…… OR ……..

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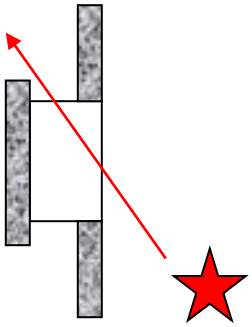
I (Optional): Power, Data port penetration of Pb:

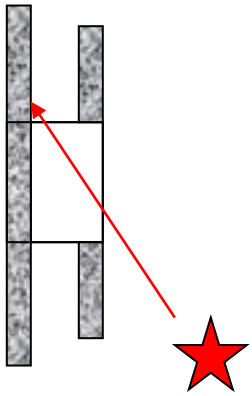
Be generous with power box Pb lapping.

(Top, cross-sectional view):

Unacceptable

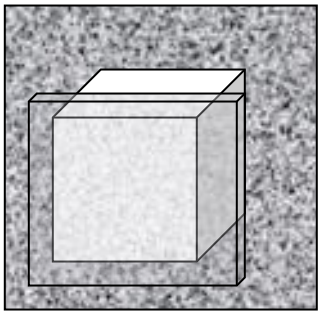


Acceptable:

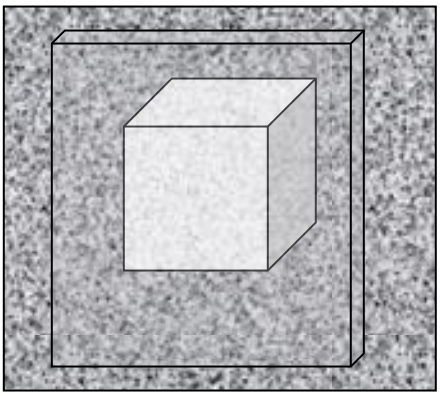


(back view):

Unacceptable



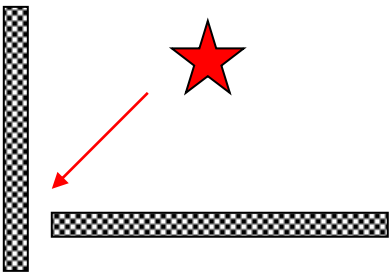
Acceptable:



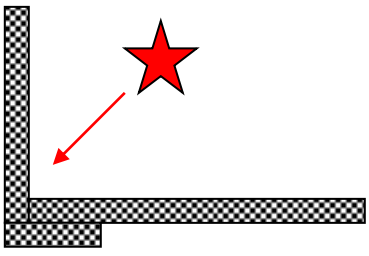
J: Corners.

(Top, cross-sectional view)

Unacceptable:



Required:



Filipow Associates *info@filipow.ca*
241 52313 Range Rd. 232, Sherwood Park AB, T8B 1B7
www.filipow.ca (780) 468-4833

K: Cosmetic: Ensure Pb on all walls is installed flat (without ripples) to ensure good, flat adhesion by drywall when gluing or attaching sheets.

SIGNED:

L.J. Filipow, D.Phil.

NRS ENGINEERING LTD
Consulting Electrical Engineers

University Hospital Northern BC Prince George

Electrical Switchgear Assessment

NRS File # N3035

September 2024

Executive Summary

NRS Engineering was engaged to review the electrical power distribution system at UHNBC campus located at 1475 Edmonton Street in Prince George, BC. The facility is a 5-floor (with penthouse) 219 bed level 3 trauma hospital originally constructed in 1960. The intent of the assessment is twofold:

1. Verify and catalog the location and condition of existing primary and secondary distributions systems
2. Estimate the remaining lifespan of all major components of the building electrical distribution system

The power distribution system is considered a high priority scope item as it's function and reliability are integral to the operation of the building. The remaining life cycle prediction of all major switchgear varies wildly and is summarized in the attached assessment spreadsheets.

Problem Analysis & System Assessments:

Details of Assessment Methods

The site was reviewed by NRS Engineering to visually assess and document the building primary and secondary distributions systems. No electrical testing was completed, but past reports were reviewed and assessment of previous problem areas reviewed. All switchgear, distribution panels, transformers, and motor control centres were located and included in the assessment scope.

System Assessments:

Main Electrical Service

The existing site is serviced with a 12,500V three phase high voltage service from two BC Hydro circuits into a high voltage transfer switch. This powers a lineup of disconnects to feed into the main transformers. That equipment was placed in approximately 2010. The main secondary and medium voltage distribution was relaced in 2023, with dual 3000kVA 12,500-347/600V dry type unit substation located in the old transformer vault within the powerhouse. This system arrangement consists of a pull pit, load break switch, isolation switch, electronic trip breaker, transformer, secondary distribution breaker section with associated BC Hydro metering.

The 347/600V secondary system consists of an essential and non-essential bus with 120/208V transformers located on each level to serve that floor area.

Much of the distribution system is original to the various building expansions, a few specific areas having been upgraded in recent years as a result of specific area renovations. Each existing system component was visually assessed, and the existing building single line was confirmed, the full assessment results are provided in Appendix A and the updated single line and switchgear location drawings are in Appendix C.

Based on published data a system of this type can have an expected operational life of 25-40 years and beyond with proper testing and maintenance.

Remaining Lifespan, Approach, Options, & Recommendations:

Main Electrical Service

Published transformer life expectancy values are typically based on maximum 100% loading and maximum winding temperature rise in a 40-degree Celsius ambient temperature environment. Table 2 below is based on research done by General Electric on transformer lifespan, it directly relates the life expectancy of the transformer to its operating environment and percentage of constant loading.

Table 2 – Transformer Life Expectancy as a function of Loading and Temperature Rise

Equivalent Contant Loading - %	Average Winding Rise - C°	Relative Life Expectancy – Times Normal Life
100	150	1
93	133	2
85	115	15
68	80	>100

From this data and the Hydro History consumption data of the building we can deduce that the transformers in this facility are not fully loaded, and several have been housed in an air-conditioned environment for there entire operating life.

Upon further application of the chart values above we can conclude that a transformer loaded to even 85% of its rated capacity in a 40 degree Celsius may exceed its relative life expectancy by 15 times.

The high voltage switches in the building were tested by Xcel in October of 2023. All high voltage equipment was cleaned, electrically tested, and lubricated. No abnormalities were identified by Wismer in any tests and the equipment was to be found in satisfactory operating condition and had suffered no apparent degradation in between testing periods.

Based on the information in Table 1 above and from discussions with Xcel we mutually concluded that the existing switches were in good operating condition and could last many times their published lifespan. To ensure continued trouble-free operation and for early identification of any abnormalities we propose to continue testing the high voltage equipment and on a 3-year annual basis. The results of all past and future tests can be compared, and any potential issues could be identified ideally before major problems occur.

Additionally, the testing scope should be expanded to include the secondary 600V essential and non-essential breakers for cleaning, lubrication and functional testing.

Remaining Distribution

All electrical 120/208V and 347/600V distribution panels in the East Tower were observed to be in good to fair operating condition. The majority of the panels are Schneider panels that are original to the building construction in approximately yr 2000. Spare breakers were confirmed to be readily available for all panels. No abnormalities were observed on any distribution panel during the site review.

As the secondary electrical equipment is functioning normally and can be readily serviced with spare parts our recommendation would be to continue operating the system and to replace parts on an as needed basis.

Most of the electrical equipment throughout the remaining portions of the building including generally 1960 construction and 1980 expansion are in poor to inadequate condition with several items critically inadequate. Some of this classification is simply due to the age of equipment with limited or non-existent spare parts, with several pieces of equipment found to be inoperative presenting risks to building use or operators.

Proposed Priority Upgrades

As noted, much of the electrical infrastructure has far exceeded its expected useful life and many pieces of equipment are at risk of imminent failure which will directly impact the facilities capability to provide adequate care.

We note below some items that appear to be of the highest priority for replacement.

Panel PB-3B and associated tie to PB-4B:

Panel PB-4B is a 1200A 277/480 panel fed from a non-essential 500KVA transformer in Electrical Room 6. Located in Level 1 Radiology area, this panel powers X-Ray 1 and 2, MRI trailer, and Nuclear Med. A 600A breaker in this panel sub feeds a key-interlocked manual transfer switch into panel PB-3B.

PB-3B-XFER is an 800A 4 Pole manual transfer switch with key interlock. This switch receives 600A NE power from PB-4B and 250A Essential power from SD-3A through 150KVA T-PB-3B. This transfer switch has a key interlock system, where the original intent was to open the breakers for some of the loads in PB-3B before transferring power to ensure sufficient capacity. Several loads have been added to this panel over time which has defeated the intent of the load shedding interlocks.

Panel PB-3B is an 800A 277/480V panel fed from manual transfer switch PB-3B-XFER. As such it is intended to operate all loads under Non-Essential power, or any single load could be selected through the key interlock system to operate on essential power.

We recommend that this arrangement be revised and replaced, eliminating key-interlock arrangements by providing adequate Essential Power for the load.

PB-40A and Related Switchgear:

PB-40A is located in mechanical room 154 adjacent to the Chem lab on level 0. During a recent power shutdown, the HV disconnect switch for the transformer, and the secondary breaker were both found to be non functional. The HV switch was cleaned and exercised, but the secondary breaker is tagged as non-functional and is a critical piece of electrical protection for much of the center core of the hospital.

Located in this electrical space, the oldest panels appear to be PB-40A, PB-40AA, PB-AB, SD-1, PNL-WW, PB-32A of which many are original to the 1960 Hospital construction. A number of breakers have been tagged out, and the remaining ones are unlikely to perform up to standard.

We recommend that all of these obsolete panels be replaced. This would be a good opportunity to reconfigure the connection between Essential, Vital and Non-Essential panels.

Electrical Room 6:

Electrical room 6 was built in 1980 with most of the equipment original to the build. Panels DV-2, NEW OR, SD-4A and SD-3A-2 are in good operating condition and have been installed in the last 1-20 years.

The medium voltage lineup DP-4 was recently serviced and with proper care and attention is likely to last for some time. It should be on the 10yr replacement list but placed at priority below the secondary equipment.

Panels SD-3A, SD-3A-1, PB-3A2, PB-4C and branch circuit panels E1Z, D1Z, E1B, D1H have exceed their expected useful life. Tie breakers to connect Essential and Non-Essential panels have been tagged out as the fuse panel case flexes during operation presenting unsafe condition which would be solved by a panel replacement. Panel PB-4C secondary main breaker is non-functional which presents a safety and operational risk to the facility.

Closure:

Class D replacement cost estimates have been prepared for replacement of all major switchgear items. These can be found in Appendix A.

We trust this report meets your present requirements. If you have any questions or comments, please contact the undersigned.

Sincerely,
NRS Engineering Ltd.

Prepared by:

Ray Ziemer, P.Eng.
President
NRS Engineering Ltd.
250.562.0551
ray@nrsengineering.ca

Appendices:

Appendix A - Replacement Cost Estimates

Appendix B – Switchgear Visual Condition Assessment

Appendix C – Updated single line and Panel locations Drawings

Appendix D – GE transformer Study

UHNBCPG - Electrical Systems Class D Costing

Item	Units	Qty	SUPPLY	INSTALL	Extended Amount
DP-4 12.5kV Switchgear Replacement Elec Rm 6					
Supply of Main and four switches	L.S.	1	$225,000		$225,000
Installation of Equipment	L.S.	1		$100,000	$100,000
Generator Rental	L.S.	1	$165,000		$165,000
Demolition	L.S.	1		$50,000	$50,000
Feeders	L.S.	1	$85,000		$85,000
Commissioning	L.S.	1	$45,000		$45,000
DP-4 Subtotal					**$670,000**
12.5kV Transformer Replacement Elec Rm 6					
T-PB-4C 450KVA 12.5kv-120/208	L.S.	1	$125,000	$75,000	$200,000
TSD-4A 500KVA 12.5kv-347/600	L.S.	1	$125,000	$75,000	$200,000
T-PB-40B 500KVA 12.5kv - 277/480	L.S.	1	$125,000	$75,000	$200,000
T-PB-3A 300KVA 12.5kv - 120/208	L.S.	1	$100,000	$75,000	$175,000
Electrical Room 6 Transformers					**$775,000**
Electrical Room 6 Larger Panels					
SD-3A 1200A 347/600		1	$100,000	$45,000	$145,000
SD-3A-2 1600A 120/208		1	$125,000	$45,000	$170,000
PB-4C 2000A 120/208		1	$225,000	$60,000	$285,000
Electrical Room 6 Large Panels					**$600,000**
PB-3B and PB-4B Radiology					
PB-4B 1600A 277/480		1	$140,000	$60,000	$200,000
PB-3B-XFER 800A transfer switch Remove and Revise Feeds		1	$125,000	$45,000	$170,000
PB-3B 800A 277/480		1	$100,000	$45,000	$145,000
PB-3B and PB-4B					**$515,000**
Secondary Panel Replacement (400A)					
Supply and Install of new Panel	L.S.	29	$30,000	$15,000	**$1,305,000**
Secondary Panel Replacement (225A and smaller)					
Supply and Install of new Panel	L.S.	215	$8,500	$8,500	**$3,655,000**
Typical MCC Replacement					
Supply and Install of new MCC Section	L.S.	32	$20,000	$15,000	**$1,120,000**
600v or Less Tranformer Replacement					
Supply and Install of new 300kVA transformer	L.S.	2	$35,000	$15,000	$100,000
Supply and Install of new 150kVA transformer	L.S.	5	$22,500	$7,500	$150,000
Supply and Install of new 75kVA transformer	L.S.	5	$15,000	$7,500	$112,500
Supply and Install of new 45kVA transformer	L.S.	2	$12,500	$7,500	$40,000
Supply and Install of new 30kVA transformer	L.S.	2	$10,000	$7,500	$35,000
Small Transformer Subtotal					**$437,500**

Summary

Electrical		$9,077,500
IPAC @	15%	$1,361,625
Contingency @	15%	$1,361,625
Engineering @	10%	$907,750
Total* (including contingency)		$12,708,500

(* does not include applicable taxes)

Condition Rating Criteria

Condition	Description
Good	-Meets or exceeds code requirements -No repairs warranted
Fair	-Appears to meet code requirements -Minor repairs can be undertaken, but not necessary - Approaching end of expected useful life
Poor	-May not meet code requirements -Minor repairs required to bring up to code -Has exceeded expected life and parts will be scarce or unavailable
Inadequate	-May not meet current code requirements -Significant repairs are required to bring up to code -Risk of injury, or significant damage to related components is possible
Critically Inadequate	-Does not meet code requirements -Significant repairs are required to bring up to code -Risk of injury, or significant damage to related component is high -Component has failed, or failure is imminent

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: UNBC Space
Asset Number: 1

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
1.01 - E	PANEL 2M	Branch Panel	Good	Approx 2000	25-40 Years	Yes	None
1.02 - E	PANEL 2A	Branch Panel	Good	Approx 2000	25-40 Years	Yes	None
1.03 - E	PANEL 2B	Branch Panel	Good	Approx 2000	25-40 Years	Yes	None
1.04 - E	PANEL 2L	Branch Panel	Good	Approx 2000	25-40 Years	Yes	None
1.05 - E	TRANSFORMER	150KVA 600-120/208	Good	Approx 2000	25-40 Years	N/A	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: Level 0 Old
Asset Number: 2

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
2.01 - E	Panel U		Poor	Building Construction	25-40 YEARS	Yes	None
2.02 - E	Panel V		Poor	Building Construction	25-40 YEARS	Yes	None
2.03 - E	Panel W		Poor	Building Construction	25-40 YEARS	Yes	None
2.04 - E	Panel X		Poor	Building Construction	25-40 YEARS	Yes	None
2.05 - E	Panel Y		Poor	Building Construction	25-40 YEARS	Yes	None
2.06 - E	Panel Z		Poor	Building Construction	25-40 YEARS	Yes	None
2.07 - E	PANEL T		Good	APPROX 2023	25-40 YEARS	Yes	None
2.08 - E	Panel E		Poor	Building Construction	25-40 YEARS	Yes	None
2.09 - E	Panel C		Poor	Building Construction	25-40 YEARS	Yes	None
2.10 - E	PANEL D		Poor	Building Construction	25-40 YEARS	Yes	None

2.11 - E	Panel F		Poor	Building Construction	25-40 YEARS	Yes	None
2.12 - E	Panel F1		Fair	Building Construction	25-40 YEARS	Yes	None
2.13 - E	Panel H		Fair	Building Construction	25-40 YEARS	Yes	None
2.14 - E	MCC-2	LOCATED UNDER STAIRS, VERY OLD	Inadequate	Building Construction	25-40 YEARS	NO	None
2.15 - E	PNL D1A		Fair	Building Construction	25-40 YEARS	Yes	None
2.16 - E	PNL G		Poor	Building Construction	25-40 YEARS	Yes	None
2.17 - E	PNL E1A		Poor	Building Construction	25-40 YEARS	Yes	None
2.18 - E	PANEL D1B		Poor	Building Construction	25-40 YEARS	N/A	None
2.19 - E	PANEL D1C		Poor	Building Construction	25-40 YEARS	Yes	None
2.20 - E	PANEL D1D		Poor	Building Construction	25-40 YEARS	Yes	None
2.21 - E	PANEL D1F		Poor	Building Construction	25-40 YEARS	Yes	None
2.22 - E	Panel UPS-OC-A		Fair	Building Construction	25-40 YEARS	Yes	None

2.23 - E	Panel UPS-OC-B		Fair	Building Construction	25-40 YEARS	Yes	NOT IN SERVICE
2.24 - E	Panel 3E-0-AC-1		Fair	Building Construction	25-40 YEARS	Yes	None
2.25 - E	Panel A ESS		Fair	Building Construction	25-40 YEARS	Yes	None
2.26 - E	Panel UPS OA		Poor	Building Construction	25-40 YEARS	Yes	None
2.27 - E	Panel UA-OB		Poor	Building Construction	25-40 YEARS	Yes	None
2.28 - E	Panel PA		Inadequate	Building Construction	25-40 YEARS	NO	None
2.29 - E	PNL P		Inadequate	Building Construction	25-40 YEARS	NO	None
2.30 - E	PNL S		Inadequate	Building Construction	25-40 YEARS	NO	None
2.31 - E	PNL SC		Inadequate	Building Construction	25-40 YEARS	NO	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: Elec Rm 1
Asset Number: 3

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
3.01 - E	Panel EIC		Poor	Building Construction	25-40 YEARS	Yes	None
3.02 - E	Panel DC3		Good	Building Construction	25-40 YEARS	Yes	None
3.03 - E	Panel 40AA		Critically Inadequate	Building Construction	25-40 YEARS	NO	None
3.04 - E	Panel 40AB		Critically Inadequate	Building Construction	25-40 YEARS	NO	None
3.05 - E	Panel SD-1		Poor	Building Construction	25-40 YEARS	NO	None
3.06 - E	Panel UPS		Good	Building Construction	25-40 YEARS	Yes	None
3.07 - E	Panel UPS-1B		Fair	Building Construction	25-40 YEARS	N/A	None
3.08 - E	Panel PB-40A		Inadequate	Building Construction	25-40 YEARS	NO	None
3.09 - E	Panel D1X		Poor	Building Construction	25-40 YEARS	Yes	None
3.10 - E	Panel IG		Poor	Building Construction	25-40 YEARS	Yes	None

3.11 - E	Panel WA		Poor	Building Construction	25-40 YEARS	Yes	None
3.12 - E	Panel PB-32A		Poor	Approx YR 2000	25-40 YEARS	NO	None
3.13 - E	Panel - WW		Poor	Building Construction	25-40 YEARS	Yes	None
3.14 - E	Panel PB-32AA		Fair	Approx 2003	25-40 YEARS	Yes	None
3.15 - E	Panel 40AC		Good	Building Construction	25-40 YEARS	N/A	Fused switchboard
3.16 - E	Medium Voltage incoming DP-4A		Poor	Building Construction	25-40 YEARS	N/A	None
3.17 - E	Medium Voltage Transformer		Fair	Building Construction	25-40 YEARS	N/A	None
3.18 - E	PB-40A Secondary Main Breaker		Critically Inadequate	Building Construction	25-40 YEARS	NO	None
3.19 - E	T-PB-40AA		Good	APPROX 2002	25-40 YEARS	N/A	None
3.20 - E	TX-SP11	300KVA 208-347/600	Good	APPROX 2002	25-40 YEARS	N/A	None
3.21 - E	T-PB-32A	225KVA 600-120/208	Poor	APPROX 1981	25-40 YEARS	N/A	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: Elec Rm 6
Asset Number: 4

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
4.01 - E	DP-4	Incoming medium voltage switches	Poor	Building Construction	25-40 YEARS	NO	None
4.02 - E	DV-2	FEDERAL PIONEER	Good	APPROX 2000	25-40 YEARS	Yes	None
4.03 - E	SD-3A-2	EATON PANEL	Good	APPROX 2010	25-40 YEARS	Yes	None
4.04 - E	SD-3A		Poor	APPROX 1980	25-40 YEARS	Yes	None
4.05 - E	PB-3A2		Inadequate	APPROX 1980	25-40 YEARS	Yes	None
4.06 - E	PB-4C		Inadequate	Building Construction	25-40 YEARS	N/A	None
4.07 - E	PB-4C MAIN BREAKER	450KVA 12500-120/208	Critically Inadequate	Building Construction	25-40 YEARS	Yes	None
4.08 - E	T-PB-4C		Poor	Building Construction	25-40 YEARS	N/A	None
4.09 - E	SD-4A	SCHNEIDER	Good	APPROX 2024	25-40 YEARS	Yes	None
4.10 - E	D1Z	FEDERAL PIONEER	Poor	Building Construction	25-40 YEARS	Yes	None

4.11 - E	NEW OR PANEL	EATON	Good	APPROX 2015	25-40 YEARS	Yes	None
4.12 - E	D1H		Poor	Building Construction	25-40 YEARS	Yes	None
4.13 - E	EIB		Poor	Building Construction	25-40 YEARS	N/A	None
4.14 - E	DV-2		Good	APPROX 2000	25-40 YEARS	Yes	None
4.15 - E	E1Z		Poor	Building Construction	25-40 YEARS	N/A	None
4.16 - E	T-PB-IFL	225KVA 600-277/480	Good	APPROX 2020	25-40 YEARS	N/A	None
4.17 - E	T-PB-3A	300KVA 600-120/208	Poor	Building Construction	25-40 YEARS	N/A	None
4.18 - E	T-OR-8	112.5KVA 600-277/480	Fair		25-40 YEARS	N/A	None
4.19 - E	NEW OR TRANSFORMER	225KVA 600-120/208	Good	APPROX 2015	25-40 YEARS	Yes	None
4.20 - E	BREAKER ON WALL	EMERGENCY POWER TO PANEL PB-3B	Poor	Building Construction	25-40 YEARS	N/A	None
4.21 - E	T-PB-3B	150KVA 600-277/480	Poor	APPROX 1980	25-40 YEARS	N/A	None
4.22 - E	T-SD-4B	12500-480/277	Poor	Building Construction	25-40 YEARS	N/A	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: Level 0 East Tower
Asset Number: 5

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
5.01 - E	PANEL OEA		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
5.02 - E	PANEL ONA		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
5.03 - E	PANEL OEB		Good	APROX YEAR 2000	25-40 YEARS	N/A	None
5.04 - E	PANEL ONB		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
5.05 - E	PANEL OND		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
5.06 - E	PANEL OED		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
5.07 - E	PANEL OEF		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
5.08 - E	PANEL ONF		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: Level 1 East Tower
Asset Number: 6

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
6.01 - E	PANEL 1NA		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
6.02 - E	PANEL 1EA		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
6.03 - E	PANEL 1NB		Good	APROX YEAR 2000	25-40 YEARS	N/A	None
6.04 - E	PANEL 1EB		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
6.05 - E	PANEL 1NC		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
6.06 - E	PANEL 1EC		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
6.07 - E	PANEL PB-12		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
6.08 - E	PANEL U1A		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
6.09 - E	PANEL 1ND		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
6.10 - E	PANEL 1ED		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: Level 1 Old
Asset Number: 7

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
7.01 - E	PANEL 1EW		Fair	APROX YEAR 2000	25-40 YEARS	Yes	None
7.02 - E	PANEL 1EX		Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
7.03 - E	PANEL 1EV		Fair	APROX YEAR 2000	25-40 YEARS	N/A	None
7.04 - E	PANEL 1ER		Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
7.05 - E	PANEL 1ES		Fair	APROX YEAR 2000	25-40 YEARS	Yes	None
7.06 - E	PANEL 1ET		Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
7.07 - E	PANEL 1EU		Fair	APROX YEAR 2000	25-40 YEARS	Yes	None
7.08 - E	PANEL 6A		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: Level 2 East Tower
Asset Number: 8

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
8.01 - E	PANEL 2NA		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
8.02 - E	PANEL 2EA		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
8.03 - E	PANEL 2NB		Good	APROX YEAR 2000	25-40 YEARS	N/A	None
8.04 - E	PANEL 2EB		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
8.05 - E	PANEL 2NC		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
8.06 - E	PANEL 2EC		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
8.07 - E	PANEL PB-15		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
8.08 - E	PANEL U2A		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
8.09 - E	PANEL 2ED		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
8.10 - E	PANEL 2EF		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: Level 2 Old
Asset Number: 9

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
9.01 - E	PANEL 2CE		Fair	Approx 2000	25-40 YEARS	Yes	None
9.02 - E	PANEL 2NE		Fair	Approx 2000	25-40 YEARS	Yes	None
9.03 - E	PANEL 2SE		Fair	Approx 2000	25-40 YEARS	N/A	None
9.04 - E	PANEL 2EL		Fair	Approx 2000	25-40 YEARS	Yes	None
9.05 - E	PANEL 2A		Fair	Approx 2000	25-40 YEARS	Yes	None
9.06 - E	PANEL PB-2A		Inadequate	BUILDING CONSTRUCTION	25-40 YEARS	Yes	None
9.07 - E	PANEL PB-2B		Fair	Approx 2000	25-40 YEARS	Yes	None
9.08 - E	PANEL 2EJ		Fair	Approx 2000	25-40 YEARS	Yes	None
9.09 - E	PANEL 2EK		Fair	Approx 2000	25-40 YEARS	Yes	None
9.10 - E	PANEL 2NJ		Fair	Approx 2000	25-40 YEARS	Yes	None

9.11 - E	PANEL 2NK		Fair	Approx 2000	25-40 YEARS	Yes	None
9.12 - E	PANEL 2NN		Fair	Approx 2000	25-40 YEARS	Yes	None
9.13 - E	PANEL 2CN		Fair	Approx 2000	25-40 YEARS	Yes	None
9.14 - E	PANEL 2SN		Fair	Approx 2000	25-40 YEARS	Yes	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer

Asset Description: Level 3 Old
Asset Number: 10

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
10.01 - E	PANEL 3A		Poor	APROX YEAR 2000	25-40 YEARS	Yes	None
10.02 - E	PANEL 3B		Poor	APPROX YEAR 2000	25-40 YEARS	Yes	None
10.03 - E	PANEL SD-2		Inadequate	APROX YEAR 2000	25-40 YEARS	N/A	None
10.04 - E	MCC-3B		Poor	APPROX YEAR 2000	25-40 YEARS	Yes	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer

Asset Description: Level 3 East Tower
Asset Number: 11

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
11.01 - E	PANEL 3NA		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
11.02 - E	PANEL 3EA		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
11.03 - E	PANEL 3NB		Good	APROX YEAR 2000	25-40 YEARS	N/A	None
11.04 - E	PANEL 3EB		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
11.05 - E	PANEL 3NC		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
11.06 - E	PANEL 3EC		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
11.07 - E	PANEL PB-13		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
11.08 - E	PANEL U3A		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
11.09 - E	PANEL 3ED		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
			Good	APPROX YEAR 2000	25-40 YEARS	Yes	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Project: UHNBC - Electrical Systems
Date: September 1, 2024
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: PENTHOUSE East Tower
Asset Number: 12

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
12.01 - E	PANEL DP-UPS		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
12.02 - E	PANEL PB-10		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
12.03 - E	PANEL PB-11		Good	APROX YEAR 2000	25-40 YEARS	N/A	None
12.04 - E	PANEL SD-13		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
12.05 - E	PANEL DP-ELEV		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
12.06 - E	PNL 4EA		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
12.07 - E	PNL 4NA		Good	APROX YEAR 2000	25-40 YEARS	Yes	None
12.08 - E	PNL U4A		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
12.09 - E	MCC-20N		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None
12.10 - E	MCC-20E		Good	APPROX YEAR 2000	25-40 YEARS	Yes	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer

Asset Description: Level 4 Old
Asset Number: 13

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
13.01 - E			Fair	APROX YEAR 2000	25-40 YEARS	Yes	None
			Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
			Fair	APROX YEAR 2000	25-40 YEARS	N/A	None
			Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
			Fair	APROX YEAR 2000	25-40 YEARS	Yes	None
			Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
			Fair	APROX YEAR 2000	25-40 YEARS	Yes	None
			Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
			Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
			Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer

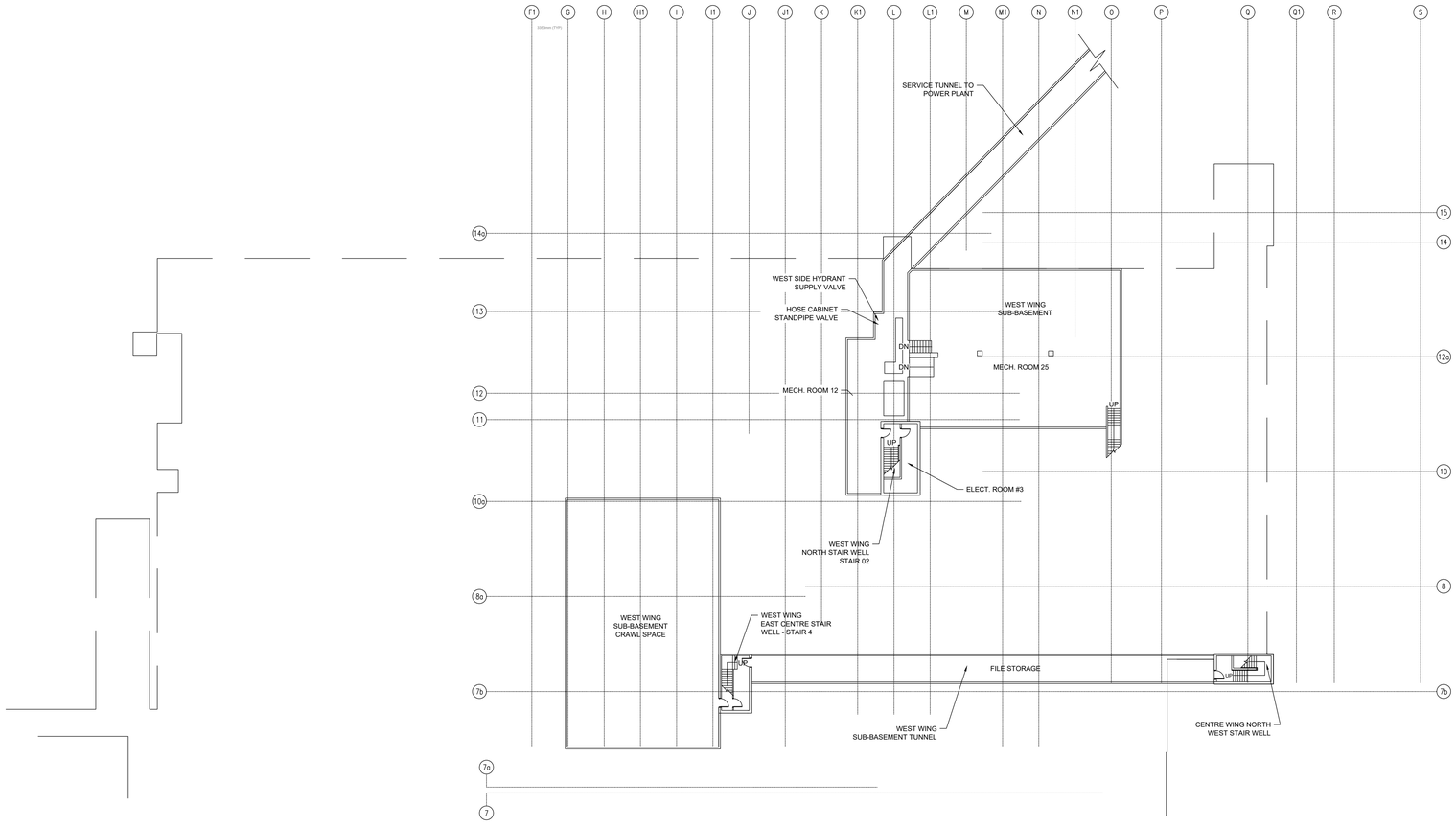
Asset Description: Level 5 Old
Asset Number: 14

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
14.01 - E	PNL 5EA		Fair	APROX YEAR 2000	25-40 YEARS	Yes	None
14.02 - E	PNL 5NA		Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
14.03 - E	PNL PB-40AD		Fair	APROX YEAR 2000	25-40 YEARS	N/A	None
14.04 - E	PNL PB-32AB		Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
14.05 - E	PNL 5NC		Fair	APROX YEAR 2000	25-40 YEARS	Yes	None
14.06 - E	PNL 5EB		Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None
14.07 - E	PNL 5NB		Fair	APROX YEAR 2000	25-40 YEARS	Yes	None
14.08 - E	PNL 5ND		Fair	APPROX YEAR 2000	25-40 YEARS	Yes	None

APPENDIX A - VISUAL CONDITION INSPECTION REPORT

Project Number: N3035
Date: September 1, 2024
Project: UHNBC - Electrical Systems
Inspection Type: Electrical (E)
Inspector Name: Ray Ziemer
Asset Description: PENTHOUSE OLD
Asset Number: 15

I.D.	Inspection Item	Ratings	Condition Rating	Installation Year	Design Life	Spare Breakers Readily Available	Comments
15.01 - E	PNL E		Inadequate	APPROX 1960	25-40 YEARS	NO	None
15.02 - E	PNL F		Inadequate	APPROX 1960	25-40 YEARS	NO	None
15.03 - E	PNL 6NA		Good	APROX YEAR 2000	25-40 YEARS	YES	None
15.04 - E	PNL 6EB		Good	APPROX YEAR 2000	25-40 YEARS	YES	None



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SUB BASEMENT & TUNNELS

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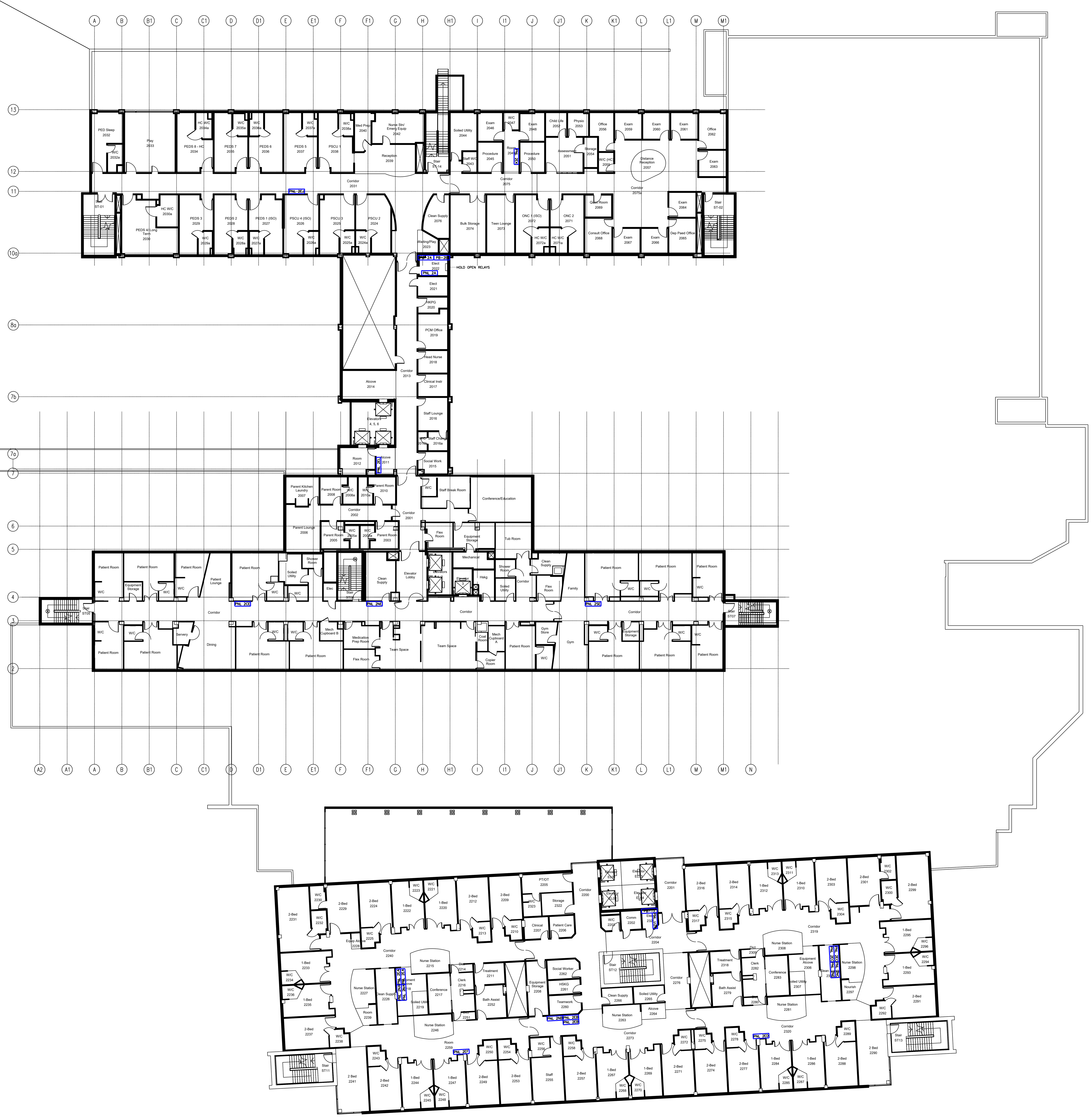

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LEVEL 3

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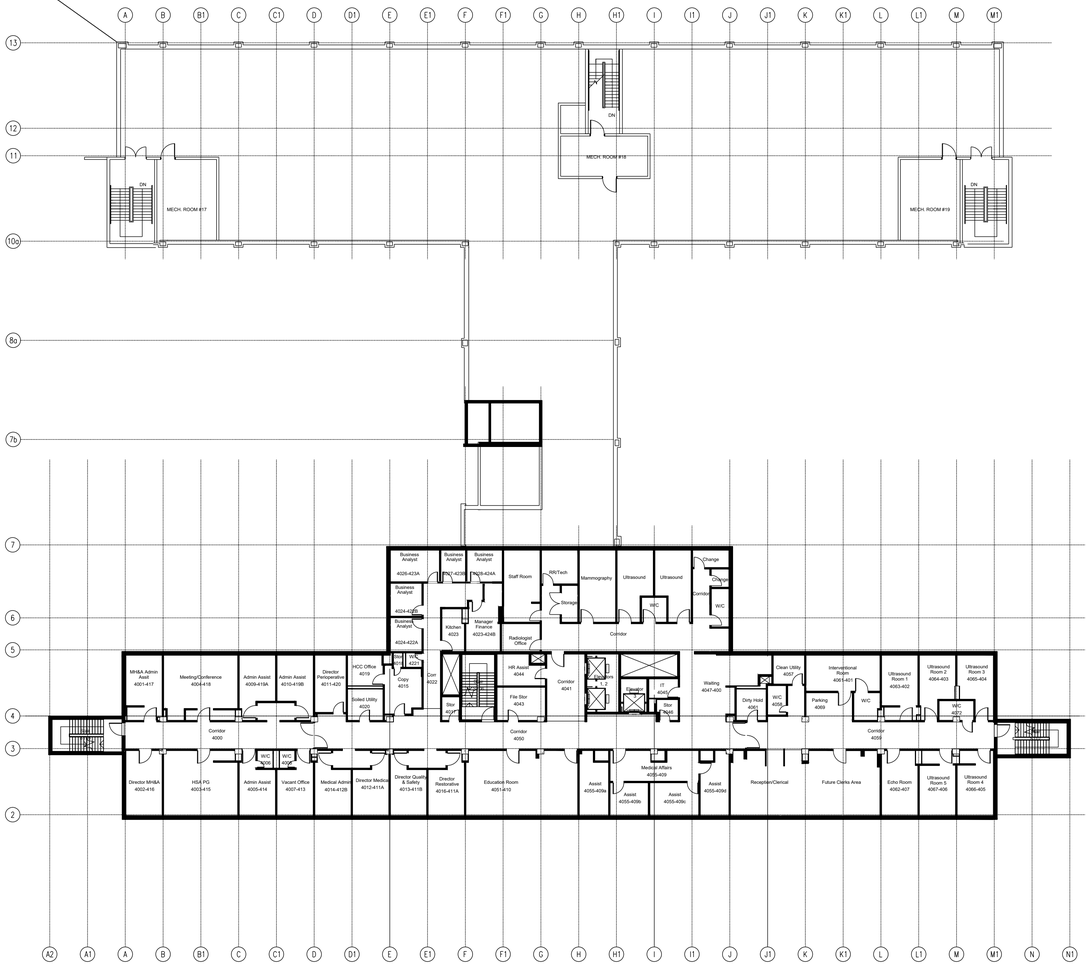

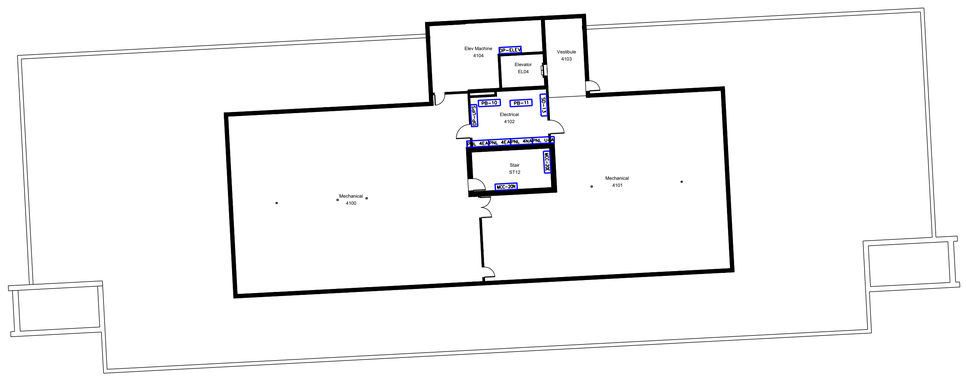

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LEVEL 4

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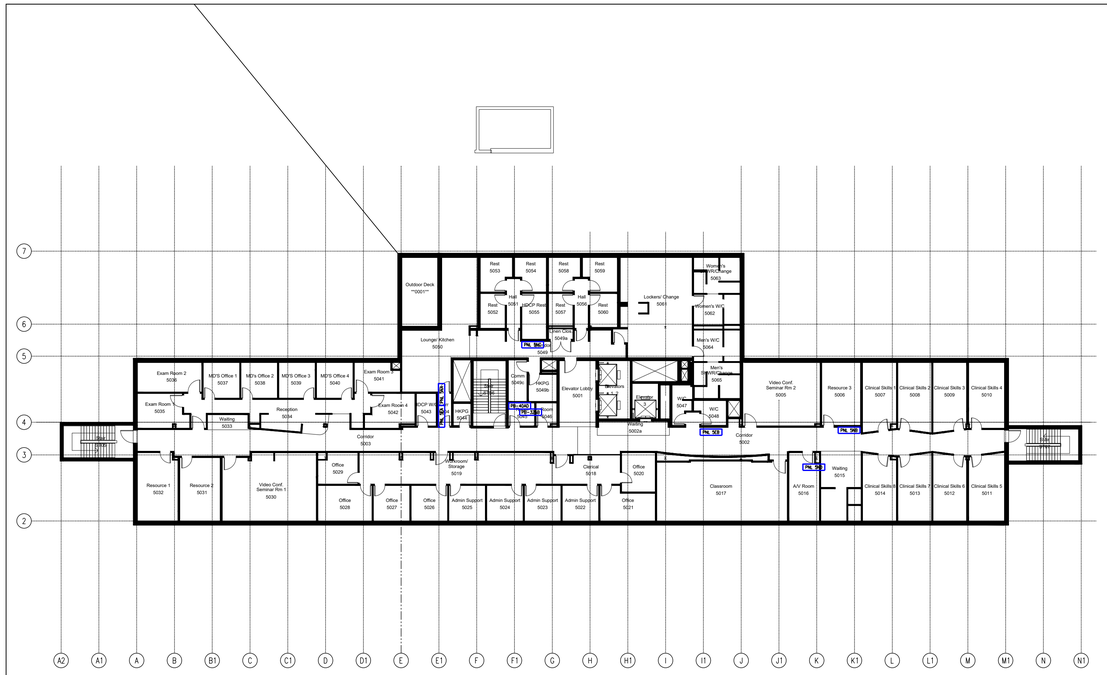

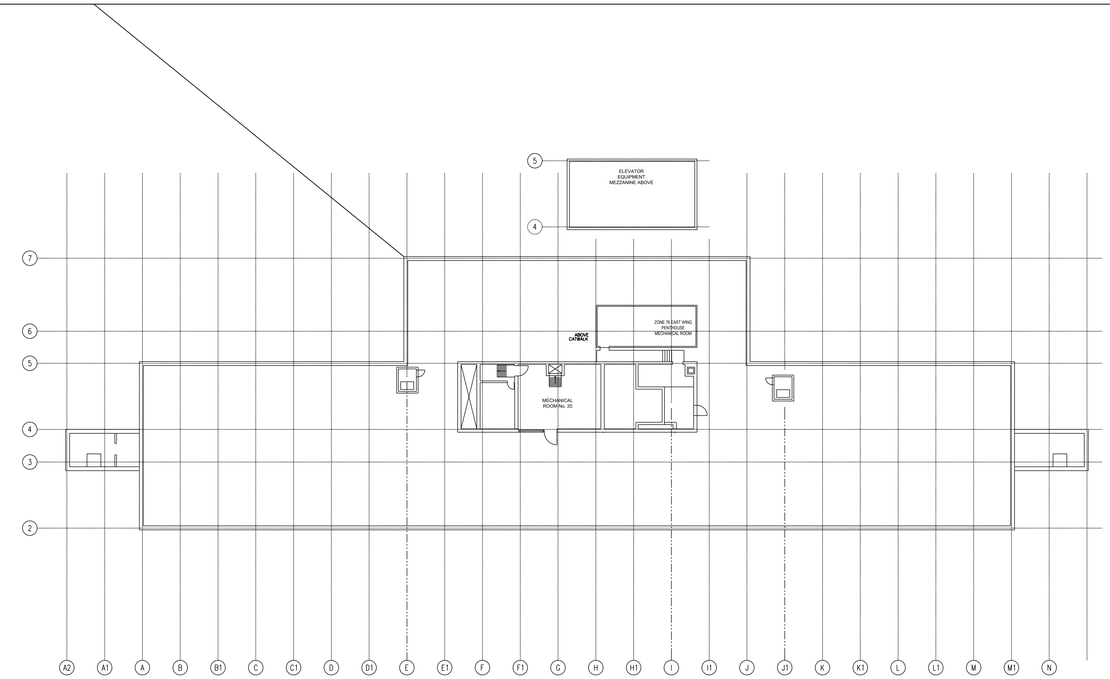

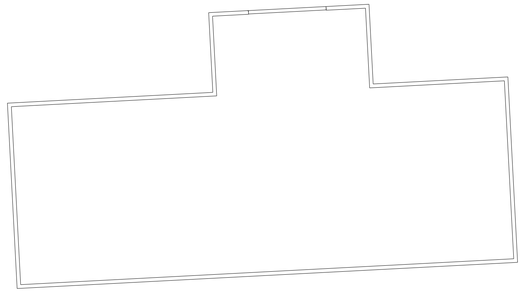

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LEVEL 5

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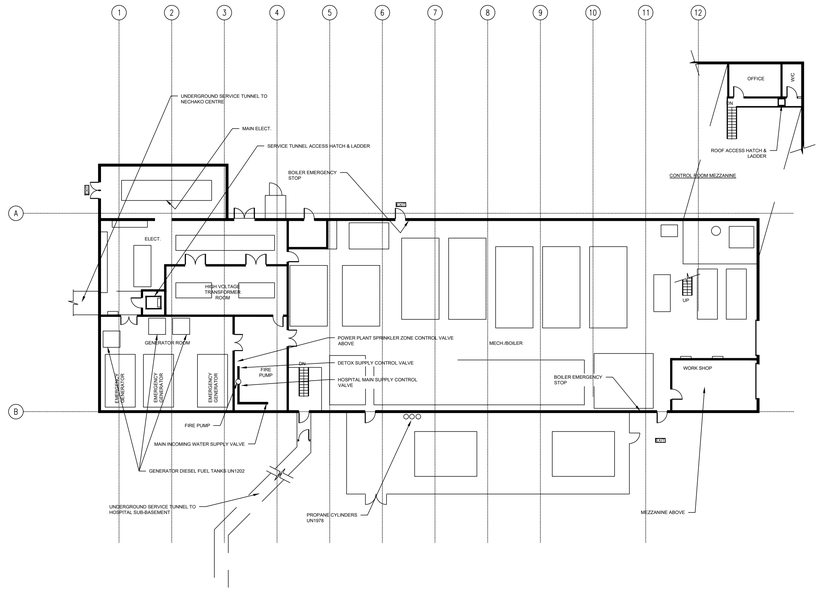

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POWER PLANT

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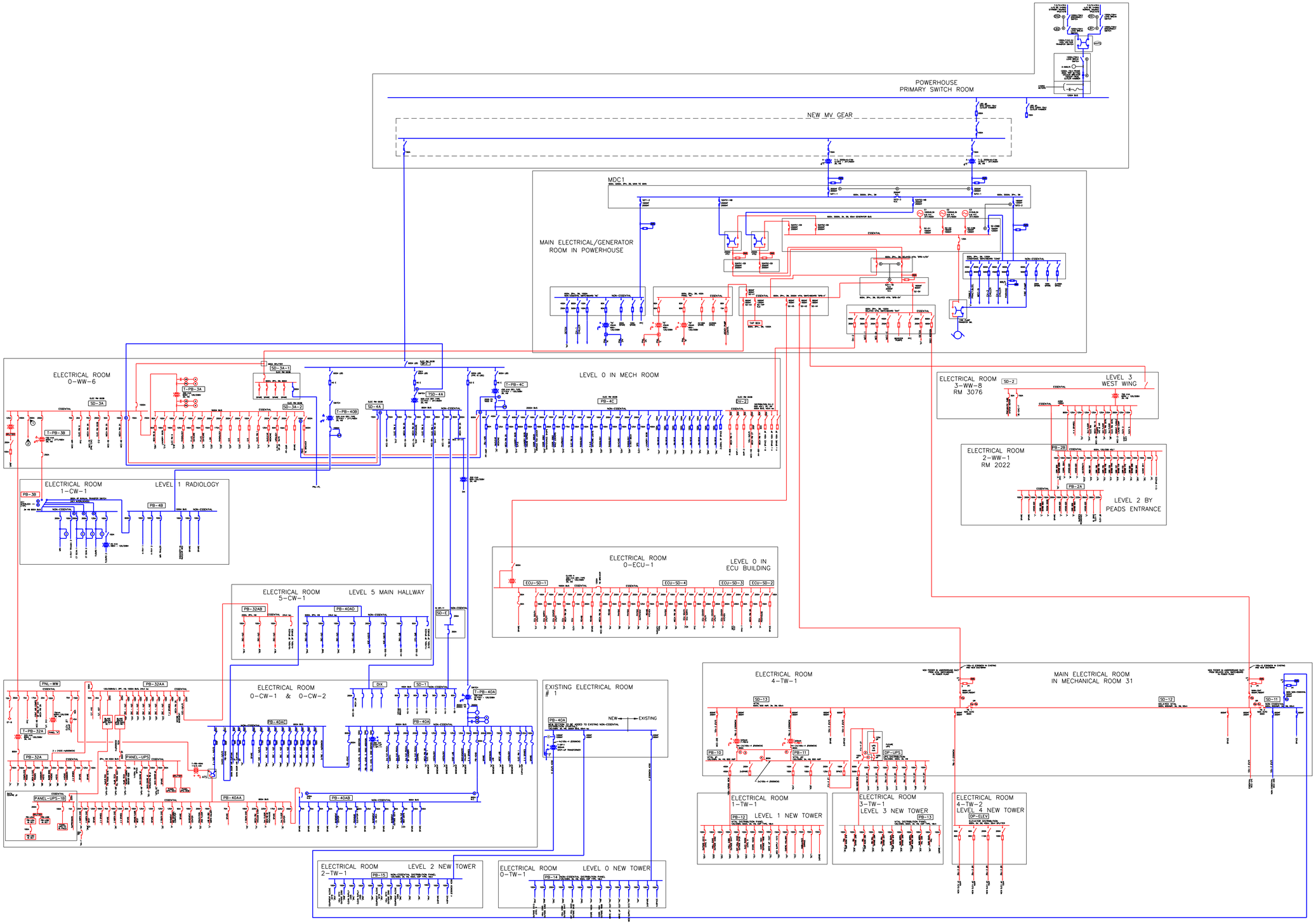
POWERHOUSE
PRIMARY SWITCH ROOM
NEW MV GEAR
MDC1
MAIN ELECTRICAL/GENERATOR
ROOM IN POWERHOUSE
ELECTRICAL ROOM
0-WW-6
LEVEL 0 IN MECH ROOM
ELECTRICAL ROOM
3-WW-8
RM 3076
LEVEL 3
WEST WING
ELECTRICAL ROOM
2-WW-1
RM 2022
LEVEL 2 BY
PEADS ENTRANCE
ELECTRICAL ROOM
1-CW-1
LEVEL 1 RADIOLOGY
ELECTRICAL ROOM
5-CW-1
LEVEL 5 MAIN HALLWAY
ELECTRICAL ROOM
0-ECU-1
LEVEL 0 IN
ECU BUILDING
ELECTRICAL ROOM
0-CW-1 & 0-CW-2
EXISTING ELECTRICAL ROOM
#1
NEW
EXISTING
ELECTRICAL ROOM
4-TW-1
MAIN ELECTRICAL ROOM
IN MECHANICAL ROOM 31
ELECTRICAL ROOM
1-TW-1
LEVEL 1 NEW TOWER
ELECTRICAL ROOM
3-TW-1
LEVEL 3 NEW TOWER
ELECTRICAL ROOM
4-TW-2
LEVEL 4 NEW TOWER
ELECTRICAL ROOM
2-TW-1
LEVEL 2 NEW TOWER
ELECTRICAL ROOM
0-TW-1
LEVEL 0 NEW TOWER

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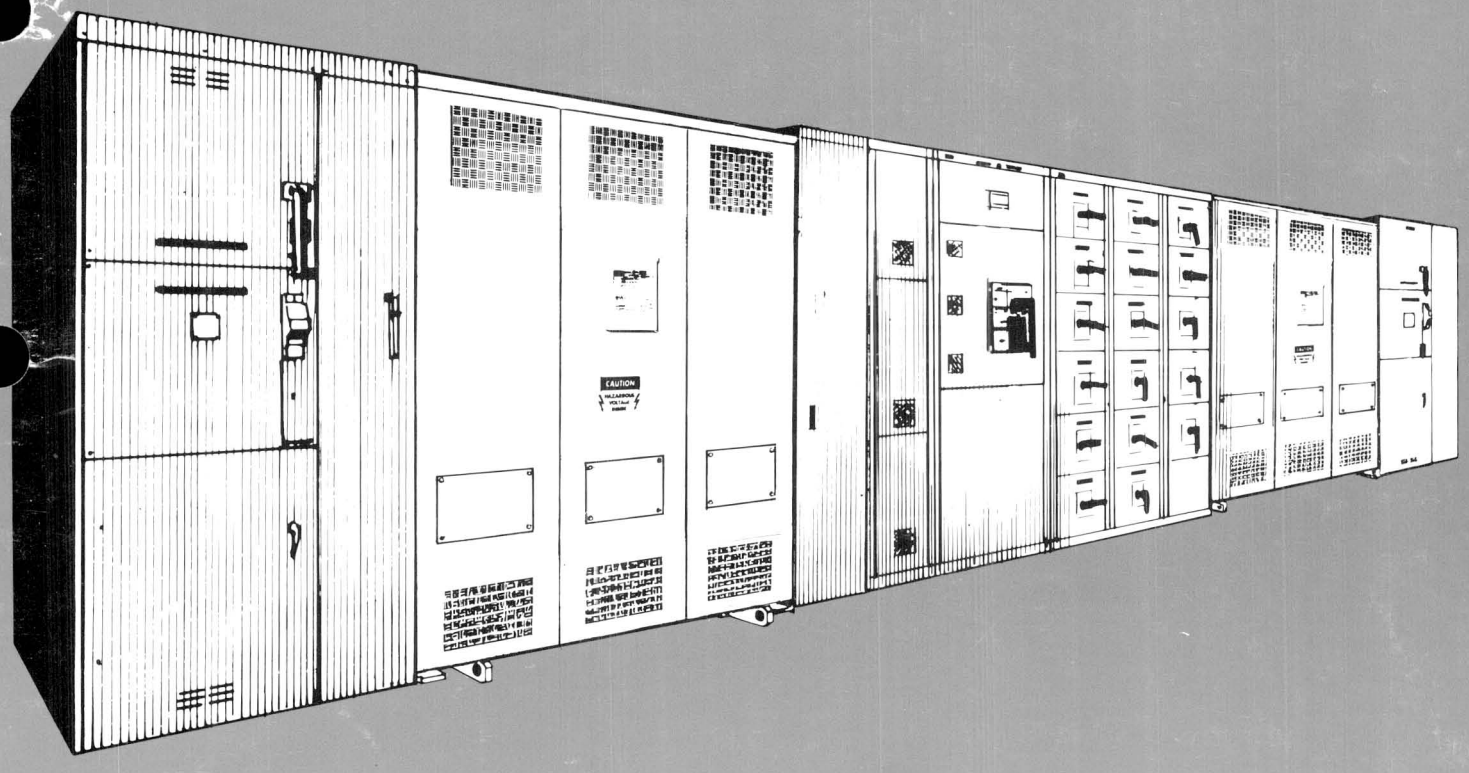


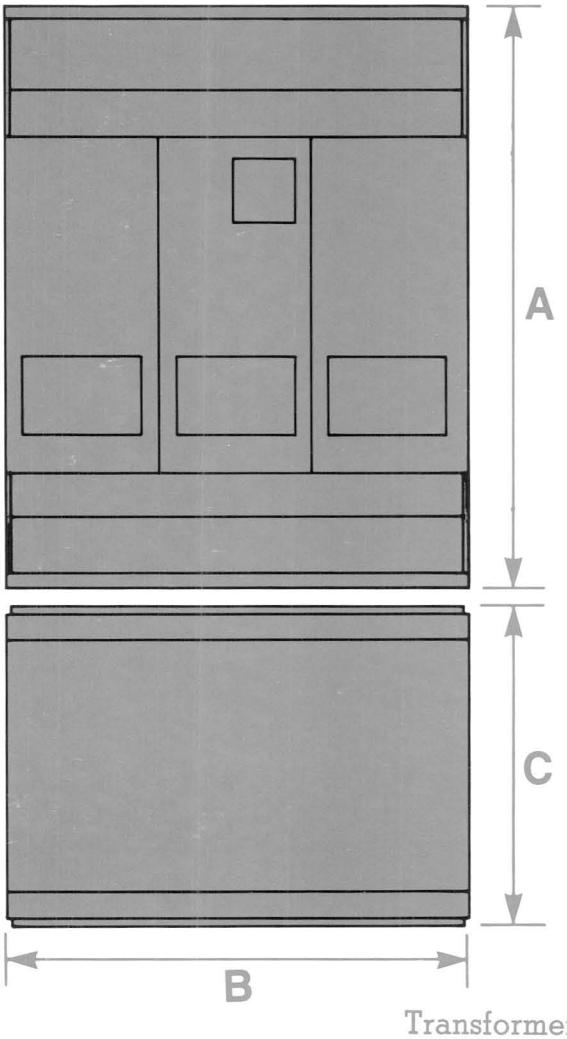
Ventilated Dry-Type Secondary Substation Transformers

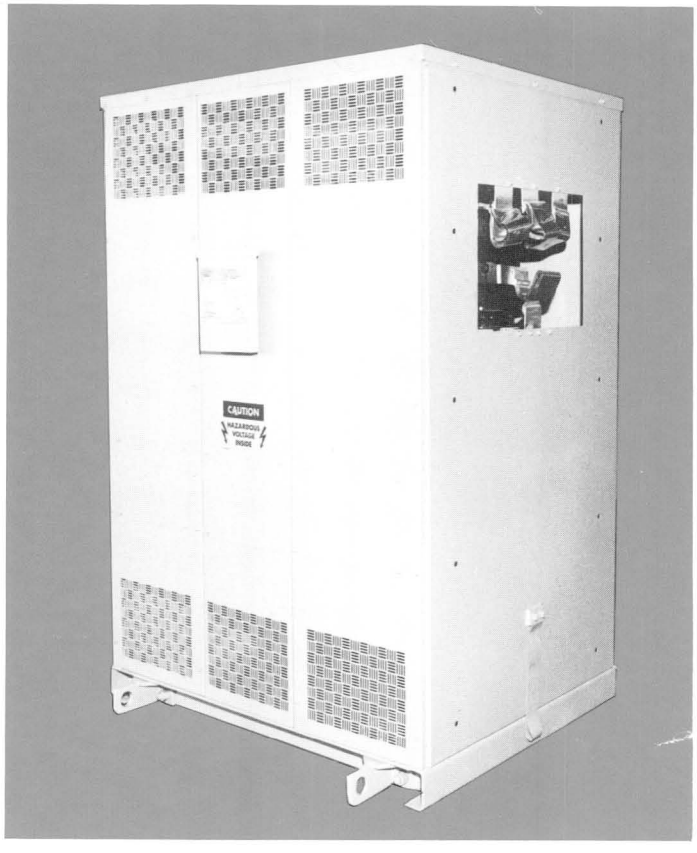
AND TERMINATION EQUIPMENTS FOR INTEGRAL SUBSTATIONS

GENERAL ELECTRIC

GE Transformers Meet Latest Applicable Standards of ANSI and NEMA

Dry-type Secondary
Substation Transformers





General Electric Dry-Type Secondary Substation Transformers are designed, manufactured and tested to meet applicable ANSI and NEMA Standards.

Through the judicious use of materials and methods each dry-type transformer is tailored to meet your specific application requirements.

They can be coupled with a wide variety of termination equipments suitable for almost any light-to-medium power-load application in commercial and industrial distribution systems.

Transformer Weights And Dimensions
Based On 150 C Rise*

kVA	"A" Inches		"B" Inches		"C" Inches		Total Weight/Pounds	
	5kV	15kV	5kV	15kV	5kV	15kV	5kV	15kV
750	90	90	60	62	44	49	3600	4150
1000	90	90	62	64	45	50	4300	4700
1500	90	100	72	70	45	51	5850	6350
2000	90	100	76	76	47	53	7300	7800
2500	90	100	80	80	54	54	8650	9300

*All dimensions are subject to change without notice and should not be used for construction purposes unless endorsed.

Standard Ratings and Characteristics

NEMA TR27

Transformer Rating

The available incoming power supply determines the primary voltage and the frequency of the transformer. The voltage that is required by the load determines the secondary voltage. Present load, plus allowance for growth, determines the kVA rating of the transformer. Transformers with specific combinations of voltages and kVA ratings are available as standard units.

All standard open-dry type transformers are three-phase, 60 Hz with high-voltage windings delta-connected. These transformers are also available in 50 Hz designs.

Standard kVA Ratings

750 kVA
1000 kVA
1500 kVA
2000 kVA
2500 kVA

Standard High-Voltage Ratings

All Delta

2400 Volts
4160 Volts
4800 Volts
6900 Volts
7200 Volts
12000 Volts
12470 Volts
13200 Volts
13800 Volts

Primary voltages are supplemented with four approximately 2½ percent full-capacity regulating taps, two above and two below normal. This combination allows compensating for either a higher or a lower than normal sustained primary voltage.

Standard Low-Voltage Ratings

208Y/120*
480Y/277
480
*Not standard above 1000 kVA

Secondary voltage rating is approximately 4.2 percent above the new standard motor voltage (460 volts), allowing for voltage drop in the line between the substation and the motor terminals without operating the motor at subnormal voltage. Motors and controls operate satisfactorily on voltages 10 percent above or below rating.

Secondary lighting voltages are standardized at the voltage rating of the lamps (120 volt). Lamp operating performance is fairly critical to voltage. Overvoltage causes overheating and subsequent short life of lighting equipment, while undervoltage reduces illumination output and may have adverse effects on the operation of fluorescent lamps. The 120 volt rating for lighting substations normally gives the best results. If the regulation is then too great, it is the usual practice to correct it with a small voltage regulator installed on each feeder.

Provision For Fan Cooling

Cooling fans on open dry-type transformers will increase the transformers' capacity by 33-1/3 percent. Provision for adding fans is inherent in all units rated 750 kVA and above. It includes:

1. Capacity in all current-carrying parts for the fan-cooled rating.
2. Provision for overload relay to control fans.

Standard Sound Levels

Self-cooled Rating kVA	Sound Level, Decibels	
	Without Fans	With Fans Running
	Open Dry-type	Open Dry-type
750	64	67
1000	64	68
1500	65	69
2000	66	71
2500	68	71

Standard Impedances

kVA	Percentage Impedance
750-2500*	5.75

* 1000 kVA units with 480 V (delta or wye) low voltage will be furnished with 8 percent impedance at standard price if requested.

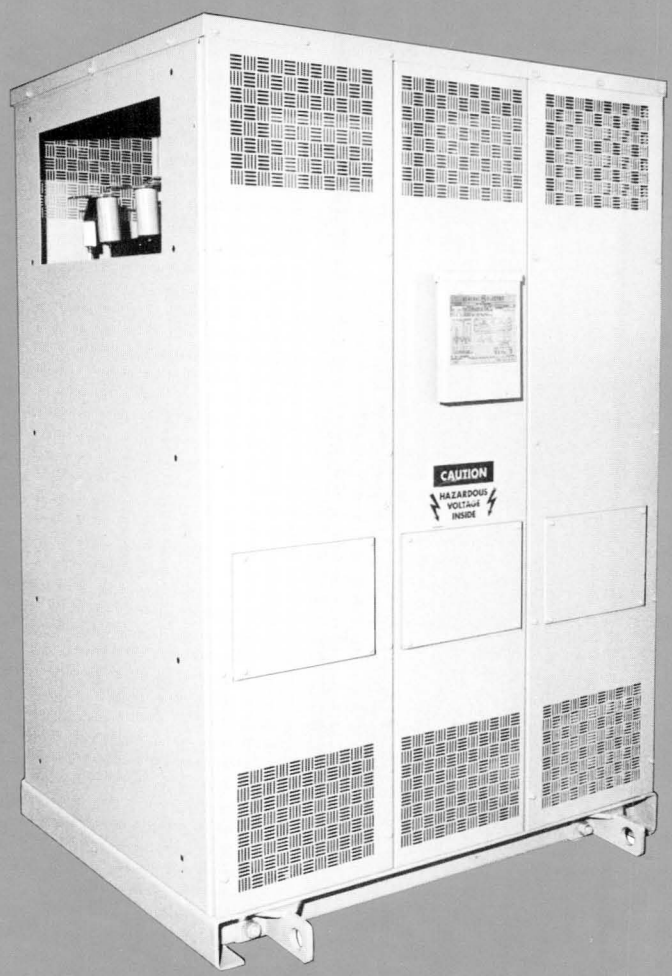
Rated Full-Load Currents Of Transformers

kVA	Primary Line-to-line Volts									Secondary Line-to-line Volts			
	2400	4160	4800	6900	7200	12,000	12,470	13,200	13,800	208	240	480	600
750	180	104	90.2	62.8	60.1	36.1	34.7	32.8	31.4	2082	1804	902	722
1000	241	139	120	83.7	80.2	48.1	46.3	43.7	41.8	2776	2406	1203	962
1500	361	208	180	126	120	72.2	69.4	65.6	62.8	—	—	1804	1443
2000	—	278	241	167	160	96.2	92.5	87.5	83.7	—	—	2406	1925
2500	—	347	301	209	200	120	115.7	109	105	—	—	3007	2405

Standard Ratings and Characteristics

Dielectric Tests Of Winding Insulation (Per ANSI 57-12.01)

Nominal System Voltage	BIL	Low Frequency Test	Impulse Tests		
			Chopped Wave		Full Wave
kV	kV	kV	kV Crest	Min. Time to Flashover, Microseconds	kV Crest
1.2	10	4	10	1.0	10
2.4	20	10	20	1.0	20
4.16	30	12	30	1.0	30
8.32	45	19	45	1.25	45
13.8	60	31	60	1.50	60



Standard kVA Ratings

Designed for 150 C average winding temperature rise by resistance above a 30 C average ambient*

History

Early dry-type transformers employed basically the same types of materials available for most electrical apparatus and were designed for 55 C rise with a total or hot spot capability of 105 C. Later, as higher temperature capability materials became available, dry type transformers were designed to operate at 80 C rise with a hot spot capability of 150 C, in order to reduce their size and cost.

During the 1950's transformers with 80 C rise were standard for dry types, until General Electric introduced dry type transformers designed for 150 C rise with an insulation system hot spot capability of 220 C.

Since the new insulation system had this capability, other temperature rise ratings no longer were necessary to produce the desired life and reliability at minimum size and cost.

Proven System

The materials of the insulation system and indeed the entire system have been thoroughly evaluated by accelerated thermal aging tests to prove their capability to operate successfully. An excellent reference on this subject is an IEEE Conference Paper by General Electric Advanced Development Engineers (Ref. No. 1)†.

The conclusions of this paper confirm the excellent service record of this insulation system during more than 20 years of use.

Life Expectancy

In addition the life expectancy is further extended in most applications such as indutrial plants, commerical buildings, hospitals and schools, where due to several factors the transformer actually operates at an equivalent constant loading of less than 100 percent. These factors are:

1. Transformers are generally over-sized relative to loading.
2. Most applications have load cycles.
3. Some are one-shift operations.

Table below shows the average winding rise and relative life expectancy for various equivalent constant loadings of 150 C rise transformer designs, based on max. 40 C ambient temperature.

Equivalent Constant Loading - %	Average Winding Rise - °C	Relative Life Expectancy (Times Normal Life)
100	150	1
93	133	2
85	115	15
68	80	> 100

While there are certain applications which may require continuous loading at close to 100 percent of nameplate kVA, in general the equivalent constant loading will be between 40-60 percent of nameplate. The value of equivalent constant loading and relative life expectancy can be calculated by reference to the ANSI Guide for Loading Dry-Type Transformers C57.96.

Loading Capabilities and Loss Economics

General Electric ventilated dry-type transformers utilize the same insulation system regardless of temperature rise requirements. All designs have a hot spot capability of 220 C. Although it is possible to design for lower temperature rises, there are several reasons why economic and system effects often make it impractical to operate lower temperature rated units above their nameplate kVA and up to their insulation system temperature capabilities.

Some of these reasons are:

A. Lower temperature rise transformers are higher in initial cost.
B. Lower temperature rise transformers are larger and heavier.
C. If long time overload capability is required above the nameplate kVA rating this can be obtained more economically by the addition of cooling fans; for short time overload capability refer to ANSI Loading Guide C57.96.
D. Overloading a transformer above its designed rating seriously increases the voltage regulation on the low voltage system, which could be detrimental to voltage sensitive equipment.
E. Down stream busway, cable, circuit breakers, etc. must be sized to carry this higher current, otherwise the additional transformer capacity cannot be utilized.
F. The size of the unit dictates a larger core and associated higher core losses. This coupled with increased load losses which increase as the square of the load current generally show that the loss economics are in favor of the design optimized at 150 C rise, when compared to initial cost.
G. The requirements for protection of the transformer are dictated by the National Electrical Code Section 450-3, requiring that primary protective equipment be set at no more than a specific multiple of its rated kVA and the associated currents. Depending on whether there is a main secondary protective device or not, this protective requirement can limit the usable kVA.

Summary

In conclusion, General Electric's dry-type transformer design utilizes high temperature proven and tested insulating materials. Substantiated by over twenty years of field experience, it has the best insulation system (consistent with current industry standards and codes) for applications in industrial plants, commercial buildings, schools, hospitals and other private and public buildings.

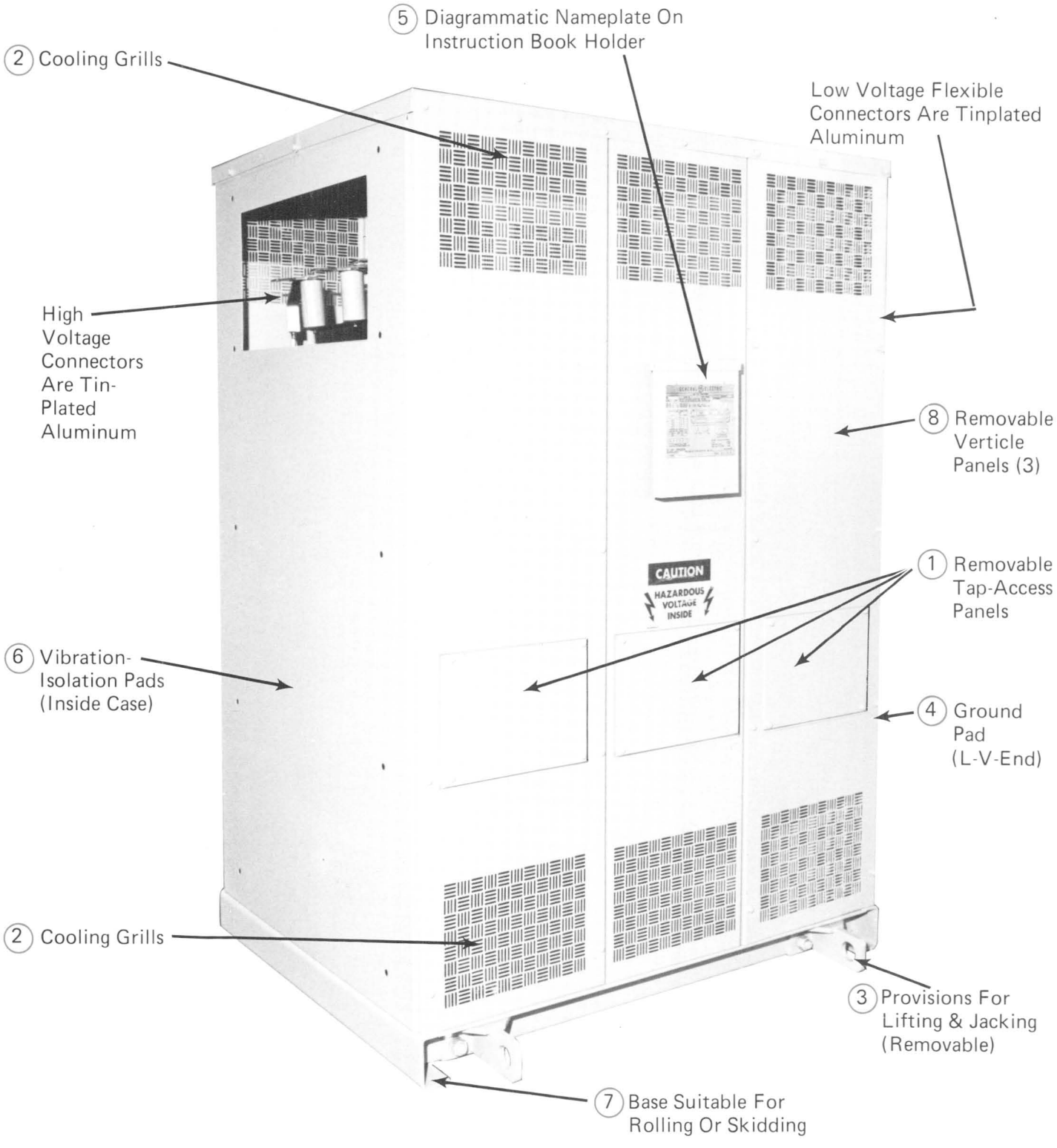
The 150 C rise temperature rating is the best choice for the user who wants low cost, small size, good system characteristics, reasonable losses and overload characteristics consistent with his desired reliability and life expectancy.

†Ref. No. 1 (IEEE Conference Paper presented at the "International Symposium on Electrical Insulation—" June 14-16, 1976)

"Thermal evaluation of a largely inorganic insulation system for use in dry-type transformers" by Dr. J.C. Crouse and J.F. Hutcheson, GE Co., Medium Transformer Department, Rome, Ga. Ref. No. 76 CH 1088-4-EI.

***Average** is for any 24-hour period with the maximum ambient not to exceed 40 C during this period.

Standard Features and Accessories



General Electric open dry-type transformers are designed for indoor applications in schools, hospitals, industrial plants, commercial buildings and anywhere that safe and dependable power are important considerations.

Standard Features and Accessories

1 — Removable tap-access panels
2 — Cooling grills at top and bottom of case
3 — Provisions for lifting and jacking
4 — Ground pad
5 — Diagrammatic nameplate
6 — Vibration-isolating pads
7 — Base suitable for rolling or skidding
8 — Removable vertical panels

Maintenance

Special maintenance requirements, inherent in other types of transformers, do not exist for open dry-type units. There is no insulating liquid, so no testing or filtering is necessary. However, periodic cleaning of the windings, leads and terminal boards is recommended. Refer to Instruction Bulletin GEK-5697 for recommended procedures. Since the vertical panels are readily removable, routine maintenance is made easier and quicker.

Tap Terminals

The winding conductor serves as the lead for the tap terminals, thus avoiding brazed joints in the windings. The tap connections, accessible through removable tap-access panels, are made by bridging the proper terminal blades with movable aluminum links. The links are clamped in position with an aluminum bolt, Belleville washer, and a steel nut. The bolt is captive making it possible to change and tighten taps with only one wrench.

Fan Cooling

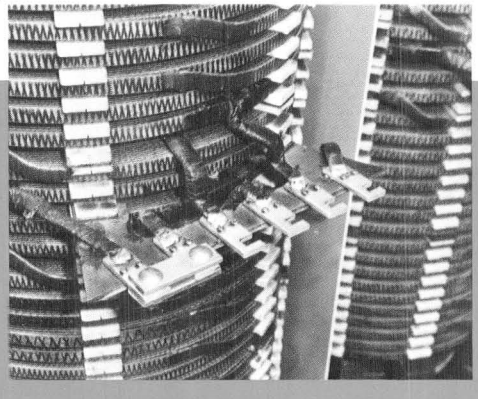
All open-dry type transformers are designed for future forced-air operation as a standard feature. To allow for the addition of fans, all bushings and other current carrying components are designed to handle the increased capacity (33-1/3%). Provisions are also made for the possible future addition of a fan control device. Since the fans are located inside the case the overall dimensions of the transformer are not increased when fans are added.

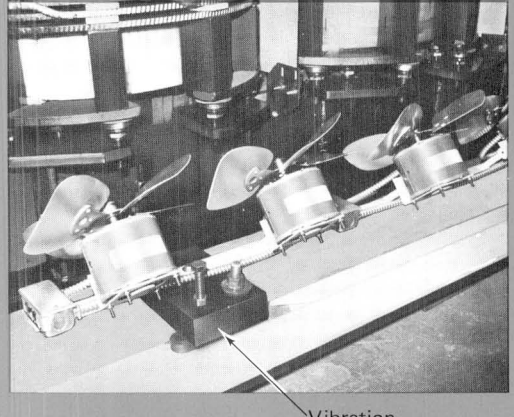
Sound Levels

Indoor usage makes the sound level of open dry-type transformers an extremely important consideration. The sound level of GE open dry-type transformers is at or below applicable industry standards (standard sound levels are listed on Page 4 of this publication).

To control sound, General Electric starts with core steel. The molecular structure of steel and magnetic flux combine to produce magnetostriction —a phenomenon that causes the transformer core to behave much like a tuning fork. The sound emitted is at frequencies that are even multiples of the power frequency. This effect is minimized and controlled by using a special grain-oriented silicon steel, carefully handling it in the factory, and by designing the core for electro-magnetic balance. Equal care is taken with the other components of the transformer to reduce or eliminate sound sources or sound amplifiers. Rubber vibration-isolating pads, put in place during installation, completely isolate the core and coil structure from the enclosure (case) and base structure.

The use of fiberglass lining in critical internal areas helps keep sound levels within specifications.



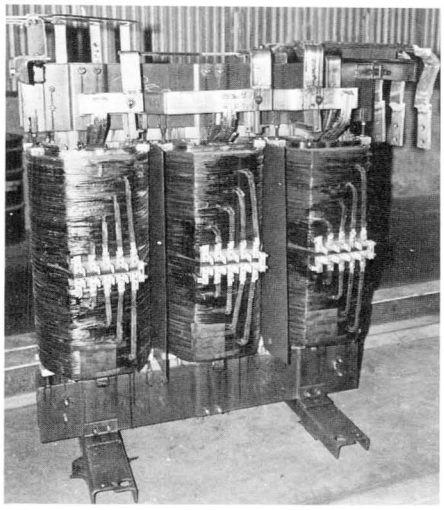


Vibration Isolation Pads

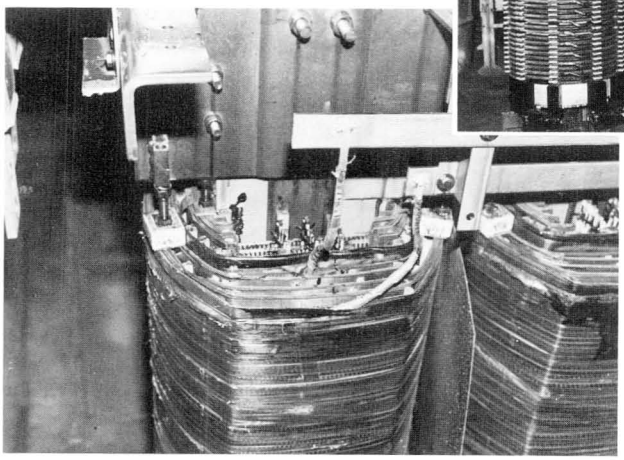
Standard Features and Accessories

Rectangular Coil Design

Standard General Electric open dry-type transformers rated 750-2500 kVA, 15 kV and below, are built with rectangular windings. First, the low-voltage



winding is pressure-wound on a rectangular mandrel. Multiple strands of aluminum conductor are used for each turn. Turn-to-turn insulation consists of a combination of thin inorganic paper, high-temperature fiber winding insulation and high-temperature phenolic varnish. Next, a flexible mica or NOMEX® pad is wrapped over the cooling duct spacers of the low-voltage winding to insulate it from the high-voltage winding. The high-voltage winding is then tension-wound directly over the mica barrier to form a single, rigid unit.

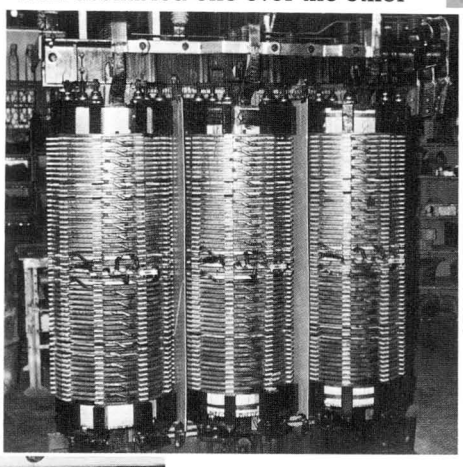


Special inorganic paper and high-temperature molded glass fiber spacers provide layer-to-layer insulation within the high-voltage winding.

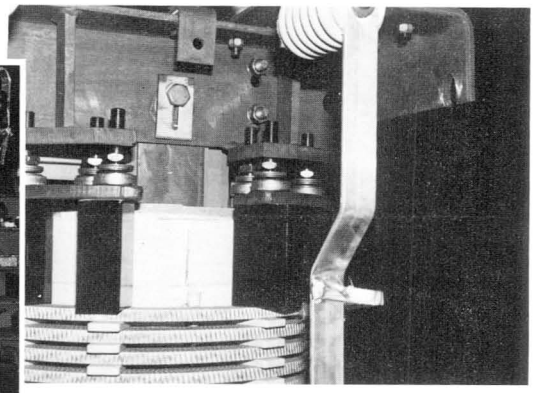
The core legs and yoke consists of stacked steel laminations interleaved to form the main support structure for the windings. The core structure itself is securely clamped in place by top and bottom core clamps that absorb vertical stress on the core. The core clamps are bolted to vertical steel tie plates located on each side of all three core legs to enable transformer to meet the ANSI short-circuit test requirements.

Round Coil Design

Standard General Electric open dry-type transformers rated above 2500 kVA, as well as some 80 C and 115 C rise units, are built with round windings. The high-voltage and low-voltage windings are wound on separate insulating cylinders as "layer" or "continuous-disk" windings and then asembled one over the other (high over low). The insulating cylinders are strong enough to support the many pounds of conductor used in the larger transformers, and are capable of resisting both the crushing short-circuit forces and the jolting that may occur during shipping and handling. The high-temperature life characteristics can withstand exposure to the heat of the core and of the low voltage (inner) winding. Age, usually the most common cause of loss of mechanical strength, does not appreciably affect the cylinder materials used in these transformers.



The core legs and yoke construction utilizes the same steel laminations as the rectangular design, except that air-cooling ducts are formed as an integral part of the core configuration. Core clamps, tie plates and adjustable jack screws, utilized in both designs, combine to hold the windings and core rigidly in place.



Completing The Insulation System

Once the windings have been assembled on the core legs the entire assembly is completely dried in special ovens, vacuum impregnated with silicone varnish, and fully cured to provide a superior 150 C rise (220 C hot-spot) insulation system.*

* For more detailed information on GE dry-type insulation systems refer to IEEE Conference Record #76CH1088-4-EI.

Testing and Finishing

Routine Tests

The following tests will be made on all transformers but not necessarily in the sequence listed. All tests are performed in accordance with the latest revision of ANSI Standard Test Code for Transformers, C57.12.91.

1. Resistance measurement of all windings.
2. Radio tests on the rated voltage connection and on all tap connections.
3. Polarity and phase-relation tests on the rated voltage connection.
4. No-load loss at rated voltage on the rated voltage connection.
5. Exciting current at rated voltage on the rated voltage connection.
6. Impedance and load loss on rated connection.
7. Applied potential tests.
8. Induced potential tests.

For more information refer to Company.

In addition to the standard tests there are other classifications of tests.

Design Tests

These are tests made on a sufficient number of representative units to demonstrate conformance with applicable standards, which need not be repeated unless there is a design change. These may be made on prototype equipment, devices, parts or components.

These might include:

1. Temperature tests to verify design criteria.
2. Impulse tests on all terminals including reduced full-wave, chopped wave, and full wave tests.
3. Short circuit capability tests.
4. Dielectric tests—including applied potential & induced potential.
5. Sound level tests.
6. Tests of mechanical components.

Other Tests

These are tests so identified in individual product standards which may be specified by the purchaser in addition to routine tests.

Examples of these are:

A. Impulse test
B. Insulation power factor test
C. Audible sound test
D. Temperature rise test

Conformance Tests

These are tests which are made by agreement between the manufacturer and the purchaser at the time the order is placed. In some cases, by mutual agreement, certain **Design Tests** may be made as **Conformance Tests.**

Short Circuit Testing Program

The General Electric Company has had an on-going short circuit test program for all types of medium size transformers manufactured at the Medium Transformer Department.

Short circuit tests were conducted at the General Electric High Power Laboratory. The program has included full-size ventilated dry type transformers rated from 1000 through 2500 kVA at various voltage ratings.

Depending on the purpose for which a particular unit was being tested, the test sequence varied (i.e.prototype units vs. actual customer units), enabling the Design Engineer to redesign critical mechanical parts such as coils, clamps, core tie plates, and bus supports.

Short-circuit testing has been performed on prototype units. This type of testing enabled General Electric to incorporate various measuring devices in development units in order to check force calculations, movement of windings, etc. It was also possible to gain knowledge of the transformer movement directly by the use of high-speed motion pictures.

In some cases units were tested to destruction to determine ultimate failure mode, since they were built entirely for development puposes.

Table 1 shows a list of one line ratings of 150 C rise ventilated dry type units tested since 1970.

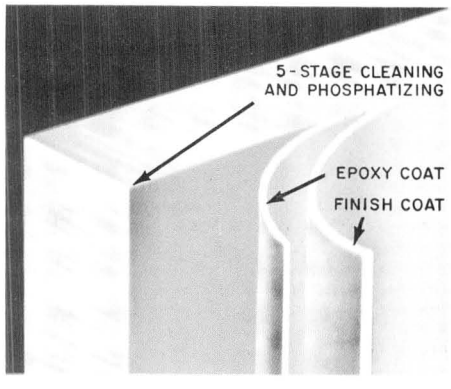
Table 1.

Year	One Line Ratings
1970	AA-T-60 HZ-1000 kVA-13800-480Y/277
1971	AA-T-60 HZ-1500 kVA-2400-480
1972	AA-T-60 HZ-2000 kVA-13800-480Y/277
1973	AA-T-60 HZ-1000 kVA-13800-480Y/277
1974	AA-T-60 HZ-1000 kVA-4800-480Y/277
1975	AA-T-60 HZ-2500 kVA-4160-480Y/277
1976	AA-T-60 HZ-2500 kVA-13800-480Y/277

Paint Finish

Once the pickled and oiled sheets are formed into panels they are processed through a 5-stage washing and phosphatizing line and thoroughly dried. After drying, the panels receive an epoxy coating applied by the powder process, which includes baking the panels at 325 F.

Once the panels have been assembled, a final coat of air-dry enamel is applied. The standard paint color for open dry-type transformers is ANSI-61 Light Gray. Other colors are available as options.



Application Considerations

Surge Protection

It is recommended that proper surge arresters be installed at the primary terminals of the substation, in order to protect the incoming line equipment and transformer from voltage surges.

If it is not possible to locate the surge protection at the transformer incoming line equipment, further investigation should be undertaken to determine if safe surge voltages can still be maintained.

Surge Arresters

To determine the type and rating of the arrester best suited to a particular system it will be necessary to (1) determine the characteristics os the incoming circuit supplying the substation primary terminals, with respect to grounding as defined in the IEEE Standard for surge arresters (IEEE Standard 28-1974), (2) shielding as defined in "USA Standard Guide for Application of Valve Type Lightning Arresters" (C62.2-1969, and (3) location of other equipment in relation to the transformer.

Impulse Strength (BIL)

The impulse strength of the standard open dry-type transformers are shown in Table on Page 4, and vary depending upon the voltage rating. The basic impulse level, commonly referred to as BIL, is defined as the specified crest value (kV) of the surge voltage which can be withstood by the transformer at its terminals.

The insulation structure must be designed to withstand, without flashover or apparent damage, a 1.2 x 50 micro-second wave of the specified crest value. The BIL rating is proven by design tests as defined by the ANSI Test Code C57.12.91.

Although the BIL ratings of dry type transformers are relatively low compared to those of liquid-filled transformers, they can be adequately protected by surge arresters.

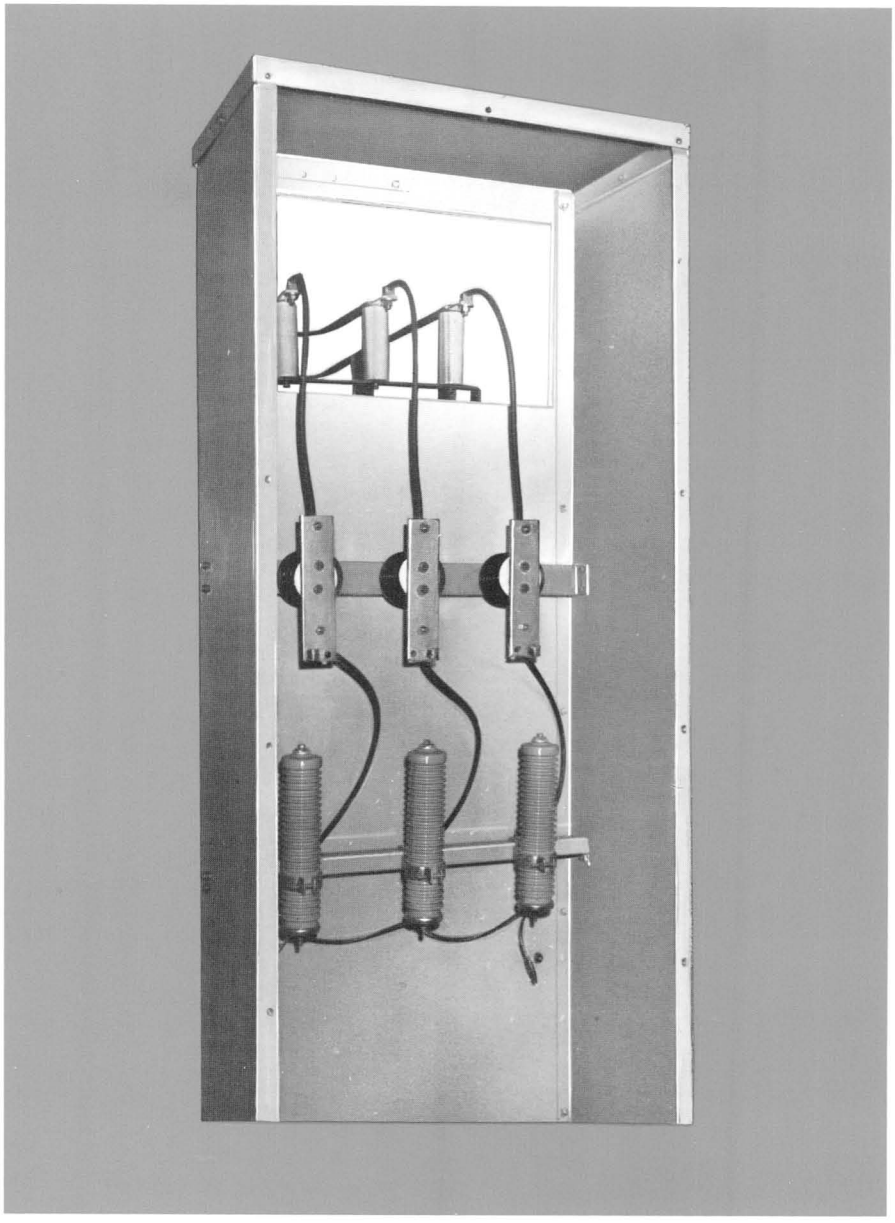
Protective Margin

In order to provide a minimum of ten percent protective margin for dry type transformers distribution type (Form 28) General Electric Surge Arresters may be used at all the listed standard voltage ratings. This is based on ANSI front-of-wave sparkover characteristics and IR discharge voltage at 5000 amps or less.

Greater margin of protection may be obtained at other voltages by the use of intermediate type or TRANQUELL® arresters, since they have better discharge characteristics.

NOTE:

It is important that a good ground path be provided from the ground side of the surge arresters in order to assure that the protective margins are maintained. It is desirable that this ground path be less than one ohm.



Location And Installation

The location and the environmental conditions surrounding the transformer are important factors influencing transformer application.

Environment

Since open dry-type transformers depend on air as their insulating medium and on air circulation for cooling, the environment in which they are placed will affect their operation and reliability. Therefore the atmosphere should be reasonably clean and dry.

If the transformer will be deenergized for some time in a moist atmosphere, space heaters are available as an option. In locations where excessive contamination may be encountered more frequent maintenance may be required. Therefore, if possible, this air movement into the area surrounding the transformer should be filtered. The ventilating openings should also be free of any nearby obstructions to the flow of cooling air.

Location

When located in an equipment room the amount of air delivered and the method of delivery are important factors.

The amount of air delivered to remove transformer losses should be approximately 100 CFM/KW of transformer loss depending on the equipment room thermal design and any additional heat which may be generated in the room from other equipment. It is important that the air flow does not directly impinge on the ventilating openings of the casing since this will disturb the natural flow of air through the transformer. Typically a standard 1500 kVA transformer would generate approximately 1000 BTU/minute at 60-percent load. The ambient temperature must be maintained at an average of 30 degrees C (86 F) with the maximum not to exceed 40 degrees C (104 F) in any 24-hour period. This, of course, may also require modification of the amount of air flow. In general the incoming air should be at least 5 C below the room temperature.

For further information refer to ANSI C57.94 "Guide for Installation and Maintenance of Dry Type Transformers."

The only foundation necessary is a level floor strong enough to support the weight of the transformer. When the unit is mounted on the main factory floor or motor room, the weight has little effect on the foundation costs. However, the unit can be mounted on a balcony or in the roof trusses, because of the minimal maintenance requirements.

Overload Capability

For short-time overloads the open dry-type transformer has approximately the same overload capability as other types. However, if it is necessary to overload the unit for longer than approximately ½ hour, its overload capability decreases.

For longer overload periods consideration should be given to the addition of fan cooling or oversizing of the unit unless some sacrifice in transformer life is an acceptable alternative.

The open dry-type transformer has the advantage of a large fan-cooled capability. The fans are located within the transformer casing and they do not increase the overall dimensions of the transformer. The fan-cooled capability enables an increase of 33-1/3 percent of the rated kVA output of the transformer. The fans are controlled from the winding temperature by simulating the temperature inside the windings at the center phase coil lead.

For further reference consult ANSI Standard C57.96 "Guide for Loading Ventilated Dry Type Transformers."

Reliability

A transformer, when operated in the environment for which it is designed and loaded in accordance with recognized industry loading guides, will have long life expectancy and good reliability. Each transformer is carefully designed and built with quality materials to insure maximum service and reliability.

Audio Sound Levels

The audio sound level of a transformer for an industrial application is normally not an important factor. If, on the other hand, the transformer is used in an office building or application where the ambient sound level is low, then the sound level of the transformer would be significant.

The NEMA sound levels of the open-dry transformer are shown on Page 3. These are based on NEMA measurement procedures as outlined in NEMA Standard TR-1.

The location of transformers with respect to walls, ceilings, and other transformers will have an affect on the sound level measured. Its method of floor mounting could also be an important factor.

Means are provided to isolate the core and coil assembly from the casing and it is important that the instructions in this regard are followed during installation.

The importance of sound level considerations is relative to the proximity of the equipment to operating personnel. If lower levels are desired they can be obtained by various means, including the design of the equipment room itself.

*Trademark of General Electric Company

Incoming Termination Equipment

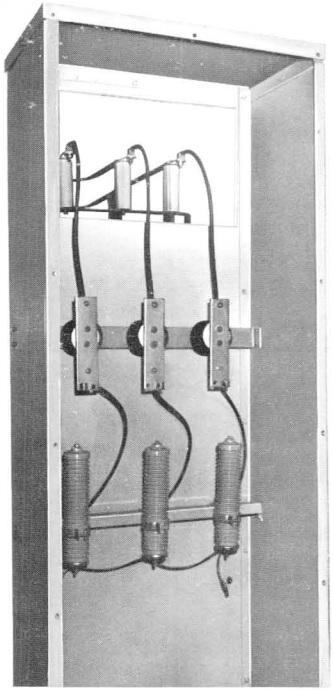
FOR DRY-TYPE SECONDARY SUBSTATION TRANSFORMERS

Air-Filled Terminal Compartment

This is a simple metal enclosure to safeguard personnel when the substation is connected directly to the incoming high-voltage line. It can be supplied with either clamp-type terminals or potheads to terminate the incoming-line cables. The low cost of this section makes it ideal when over-current protection is provided elsewhere.

The compartment is suitable for single or loop feed and for either top or bottom cable entrance. A bolted-on end panel gives easy access to the cable fittings.

Potheads can be supplied with special fittings such as wiping sleeves, stuffing boxes, armor clamps, or conduit couplings for any of the common types of cable.



Air filled compartment with surge arresters and clamp-type terminals mounted for bottom cable entrance.

Oil Cutouts

If fuses are required, oil cutouts are the most economical interrupter switches available. The three-pole, two-position, (OPEN/CLOSED) cutouts are operated simultaneously by a handle accessible through a hinged door on the end of the compartment for 5 kV and on the side for 15 kV. Cables and other live parts are completely metal enclosed. They are not accessible through the operating door, so operators are protected.

Either clamp-type terminals or potheads can be used to terminate cables. The compartment can be specified by the customer for single or loop feed, top or bottom cable entrance.

Switch contacts of the cutouts are completely metal enclosed. The contacts operate under oil, completely submerging the arc flame during circuit interruption. The cutout can be supplied with fuses which will clear fault currents up to 11,000 amps at 4160 volts and 7000 amps at 13,800 volts.

Versatile and Reliable Air-Interrupter Switches

Switches are rated for use with dry type transformers rated 112.5 through 2500 kVA, 2400 through 13,800 volts.

The basic switch, incorporating a stored-energy operating mechanism, has an interrupting rating of 600 amp at all voltages. The stored-energy mechanism provides a positive, controlled closing and opening stroke independent of the operator.

All air switches meet NEMA Standard SG-5 for power switching equipment and ANSI Standard C37.30.

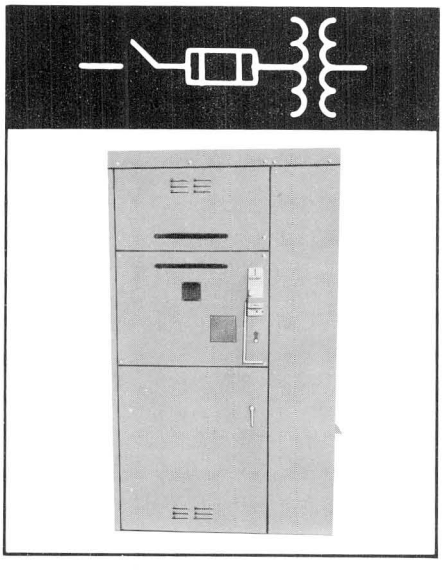
Incoming-line cables can enter the top or bottom of the compartment and can be connected for either single or loop feed. Cables can be terminated with clamp-type terminals or potheads. The terminals are easily accessible to apply test voltage or check the phasing of the unit.

Oil cutouts are operated by a handle accessible through a hinged door.

Two observation windows of shatterproof safety glass are provided in the sheet steel door. The windows are sized and located to give an adequate view of the switch contacts, but are small enough to provide maximum personnel protection during inspection. Current-limiting fuses can be included in the compartment under the interrupter switch. They can provide interrupting capacity sufficient to clear a fault at the low-voltage terminals. When fuses are furnished, the fuse compartment door is mechanically interlocked with the switch so the fuse door cannot be opened unless the interrupter switch is in the OPEN position. Likewise, the interrupter switch cannot be closed unless the fuse door is also closed. Key interlocking with low-voltage circuit-interrupting devices can also be furnished. Lightning arresters can be supplied in the switch compartment for added protection against voltage surges.

Two-Position Air-Interrupter Switch

This switch consists of a two-position (OPEN/CLOSED), three-pole mechanism. All three poles are operated simultaneously by a non-removable handle on the front of the switch compartment. A mechanical position indicator is included.



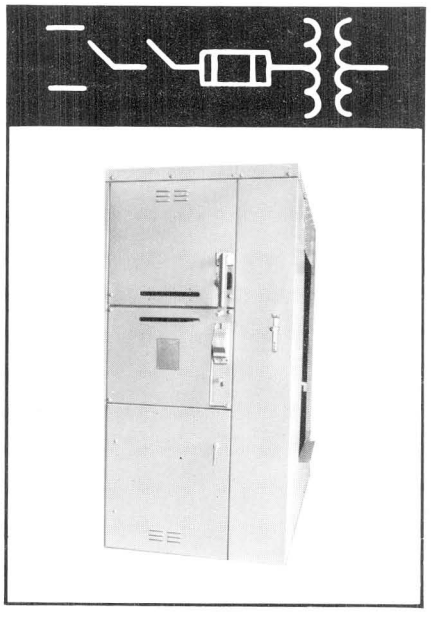
Air Switch Continuous and Short-circuit Current Ratings

kV	BIL	Continuous Rating and Loadbreak	Momentary and Close and Latch Assembly (KA without fuses)
5	60	600	40
5	60	1200	61
15	95	600	40
15	95	1200	61
15	95	1200	80

Air-Interrupter Selector Switch

Where there are two separate incoming lines, the interrupter selector switch gives three positions (LINE 1/OPEN/LINE 2). This gives continuity of service by allowing the operator to switch from one incoming line to the other in case primary feed fails, or to the OPEN position for planned maintenance.

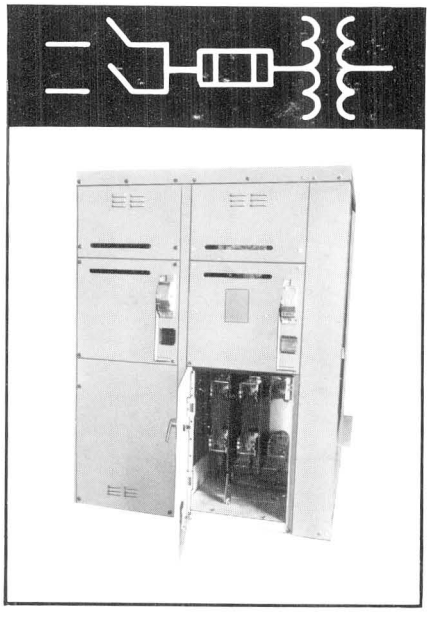
The unit consists of a two-position (OPEN/CLOSED) air-interrupter switch in series with a two-position (LINE 1/LINE 2) selector switch. The selector switch is a dead-break device and is mechanically interlocked so it cannot be operated unless the interrupter switch is open.



Double-Air-Interrupter Switch

This three-position (LINE 1/OPEN/LINE 2) switch is also used where there are two separate incoming lines, and allows the operator to switch from one line to the other, or to OPEN for planned maintenance.

The double switch has the advantage of isolating the two lines, permitting maintenance of one line while the other line is energized and reducing the probability of fault transfer from one cable to the other. This is accomplished by using two two-position (OPEN/CLOSED) air-interrupter switches, key-interlocked so both incoming line switches cannot be closed at the same time (not LOOP FEED through the switches).



Application Information

Surge Protection

There are three types of surge arresters available; Distribution, Intermediate and TRANQUELL®.

Intermediate and TRANQUELL arresters generally provide greater protective margin for the equipment than Distribution type.

Interlocking

To safeguard personnel and reduce switch contact maintenance, the high-voltage switch should be operated while de-energized or while carrying only the magnetizing current of the transformer.

Key interlocking the high-voltage switch with the low-voltage main circuit breaker makes it necessary to remove the low-voltage load before opening the high-voltage switch. When required, this feature is included on GE Substations.

Application Of Unfused Interrupter Switches

High Voltage	2400-4800V		6900-7200V		12000-13800V
Transformer kVA	750	1000-2500	750-1500	2000-2500	750-2500
Air Switch	X	X	X	X	X
Oil Cutouts	X	—	X	—	X

Additional key interlocking can be provided to coordinate with other circuit devices. These include alternate feeds from additional high-voltage sources, low-voltage tie breakers for double-ended substations, and additional low-voltage bus or cable feeds from emergency or other sources.

If such additional interlocking is required, complete information must be provided by the system engineer responsible for the overall substation coordination.

Fusing

Fuses, while available for air switches and cutouts, are not generally required on Integral Distribution Centers. A plain interrupter switch does not involve the expense and coordination problems of fuses and it is adequate for all units that can be protected by remote overcurrent relays.

Sometimes, though, other loads on the circuit are great enough that the National Electrical Code requires fuses on the incoming side of the substation. For example, if the kVA size of the substation is less than about 1/4 to 1/6 of the total load on the feeder, an interrupter switch and fuse combination should be used to protect against short circuits.

Minimum suggested primary fuses are listed in the table on page 15 for the self-cooled rating.

It is essential that the coordination of fuses with other primary and secondary devices be checked before selecting the fuse rating.

Fuse Interrupting Rating RMS Amperes

Operating Voltage	Oil Cutouts With Fuse Link (Asymmetrical)	Air Switch With EJ Fuse (Symmetrical)	Air Switch with Type SM-4S S & C Fuses (Asymmetrical)
2400	11000	50,000	27,500
4160	11000	50,000	27,500
4800	10000	50,000	25,000
6900	5000	50,000	25,000
7200	5000	50,000	20,000
12470	7000	50,000	20,000
13200	7000	50,000	20,000
13800	7000	50,000	20,000

Minimum Suggested Primary Fuses*

3ϕ Self-Cooled Transformer kVA	Rated Primary		GE Type EJ-01 9F62 Series†	S & C Type (Slow Char.)	GE Oil Cutout Fuse Link
	Voltage Volts	Current Amps		SM-4S	
750	2400	180	200E	200E	9F57CAA200
	4160	104	125E	125E	125
	4800	90.2	100E	100E	100
	6900	62.8	65E	65E	065
	7200	60.1	65E	65E	065
	12000	36.1	50E	40E	040
	12470	34.7	50E	40E	040
	13200	32.8	50E	40E	040
	13800	31.4	50E	40E	040
1000	2400	241	250E	—	—
	4160	139	150E	150E	9F57CAA140
	4800	120	125E	125E	125
	6900	83.7	100E	100E	100
	7200	80.2	100E	100E	100
	12000	48.1	50E	50E	050
	12470	46.3	50E	50E	050
	13200	43.7	50E	50E	050
	13800	41.8	50E	50E	050
1500	2400	361	400E	—	—
	4160	208	250E	—	—
	4800	180	200E	200E	9F57CAA200
	6900	126	125E	150E	140
	7200	120	125E	125E	125
	12000	72.2	80E	80E	075
	12470	69.6	80E	80E	075
	13200	65.6	80E	80E	075
	13800	62.8	65E	65E	065
2000	4160	278	300E	—	—
	4800	241	250E	—	—
	6900	167	175E	175E	9F57CAA200
	7200	160	175E	175E	200
	12000	96.2	100E	100E	100
	12470	92.5	100E	100E	100
	13200	87.5	100E	100E	100
	13800	83.7	100E	100E	100
2500	4160	347	400E	—	—
	4800	301	350E	—	—
	6900	209	250E	—	—
	7200	200	250E	200E	—
	12000	120	125E	125E	9F57CAA125
	12470	115.5	125E	125E	125
	13200	109	125E	125E	125
	13800	105	125E	125E	125

*If FA rating required, a larger fuse should be selected in some ratings.
†The minimum fuse rating is the smallest fuse which will withstand transformer inrush.

Outgoing Termination Equipments

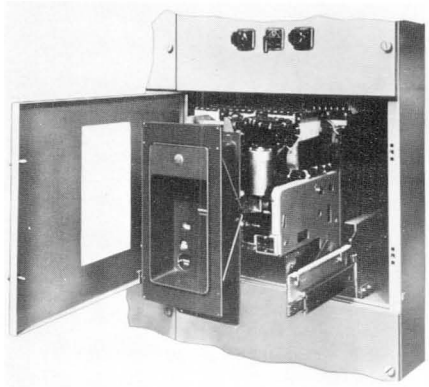
FOR INTEGRAL SUBSTATION APPLICATION

The power-distribution requirements of different loads vary widely. That's why General Electric's building-block approach to building Integral Distribution Centers has particular meaning in the outgoing section. There are five basic building blocks, and some of these have modular construction within themselves, to give even more flexibility.

Air-Filled Terminal Compartment

This is a simple metal enclosure with camp-type terminals identical to the incoming-line compartment described on page 12.

Type AKR Air Circuit Breaker



Your Integral Distrubition Center can be supplied with a single Type AKR low-voltage power circuit breaker, as shown in Table 1. Breakers are available for drawout mounting and for either manual or electrical operation.

A stored energy closing mechanism is standard with either manual or electrical operation. Pre-charged springs in this mechanism provide a powerful, uniform closing force which is independent of the operating force. This quick, positive closing prevents unnecessary arcing between contacts resulting in longer contact and breaker life.

Solid-state trip devices are available with AKR breakers. The Micro VersaTrip® trip device is shown in Table 1.

For more detailed information, refer to GEA-10265.

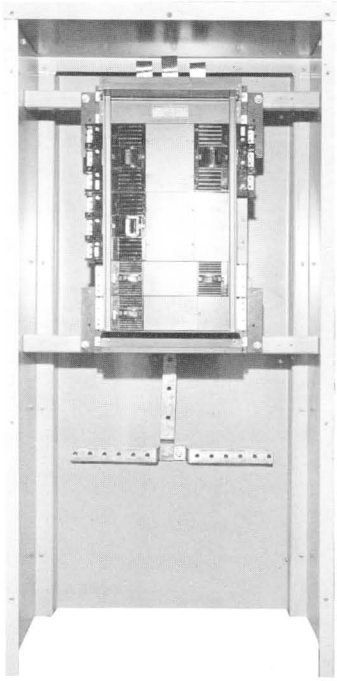
Molded-Case Circuit Breakers

Molded-case circuit breakers can be arranged to provide a main breaker, a main breaker with feeder breakers, or feeder breakers only. Any combination of the breakers shown in Table 2 can be used, as long as the height does not exceed 48 "X" units and the width does not exceed the panel space available.

A typical arrangement for determining the number of "X" units, interrupting rating, trip rating and cable lug sizes is given in Table A.

Main circuit breakers in the compartment panel may be furnished with continuous current ratings up to 1200 amperes and interrupting capacity up to 65,000 amperes symmetrical at 240 volts. Micro VersaTrip breakers are available in J or K frame construction.

Additional separately mounted main circuit breakers can be furnished with continuous current ratings up to 3000 amps and interrupting capacity up to 200,000 amperes symmetrical at 240 volts. Additional compartment width may be required. Refer to Table 3 on page 17 for application guide.



See Table A for typical panel arrangement.

Table A. Typical panel arrangement (maximum space available is 48X)

1200 Amp TKM FRAME 2- or 3-pole		8X
800 Amp TKM FRAME 2- or 3-pole		6X
600 Amp TJK Frame 2- or 3-pole	600 Amp TJK Frame 2- or 3-pole	6X
225 Amp TFK Frame 2- or 3-pole	225 Amp TFK Frame 2- or 3-pole	3X
100 Amp TED Frame 3-pole	100 Amp TED Frame 3-pole	3X
Filler		1X
	TOTAL	27X

ψ For units without metering.

Metering and Control Power Equipment

Simple secondary metering and control equipment can be mounted in the outgoing section of your Integral Distribution Center. Often, though, the compartment must be larger to add this equipment and still provide adequate tolerances and working space. Standard equipments available include:

Metering

Ammeters	Power-factor meters
Voltmeters	Frequency meters
Wattmeters	Watthour meters
Varmeters	kVA meters

Instrument transformers
- Current transformers
- Potential transformers

Control-power transformers

Table 1. Application guide for AKR circuit breakers

Breaker Type	Max Amp	Interrupting Rating* (Sym KA RMS) 240V	480V	600V	Sensor Current Rating (Amperes) Fixed Sensors	Tapped Sensors	Current Setting (Mult. of Sensor Current Rating)
AKR-30†	800	42	30	30	100 150 225 300 400 600 800	100, 150 225, 300 or 300, 400, 600, 800	0.5, 0.6, 0.7, 0.8, 0.85, 0.9, 0.95, 1.0 (x)
AKR-30H	800	50	42	42			
AKR-50†	1600	65	50	42	300 400 600 800 1200 1600	300, 400 600, 800 or 600, 800, 1200, 1600	Same as above
AKR-50H	1600	65	65	65			
AKRT-50	2000	65	65	65	800 1200 1600 2000	(800, 1200, 1600, 2000)	Same as above
AKR-75	3200	85	65	65	1200 1600 2000 3200	(1200, 1600, 2000, 3200)	Same as above
AKR-100	4000	130	85	85	1600 2000 3000 4000	(1600, 2000, 3000, 4000)	Same as above

*With instantaneous trip
†Breakers with extended short-circuit ratings also available.
(x) = Sensor current rating

Table 3. Application guide—Power Break® circuit breakers‡

Max Amp	Interrupting Rating Amperes Symmetrical 240V	480V	600V	Sensor Ampere Ratings	Space Used
800	65,000	50,000	42,000	200, 400, 600, 800	18X
1600	85,000	65,000	50,000	800, 1000, 1200, 1600	18X
2000	85,000	65,000	50,000	1000, 1200, 1600, 2000	18X
3000	100,000	100,000	85,000	400, 600, 800, 1000, 1200, 1600 2000, 2500, 3000	18X
4000	100,000	100,000	85,000	4000	(a)

‡Available with Micro Versa Trip®.
(a) Refer to factory for space requirements.

Table 2. Application guide—Molded-case circuit breakers

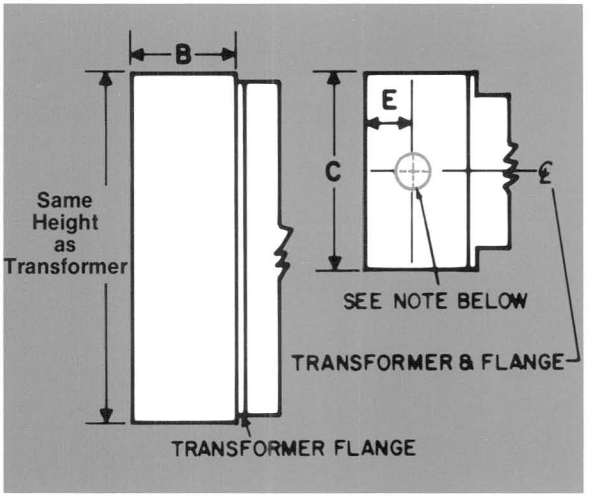
Type Frame	Type Max. Amperes	Interrupting Capacity (Amperes)¶ 240V	480V	600V	Trip Rating (Amperes)	Breaker Space (Max. 48X) △ 2-pole	3-pole
TED-6§	100	18,000	14,000	14,000	15, 20, 30, 40, 50, 60, 70, 90, 100, 110, 125, 150	2 Xθ 2 Xθ	3 Xθ 3 Xθ
THED§	100	65,000	25,000	18,000	15, 20, 30, 40, 50, 60, 70, 90, 100, 110, 125, 150	3 Xθ 3 Xθ	3 Xθ 3 Xθ
TFJ§	225	25,000	22,000	22,000	70, 90, 100, 125, 150, 175, 200, 225	3 Xθ	3 Xθ
TFK	225	25,000	22,000	22,000	70, 90, 100, 125, 150, 175, 200, 225	3 Xθ	3 Xθ
THFK	225	35,000	25,000	22,000	70, 90, 100, 125	3 Xθ	3 Xθ
		42,000	25,000	22,000	150, 175, 200, 225		
TJJ§	400	42,000	30,000	22,000	125, 150, 175, 200, 225, 250, 300, 350, 400	6 Xθ	6 Xθ
TJK-4	400	42,000	30,000	22,000	125, 150, 175, 200, 225, 250, 300, 350, 400	6 Xθ	6 Xθ
THJK-4	400	65,000	35,000	25,000	125, 150, 175, 200, 225, 250, 300, 350, 400	6 Xθ	6 Xθ
TJK-6 TJ4V	600	42,000	30,000	22,000	250, 300, 350, 400 500, 600	6 Xθ	6 Xθ
TKM-8	800	42,000	30,000	22,000	125, 150, 175, 200, 225 300, 350, 400, 500, 600 700, 800	6 X	6 X
THKM-8	800	65,000	35,000	25,000	125, 150, 175, 200, 225 300, 350, 400, 500, 600	6 X	6 X
					700, 800	6 X	6 X
TKM-12 TK4V	1200	42,000	30,000	22,000	700, 800	8 X	8 X
					1000	8 X	8 X
					1200	8 X	8 X
THKM-12	1200	65,000	35,000	25,000	700, 800	8 X	8 X
					1000	8 X	8 X
					1200	8 X	8 X

§ Breaker has fixed trip unit.
¶ U/L listed interrupting ratings—symmetrical.
θ Two breakers of size shown can be mounted side by side in this space.
△ For units without metering. When metering is required, consult factory for maximum breaker space available.

Dimensions and Weights

INCOMING TERMINATION EQUIPMENTS

AIR FILLED TERMINAL COMPARTMENT AND OIL CUTOUT—FUSED OR UNFUSED WITH ONE POTHEAD 3/C WITH 500 MCM MAXIMUM CONDUCTOR.

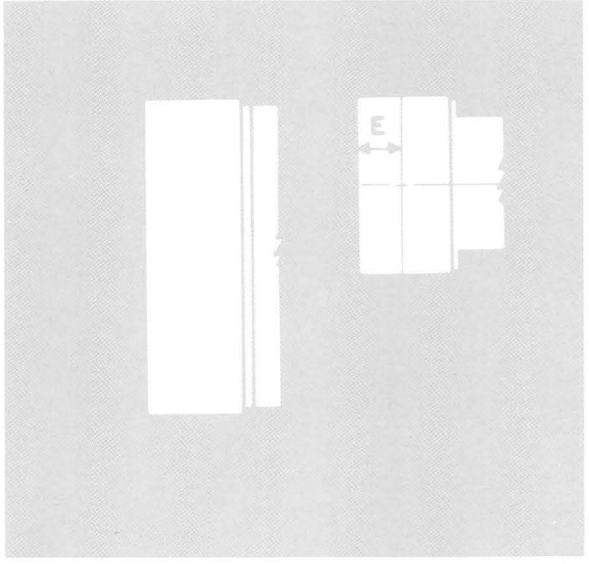


Note: Location of wiping sleeve or stuffing box for cable entrance†

kV	Entrance	Dimensions in Inches			Weight (in pounds)
		B	C	E	
5	Top	14.8 26.3	38.4 38.4	9.8 15.95	350 600
	Bottom	14.8 26.3	38.4 38.4	7.45 15.95	350 600
15	Top	14.8 51.5	38.4 41.25	9.8 8.32	350 1300
	Bottom	21.3 51.5	38.4 41.25	10.95 7.3	350 1300

† for top entrance additional clearance required, 17.3″ max.
Black = Air filled terminal compartment.
Green = Oil cutout.

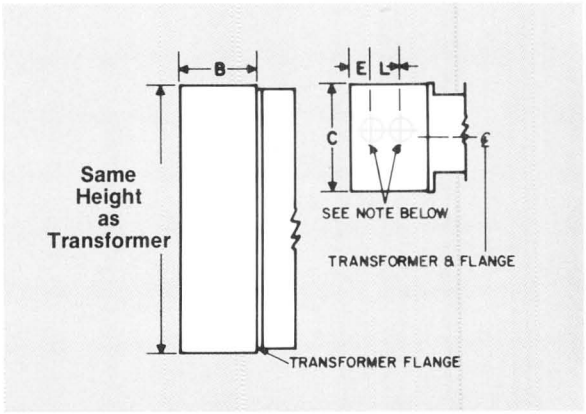
AIR FILLED TERMINAL COMPARTMENT AND OIL CUTOUT—FUSED OR UNFUSED WITH CLAMP TYPE TERMINALS WITH 500 MCM MAXIMUM CONDUCTOR.



kV	Dimensions in Inches			Weight (in pounds)
	B	C	E	
5	14.8 26.3	38.4 38.4	** 14.3	200 500
15	21.3 51.5	38.4 41.25	** 8.0	250 1200

** Entire plan area available for cable entrance
Black = Air filled terminal compartment.
Green = Oil cutout.

AIR FILLED TERMINAL COMPARTMENT AND OIL CUTOUT—FUSED OR UNFUSED WITH TWO POTHEADS 3/C WITH 500 MCM MAXIMUM CONDUCTOR.

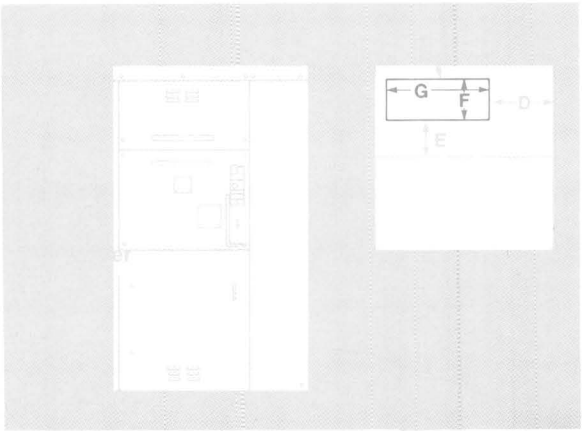


Note: Location of wiping sleeves or stuffing boxes for cable entrance†

kV	Entrance	Dimensions in Inches				Weight (in pounds)
		B	C	E	L	
5	Top	21.3 26.3	38.4 38.4	8.3 8.07	8.0 7.88	500 700
	Bottom	21.3 26.3	38.4 38.4	6.07 8.07	7.88 7.88	500 700
15	Top	21.3 59.5	38.4 41.25	8.3 8.12	8.0 8.0	500 1400
	Bottom	26.3 59.5	38.4 41.25	8.07 7.12	7.88 7.88	500 1400

* = 90″ for 2500 kVA units, 5 & 15 kV.
† for top entrance additional clearance required, 17.3″ max.
Black = Air filled terminal compartment.
Green = Oil cutout.

AIR INTERRUPTER SWITCHES

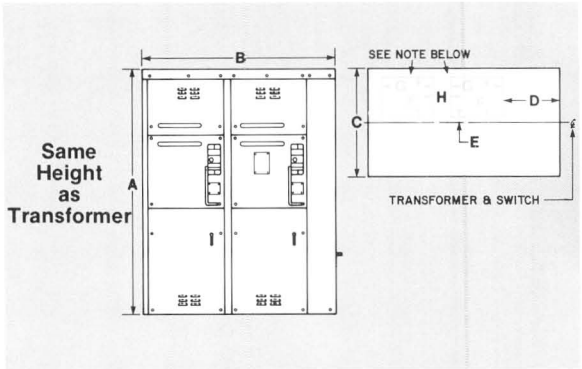


Note: Available space for primary leads at top and bottom

kV Type	Dimensions in Inches					Weight (in pounds)
	B	C	D	E	F & G	
5 Two Position	34.5	50	9.3	9.25	12.5 x 23	†800
15 Two Position	46	53	16.8	10.31	13 x 25	†1100
5 Selector	34.5	69	9.3	6.45	20 x 23	‡1200
15	46	81	19.5	2.4	31.75 x 19.75	‡1500

* A = 90″ for 2500 kVA units, 5 & 15 kV
† (1) for pothead add 100 pounds per 3/C or 3-1C sets
(2) for fuses add 200 pounds
(3) for Lightning Arresters add 100 pounds
‡ (1) for potheads add 200 pounds per 2-3/C or 3-1C sets
(2) for fuses add 200 pounds
(3) for Lightning Arresters add 100 pounds

DOUBLE AIR INTERRUPTER SWITCH



Note: Available space for primary leads at top and bottom

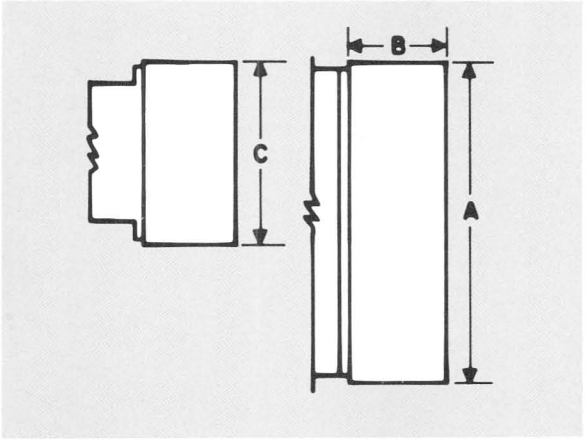
kV	Dimensions in Inches						Weight (in pounds)
	B	C	D	E	F & G	H	
5	61.81	50	9.3	7.75	16 x 23	4.36	‡1500
15	79.3	53	15.85	9.0	12.5 x 27	6.3	‡2100

‡ (1) for potheads add 200 pounds per 2-3/C or 3-1C sets
(2) for fuses add 200 pounds
(3) for Lightning Arresters add 100 pounds

Dimensions and Weights

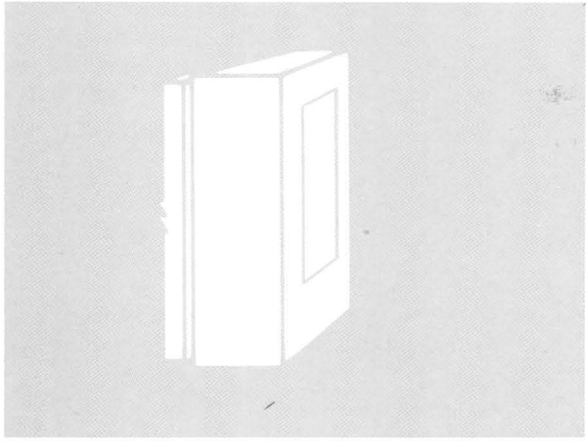
OUTGOING TERMINATION EQUIPMENTS

AIR-FILLED TERMINAL COMPARTMENT



No. of Cables per phase	"A"	"B" (inches)	"C" (inches)	Approximate Weight (pounds)
1 to 4	Same height as transforming section	15	39	250
5 to 8		22	39	400

TYPE AK BREAKER COMPARTMENT‡

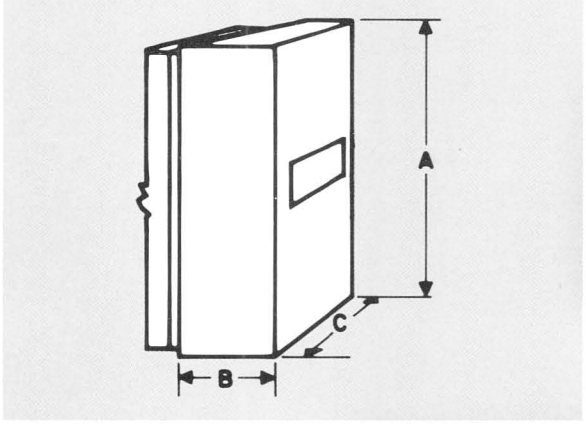


Type Breaker	"B" (inches)		"C" (inches)	Approximate Weight (pounds)	
	Stationary	Drawout		Stationary	Drawout
AKR-30	24	30	39	450	550
AKR-50	29	38	39	700	1000
AK-2-75	34	40	39	1000	1300
AK-2-100	38	44	44	1200	1800

† "A" dimension is same height as transforming section.

‡ In some cases the addition of metering will change the dimensions of the compartment. When metering is required, contact your GE Sales Office for additional information.

MOLDED-CASE BREAKER OR QMR FUSIBLE SWITCH COMPARTMENT‡



Type Panelboard	"A"	"B" (inches)	"C" (inches)	Approximate Weight (pounds)
Molded Case Breakers	Same height as transforming section	22†	39	500

† For main circuit breaker larger than 1200 amps dimension will be increased.

‡ In some cases the addition of metering will change the dimensions of the compartment. When metering is required, contact your GE Sales Office for additional information.

All dimensions are subject to change without notice and should not be used for construction purposes unless endorsed.

Fill in number

Fill in quantity and rating, cross out one

Item No. . . . . Integral Distribution Center
Unit Substation Specifications
. . . . . kVA *(indoor) (outdoor)* Secondary
Unit Substation(s)

General Arrangement

Cross out one

Cross out two

These specifications cover a complete *(outdoor) (indoor)* distribution center unit substation from the incoming line terminals to the outgoing feeder terminals. The unit shall be arranged so that facing the front of the unit, the incoming line section shall be on the *(left) (right)* and the low-voltage outgoing section on the (right (left).

Ratings

Fill in rating

The substation shall have the following self-cooled ratings.

Capacity . . . . . kVA
Frequency . . . . . 60 Hertz
Phases . . . . . three

Fill in rating
Cross out one
and fill in rating

Incoming 3-wire circuit . . . . . volts
Outgoing (3) (4)-wire circuits . . . . . volts

THE UNIT SUBSTATION WILL CONSIST OF THE FOLLOWING COORDINATED COMPONENTS:

1. Incoming Line Section

Select one

Air-filled Terminal Compartment

1—Air-filled low-voltage terminal compartment shall be mounted integrally with the transformer with *(pothead) (set of clamp-type terminals)* for a quantity of . . . . *(single-) (three-)* conductor *(lead-) (rubber-)* covered cable(s), size . . . . *(MCM) (AWG)* entering from *(below) (above)*.
3—TRANQUELL® (distribution type) . . . . . kV surge arresters mounted inside terminal compartment.

Old Cutouts

1—Set of three, gang-operated, oil cutouts rated *(5 kV) (15 kV)* mounted in an air-filled terminal chamber integral with the transformer. *(Key interlocking with the low-voltage secondary circuit breakers is required).*
1—Set of three fuse links mounted in above cutouts. These fuses shall be rated . . . . amperes and will be applied on a circuit having a short-circuit capacity of . . . . kVA symmetrical at . . . . volts.
(Pothead) (set of clamp-type terminals) for a quantity of . . . . *(single-) (three-)* . . . . conductor *(lead-) (rubber-)* covered cable(s), size . . . . *(MCM) (AWG)* entering from *(below) (above)*.
3—*(Station) (Intermediate) (Distribution)* class . . . . . kV surge arresters mounted inside terminal compartment.

Air-interrupter Switch

1—Two-position: open-close, three-pole, gang-operated, air-interrupter switch with stored-energy operating mechanism rated *(5) (15)* kV, *(600 amps continuous, 600 amps load interrupting, 40,000 amps asymmetrical momentary) (1200 amps continuous, 1200 amps load interrupting, 60,000 amps asymmetrical momentary). (Key interlocking with low-voltage main breaker may be required.)*
3—Power fuses *(GE Type EJ) (S&C Type SM4S) (S&C Type SM5S)* are to be mounted in separate compartment within the switch unit accessible through a hinged door mechanically interlocked with interrupter switch. Fuses shall be rated . . . . amperes and applied on circuit having short-circuit capacity of . . . . kVA symmetrical at . . . . volts.
(Pothead) (set of clamp-type terminals) for a quantity of . . . . *(single-) (three-)* conductor *(lead-) (rubber-)* covered cable(s), size . . . . *(MCM) (AWG)* entering from *(below) (above)*.
3—*(Station) (Intermediate) (Distribution)* class . . . . kV surge arresters are to be mounted inside the incoming-line compartment.

Air Selector Switch

1—Air interrupter, three-pole, gang-operated, selector switch rated *(5) (15)* kV, 600 amps continuous and load interrupting rating 40,000 amps asymmetrical momentary. It will consist of a two-position: open-close air switch with stored-energy mechanism in series with a two-position, line 1—line 2, dead-break switch. The two switches are to be mechanically interlocked so that the open-close interrupter switch must be in the open position before the line 1—line 2, dead-break switch can be operated. *(Key interlocking of the interrupter switch with low breakers is required.)*
3—Power fuses *(GE Type EJ) (S&C Type SM4S) (S&C Type SM5S)* are to be mounted in separate compartment within the switch unit accessible through a hinged door mechanically interlocked with interrupter switch. Fuses shall be rated . . . . amperes and applied on a circuit having short-circuit capacity of . . . . kVA symmetrical at . . . . volts.
(Pothead) (set of clamp-type terminals) for a quantity of . . . . *(single-) (three-)* conductor *(lead-) (rubber-)* covered cable(s), size . . . . *(MCM) (AWG)* entering from *(below) (above)*.
3—*(Station) (Intermediate) (Distribution)* class . . . . kV surge arresters are to be mounted inside the compartment and are to be connected to the bus between the two switches.

Double Air-interrupter Switch

1—Double air-interrupter switch rated *(5) (15)* kV, *(600 amps continuous, 600 amps load interrupting, 40,000 amps asymmetrical momentary) (1200 amps continuous, 1200 amps load interrupting, 60,000 amps asymmetrical momentary).* The equipment will consist of 2—two-position: open-close, three-pole, gang-operated, air interrupter switches, equipped with stored-energy mechanisms, which are connected to a common load-side bus. The switches will be key interlocked so that only one switch can be in the closed position.
3—Power fuses *(GE Type EJ) (S&C Type SM4S) (S&C Type SM5S)* will be mounted in a separate compartment within the switch unit accessible through a hinged door that is key interlocked so that both switches must be in the open position before the door can be opened. Fuses shall be rated . . . . amperes and are to be connected to the load-side switch bus. The incoming circuit has a short-circuit capacity of . . . . kVA symmetrical at . . . . volts.
(Potheads) (set of clamp-type terminals) for a quantity of . . . . *(single-) (three-)* conductor *(lead-) (rubber-)* covered cable(s), size . . . . *(MCM) (AWG)* entering from *(below) (above)*.
3—*(Station) (Intermediate) (Distribution)* class . . . . kV surge arresters are to be mounted inside the compartment and are to be connected to the common bus between the switches and power fuses.

GUIDE FORM SPECIFICATIONS (CONTINUED)

Select one

2. Transforming Section

Cross out one
Fill in ratings and cross out one

The transformer section of the unit substation shall be designed and built in accordance with the latest applicable NEMA Standards. It shall be ventilated dry type, self-cooled (with fans) and rated: AA (/FA), 60 Hertz, ... kVA 150 C *(115 C) (80 C)*, ... volts delta primary, ... volts *(wye) (delta)* secondary. Impedance, sound level and voltage connections will be in accordance with NEMA Standards.

The transformer shall have four approximately 2 1/2 percent rated kVA taps, two above and two below rated primary voltage. These taps shall be available by means of an internal terminal board located behind removable plates on the side of the transformer case and are to be changed only when the transformer is de-energized.

Standard Accessories

- Diagrammatic nameplate
- Ventilating louvers
- Removable side sheets
- Vibration-isolating pads
- Provision for lifting
- Provision for jacking
- Base suitable for rolling or skidding
- Ground pad on low-voltage end of enclosure

Optional Accessories

- Fans for auxiliary cooling mounted inside enclosure
- Overload indicator (with alarm contacts)

Test Requirements

The transformer core and coils shall be designed and built to meet the requirements of "Distribution and Power Transformer Short-circuit Test Code" ANSI C57.12.90a—IEEE 262A-1974. Each bidder shall submit to the engineer for his review and approval a complete listing of all full-size transformers of his manufacture within the rating category covered by these specifications.

Each transformer will receive all standard commercial tests in accordance with ANSI C57.12.90. (In addition, the following special tests will be performed on each transformer in accordance with applicable ANSI Standards—[impulse test on high-voltage winding] [sound level test] [temperature test at the self-cooled rate].)

3. Outgoing Line Section

Molded-case Circuit-breaker Panelboard

Consisting of a dead-front panelboard of the convertible circuit-breaker type containing individual molded-case circuit breakers, manually operated, with thermal-magnetic overcurrent protection assembled into a single unit. The panelboard shall be mounted in a metal-enclosed compartment mounted integral with the transformer. The following breakers are included.

Fill in ratings

1—Main air circuit breaker, molded-case, manually operated, stationary-type 3-pole, ... frame, rated . . . . .amp, ...amps interrupting capacity at . . . . .volts, set to trip at . . . . .amps.

Fill in quantity and ratings

. . . . .feeder breakers, molded-case, manually operated, stationary-type interrupting rating at . . . . .volts as follows:

Fill in quantity and ratings

Qty	Frame	Pole	Max Amp	Interrupting Rating (Amp)	Set to Trip at (Amp)
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....

AKR Air Circuit Breaker

Consisting of a single Type AKR air circuit breaker of the drawout construction mounted in a metal-enclosed compartment mounted integral with the transformer. The breaker shall be of the stored-energy type and shall be *(manually) (electrically)* operated. The breaker shall be . . . . . amps frame size with . . . . . amps trip rating. Each pole of the breaker shall be equipped with dual magnetic long-time and instantaneous-overcurrent tripping devices.

Air-filled Terminal Compartment

Air-filled, low-voltage terminal compartment shall be mounted integrally with the transformer with *(pothead) (set of clamp-type terminals)* for a quantity of . . . . . *(single-) (three-)* conductor *(lead-) (rubber-)* covered cable(s), size . . . . . *(MCM) (AWG)* entering from *(below) (above)*.

GENERAL ELECTRIC COMPANY
DISTRIBUTION & MEDIUM TRANSFORMER BUSINESS DEPARTMENT
HICKORY, N.C. 28603

GENERAL ELECTRIC

GEA-10423D (5M) 10/85