



Kingston Health
Sciences Centre

Centre des sciences de
la santé de Kingston



Hôpital
Hôtel Dieu
Hospital



Hôpital Général de
Kingston General
Hospital

Kingston Health Sciences Centre

HDH - UCC - General X-Ray Room Equipment Replacement

Construction Documents Project Manual

Issued For Bid/Permit

2026/06/30

HDR Project No. / Client PLO Number 10460977 / PLO26-012



Mechanical & Electrical

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SECTION 00 00 07
 SEAL SHEET

COMPANY	SEAL	SECTIONS
HDR Architecture Associates, Inc. 27 Princess Street, Suite 400 Kingston, Ontario. K7L 1A3 Telephone: (613) 549-1403		Divisions 0, 1, 2, 6, 7, 8 and 9.
PRIME CONSULTANT		
WSP Canada Inc. 1224 Gardiners Road, Suite 201 Kingston, Ontario, K7P 0G2, Canada Telephone: (613) 634-7373		Divisions 20, 21, 22, 23 & 25.
MECHANICAL CONSULTANT		
WSP Canada Inc. 1224 Gardiners Road, Suite 201 Kingston, Ontario, K7P 0G2, Canada Telephone: (613) 634-7373		Divisions 26, 27 & 28.
ELECTRICAL CONSULTANT		

END OF SEAL SHEET

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SECTION 00 01 15
LIST OF DRAWINGS

ARCHITECTURAL

A000 COVER SHEET
A001 INFORMATION SHEET & DETAILS
A050 LEVEL 0 - DEMOLITION PLAN & REFLECTED CEILING PLAN
A100 LEVEL 0 - NEW WORK PLAN & REFLECTED CEILING PLAN

MECHANICAL

M100 KEY PLAN AND LEGENDS
M201 LEVEL 0 - FIRE PROTECTION AND PLUMBING NEW WORK
M301 LEVEL 0 - HVAC DEMOLITION AND NEW WORK PLANS

ELECTRICAL

E000 KEY PLAN AND LEGENDS
E001 LIGHTING DEMOLITION AND NEW WORK
E002 POWER AND SYSTEMS DEMOLITION AND NEW WORK
E100 EQUIPMENT LAYOUT
E200 ELECTRICAL DETAILS
E201 ELECTRICAL DETAILS
E202 ELECTRICAL DETAILS

GE HEALTHCARE (FOR REFERENCE AND COORDINATION ONLY)

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16-E5 POWER REQUIREMENTS

END OF LIST OF DRAWINGS

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SECTION 00 21 13 INSTRUCTIONS TO BIDDERS

1.1 COMPLIANCE

- A. The bidder acknowledges that by submitting a compliant bid, it has accepted an offer by the *Owner* to enter into a “bid contract” for the evaluation of bids and the award of the *Contract*, if an award is made. The bidder acknowledges that the terms of the “bid contract” are represented by the Bid Documents.
- B. A bid which fails to comply with the requirements of these Instructions to Bidders may cause a bid to be declared non-compliant.

1.2 INTENT

- A. The intent of this Bid call is to obtain an offer to perform work to complete the *Kingston Health Sciences Centre - HDH - UCC - General X-Ray Room Equipment Replacement* for a Stipulated Price contract, in accordance with the *Contract Documents*.
- B. Initiate work within 2 weeks of receipt of notice of *Contract* award.
- C. Achieve *Ready-for-Takeover* and *Total Completion of the Work* by the *Scheduled Ready-for-Takeover Date* and *Scheduled Total-Completion Date* as defined by Supplementary Conditions 2.2 H. and 2.2 I.

1.3 CONTRACT DOCUMENTS IDENTIFICATION

- A. *Contract Documents* are identified as *Kingston Health Sciences Centre - HDH - UCC - General X-Ray Room Equipment Replacement, HDR Architecture Associates, Inc. / Owner’s* project number *Contract* number 10460977 / PLO26-012 as prepared by *HDR Architecture Associates, Inc.*, Prime Consultant; and *WSP Canada Inc. Consulting Engineers*, Mechanical & Electrical Consultant.
- B. The form of *Contract* for this project will be the CCDC 2-2020 and Supplementary Conditions included in section 00 73 00.
- C. The following documents form the basis of this bid process (the “Bid Documents”):
 - 1. Instructions to Bidders
 - 2. Bid Forms
 - 3. Agreement, Definitions and General Conditions of the CCDC 2-2020
 - 4. Supplementary Conditions
 - 5. *Specifications* (per List of Contents)
 - 6. *Drawings* (per List of Drawings)
 - 7. Addenda issued during bidding period
- D. Check Bid Documents for completeness upon receipt. Inform *Consultant* immediately should any documents be missing or incomplete or upon finding any discrepancies or omissions.
- E. Documents obtained from sources other than the Prime Consultant may be incomplete or otherwise deficient. Bidders assume all risks associated with the use of such documents.
- F. Unauthorized reproduction of Bid Documents is prohibited without written consent of the *Consultant*.
- G. The Bid Documents are made available only for the purpose of submitting bids for the *Project*. Availability and/or use of the Bid Documents do not confer a license or grant for any other purpose.
- H. Bid Documents are on display at the following construction association plans rooms:
 - 1. Kingston Construction Association, 1575 John Counter Boulevard, Kingston, Ontario. K7M 3L5

- I. Except as otherwise defined in these Instructions to Bidders, the defined terms in these Bid Documents are taken from the *Contract*. The term *Contract* is defined in the Agreement.

1.4 CONDITIONS OF THE PLACE OF THE WORK

- A. The *Place of the Work* is located at the *Hotel Dieu Hospital Site, 166 Brock St, Kingston, Ontario*.
- B. Before submitting a bid, investigate the *Place of the Work* to fully ascertain existing conditions, circumstances and limitations affecting the *Work*. No allowances will be made for additional costs and no claims will be entertained in connection with conditions which could reasonably have been ascertained by such investigation or other due diligence prior to submitting a bid.

1.5 MANDATORY SITE MEETING

- A. A mandatory site meeting has been scheduled to take place on **July 7th, 2026 @ 11:00 h** and is to commence from the **166 Brock Street Hotel Dieu Hospital Johnson Street Staff Entrance**. All prequalified general contract bidders and mechanical and electrical subcontract bidders must attend and will be required to sign the "Site Meeting Log" to confirm their attendance.
- B. **All general contractor bidders and mechanical and electrical subcontract bidders are to advise the Consultant and Owner of their intent to bid and identify name(s) of individuals that will be attending the Mandatory Site Meeting by 12:00 hr July 6th, 2026.**
 1. *Consultant* representative:
Reginald Hesman
HDR Architecture Associates, Inc.
Email: reginald.hesman@hdrinc.com
 2. *Owner* representative:
Nancy Wartman
Kingston Health Sciences Centre
Email: nancy.wartman@kingstonhsc.ca
- C. Bidders not in attendance at the mandatory site visit, as determined by the "Site Meeting Log," will not be permitted to submit a bid for this project. Bids received by the *owner*, submitted by general contract bidders not in attendance, will be returned unopened.

1.6 PREQUALIFICATION

- A. The following bidders have been prequalified:
 1. Bradford Construction Ltd.
 2. David J. Cupido Construction Ltd.
 3. Emmons & Mitchell Construction (2000) Ltd.
 4. Frecon Construction Ltd.
 5. Gen-eer Construction Ltd.
 6. Jumec Construction Inc.
 7. K. Knudsen Construction Ltd.
 8. M. Sullivan & Son Ltd.
 9. Tom Belch & Sons Building Contractors Ltd.
- B. Bidders must use *Subcontractors* from the following prequalified list:
 1. Mechanical Subcontract Bidders:
 - a. Alex McCoy Plumbing & Heating Ltd.
 - b. Allen Mechanical Inc.
 - c. Brough Sheet Metal Co. Ltd.
 - d. E.S. Fox Ltd.
 - e. Hamilton Smith Ltd.
 - f. Kelson Mechanical Eastern Inc.
 - g. Modern Niagara Toronto Inc.
 2. Electrical Subcontract Bidders:
 - a. Earl Carr Electric Canada Ltd.

- b. E.S. Fox Ltd.
- c. Irwin Electrical Contracting
- d. McClement Electric Ltd.
- e. Modern Niagara Toronto Inc.
- f. Parallel Electric Ltd.
- 3. Fire Alarm
 - a. Siemens
- 4. BAS
 - a. Ainsworth

C. Bids received from bidders which have not been prequalified shall be returned unopened.

1.7 BID AND PERFORMANCE SECURITY

- A. Each bid submitted shall be accompanied by bid security in the form of a Bid Bond in an amount of not less than 10% of Bid price submitted, naming the *Owner* as obligee and issued by a surety licensed to conduct surety and insurance business in Ontario. The bid security is for the benefit of the *Owner* and stands as security that the bidder, if awarded the *Contract*, will deliver the performance security and evidence of insurance and other documents required by these Instructions to Bidders or by the *Contract*, and will execute the *Contract*. The bid security shall remain valid for a period of ninety (90) days from the date of bid submission. No other form of bid security is acceptable.
- B. The bid security of the bidder whose bid is accepted will be retained by the *Owner* to compensate the *Owner* for the damages it will suffer should the successful bidder fail to execute the *Contract* and/or fail to provide the specified performance security and/or evidence of insurance and other documents required by these Instructions to Bidders or by the *Contract*.
- C. The bid security of the bidder whose bid is accepted will be returned after the delivery of the specified performance security and evidence of insurance and other documents required by these Instructions to Bidders or by the *Contract*, and after the execution of the *Contract*. The bid security of all other bidders will be returned after the execution of the *Contract* or after the expiry of this bid process without an award of *Contract* or after the rejection of all bids.
- D. Each bid shall be accompanied by an agreement to bond issued by the same surety company that provides the bid bond, undertaking to provide a fifty percent (50%) Performance Bond and a fifty percent (50%) Labour and Material Payment Bond, both to be delivered to the *Owner* if the bidder is awarded the *Contract*.
- E. Bids not accompanied by the required bid security, the required agreement to bond and declaration of insurance may be declared non-compliant and be disqualified at the discretion of the *Owner*.
- F. Include the cost of all bonds in the bid price.
- G. All forms shall be latest CCDC approved bonding forms.

1.8 UNDERTAKING OF INSURANCE

- A. Provide signed "Undertaking of Insurance" on standard form provided by insurance company stating intention to provide insurance to Bidder in accordance with insurance requirements of *Contract Documents*. Include this form with Bid submission.

1.9 AMENDMENTS TO BID DOCUMENTS

- A. Direct questions arising during the bidding period to:
Reginald Hesman
HDR Architecture Associates, Inc.
Email: reginald.hesman@hdrinc.com
- B. The Bid Calling Authority shall be the sole contact for bidding inquiries on this *Project*.

- C. Neither the *Owner* nor the *Consultant* will be responsible for instructions, clarifications or amendments communicated orally. Instructions, clarifications or amendments which affect the Bid Documents may only be made in writing by written addendum.
- D. If bidders find discrepancies, omissions, errors, departures from building by-laws, codes or good practice, and points considered to be ambiguous or conflicting, they shall bring them to the attention of the Bid Calling Authority in writing, and not less than seven (7) *Working Days* before the bid closing date, so that the *Consultant* may, if the *Consultant* deems it necessary, issue instructions, clarifications or amendments by addendum to all bidders prior to the bid closing date. The *Consultant* will endeavor to issue such addenda at least forty-eight (48) hours prior to bid closing.
- E. Addenda issued during the bidding period shall become part of the Bid Documents and their receipt shall be acknowledged in the space provided on the Bid Form. Addenda will be sent to all bidders. Associated costs shall be included in the Base Bid.

1.10 REQUESTS FOR CLARIFICATION

- A. The *Consultant* may contact any one or more bidders to request clarification without any obligation to contact other bidders. Such additional clarification shall be provided promptly by the bidder to the *Consultant*.
- B. Requests for information shall not be construed as acceptance of a bid.

1.11 PRODUCT/SYSTEM OPTIONS

- A. Where Bid Documents stipulate a particular product, consideration for *Consultant* approved equivalents will be considered by *Consultant* up to ten (10) days before receipt of Bids.
- B. Bidders shall supply the *Consultant* with all pertinent data required to carry out a detailed review of the proposed equivalent.
- C. When a request to substitute a product is made, *Consultant* may approve equivalents and will issue an Addendum to known bidders.
- D. In submission of equivalents to products specified, Bidders shall include in their Bid, any changes required in work to accommodate such substitutions. A later claim by Bidder for an addition to contract price because of changes in work necessitated by use of substitutions shall not be considered.
- E. Unless equivalents are submitted in this manner and subsequently accepted, provide products as specified.

1.12 VALUE ADDED TAXES

- A. The bid price shall not include any *Value Added Taxes*. All other eligible taxes shall be included in the bid price. Any taxes or increases to taxes announced prior to the date of the issuance of the Bid Documents and scheduled to come into effect subsequent to it shall be taken to be included in the bid price.

1.13 BID COMPLETION

- A. Fill in all blank spaces on the Bid Forms in ink, or typewritten, providing all information requested, and ensure an authorized person or persons sign all forms where indicated. Failure to provide all requested information on the Bid Form and failure to fill in all blank spaces may result in a bid being declared non-compliant at the *Owner's* discretion.
- B. Use only the Bid Form issued as part of the Bid Documents for this Project. If any or all pages of the Bid Forms are amended by addendum, the Bid Form will be reissued in its entirety. The latest Bid Form shall be used when submitting as bid. Failure to comply with this paragraph may result in the bid being declared non-compliant at the *Owner's* discretion.

- C. Information provided by bidders on the Bid Forms may be amended prior to bid closing, provided corrections are initialed by an authorized representative of the bidder. Other modifications, erasures, additions, conditions, qualifications or un- initialed pre-closing amendments may result in the bid being declared non-compliant at the *Owner's* discretion.
- D. Bids that are not originals, are unsigned, improperly signed, un- initialed, incomplete, conditional or illegible, may be declared non-compliant at the *Owner's* discretion.
- E. Bid Price
 - 1. The Bid Form provides that the bid price shall be provided in numbers and expanded written text.
 - 2. Where the Bid Forms require the bidder to provide a breakdown of the bid price, the bid price shall govern in the case of conflict or ambiguity between the bid price and the sum of the breakdown of the bid price.
 - 3. In the case of a conflict or ambiguity between the numeric and written bid price, the numeric price shall govern.
- F. Listing of *Subcontractors*
 - 1. Where required by the Bid Documents, a bidder shall complete and submit a Supplementary Bid Form – List of *Subcontractors*, naming the *Subcontractors* and *Suppliers* which the bidder will employ to perform an item of the *Work* called for by the *Contract*. Failure of the bidder to list *Subcontractors* and *Suppliers*, where required, or the listing by a bidder of more than one *Subcontractor* and *Supplier* to perform or supply an item of work listed, may result in the bid being declared non-compliant.
 - 2. Where a bidder lists “own forces” in lieu of a *Subcontractor*, the bidder shall carry out such item of the *Work* with its own forces. Where “own forces” have been listed by a bidder, the *Owner* reserves the right to obtain information from the bidder and from third parties respecting the qualifications and experience of the bidder’s “own forces” for such item of the *Work*. If the *Owner*, acting reasonably, determines that the bidder’s “own forces” are not sufficiently qualified or sufficiently experienced to undertake such item of the *Work*, it may reject the bid.
- G. Itemized Prices: Where required by the Bid Document, a bidder shall complete and submit a Supplementary Bid Form – Itemized Prices. The costs associated with Itemized Prices shall be included in the base bid and are provided to the *Owner* for informational purposes. The *Owner* reserves the right to use such pricing to delete scope from the project for budgetary reasons, at their discretion.
- H. Identified Prices: Where required by the Bid Document, a bidder shall complete and identify on their submitted bid form. The costs associated with Identified Prices shall be included in the base bid and are provided to the *Owner* for informational purposes.
- I. Alternative Prices: Where required by the Bid Documents, a bidder shall complete and submit a Supplementary Bid Form – Alternative Prices. Alternative prices shall show the net difference in cost of supplying and installing the alternative constructions or materials in lieu of the constructions or materials indicated on the drawings and/or described in the specifications. The *Owner* reserves the right to accept or reject any or all alternative prices, at their discretion.
- J. Unit Prices: Where required by the Bid Documents, a bidder shall complete and submit a Supplementary Bid Form – Unit Prices. Submit Unit Prices for the items of work listed. Unit Prices shall show the total cost of supplying and installing work listed. Unit Prices shall include all overhead and profit for the *Contractor* and *Subcontractor* and shall follow the intent and conditions for each part of the work indicated on the drawings and/or described in the specifications.
- K. Separate Prices: Provide separate prices for items of work as listed on the Bid Form. Separate Prices ARE NOT included in the Base Bid submitted. The *Owner* reserves the right to accept or reject any or all alternative prices, at their discretion.

1.14 BID ELIGIBILITY

- A. Bid eligibility will be determined by and at the discretion of the *Owner* and Bid Calling Authority based on the requirements set by the Bid Documents.
- B. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may be declared informal at the discretion of the *Owner*.
- C. The *Owner* reserves the right to obtain additional information from the bidders following receipt of the bids and prior to the selection of a successful bidder, as required to aid in the review and selection of a successful bidder, including, but not limited to the correction of irregularities.

1.15 BID SUBMISSION

- A. Submit one (1) completed original of the Base Bid Form, and any required Supplementary Bid Forms, accompanied by the bid enclosures, in a sealed opaque envelope. Ensure that the outside of the envelope bears the bidder's return address and a label clearly identifying the *Project* Name and *Contract* Number for which the bid is submitted.
- B. Bids shall be signed under seal, executed, and dated and will be addressed to and received by:

Mr. Adam Bondy
Director, Capital Projects & Planning
Kingston Health Sciences Centre
Planning Office
24 Barrie Street,
Kingston ON K7L 3J6

- C. Bids must be received before **15:00 h local time on July 21st, 2026**. The term "local time" shall mean the time as measured by the identified clock at the recipient's location.
- D. Bids will be date and time stamped at the place receiving the bids.
- E. Bids which are submitted by facsimile transmission or by electronic means will not be considered.
- F. Bidders are solely responsible for the method and timing of delivery of their bids.

1.16 BID EXPIRY PERIOD

- A. Bids shall be irrevocable for a period of ninety (90) days from the date of submission, after which period the bid expires.

1.17 BID OPENING AND EVALUATION

- A. Bids will be opened in public at the office of the *Owner*, located at **24 Barrie Street, Kingston, Ontario, Room 17-205** immediately following the close of bids.
- B. To gain access to the building, please call:

Nancy Wartman
Kingston Health Sciences Centre
Email: nancy.wartman@kingstonhsc.ca
Phone: 613.549.6666 x 63647

- C. In the event that more than one envelope is received from the same bidder, only the last envelope received will be considered.
- D. The Bids will be reviewed by the Bid Calling Authority and the *Owner*.
- E. CCDC 23-2005 "A Guide to Calling Bids and Awarding Contracts" and CCA 29-1995 "A Guide on Standard Contracting and Bidding Procedures" will be used as guidelines in reviewing the bids.

1.18 AWARD OF CONTRACT, EXECUTION OF THE CONTRACT AND DOCUMENTS TO BE DELIVERED

- A. Bidders shall not issue or make any statements or news release concerning their bid, the bid process, the *Owner's* evaluation of the bids, or the *Owner's* award or cancellation of the bid process without the express written consent of the *Owner*.
- B. If the *Owner* decides to award the *Contract* to a bidder, the *Consultant* will issue a Letter of Intent on behalf of the *Owner*.
- C. Prior to commencing the *Work*, the *Contractor* shall deliver to the *Owner* the following:
 - 1. Performance Bond and the Labour and Material Payment Bond described in the Bid Documents, the form of such bonds to comply with the requirements of the *Contract*;
 - 2. Certificate of Insurance. Certified true copies of the insurance policies required by the Bid Documents shall be provided within 90 days of notice of award of contract; and
 - 3. Current Clearance Certificate issued by the Workplace Safety and Insurance Board.
 - 4. Schedule "A" – Key Personnel as outlined in 01 11 00 paragraph 1.2.
- D. The *Contractor* shall execute the *Contract* and deliver the executed original to the *Owner* within ten (10) *Working Days* of receipt from the *Consultant*.
- E. The *Owner* will be recognized as "*Kingston Health Sciences Centre*".

1.19 LIMIT OF LIABILITY

- A. The liability of the bidder to the *Owner* for loss and damage arising out of the bidder's breach of the "bid contract" shall be limited to the lesser of the actual loss suffered by the *Owner* and the amount indicated on the Bid Bond.
- B. The liability of the *Owner* to any bidder for loss and damage arising in tort or for the breach by the *Owner* of the "bid contract" shall be limited to the lesser of the sum of the Bid Bond and the reasonable cost to the bidder of preparing its bid.

1.20 DISPUTES

- A. In the event of a dispute arising in connection with this bid process including, without limitation, a dispute concerning the existence of the "bid contract" or a breach of the "bid contract", or a dispute as to whether the bid of any bidder was submitted on time or whether a bid is compliant, the *Owner* may refer the dispute to a confidential binding arbitration pursuant to the Arbitration Act, 1991, as amended, before a single arbitrator with knowledge of procurement/bidding law. In the event that the *Owner* refers the dispute to arbitration, the bidder agrees that it is bound to arbitrate such dispute with the *Owner*. Unless the *Owner* shall refer such dispute to binding arbitration, there shall be no arbitration of such dispute.
- B. In the event the *Owner* refers a dispute to binding arbitration, the *Owner* may give notice of the dispute to one or more of the other bidders who submitted bids, whether or not they may be compliant, each of whom shall be a party to and shall be entitled to participate in the binding arbitration, and each of whom shall be bound by the arbitrator's award, whether or not they participated in the binding arbitration.
- C. In the event the *Owner* refers a dispute to binding arbitration, the parties to the arbitration shall exchange brief statements of their respective positions on the dispute, together with the relevant documents, and submit to a binding arbitration hearing which shall last no longer than two days, subject to the discretion of the arbitrator to increase such time. The parties further agree that there shall be no appeal from the arbitrator's award.
- D. This Article is not intended to form part of any "bid contract" that may come into being between a bidder and any prospective *Subcontractor* or *Supplier* of that bidder.

END OF INSTRUCTIONS TO BIDDERS

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SECTION 00 41 00
BID FORM

Name of Contractor:

Bid For: Kingston Health Sciences Centre
HDH - UCC - General X-Ray Room Equipment Replacement
Kingston, Ontario.

To: Adam Bondy
Director, Capital Projects & Planning
Kingston Health Sciences Centre
Planning Office
24 Barrie Street,
2nd Floor, Room 17-213
Kingston ON K7L 3J6

We, the undersigned, having carefully examined the Bid Documents, visited the site, and taken into account all conditions affecting the *Work*, hereby offer to furnish all necessary labour, *Products* and *Construction Equipment* required to perform expeditiously, and complete in a satisfactory manner, the above mentioned *Project* in accordance with the Bid Documents, for the Stipulated Sum of

.....
.....dollars (\$)

We confirm that the above sum includes all applicable taxes, royalties, custom duties, overhead and profit, insurance premiums, permits, and all other charges at the date of this Bid, and is not subject to revisions due to changes in the cost of labour, materials or other items, but does not include any *Value Added Taxes*.

1.1 VALUE ADDED TAXES

The Stipulated Sum does not include *Value Added Taxes*.

1.2 SITE SUPERVISION

- A. MANDATORY bid requirement – Reference 01 35 33 – Infection Control Guidelines for Construction. All construction site supervisors shall be CSA trained and be able to provide proof of course completion by the Canadian Standard Association in CSA Z317.13 Infection Control during Construction, Renovation and Maintenance of Health Care Facilities. Third party training is not accepted. *Failure to provide this at the time of the bid shall result in the disqualification of the bid.*
- B. Proposed Site Supervisor

1.3 SUBCONTRACTS

We list hereunder the names of the *Subcontractors* whose bids we have used in our Bid and with whom we intend to award subcontracts, if awarded the *Contract*. We acknowledge that no changes to the list will be made without the *Consultant's* approval.

1.4 TRADE NAME

Demolition	.....
Structural Steel	.....
Millwork and Finish Carpentry	.....
Gypsum Board, Framing	.....
Acoustical Panel Ceiling, Suspension	.....
Door and Frames, Glazing, Hardware	.....
Flooring	.....
Painting	.....
Fire Suppression	.....
Mechanical Prime	.....
Electrical Prime	.....

1.5 VALIDITY OF THE BID

Our bid will remain in good standing for a period of ninety (90) days after the closing date of general contract bids.

1.6 COMPLETION OF THE WORK

We understand the sequence of work as outlined in the Project Manual and undertake to complete the work within _____ weeks.

1.7 ACCEPTANCE OF THE BID

We recognize the right of the *Owner* not to accept the lowest or any other bid received.

1.8 ALTERNATIVES

We hereby submit for your consideration the following alternatives and understand that the *Owner* may reject any or all of these proposals:

SPEC SECTION	ADD TO STIPULATED SUM	DEDUCT FROM STIPULATED SUM
_____	_____	_____
_____	_____	_____
_____	_____	_____

1.9 ENCLOSURES

We enclose herewith the following:

- A. Letter of Consent from the Surety Company.

- B. A Bid Bond made out in favour of the *Owner* in the amount of 10% of the Bid Price.
- C. Undertaking of Insurance.
- D. A copy of Site Supervisor *Certificate of Attendance for the Fundamentals of Infection Control during Construction, Renovations or Maintenance of Health Care Facilities*

1.10 SCHEDULE OF VALUES (REQUIRED WITH BID)

- A. Schedule of Values (SOV) – Bid Form Attachment is REQUIRED to be submitted with this Bid Form.
 - 1. The Schedule of Values shall allocate 100% of the Base Bid Amount.
 - 2. The total of all line items must equal the Base Bid.
 - 3. The SOV shall be used for:
 - a. Evaluation of bid completeness
 - b. Progress payments
 - c. Change order pricing
- B. Failure to include a Schedule of Values may render the bid non-compliant.

1.11 ADDENDA

We acknowledge receipt of the following addenda issued during the bidding period.

Addendum No. _____ dated _____.

Addendum No. _____ dated _____.

Addendum No. _____ dated _____.

Addendum No. _____ dated _____.

Addendum No. _____ dated _____.

Addendum No. _____ dated _____.

1.12 BID EVALUATION

We understand that the Bid will be evaluated based on the Base Bid only and the below Identified prices are included in the Base Bid.

Dated at _____

This _____ Day of _____ 2026.

Seal (If a Corporation)
Signature of Bidder

END OF BID FORM

SCHEDULE OF VALUES (SOV) – BID FORM ATTACHMENT

1.1 PRICE BREAKDOWN BY DIVISION

DIVISION	VALUE
01 GENERAL CONDITIONS	\$
02 EXISTING CONDITIONS	\$
03 CONCRETE	\$
04 MASONRY	\$
05 METALS	\$
06 WOOD, PLASTICS, AND COMPOSITES	\$
07 THERMAL AND MOISTURE PROTECTION	\$
08 OPENINGS	\$
09 FINISH	\$
10 SPECIALTIES	\$
11 EQUIPMENT	\$
12 FURNISHINGS	\$
13 SPECIAL CONSTRUCTION	\$
14 CONVEYING EQUIPMENT	\$
20 MECHANICAL COMMON WORK RESULTS	\$
21 FIRE SUPPRESSION	\$
22 PLUMBING	\$
23 HEATING, VENTILATING AND AIR CONDITIONING	\$
25 INTEGRATED AUTOMATION	\$
26 ELECTRICAL	\$
27 COMMUNICATIONS	\$
28 ELECTRONIC SAFETY AND SECURITY	\$
TOTAL	\$

SECTION

AMENDMENTS TO THE STIPULATED PRICE CONTRACT, CCDC2-2020

The Standard Construction Document for Stipulated *Price the Contract*, English version, consisting of the Agreement Between *the Owner* and the *Contractor*, Definitions, and General Conditions of the Stipulated *Price the Contract*, Parts 1 to 13 inclusive, governing same is hereby made part of these *the Contract Documents*, with the following amendments, additions and modifications:

PART 1 - AGREEMENT BETWEEN OWNER AND CONTRACTOR

1.1 ARTICLE A-1 THE WORK

- A. Delete paragraph 1.3 and replace it with the following:
“1.3 commence the *Work* by the _____ day of _____ in the year _____ and, subject to adjustment in the *Contract Time* as provided for in the *Contract Documents* attain *Ready-for Takeover*, by the *Scheduled Ready-to-Takeover Date*; and attain the *Total Completion of the Work* by the *Scheduled Total Completion Date*. (Refer to Section 00 21 13, Instruction to Bidders Item 1.2 B)

1.2 ARTICLE A-5 – PAYMENT

- A. Amend paragraph 5.1.3, in the first line, by deleting the words “the issuance of the” and replacing them with “receipt of the *Consultant*’s”.
- B. Delete paragraph 5.2.1 and replace it with the following:
“Should either party fail to make payments as they become due under the terms of the *Contract* or in an award by arbitration or a court, interest shall also become due and payable on such unpaid amounts at 1% above the prime rate. Such interest shall be compounded on a monthly basis. The prime rate shall be the rate of interest quoted by Bank of Canada for prime business loans as it may change from time to time.”
- C. Amend paragraph 5.2.1(1) by deleting “for the first 60 days”.
- D. Delete paragraph 5.2.1(2) and replace it with “Intentionally deleted”.

1.3 ARTICLE A-6 – RECEIPT AND ADDRESSES FOR NOTICES IN WRITING

- A. Delete paragraph 6.1 and replace it with the following:
“*Notices in Writing* between the parties or between them and the *Consultant* shall be considered to have been received by the addressee on the date of receipt if delivered by hand or by commercial courier or if sent during normal business hours by fax and addressed as set out below. Such *Notices in Writing* will be deemed to be received by the addressee on the next business day if sent by fax after normal business hours or if sent by overnight commercial courier. Such *Notices in Writing* will be deemed to be received by the addressee on the fifth *Working Day* following the date of mailing, if sent by pre-paid registered post, when addressed as set out below. An address for a party may be changed by *Notice in Writing* to the other party setting out the new address in accordance with this Article.”

1.4 ARTICLE A-8 – SUCCESSION

- A. Amend paragraph 8.1 by inserting “permitted” before “assigns”.

1.5 ARTICLE A-9 TIME OF THE ESSENCE

- A. Add new Article A-9 as follows:
 - “9.1 The *Contractor* acknowledges and agrees that one of the reasons the *Contractor* was selected for the *Work* is the *Contractor*’s representation and warranty that it will attain *Ready-for-Takeover* and the *Total Completion of the Work* by the dates set out in Article A-1, paragraph 1.3, and the *Contractor* acknowledges and agrees that they have been advised by the *Owner* that it is critical to the *Owner* that *Ready-for-Takeover* be achieved by the prescribed dates and that time is of the essence of this *Contract*.

- 9.2 No approval or consent of, or certification, inspection, review, comment, verification, confirmation, acknowledgement or audit by, any governmental authority, the *Owner*, or the *Consultant*, or anyone on their behalf, shall relieve the *Contractor* from performing or fulfilling any of its obligations under the *Contract*. Without limitation, whenever any drawings, plans, procedures, programs or other work product of the *Contractor* requires any review, inspection, comment or approval by any governmental authority, the *Owner*, or the *Consultant*, or anyone on their behalf, any such review, inspection, comment or approval shall not, in any way, reduce or modify any of the *Contractor's* obligations under the *Contract*.
- 9.3 If any part of the *Contract* or the application of such part to any party, person or circumstance shall, to any extent, be invalid or unenforceable, the remainder of the *Contract*, or the application of such part to any other party, person or circumstance, shall not be affected thereby and each provision of the *Contract* shall be valid and enforceable to the fullest extent permitted by law.
- 9.4 The terms of the *Contract*, which by their nature are continuing, shall survive the termination or other expiration of the *Contract*.
- 9.5 This Agreement, including the *Contract Documents* described herein and the attachments, documents and other agreements to be furnished or executed in connection herewith, supersede all prior negotiations, representations or agreements, either written or oral, with respect to the subject matter hereof. No modification to the *Contract* shall be effective unless made in writing signed by both the *Owner* and the *Contractor*, unless otherwise provided for herein.
- 9.6 This Agreement may be executed at different times and in counterparts, each of which when executed and delivered, including any counterpart executed by a Party and transmitted by email by way of pdf attachment or facsimile transmission, shall be deemed an original, but all of which together will constitute one and the same instrument binding upon the parties hereto, notwithstanding that all such parties may not have executed the same counterpart. Signature and delivery by any party of signature pages by an electronic signature service shall be as binding an execution and delivery of this Agreement by such party as if the party had delivered an actual physical original of this Agreement with an ink signature from such party."

PART 2 - DEFINITIONS

2.1 AMEND DEFINITION OF, "*CONSULTANT*", BY ADDING THE FOLLOWING TO THE END OF THAT DEFINITION:

- A. "For purposes of the *Contract*, the terms "*Consultant*", "Architect" and "Engineer" shall be considered synonymous."

2.2 ADD THE FOLLOWING NEW DEFINITIONS:

- A. "'*Act*' means the *Construction Act* (Ontario), RSO 1990, c C.30."
- B. "'*Commissioning*' means the process of putting the *Work* or any part thereof into operation and includes Start-Up, Verification and Performance Testing as described in the *Contract Documents*."
- C. "'*COVID-19*' means the novel coronavirus infectious disease SARS-CoV-2 as referenced by the World Health Organization, including all related viruses, diseases, or variants, and any subsequent waves."
- D. "'*Dispute*' has the meaning ascribed in GC 8.1.1."
- E. "'*Environmental Programs*' means the environmental plans, programs, procedures and requirements of the *Owner*. The *Environmental Programs* incorporate the *Owner's* infection control program including measures to suppress dust and noise and to avoid conditions likely to propagate mould or fungus of any kind."
- F. "'*Key Personnel*' means the project managers, superintendents, coordinators or other personnel of the *Contractor*, if any, identified in Schedule "A" – Key Personnel to the *Contract*. Reference project manual section 01 11 00 and Schedule "A" submittal.
- G. "'*OHSA*' means the *Occupational Health and Safety Act* (Ontario), RSO 1990, c O.1, as amended, and all regulations passed thereunder."

- H. “‘Scheduled Ready-for-Takeover Date’ means October 30th, 2026.”
- I. “‘Scheduled Total Completion Date’ means November 13th, 2026”
- J. “‘Submittals’ are documents, items or other forms of information required by the *Contract Documents* to be provided by the *Contractor* to the *Owner* or the *Consultant*, and include, without limitation: (a) *Shop Drawings*, samples, models, mock-ups to indicate details or characteristics, before the portion of the *Work* that they represent can be fabricated and incorporated into the *Work*; and (b) *Record Drawings*, manuals and other close-out documentation to provide instructions for the operation and maintenance of the *Work*”.
- K. “‘Total Completion of the Work’ means the date that the *Work* is fully complete as prescribed by the *Contract Documents*, including, without limitation, the rectification of all defects and deficiencies.”
- L. “‘WSIB’ means the Workplace Safety & Insurance Board.”

PART 3 - GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT

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

3.1 GC 1.1 - CONTRACT DOCUMENTS

- A. Amend paragraph 1.1.3 by inserting “Applying the standard of care described in paragraph 1.5.1.1 of GC 1.5 – PROJECT REQUIREMENTS,” at the beginning of the first sentence.
- B. Amend paragraph 1.1.4 by inserting “Except for its obligations to review under GC 1.1.3 and to report under this GC 1.1.4,” at the beginning of the first sentence and by adding “Neither the *Owner* nor the *Consultant* will be responsible for oral instructions.” after the second sentence.
- C. Amend paragraph 1.1.5.1 by moving the reference to “Supplementary Conditions” to the top of the order of priority.
- D. Delete subparagraph 1.1.5.5 in its entirety and substitute new subparagraph 1.1.5.5 as follows:
“In case of discrepancies, noted materials and annotations shall take precedence over graphic indications in the *Contract Documents*.”
- E. Add the following as paragraph 1.1.6.3:
“The *Specifications* are divided into divisions and sections for convenience but shall be read as a whole and neither such division nor anything else contained in the *Contract Documents* will be construed to place responsibility on the *Consultant* to settle disputes among the *Subcontractors* and *Suppliers* in respect to such divisions. The *Drawings* are, in part, diagrammatic and are intended to convey the scope of the *Work* and indicate general and appropriate locations, arrangement and sizes of fixtures, equipment and outlets. The *Contractor* shall obtain more accurate information about the locations, arrangement and sizes from study and coordination of the *Drawings*, including *Shop Drawings* and shall become familiar with conditions and spaces affecting these matters before proceeding with the *Work*. Where site conditions require reasonable minor changes in indicated locations and arrangements, the *Contractor* shall make such changes at no additional cost to the *Owner*. Similarly, where known conditions or existing conditions interfere with new installation and require relocation, the *Contractor* shall include such relocation in the *Work*. The *Contractor* shall arrange and install fixtures and equipment in such a way as to conserve as much headroom and space as possible. The schedules are that portion of the *Contract Documents* wherever located and whenever issued, compiling information of similar content and may consist of *Drawings*, tables and/or lists.”
- F. Delete paragraph 1.1.8 in its entirety and substitute new paragraph 1.1.8:
“1.1.8 The *Owner* shall provide the *Contractor*, without charge, up to six copies of the *Contract Documents* if requested in writing.”
- G. Amend paragraph 1.1.9 by adding the following to the end of the paragraph:
“The *Specifications* may be divided into Divisions and the Divisions into Sections for the purpose of convenience, but a Section may consist of work of more than one *Subcontractor* or *Supplier*. The *Specifications* are intended to be read as a whole.”

H. Delete paragraph 1.1.10 in its entirety and substitute new paragraph 1.1.10 as follows:

“1.1.10 The design information furnished to the *Contractor* as part of the *Contract Documents*, including the *Drawings* and *Specifications*, are the property of the *Owner* and/or the *Consultant*, and are to be used by the *Contractor* only for the purposes of performing the *Work*. The *Contractor* shall not copy, alter or utilize the aforesaid design information for any purpose unrelated to the *Work* without written authorization from the *Owner* and the *Consultant*.”

I. Add new paragraph 1.1.12 as follows:

“1.1.12 The table of contents, titles, section headings, running headlines and marginal notes contained in the *Contract Documents* are solely to facilitate reference to various provisions of the *Contract Documents* and in no way affect or limit the interpretation or construction of the provisions to which they refer.”

3.2 GC 1.4 ASSIGNMENT

A. Delete paragraph 1.4.1 in its entirety and substitute new paragraph 1.4.1 as follows:

“1.4.1 The *Contractor* shall not assign the *Contract* or any of its rights or interest in the *Contract*, nor shall the *Contractor* assign or subcontract all or substantially all of the *Work* or the *Contractor*’s responsibilities under the *Contract* to a single *Subcontractor* or any other person, without the prior written consent of the *Owner*, which consent may not be unreasonably withheld. The *Owner* may assign the *Contract* without the consent of the *Contractor* upon providing *Notice in Writing* to the *Contractor*.”

3.3 GC 1.5 PROJECT REQUIREMENTS

A. Add new paragraph 1.5.1 as follows:

“1.5.1 The *Contractor* represents, covenants and warrants to the *Owner* that:

- .1 it has the necessary high degree of experience and expertise required to perform the *Work* and it will in the performance of the *Work* exercise a standard of care, skill and diligence that would normally be provided by an experienced and prudent contractor providing similar services for hospital projects of a similar nature, and the *Contractor* shall exercise the same standard of due care and diligence in respect of any *Products*, personnel, or procedures which it may recommend to the *Owner*;
- .2 the personnel it assigns to the *Project* are experienced and it has a sufficient staff of qualified and competent personnel to replace its designated *the Contract* personnel referred to in GC 3.5, subject to the *Owner*’s approval, in the event of death, incapacity, termination or resignation;
- .3 there are no pending, threatened or anticipated claims or litigation involving the *Contractor* that would have a material adverse effect on the financial ability of the *Contractor* to perform the *Work*, and
- .4 it will achieve *Ready-for-Takeover* and the *Total Completion Date* by the date set out in Article A-1, paragraph 1.3.”

3.4 GC 2.2 - ROLE OF THE CONSULTANT

A. Amend paragraph 2.2.3 by adding the following to the end of that paragraph:

“The presence of such project representatives at the *Place of the Work* or the *Work* shall not relieve the *Contractor* from any responsibility to perform the *Work* as required by the *Contract Documents*.”

B. Amend paragraph 2.2.5 by: (a) adding the word “, schedules” after the word “techniques”; (b) adding the words “to the *Contractor*” after the words “the *Consultant* will not be responsible” in the first sentence, (c) adding to the following to the end of the second sentence “or to adhere to the construction schedule”, and (d) adding the following sentence to the end of the paragraph: “the *Consultant* will not have control over, charge of or be responsible for the acts or omissions of the *Contractor*, *Subcontractors*, *Suppliers*, or their agents, employees, or any other person performing any portion of the *Work*.”

- C. Amend paragraph 2.2.6 by deleting the words “Except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER” and capitalizing “the”.
- D. Amend paragraph 2.2.7 by adding “the *Contractor* or the *Owner* on its own behalf or on behalf of” after the word “by” in the second line.
- E. Amend paragraph 2.2.12 by: (a) deleting the word “will” and replacing it with the word “may”; and (b) adding the following to the end of that paragraph:

“The *Contractor* shall be responsible for requesting any additional instructions or clarifications that may be required from the *Consultant* which are needed for the performance of the *Work*, and shall request such instructions or clarifications in time to avoid any delay or additional cost of the *Work*. If, in the opinion of the *Contractor*, the *Supplemental Instruction* involves an adjustment in the *Contract Price* or the *Contract Time*, the *Contractor* shall, within ten (10) *Working Days* of receipt of a *Supplemental Instruction* provide the *Consultant* with a written notice to that effect. In the event that the *Contractor* needs additional information to determine whether a *Supplemental Instruction* involves an adjustment of the *Contract Price* or the *Contract Time*, the *Contractor* may issue a written request to the *Consultant* seeking such additional information. The *Contractor* shall, within ten (10) *Working Days* of receipt of such additional information, provide the *Consultant* with a written notice if, in the opinion of the *Contractor*, the *Supplemental Instruction* involves an adjustment in the *Contract Price* or the *Contract Time*. Failure to provide written notification within the time stipulated in this paragraph 2.2.12 shall be deemed an acceptance of the *Supplemental Instruction* by the *Contractor* without adjustment in the *Contract Price* or the *Contract Time*.”
- F. Amend paragraph 2.2.13 by deleting the word “submittals” and replacing it with “*Submittals*”.
- G. Amend paragraph 2.2.18 by deleting the words “immediately engage a *Consultant* against whom the *Contractor* makes no reasonable objection and” and replace it with “engage a *Consultant*”.
- H. Add new paragraph 2.2.19 as follows:

“2.2.19 Neither the *Contractor* nor any *Subcontractor*, *Supplier* or other third party shall have any claim against the *Consultant* as a result of the performance or non-performance of the *Consultant*’s services. The *Contractor* shall include this provision in any contracts it makes with its *Subcontractors*, *Suppliers* and others and shall require such *Subcontractors*, *Suppliers* and others to include the same term in their contracts with sub-subcontractors, sub-suppliers and others.”

3.5 GC 2.3 – REVIEW AND INSPECTION OF THE WORK

- A. Amend paragraph 2.3.2 by inserting in line 1 “, *Commissioning*” after “inspections,” and inserting in line 3 “and *Commissioning*” after “inspection”.
- B. Amend paragraph 2.3.3 by inserting in line 1 “, *Commissioning*” after “certificates”.
- C. Amend paragraph 2.3.4 by inserting in line 2 “*Commissioning*” after “inspections,” and inserting in line 3 “or *Commissioning*” after “tests”.
- D. Amend paragraph 2.3.5 by inserting “Subject to paragraph 2.3.4” at the beginning of the third sentence.
- E. Amend paragraph 2.3.6 and paragraph 2.3.7 by inserting “or *Commissioning*” after “inspection” in all instances.

3.6 GC 2.4 - DEFECTIVE WORK

- A. Amend paragraph 2.4.1 by: (a) adding the words “or the *Owner*” after “the *Consultant*” in the first line; and (b) by adding the following to the end of the paragraph:

“The *Contractor* shall rectify, in a manner acceptable to the *Owner* and the *Consultant*, all defective work and deficiencies throughout the *Work*, whether or not they are specifically identified by the *Consultant*.”
- B. Amend paragraph 2.4.3 by deleting the words “the difference in value between the work as performed and that called for by the *Contract Documents*” and inserting the words “the value of such work as is necessary to correct any non-compliance with the *Contract Documents*.”
- C. Add new paragraphs 2.4.4, 2.4.5, and 2.4.6 as follows:

- “2.4.4 The *Contractor* shall prioritize the correction of any defective work which, in the sole discretion of the *Owner*, adversely affects the day to day operation of the *Owner*.”
- 2.4.5 Upon notification of a defect in the *Work*, the *Contractor* shall promptly, and no later than five (5) *Working Days*, provide a written statement outlining the proposed remedial measures and a schedule for implementation. Once approved by the *Consultant*, the *Contractor* shall proceed with the remedial measures without adversely affecting the construction schedule.
- 2.4.6 Notwithstanding any rejection of the *Work* by the *Consultant* or the *Owner*, or the deduction of an amount otherwise due to the *Contractor* by the *Owner* as a result of defective work, the *Contractor* is required to continue the *Work* in accordance with the *Contract Documents*.”

3.7 GC 3.1 - CONTROL OF THE WORK

- A. Amend paragraph 3.1.1 by inserting the words “schedule, coordinate and” after the word “effectively”.
- B. Amend paragraph 3.1.2 by adding the word “, schedules” after the word “techniques” and by adding the following to the end of the sentence: “and shall coordinate the *Work* so as not to interfere with, interrupt, obstruct, delay, or otherwise affect, the work of others”.
- C. Add new paragraph 3.1.3:
 - “3.1.3 Prior to commencing individual procurement, fabrication and construction activities, the *Contractor* shall verify, at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included or exact locations are not apparent, the *Contractor* shall immediately notify the *Consultant* in writing and obtain written instructions from the *Consultant* before proceeding with any part of the affected *Work*.”

3.8 GC 3.2 - CONSTRUCTION BY THE OWNER OR OTHER CONTRACTORS

- A. Delete subparagraphs 3.2.2.1 and 3.2.2.2 in their entirety.
- B. Amend paragraph 3.2.3.2 by adding the following to the end of that paragraph:
 - “, and for *Other Contractors* or the *Owner's* own forces, the *Contractor* shall assume overall responsibility for compliance with *OHS*A and all other aspects of the applicable health and safety legislation of the *Place of the Work*, including the responsibilities of the “constructor” under *OHS*A.”
- C. Amend paragraph 3.2.3.4 by adding the following to the end of that paragraph:
 - “Failure by the *Contractor* to so report shall invalidate any claims against the *Owner* by reason of the deficiencies in the work of *Other Contractors* or the *Owner's* own forces except for those deficiencies not then reasonably discoverable;”
- D. Add new subparagraph 3.2.3.5:
 - “Subject to GC 9.4 CONSTRUCTION SAFETY, for the *Owner's* own forces and for the *Other Contractors*, assume overall responsibility for compliance with all aspects of the applicable health and safety legislation in the *Place of the Work*, including all of the responsibilities of the constructor under the *OHS*A.”
- E. Delete the last sentence of paragraph 3.2.5.
- F. Delete paragraph 3.2.6 in its entirety and substitute the following:
 - “3.2.6 Entry by the *Owner*, the *Owner's* forces and/or by *Other Contractors* does not indicate acceptance of the *Work* and does not relieve the *Contractor* of any responsibility under the *Contract* including the responsibility to complete the *Work*.”
- G. Add new paragraph 3.2.7 as follows:
 - “3.2.7 Placing, installing, application and connection of work by the *Owner*, the *Owner's* own forces, and/or by *Other Contractors*, on and to the *Work* will not relieve the *Contractor's* responsibility to provide and maintain the specified warranties unless a defect has been created by the *Owner*, the *Owner's* own forces or *Other Contractors*.”

3.9 GC 3.3 - TEMPORARY WORK

A. Add new paragraph 3.3.4 as follows:

- “3.3.4 Temporary or trial usage of any mechanical device, machinery, apparatus, equipment or materials shall not be construed as evidence of acceptance of the same and no claim for damage shall be made by the *Contractor* for damage to or breaking of any part of such work which may be used.”

3.10 GC 3.4 - CONSTRUCTION SCHEDULE

A. Delete paragraph 3.4.1 and replace it with the following new paragraph 3.4.1 as follows:

“3.4.1 The *Contractor* shall:

- .1 unless it is required to be submitted earlier in accordance with the *Specifications*, then prior to site mobilization, submit to the *Owner* and the *Consultant* for their review and acceptance a construction schedule, indicating the critical milestone dates for the *Project* using a scheduling program which is approved by the *Consultant*, acting reasonably, to demonstrate that the *Work* will be performed in conformity with the *Contract Time* and the *Contract Documents*. The *Contractor* shall provide the schedule information required by this paragraph 3.5.1.1 in both electronic format and hard copy. Once accepted by the *Owner* and the *Consultant*, the construction schedule submitted by the *Contractor* shall become the baseline construction schedule;
- .2 provide the necessary expertise and resources, including, without limitation, manpower and *Construction Equipment*, as are necessary to maintain progress under the accepted baseline construction schedule referred to in paragraph 3.4.1.1 or any successor or revised schedule accepted by the *Owner*;
- .3 monitor the progress of the *Work* on a weekly basis relative to the construction schedule, reviewed and accepted pursuant to paragraph 3.4.1.1, or any successor or revised schedule accepted in writing by the *Owner* pursuant to GC 3.4, update the construction schedule on a monthly basis, and advise the *Consultant* and the *Owner* by *Notice in Writing* of any variation from or slippage in the baseline construction schedule or any other schedule; and
- .4 if after applying the expertise and resources required under paragraph 3.4.1.2, the *Contractor* forms the opinion that the slippage in the construction schedule or any other schedule, reported in paragraph 3.4.1.3, cannot be recovered by the *Contractor*, it shall, in the same notice provided under paragraph 3.4.1.3, indicate to the *Consultant* if the *Contractor* intends to apply for an extension of the *Contract Time*.”

B. Add a new paragraph 3.4.2 as follows:

- “3.4.2 Without limiting the other obligations of the *Contractor* under GC 3.4, the *Contractor* shall not amend the construction schedule without the prior written consent of the *Owner*. In addition, at each site construction meeting, the *Contractor* shall provide to the *Owner* and the *Consultant* a two (2) week look-ahead schedule indicating the major activities to be undertaken or constructed in such two (2) week period.”

C. Add new paragraph 3.4.3:

- “3.4.3 If at any time it should appear to the *Owner* or the *Consultant* that the actual progress of the *Work* is behind schedule or is likely to become behind schedule, based on critical path methodology, or if the *Contractor* has given notice of such to the *Owner* or the *Consultant* pursuant to 3.4.1.3, the *Contractor* shall take appropriate steps to cause the actual progress of the *Work* to conform to the schedule and shall produce and present to the *Owner* and the *Consultant* a recovery plan demonstrating how the *Contractor* will achieve the recovery of the schedule. The *Owner* may instruct the *Contractor*, at the *Contractor*’s expense, to employ additional labour and equipment or work overtime or employ any other reasonable procedures, at no expense to the *Owner*, to bring the *Work* back to conform with the schedule.”

3.11 GC 3.5 - SUPERVISION

A. Delete paragraph 3.5.1 in its entirety and substitute new paragraph 3.5.1:

- “3.5.1 The *Contractor* shall provide all necessary supervision and appoint competent representatives who shall be in attendance at the *Place of the Work* while *Work* is being performed. The appointed

representatives shall not be changed except for valid reasons, and upon the *Contractor* obtaining the *Owner's* written consent, which consent shall not be unreasonably withheld."

- B. Add new paragraphs 3.5.3, 3.5.4, 3.5.5, and 3.5.6 as follows:

- "3.5.3 The *Contractor* shall employ competent *Key Personnel* who will not be removed or replaced during the course of the *Work* without the prior written consent of the *Owner*, which approval shall not be unreasonably withheld.
- 3.5.4 The *Contractor's* site supervisor for the *Contract* shall devote their full time during working hours to the *Project* and remain at the *Place of the Work* until a final certificate of payment has been issued by the *Consultant* and all deficiencies in the *Work* have been rectified to the satisfaction of the *Owner*. The full-time site supervisor for the *Contract* shall be named in the Schedule "A" – *Key Personnel* and any acceptable replacement shall represent the *Contractor* at the *Place of the Work* and notices and instructions given to the site supervisor for the *Contract* by the *Consultant* shall be held to have been received by the *Contractor*.
- 3.5.5 The *Owner* acting reasonably, shall have the right to give written notice to the *Contractor* who shall, within seven (7) days of receipt of the written notice, at the *Contractor's* sole expense, remove from the *Project* any representative or employee of the *Contractor*, *Subcontractors* or *Suppliers* who, in the opinion of the *Owner* are unacceptable or a detriment to the *Project*. The *Contractor* shall not be entitled to receive any compensation or extension of the *Contract Time* in connection with such removal.
- 3.5.6 The supervisor appointed by the *Contractor* shall demonstrate competency in both spoken and written English."

3.12 GC 3.6 - SUBCONTRACTORS AND SUPPLIERS

- A. Delete paragraph 3.6.2 in its entirety and substitute new paragraph 3.6.2:

"3.6.2 The *Contractor* agrees not to change *Subcontractors* without prior written approval of the *Owner*, which approval will not be unreasonably withheld. Where the *Contractor* wishes to change any identified *Subcontractors* or *Suppliers*, the *Contractor* shall set out in writing to the *Owner* sufficient reasons for the desired change. The *Owner* or *Consultant* shall advise the *Contractor* if the *Owner* agrees to the proposed change. If the *Owner* is not satisfied with the *Contractor's* reason for wanting to change an identified *Subcontractor* or *Supplier*, the *Contractor* shall be required to proceed with the identified *Subcontractor* or *Supplier*."

- B. Amend 3.6.4 by inserting the following at the end of the paragraph:

"unless the request to change a proposed *Subcontractor* or *Supplier* is a result of issues with the ability of the *Subcontractor* or *Supplier* to complete the *Work* in a proper manner, in which case the *Contractor* will not be entitled to any change in the *Contract Price* or the *Contract Time*".

- C. Add a new paragraph 3.6.7 as follows:

"3.6.7 The *Owner* may assign to the *Contractor*, and the *Contractor* agrees to accept, any contract procured by the *Owner* for work or services or *Products* required on the *Project* that has been pre-tendered or pre-negotiated by the *Owner*, where the *Owner* has identified, before bid close, the contract or contracts that are to be assigned to the *Contractor*."

3.13 GC 3.7 - LABOUR AND PRODUCTS

- A. Amend paragraph 3.7.1 by: (a) adding the words "agents, *Subcontractors* and *Suppliers*" after the word "employees"; and (b) adding the following three new sentences to the end of that paragraph:

"Without in any way limiting the generality of the foregoing, the *Contractor* shall prepare and implement the job site rules more particularly described in the *Contract Documents*. If no job site rules are described in the *Contract Documents*, the *Contractor* shall draft job site rules for the review and approval of the *Owner*. Any such job site rules prepared by the *Contractor* shall be consistent with the *Contractor's* duties and obligations under the *OHSA* and shall also include provisions making smoking and the consumption of alcohol or non-prescription drugs on the *Project* site the subject of discipline proceedings and/or termination of employment."

- B. Amend paragraph 3.7.2 by adding the following sentence at the end of that paragraph:

"The *Contractor* represents and warrants that the *Products* provided in accordance with the *Contract Documents* are not subject to any conditional sales contracts and are not subject to any security rights

claimed or obtained by any third party which may subject any of the *Products* to seizure and/or removal from the *Place of the Work*.”

- C. Delete paragraph 3.7.3 and replace it with the following:

“3.7.3 *Products* provided shall be new and shall conform to all current applicable specifications of the Canadian Standards Association, Canadian Standards Board or General Standards Board, ASTM, National Building Code, Ontario Building Code and all governmental authorities having jurisdiction at the *Place of the Work*, unless otherwise specified. *Products* which are not specified shall be of a quality consistent with those specified and their use acceptable to the *Consultant*. *Products* brought on to the *Place of the Work* by the *Contractor* shall be deemed to be the property of the *Owner*, but the *Owner* shall be under no liability for loss thereof or damage thereto arising from any cause whatsoever, and such *Products* shall be at the sole risk of the *Contractor*.”

- D. Add new paragraphs 3.7.4, 3.7.5 and 3.7.6 as follows:

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

3.7.5 The *Contractor* shall not employ any persons on the *Work* whose labour affiliation, or lack thereof, is incompatible with other labour employed in connection with the *Work*. Any costs arising from labour disputes as a result of the employment of any such person by the *Contractor*, its *Subcontractors* or *Suppliers*, shall be the sole expense of the *Contractor*.

“3.7.6 The *Contractor* shall cooperate with the *Owner* and its representatives and shall take all reasonable and necessary actions to maintain stable and harmonious labour relations with respect to the work at the *Place of the Work*, including cooperation to attempt to avoid work stoppages, trade union jurisdictional disputes, and other labour disputes.”

3.14 GC 3.8 - SHOP DRAWINGS

- A. Add the words “AND OTHER SUBMITTALS” to the title of GC 3.8 after “SHOP DRAWINGS”.

- B. Add “and *Submittals*” after the words “*Shop Drawings*” in clauses 3.8.1, 3.8.2, 3.8.3, 3.8.3.2, 3.8.5, and 3.8.6.

- C. Delete paragraph 3.8.3 in its entirety and substitute new paragraph 3.8.3:

“3.8.3 Prior to the first application for payment, the *Contractor* and the *Consultant* shall jointly prepare a schedule of the dates for submission and return of *Shop Drawings* and any *Submittals*, and that:”

- D. Delete subparagraph 3.8.3.1 in its entirety and substitute new subparagraph 3.8.3.1:

“the *Contractor* has determined and correlated the field measurements with the *Shop Drawings* and any *Submittals* and field construction conditions, *Product* requirements, catalogue numbers and similar data, or will do so if not possible at that time, and”

- E. Delete paragraph 3.8.7 in its entirety and substitute new paragraph 3.8.7:

“3.8.7 The *Consultant* will review and return *Shop Drawings* and *Submittals* in accordance with the schedule agreed upon in paragraph 3.8.2, or, in the absence of such schedule, within fifteen (15) *Working Days*. If, for any reason, the *Consultant* cannot process the *Shop Drawings* and *Submittals* within the agreed-upon schedule or with reasonable promptness, the *Consultant* shall notify the *Contractor* and they shall meet to review and arrive at an acceptable revised schedule for processing. The *Contractor* shall update the *Shop Drawings* and *Submittals* schedule to correspond to changes in the construction schedule. Changes in the *Contract Price* or the *Contract Time* may be made only as provided in the *Contract*.”

3.15 GC 3.9 - DOCUMENTS AT THE SITE

- A. Add a new GC 3.9 DOCUMENTS AT THE PLACE OF THE WORK as follows:

“GC 3.9 DOCUMENTS AT THE PLACE OF THE WORK

3.9 The *Contractor* shall keep one copy of the current the *Contract Documents*, *Supplemental Instructions*, *Contemplated Change Orders*, *Change Orders*, *Change Directives*, reviewed *Shop*

Drawings, Submittals, reports and records of meetings at the Place of the Work, in good order and available to the Owner and the Consultant."

3.16 GC 3.10 - CLEAN UP

- A. Add a new GC 3.10 CLEAN UP as follows:

"GC 3.10 CLEAN UP

- 3.10.1 The *Contractor* shall maintain the *Work* and *Place of the Work* in a safe and tidy condition and free from the accumulation of waste products and debris, other than that caused by the *Owner*, *Other Contractors*, or their employees.
- 3.10.2 Before applying for *Substantial Performance of the Work* as provided in GC 5.4 – SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK, the *Contractor* shall remove waste products and debris, other than that resulting from the work of the *Owner*, *Other Contractors*, or their employees, and shall leave the *Place of the Work* clean and suitable for use or occupancy by the *Owner*. The *Contractor* shall remove products, tools, *Construction Equipment*, and *Temporary Work* not required for the performance of the remaining work.
- 3.10.3 Prior to application for the final payment, the *Contractor* shall remove any remaining products, tools, *Construction Equipment*, *Temporary Work*, and waste products and debris, other than those resulting from the work of the *Owner*, *Other Contractors*, or their employees."

3.17 GC 3.11 - USE OF THE WORK

- A. Add new GC 3.11 USE OF THE WORK as follows:

"GC 3.11 USE OF THE WORK

- 3.11.1 The *Contractor* shall confine *Construction Equipment*, *Temporary Work*, storage of *Products*, waste products and debris, and operations of employees and *Subcontractors* to limits indicated by laws, ordinances, permits, or the *Contract Documents* and shall not unreasonably encumber the *Place of the Work*.
- 3.11.2 The *Contractor* shall not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety of the *Work*.
- 3.11.3 Except for those normally used during the performance of the *Work*, such as elevator, mechanical, electrical, hydro, the *Contractor* shall not use any service plant or equipment installed as part of the *Work* without prior written consent from the *Owner*. On receipt of such consent, the *Contractor* shall be subject to any conditions set out as part of such consent and shall be responsible for all costs, damage and compensation for wear and tear.
- 3.11.4 If storage or other areas are required for the *Work* in addition to the *Work Site*, the *Contractor* shall be responsible for making arrangements to obtain the additional areas and obtaining any necessary permits, permission or authorization and, if required, for making permit, rental or other payments that may be required for such purpose."

3.18 GC 3.12 – CONTRACTOR'S USE OF PERMANENT EQUIPMENT OR SYSTEMS

- A. Add a new GC 3.12 as follows:

"GC 3.12 CONTRACTOR'S USE OF PERMANENT EQUIPMENT OR SYSTEMS

- 3.12.1 With the prior written approval of the *Owner*, the *Contractor* may make use of elements of the mechanical and electrical systems or equipment comprising a permanent part of the *Work* for the purpose of providing heat or power to the *Project* during the final stages of construction. In such event, and before the issuance of the certificate of *Substantial Performance of the Work*, the *Contractor* shall clean and make good, to the satisfaction of the *Consultant*, such systems and equipment as it had been permitted to use. The *Contractor* shall pay any and all costs associated with such use, cleaning and making good.
- 3.12.2 Where the *Contractor* has made use of elements of the mechanical and electrical systems or equipment comprising a permanent part of the *Work*, as described in paragraph 3.12.1 above, the *Contractor* shall obtain, from the manufacturer or *Supplier* of the systems or equipment used, a

confirmation from such manufacturer or *Supplier* that the warranty on such systems or equipment begins on the date of *Substantial Performance of the Work* and is not impaired in scope or reduced in time by virtue of the *Contractor's* use of such systems or equipment."

3.19 GC 4.1 - CASH ALLOWANCES

- A. Delete paragraph 4.1.4 in its entirety and substitute new paragraph 4.1.4:

"4.1.4 Any surpluses in one or more cash allowance may at the election of the *Owner* be expended pursuant to paragraph 4.1.3 in respect of other cash allowances or to fund changes in the *Work* by way of *Change Order* or *Change Directive*, as the case may be, but without the imposition of Overhead or profit in respect *Work* pertaining to such other cash allowances or changes."

- B. Delete paragraph 4.1.5 in its entirety and substitute new paragraph 4.1.5:

"4.1.5 Where the value of the *Work* under cash allowances exceeds the aggregate amount of all the cash allowances stated in the *Contract Documents*, the *Contractor* shall be compensated for the approved amount of such excess and for *Overhead* and profit on such approved amount, with the *Contract Price* being adjusted to reflect such excess, all pursuant to and only to the extent permitted under, GC 6.1 – CHANGES, 6.2 – CHANGE ORDER and GC 6.3 – CHANGE DIRECTIVE."

- C. Delete paragraph 4.1.7 in its entirety and substitute new paragraph 4.1.7:

"4.1.7 The *Contractor* shall provide a schedule prior to the first application for progress payment that shows when the items called for under cash allowances must be ordered to avoid delaying the progress of the *Work*."

- D. Add new paragraph 4.1.8:

"4.1.8 The *Owner* reserves the right to call, or to have the *Contractor* call, competitive bids for portions of the *Work*, to be paid for from cash allowances. If the *Owner* determines to proceed with competitive bids, the *Contractor* shall comply with the directions of the *Owner*."

3.20 GC 5.1 - FINANCING INFORMATION REQUIRED OF THE OWNER

- A. Amend the heading, "GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER" to read, "GC 5.1 FINANCING INFORMATION REQUIRED".

- B. Delete paragraph 5.1.1 in its entirety and substitute new paragraph 5.1.1:

"5.1.1 The *Contractor* shall provide the *Owner* with timely *Notice in Writing* of any material change in its financial ability to (a) properly complete the *Work* in accordance with the *Contract Documents* or (b) fulfil its obligations under the *Contract*."

- C. Delete paragraph 5.1.2 in its entirety and substitute the following: "Intentionally deleted".

3.21 GC 5.2 - APPLICATIONS FOR PAYMENT

- A. Amend paragraph 5.2.2 by adding the following sentence to the end of that paragraph:

"Applications for payment shall be made in a form that is mutually acceptable to the *Owner* and the *Contractor*, and shall include, as a separate line item, the applicable *Value Added Taxes* payable on that application."

- B. Amend paragraph 5.2.3 by: (a) deleting the word "delivered" and replacing it with the words "incorporated into"; and (b) adding the following to the end of that paragraph:

"No amount claimed shall include *Products* incorporated into to the *Place of the Work* unless the *Products* are free and clear of all security interests, liens, and other claims of third parties."

- C. Add to the end of paragraph 5.2.8 the following new sentence:

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

- D. Add new paragraph 5.2.9:

"5.2.9 The *Contractor* shall submit, with each application for payment, as true conditions precedent to the *Contractor's* right to payment under this *Contract*:

- .1 after the first payment, a Statutory Declaration, on an original form of CCDC Document 9A-2001, stating that payments in connection with the *Work*, as noted in the Statutory Declaration, have been made to the end of the period immediately preceding that covered by the current application.”
 - .2 evidence of compliance with workers’ compensation legislation at the *Place of the Work*, including a WSIB Clearance Certificate, with each application for progress payment.
 - .3 if the application is for payment of the lien holdback amount, a written request for release of holdback including a declaration that no written notices of lien have been received by the *Contractor*.”
- E. Add new paragraph 5.2. 10:
“5.2.10 The *Contractor* shall prepare and maintain current as-built Drawings which shall consist of the Drawings and Specifications revised by the *Contractor* during the *Work*, showing changes to the Drawings and Specifications, which current as-built Drawings shall be maintained by the *Contractor* and made available to the *Consultant* for review with each application for progress payment. The *Consultant* reserves the right to retain a reasonable amount for the value of the as-built Drawings not presented for review.”

3.22 GC 5.3 - PAYMENT

- A. Add a new paragraph 5.3.2 as follows:
“5.3.2 If the *Contractor* fails to provide a statutory declaration as required by paragraph 5.2.8, or if the *Contractor* fails to demonstrate compliance with GC 10.4 – WORKERS’ COMPENSATION, the *Owner* shall be entitled to deduct from amounts otherwise payable to the *Contractor* an amount sufficient to cover any liability which it might incur as a result of the *Contractor*’s failure to provide a statutory declaration or to demonstrate compliance with GC 10.4.”

3.23 GC 5.4 - SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

- A. Amend paragraph 5.4.1 by deleting the words “20 calendar days” in the second line and substituting the words “fifteen (15) *Working Days*” therefor, and by adding the following at the beginning of the paragraph:
“5.4.1 When the *Contractor* considers that the *Work* is substantially performed, or if permitted by the lien legislation applicable to the *Place of the Work* a designated portion thereof which the *Owner* agrees to accept separately is substantially performed, the *Contractor* shall, within one (1) *Working Day*, deliver to the *Consultant* and the *Owner* a written application for payment of the lien holdback amount, in accordance with GC 5.3, for review by the *Consultant* to establish *Substantial Performance of the Work* or substantial performance of the designated portion of the *Work*.”
- B. Delete paragraph 5.4.2 in its entirety and substitute the following: “Intentionally deleted”.
- C. Delete paragraph 5.4.3 in its entirety and substitute new paragraph 5.4.3:
“5.4.3 Subject to the terms and conditions of the *Contract*, the requirements of any *Payment Legislation*, and any Notice of Non-Payment of Holdback, the holdback amount authorized by the certificate for payment of the holdback shall be due and payable on the first (1st) *Working Day* following the expiration of the holdback period stipulated in the *Payment Legislation* applicable to the *Place of the Work*. The *Owner* may retain out of the holdback amount any sums required by law to satisfy any liens against the *Work* or, if permitted by the lien legislation applicable to the *Place of the Work*, other third party monetary claims against the *Contractor* which are enforceable against the *Owner*.”
- D. Amend paragraph 5.4.5 by deleting “hereby agrees to release, and shall release,” and substituting “may agree to release”.
- E. Add new paragraph 5.4.7 as follows:
“5.4.4 The *Contractor* shall publish a copy of the Certificate of *Substantial Performance of the Work* within seven (7) days of receiving a copy of the Certificate of *Substantial Performance of the Work* signed by the *Consultant*, and the *Contractor* shall provide suitable evidence of the publication to the *Consultant* and the *Owner*. If the *Contractor* fails to publish such notice, the *Owner* shall be at liberty to publish and back charge the *Contractor* its reasonable costs for doing so.”

3.24 GC 5.5 – FINAL PAYMENT

- A. Delete paragraph 5.5.1 in its entirety and substitute new paragraph 5.5.1:

“5.5.1 When the *Contractor* considers that the *Work* is completed and satisfies the requirements of *Total Completion of the Work* and *Completion of Commissioning*, the *Contractor* shall submit an application for final payment. The *Contractor's* application for final payment shall be accompanied by any documents or materials not yet delivered as agreed to in writing by the *Owner* pursuant to paragraph 12.1.2 of GC 12.1 - READY-FOR-TAKEOVER together with fully complete as-built *Drawings*. Should the *Contractor* fail to deliver any of the said documents, or other documents required to be delivered pursuant to the *Contract Documents*, the *Owner* shall be at liberty to withhold from amounts otherwise payable to the *Contractor*, an amount, in the discretion of the *Owner*, up to the full amount otherwise payable to the *Contractor* as security for the obligation of the *Contractor* to deliver the undelivered documents.”

- B. Delete from the first line of paragraph 5.5.2 the words, “calendar days” and substitute the words “*Working Days*”.

- C. Delete paragraph 5.5.4 in its entirety and substitute new paragraph 5.5.4:

“5.5.4 Subject to the other requirements of the *Contract*, the unpaid balance of the *Contract Price* shall become payable to the *Contractor* on the tenth (10th) *Working Day* following the issuance of the *Consultant's* final certificate for payment, subject to the *Owner's* right to withhold payment from the unpaid balance of the *Contract Price* for any amounts required pursuant to GC 5.6 DEFERRED WORK, and any sums required to satisfy any lien or trust claims arising from the *Work*”.

- D. Add new paragraph 5.5.5:

“5.5.5 As additional preconditions for release of the final payment, the *Contractor* shall submit the following documentation:

- .1 the *Contractor's* written request for release of final payment, including a declaration that no written notices of lien have been received by it.;
- .2 the *Contractor's* Statutory Declaration CCDC 9A-2001.; and
- .3 the *Contractor's* WSIB Clearance Certificate.”

3.25 GC 5.6 - DEFERRED WORK

- A. Add new paragraph GC 5.6.2:

“5.6.2 Notwithstanding the provisions of GC 5.3 PAYMENT, GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK and GC 5.5 FINAL PAYMENT, the *Owner* may withhold payment of any amounts otherwise due under the *Contract* on account of any costs or damages the *Owner* has incurred or, is likely to incur, by reason of:

- .1 defective or incomplete portions of the *Work* or damage to the work of *Other Contractors* not rectified in accordance with the *Contract*;
- .2 failure of the *Contractor* to indemnify the *Owner* in accordance with the terms of the *Contract*;
- .3 failure of the *Contractor* to fulfil its obligations in respect of construction liens in accordance with GC 14.2 CONSTRUCTION LIENS;
- .4 evidence of the *Contractor's* failure to make payments to *Subcontractors* or *Suppliers*;
- .5 unsatisfactory prosecution of the *Work* by the *Contractor* or any *Subcontractor*, and
- .6 failure to attain the *Contract Time*. ”

- B. Add new paragraph GC 5.6.3:

“5.6.3 Where the *Owner* has withheld payment of any portion of the *Contract Price* pursuant to the provision of paragraphs 5.6.1 or 5.6.2, the *Owner* shall be entitled to apply such withheld portion towards any costs or damages suffered by the *Owner*.”

3.26 GC 6.1 – OWNER’S RIGHT TO MAKE CHANGES

- A. Amend paragraph 6.1.2 by adding the following to the end of that paragraph:

“This requirement is of the essence and it is the express intention of the parties that any claims by the *Contractor* for a change in the *Contract Price* and/or the *Contract Time* shall be barred unless there has been strict compliance with PART 6 – CHANGES IN THE WORK. No course of conduct or dealing between the parties, no express or implied acceptance of alterations or additions to the *Work*, and no claims that the *Owner* has been unjustly enriched by any alteration or addition to the *Work*, whether in fact there has been any such unjust enrichment or not, shall be the basis of a claim for additional payment under this *Contract* or a claim for any extension of the *Contract Time*.”

- B. Add new paragraphs 6.1.3, 6.1.4, 6.1.5, 6.1.6, and 6.1.7, 6.1.8, 6.1.9, 6.1.10, 6.1.11, and 6.1.12 as follows:

“6.1.3 The *Contractor* shall not be entitled to receive any compensation or extension of the *Contract Time*, and the *Owner* shall have no obligation or liability to pay compensation to the *Contractor*, unless a *Change Order* or *Change Directive* has been issued to the *Contractor*, in writing, and before the *Contractor* commences with any work in respect of such *Change Order* or *Change Directive*.

6.1.4 There shall be no adjustment to the *Contract Time* should the *Contractor* fail to present a request for a specific adjustment to the *Contract Time*, if any:

- .1 at the time of first presenting a request for adjustment to the *Contract Price* in response to a *Contemplated Change Order*; or
- .2 within ten (10) *Working Days* of receipt of a *Change Directive*.

6.1.5 There shall be no adjustments to the *Contract Time* or the *Contract Price* or compensation or payment of any kind whatsoever relating to a *Contractor* claim unless notice in writing of the claim is given to the *Owner*, through *Consultant* not later than twenty (20) *Working Days* after the *Contractor* becomes aware of the claim.

6.1.6 Any *Change Order* or *Change Directive* shall clearly set out what, if any, extension of the *Contract Time* is anticipated as a result thereof and failing the inclusion of the same, the *Contractor* shall be barred in making a claim for extension of the *Contract Time* in respect thereof.

6.1.7 The following fee percentage and overhead charges shall be applied to additional work directed by the *Consultant* through a *Change Directive* or *Change Order*:

- .1 for changes to the *Work* with a value of less than or equal to \$50,000, the *Contractor* shall be entitled to mark-ups for overhead and profit of ten percent (10%) on work performed by the *Contractor*’s own forces plus five percent (5%) on work performed by *Subcontractors*; and
- .2 for changes to the *Work* with a value greater than \$50,000, the *Contractor* shall be entitled to mark-ups for overhead and profit of seven and a half percent (7.5%) on work performed by the *Contractor*’s own forces plus five percent (5%) on work performed by *Subcontractors*.
- .3 Where a change is made in work to be carried out by the *Contractor*’s own forces, and for which no the *Contract* unit prices are scheduled, the value of the additional work shall be determined by adding to the reasonable cost of materials and labour (as assessed by the *Consultant*), an allowance for the *Contractor*’s combined overhead and profit of not more than ten percent.
- .4 Where such a change is made in work to be carried out by a *Subcontractor*, the value of the additional work shall be determined in a similar manner; the allowances for *Subcontractor*’s overhead and profit, being not more than ten percent for overhead and five percent for profit. In such cases, the *Contractor* shall be permitted to add an allowance in

- respect of combined overhead and profit of not more than ten percent on the total of the *Subcontractor's* quotation.
- .5 Additional charges for bonds and insurance relating to the increased value of the *Work* as a result of changes in the *Work*, shall be included in the *Contractor's* and *Subcontractor's* overhead relating to the change in the *Work*.
- .6 *Work* performed by *Subcontractor* to a *Subcontractor* (sub-subcontractor): Cost of sub-contractor's work plus 5% for the *Contractor's* overhead and profit. *Subcontractor's* mark-up shall consist of cost of sub-sub-contractor's work plus 5% for overhead and profit. Sub-subcontractor's mark-up shall consist of the actual cost of the work plus 10% for overhead and profit.
- .7 Rates for labour shall be based on standard normal time prevailing rate in the area of work. Rates used in determination of additional work value shall be mutually agreed upon by the *Owner*, *Consultant* and the *Contractor* prior to the commencement of additional work."
- 6.1.8 Overtime labour costs and labour burdens are the lesser of either the basic or approved overtime hourly wages actually paid for labour in the direct employ of the *Contractor*, *Subcontractor* and Supplier or, those hourly wages established in the community under collective bargaining agreements in effect at the time of the changed *Work* being performed, plus a labour burden mark-up of 50% for every hour the worker consumes in the interests of the changed *Work* on the *Project*. Labour burden covers the full cost of labour in addition to actual wages paid, and includes, but is not necessarily limited to, the cost of workers compensation, employment insurance, holiday pay, travelling time (related to the change) consumed at all times other than actually performing *Work* onsite, sick time, travelling expenses and subsistence allowances, welfare, union dues, industrial training, Canada or Quebec Pension plans, or other pension funds, rest periods, small tools allowances, uniforms, safety equipment and protection, insurance against property damage and personal injury, medical and dental insurance, and all other items reasonably expected to be provided as part of the cost of labour for the provision of the changed *Work*.
- 6.1.9 There shall be no adjustments to the *Contract Time* or the *Contract Price* or compensation or payment of any kind whatsoever including potential or contingent costs for matters such as loss of profit, loss of productivity, loss of opportunity or any other such losses based on the quantity, scope or cumulative value or number of changes in the *Work* whether resulting from one or more *Change Orders* or *Change Directives*, unless agreed in writing by the parties in a *Change Order*.
- 6.1.10 Superintendent costs means the overhead costs associated with the provision of superintendence of the *Work* of the *Contractor*, *Subcontractor* or Supplier. Where a Superintendent actually performs *Work* on the improvement, then such costs are payable at the appropriate labour cost as defined in Item 2 above. The additional costs associated with the overhead portion of the superintendent *Work* are to be included in the appropriate the *Contractor's*, *Subcontractor's* and Supplier's overhead costs.
- 6.1.11 Overhead and profit costs means all costs relating to the changed *Work* by the *Contractors*, *Subcontractors* and Suppliers. Overhead and profit costs include, but are not necessarily limited to, the following: profit, superintendence (other than the actual labour cost and labour burden for a working superintendent) head office costs, site security, temporary facilities, parking, travel and subsistence (including meals and accommodation), site office and communication, disposal (including waste and debris storage transportation and disposal), and small tools (other than those covered by labour burden) estimating, drafting and engineering (including cost associated with any required additional drafting, detailing and modifications to shop or engineering drawings resulting from the change and the distribution and processing of the same), time sensitive costs, schedule acceleration costs, impact costs, financing costs, quality assurance, code compliance inspection and testing services, royalties, patent fees, damages for infringement of patents and costs of defending suits thereof, adjustments in premiums for all bonds and insurance, and adjustments in taxes and duties, the charges for all long distance telephone, facsimile and other communications, courier services, as-built and record drawings, and petty cash items and other

such items reasonably expected to be provided as part of the overhead costs relating to the provision of the changed *Work*.

- 6.1.12 The *Owner*, through the *Consultant*, reserves the right to authorize payment for a change in the *Work* by means of the *Cash Allowance*.”

3.27 GC 6.2 - CHANGE ORDER

- A. Delete paragraph 6.2.1 inserting new paragraph 6.2.1 as follows:

“6.2.1 When a change in the *Work* is proposed or required, *Consultant* or the *Owner* shall provide a notice describing the proposed change in the *Work* to the *Contractor*. The *Contractor* shall provide:

- .1 a quotation from the *Contractor*, on the *Contractor's* letterhead and with the *Contractor's* signature;
- .2 quotations from all *Subcontractors*, each on *Subcontractor's* respective letterhead and with *Subcontractor's* respective signature; and
- .3 the following information in quotations from *Subcontractors* and the *Contractor*:
 - (1) a complete breakdown for all items of material;
 - (2) a total number of hours for labour;
 - (3) a dollar rate applied against individual material items and labour quantities;
 - (4) stipulated adjustment in the *Contract Time*, if any, for the proposed change in the *Work*;
 - (5) percentage values for overhead and profit by the *Contractor* and *Subcontractors*; and
 - (6) all mathematical calculations, which shall be complete.

Quotations submitted with any of the above items or information in this paragraph 6.2.1 missing or incorrect will be returned for revision.”

3.28 GC 6.3 - CHANGE DIRECTIVE

- A. Delete paragraphs 6.3.7.1(1), (2), (3) and (4) and replace them with the following:

- “(1) carrying out the *Work*, including necessary supervisory services;”
- “(2) intentionally left blank;”
- “(3) engaged in the preparation of *Shop Drawings*, fabrication drawings, coordination drawings and *Project* record drawings: or...”
- “(4) including clerical staff engaged in processing changes in the *Work*.”

- B. Delete paragraphs 6.3.7.5, 6.3.7.11, 6.3.7.15 and 6.3.7.19.

- C. Add new paragraph 6.3.14 as follows:

“6.3.14 For purposes of calculating the cost of performing the work attributable to a Change Directive, the *Contractor* shall not be entitled to charge the following:

- .1 head office salaries and benefits and all other overhead or general expenses, except only for the salaries, wages and benefits of personnel described in paragraph 6.3.7.1 and the contributions, assessments or taxes referred to in paragraphs 6.3.7.2;
- .2 capital expenses and interest on capital;
- .3 general clean-up, except where the performance of the work in the *Change Directive* causes specific additional clean-up requirements;
- .4 wages paid for field supervision of *Subcontractors*;
- .5 wages, salaries, rentals, or other expenses that exceed the rates that are standard in the locality of the *Place of the Work* that are otherwise deemed unreasonable by the *Consultant*;
- .6 any costs or expenses attributable to the negligence, improper work, deficiencies, or breaches of the *Contract* by the *Contractor* or *Subcontractor*; and
- .7 any cost of quality assurance, such as inspection and testing services, charges levied by authorities, and any legal fees unless any such costs or fees are pre-approved in writing by the *Owner*.”

3.29 GC 6.4 - CONCEALED OR UNKNOWN CONDITIONS

- A. Amend paragraph 6.4.2 by adding a new first sentence which reads as follows:

“Having regard to paragraph 6.4.1, if the *Contractor* believes that the conditions of the *Place of the Work* differ materially from those reasonably anticipated, or differ materially from those indicated in the *Contract Documents*, or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1, it shall notify the *Owner* and *Consultant* in writing no later than five (5) *Working Days* after the first observation of such conditions.”

- B. Amend the existing second sentence of paragraph 6.4.2 so that, as amended, it reads as follows:
“If the finding is that the conditions differ materially, or were concealed from discovery notwithstanding the conduct of the investigation described in paragraph 6.4.1, and this would cause an increase or decrease in the *Contractor*’s cost or time to perform the *Work*, the *Consultant*, with the *Owner*’s approval, will issue appropriate instructions for a change in the *Work* as provided in GC6.2 – CHANGE ORDER or GC6.3 – CHANGE DIRECTIVE.”
- C. Delete paragraph 6.4.3 and substitute the following:
“6.4.3 If the *Consultant* makes a finding pursuant to paragraph 6.4.2 that no change in the *Contract Price* or the *Contract Time* is justified, the *Consultant* shall report in writing the reasons for this finding to the *Owner* and the *Contractor*.”
- D. Add new paragraphs 6.4.5 and 6.4.6:
“6.4.5 The *Contractor* confirms that, prior to entering into the *Contract*, applying the standard of care described in paragraph 1.5.1.1 of GC 1.5 - PROJECT REQUIREMENTS, it carefully investigated the *Place of the Work*. Notwithstanding any other provision in the *Contract*, the *Contractor* is not entitled to compensation or to an extension of the *Contract Time* for conditions which could reasonably have been ascertained by the *Contractor* by such investigation undertaken prior to the submission of the bid.
6.4.6 The *Contractor* shall not be entitled to claim, and waives its rights to make a claim, for any additional compensation or any increase to the *Contract Time* or the *Contract Price*, if the *Contractor* fails to provide notice to the *Owner* as required in paragraph 6.4.1.”

3.30 GC 6.5 - DELAYS

- A. Delete the period at the end of paragraphs 6.5.1 and 6.5.2 and substitute the following words in each case, “but excluding any any consequential, indirect or special losses or damages, including but not limited to loss of use, loss of productivity, loss of revenue, loss of opportunity, overhead and/or profit.”
- B. Amend paragraph 6.5.3 by adding the following to the end of that paragraph:
“, in which case the *Contractor* shall be reimbursed by the *Owner* for reasonable direct costs directly flowing from the delay but excluding any consequential, indirect or special losses or damages, including but not limited to loss of use, loss of productivity, loss of revenue, loss of opportunity, overhead and/or profit.”
- C. Amend paragraph 6.5.3.3 by adding “epidemics or pandemics (except for *COVID-19*),” after the word “conditions,”
- D. Add new subparagraphs 6.5.6, 6.5.7, 6.5.8, 6.5.9, 6.5.10, 6.5.11, and 6.5.12:
“6.5.6 During and throughout the performance of the *Work*, the *Contractor* shall assume any and all known conditions of *COVID-19* at the time of the execution of this *Contract*, and without limitation shall comply with any and all vaccination and/or *COVID-19* policies and procedures of the *Owner*. Where there is any delay to the *Contract Time* and/or *Project* or increase to the cost of the *Work*, caused by, resulting from, or related to any stop work order, legislation, measures, or direction, issued by any governmental authority having jurisdiction over the *Project*, in respect to, related to, or resulting from *COVID-19* which arises after the execution of this *Contract*, then:
.1 the *Contractor* shall be entitled to an extension of the *Contract Time* for a reasonable time caused by such stop work order, other order, measure, or direction; and
.2 the *Contractor* shall not be entitled to any increase in compensation whatsoever, including, without limitation, any (a) increase to the *Contract Price*, payment of (b) costs, expenses or damages, and/or (c) any consequential, indirect or special losses or damages, including but not limited to loss of use, loss of productivity, loss of revenue, loss of opportunity, overhead and/or profit.

- 6.5.7 The *Contractor* shall at all times perform the services required to perform the *Work* in accordance with the *Contract Documents* diligently and expeditiously, to maintain an orderly progress of the *Work*, and in conformity with the *Contract Time* and any revisions made thereto in accordance with the *Contract Documents*. The *Contractor* shall at all times provide sufficient personnel to accomplish its services within the *Contract Time*.
- 6.5.8 If the *Contractor* is delayed in the performance of the *Work* by an act or omission of the *Contractor* or anyone employed or engaged by the *Contractor* directly or indirectly, or by any cause within the *Contractor's* control, then the *Contractor* shall take appropriate steps, in accordance with paragraph 3.4.2 of GC 3.4 – CONSTRUCTION SCHEDULE to recover any lost time, and the costs of such recovery efforts shall be to the *Contractor's* account. The *Owner* shall be reimbursed by the *Contractor* for all reasonable costs incurred by the *Owner* as the result of such delay, including all services required by the *Owner* from the *Consultant* as a result of such delay by the *Contractor* and, in particular, the cost of the *Consultant's* services during the period between the date of *Ready-for-Takeover* stated in Article A-1 herein as the same may be extended through the provisions of these General Conditions and any later, actual date of *Ready-for-Takeover* achieved by the *Contractor*.
- 6.5.9 The *Contractor* shall be responsible for the care, maintenance and protection of the *Work* in the event of any suspension of construction as a result of the delay described in paragraphs 6.5.1, 6.5.2 or 6.5.3. In the event of such suspension, the *Contractor* shall be reimbursed by the *Owner* for the reasonable costs incurred by the *Contractor* for such care, maintenance and protection, but excluding the costs of the *Contractor's* head office personnel. The *Contractor's* entitlement to costs pursuant to this paragraph 6.5.9, if any, shall be in addition to amounts, if any, to which the *Contractor* is entitled pursuant to paragraphs 6.5.1, 6.5.2 or 6.5.3.
- 6.5.10 Without limiting the obligations of the *Contractor* described in GC 3.2 – CONSTRUCTION BY OWNER OR OTHER CONTRACTORS and GC 9.4 – CONSTRUCTION SAFETY, the *Owner* may, by Notice in Writing, direct the *Contractor* to stop the *Work* where the *Owner* determines that there is an imminent risk to the safety of persons or property at the *Place of the Work*. In the event that the *Contractor* receives such notice, it shall immediately stop the *Work* and secure the Project site. The *Contractor* shall not be entitled to an extension of the *Contract Time* or to an increase in the *Contract Price* unless the resulting delay, if any, would entitle the *Contractor* to an extension of the *Contract Time* or the reimbursement of the *Contractor's* costs as provided in paragraphs 6.5.1, 6.5.2 or 6.5.3.
- 6.5.11 If the *Contractor* is delayed in the performance of the *Work* by a labour dispute, civil disobedience, riot, sabotage, acts of God or any of the events described in paragraphs 6.5.3.1 through 6.5.3.4 for a period of thirty calendar days or longer, the *Owner* may terminate the *Contract* by giving Notice in Writing to that effect. In such event, the *Owner* shall pay for the *Work* performed up to the effective date of termination, including mobilization and demobilization costs, and for such additional costs, if any, directly flowing from such termination which are a reasonable consequence of the termination, but excluding any consequential, indirect or special losses or damages, including but not limited to loss of use, loss of productivity, loss of revenue, loss of opportunity, overhead and/or profit. The *Owner* shall not be liable to the *Contractor* for any other claims, costs or damages whatsoever arising from such termination of the *Contract*.
- 6.5.12 The *Contractor* shall provide the *Consultant* with prompt written notice of any actual or anticipated labour dispute which may reasonably be expected to affect the *Contractor's* performance of the *Work*.”

GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

- A. In paragraph 6.6.5, delete “claim” in the second line and substitute “necessary claim information”.
- B. Add new paragraphs 6.6.7 and 6.6.8 as follows:

“6.6.7 The *Owner* may make claims arising out of the costs incurred for additional services provided by *Consultant* resulting from the *Contractor*’s failure to perform the *Work* in accordance with the terms and conditions of the *Contract*, including the *Contractor*’s issuance of unnecessary requests for information. *Consultant* will notify the *Owner* and the *Contractor* where it has been determined that additional services will be required or have been provided in order not to cause a delay. The *Owner* shall make claims against the *Contractor* based on *Consultant*’s invoices.

6.6.8 The *Contractor* shall not make claims arising out of any *COVID-19* conditions known at the time of the execution of this *Contract*.”

3.31 GC 7.1 - OWNER’S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR’S RIGHT TO CONTINUE WITH THE WORK, OR TERMINATE THE CONTRACT

- A. Amend paragraph 7.1.2 by (a) adding the words “or fails or neglects to maintain the latest construction schedule” immediately following the word “properly” in the first line; (b) adding the words “or the *Owner* determines that sufficient cause exists to justify such action,” in line three after the words “substantial degree”; and (c) deleting the words “including references to applicable provisions of the *Contract*”.
- B. Delete paragraph 7.1.5.2 and insert new paragraph 7.1.5.2 as follows:
“withhold further payment to the *Contractor* until the *Owner* has completed all *Work* required by the *Contract Documents* and satisfied any of its costs or damages resulting from the *Contractor*’s default,”
- C. Amend paragraph 7.1.5.3 by deleting the words “as certified by the *Consultant*”.

3.32 GC 7.2 - CONTRACTOR’S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

- A. Amend paragraph 7.2.2, by: (a) in line 1, by deleting “20” and replacing it with “35”; (b) adding the words “or related to *COVID-19*” after the first instance of the word “the *Contractor*” in the third line; and (c) adding the following second sentence at the end of the paragraph: “If the *Work* is suspended or otherwise delayed as a result of *COVID-19* for a period of ninety (90) *Working Days*, the *Contractor* may, upon giving the *Owner* twenty (20) days *Notice in Writing*, terminate the *Contract*.”
- B. Delete subparagraph 7.2.3.1 in its entirety and substitute the words “Intentionally deleted.”
- C. Delete subparagraph 7.2.3.3 in its entirety and substitute new subparagraph 7.2.3.3:
“the *Owner* fails to pay the *Contractor* when due the amount certified by the *Consultant* or awarded by adjudication, arbitration or a court, except where the *Owner* has a bona fide claim for set off, or”
- D. Delete from line 2 of subparagraph 7.2.3.4, the words, “except for GC5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER,”.
- E. Delete paragraph 7.2.5 and replace it with the following:
“7.2.5 If the default cannot be corrected within the five (5) *Working Days* specified in paragraph 7.2.4, the *Owner* shall be deemed to have cured the default if it
 - .1 commences the correction of the default within the specified time; and
 - .2 provides the *Contractor* with an acceptable schedule for such correction; and
 - .3 completes the correction in accordance with such schedule.”
- F. Add new paragraphs 7.2.6 and 7.2.7:
“7.2.6 If the *Contractor* terminates the *Contract* under the conditions described in this GC 7.2, the *Contractor* shall be entitled to be paid for all *Work* performed to the date of termination. The *Contractor* shall also be entitled to recover the direct and demonstrable costs and expenses associated with termination, including the costs of demobilization, losses sustained on Products and construction machinery and equipment. The *Contractor* shall not be entitled to any recovery for any consequential, indirect or special losses or damages, including but not limited to loss of use, loss of productivity, loss of revenue, loss of opportunity, overhead and/or profit.
- 7.2.7 The *Owner*’s withholding of progress payments, holdback payment and/or final payments pursuant to GC 5.6 shall not constitute a default under paragraph 7.2.3 permitting the *Contractor* to stop the *Work* or terminate the *Contract*.”

3.33 GC 8.1 AUTHORITY OF THE CONSULTANT

- A. Delete paragraphs 8.1.1, 8.1.2 and 8.1.3 and substitute the following:

“8.1.1 Differences between *the Owner* and the *Contractor* as to the interpretation, application, or administration of this *Contract*, or any failure to agree where agreement between the parties is called for in the *Contract* (the “Dispute”) which are not resolved in the first instance by finding of *Consultant* pursuant to the provisions of GC - 2.2 ROLE OF THE CONSULTANT, paragraphs 2.2.6 and 2.2.7 shall be settled in accordance with the requirements of this GC 8.1.

8.1.2 The claimant shall give written notice of the Dispute (“Notice of Dispute”) to the other party no later than seven (7) days after the receipt of *Consultant*’s finding given under paragraphs 2.2.7 or 2.2.8 of GC 2.2 ROLE OF THE CONSULTANT. The Notice of Dispute shall set forth particulars of the matters in dispute, the probable extent and value of the damage, and the relevant provisions of the *Contract Documents*. The other party shall reply within seven (7) days of receipt of the Notice of Dispute, or such longer period as mutually agreed by the parties in writing, setting out the response and any relevant provisions of the *Contract Documents*.

8.1.3 The parties shall make all reasonable efforts to resolve the Dispute by amicable negotiations and agree to provide, without prejudice, full, frank, candid, and timely disclosure of relevant facts, information and documents to facilitate the negotiations.

8.1.4 If the *Dispute* is not resolved promptly by amicable negotiations in accordance with GC 8.1.3, *Consultant* may provide instructions that, in *Consultant*’s opinion, are necessary for the proper performance of the *Work* and to prevent delays pending settlement of the *Dispute*. The parties shall act immediately according to such instructions, it being understood that by so doing neither party will jeopardize any claim they may have. If it is subsequently determined that such instructions were in error or at variance with the *Contract Documents*, *the Owner* shall pay the *Contractor* verifiable costs incurred by the *Contractor* in carrying out such instructions, which the *Contractor* was required to do beyond what the *Contract Documents* correctly understood and interpreted would have required the *Contractor* to do including costs resulting from interruption of the *Work*.

8.1.5 It is agreed that no act by either party shall be construed as a renunciation or waiver of any of their rights or recourses, provided the party has given the notices in accordance with paragraph 8.1.2 and has carried out the instructions as provided in paragraph 8.1.4, if any.

8.1.6 If the parties have not been able to resolve the Dispute in accordance with paragraph 8.1.3, the parties may agree to submit the *Dispute* to be finally resolved by arbitration under the rules of arbitration as provided in CCDC 40 in effect at the time of the execution of the *Contract*.

8.1.7 If no agreement is made for arbitration, then either party may submit the *Dispute* to such judicial tribunal as the circumstances may required.”

3.34 GC 8.3 NEGOTIATION, MEDIATION AND ARBITRATION

- A. Delete 8.3 in its entirety and substitute the following: “Intentionally deleted”.

3.35 GC 8.4 - RETENTION OF RIGHTS

- A. Amend paragraph 8.4.2 by deleting “paragraph 8.3.6 of GC 8.3 – NEGOTIATION, MEDIATION AND ARBITRATION” and substituting “GC 8.1 – AUTHORITY OF THE CONSULTANT”.

- B. Add new subparagraph 8.4.3:

“8.4.3 If the either party give a *Notice in Writing* described in paragraph 8.3.6 to have a *Dispute* resolved by arbitration, the *Contractor* agrees that this paragraph 8.4.3 shall be construed as a formal consent to the stay of any lien proceedings until an award is rendered in the arbitration or such *Dispute* is otherwise resolved between the parties. In no event shall the *Contractor* be deprived of its right to enforce its lien against the *Project* should the *Owner* fail to satisfy any arbitral award against it in full on the dispute in respect of which the lien proceedings were commenced. Provided

nothing in this paragraph 8.4.3 shall prevent the *Contractor* from taking the steps required by the *Act* to preserve and/or perfect a lien to which it may be entitled.”

3.36 GC 9.1 - PROTECTION OF WORK AND PROPERTY

- A. Delete subparagraph 9.1.1.1 in its entirety and substitute new subparagraph 9.1.1.1:
“errors or omissions in the *Contract* Documents which the *Contractor* could not have reasonably discovered applying the standard of care described in paragraph 1.5.1.1 of GC 15 – PROJECT REQUIREMENTS; or”
- B. Delete paragraph 9.1.2 in its entirety and substitute the following new paragraph 9.1.2:
“9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground utilities and structures indicated in or reasonably apparent or determinable from the *Contract* Documents or that are reasonably discoverable by applying to an inspection of the *Place of the Work* the degree of care and skill described in paragraph 1.5.1.1 of GC 1.5 – PROJECT REQUIREMENTS.”
- C. Add a new paragraphs 9.1.5, 9.1.6 and 9.1.7 as follows:
 - “9.1.5 Without in any way limiting the *Contractor*’s obligations under this GC 9.1, should the *Contractor* or any *Subcontractor* or *Supplier* cause loss or damage to trees or other plantings, whether owned by the *Owner* or third parties, the *Contractor* shall be liable for the replacement cost of the trees or other plantings damaged, including the cost of any arborist or other consultant, and such costs may be deducted by the *Owner* from amounts otherwise owing to the *Contractor*.”
 - “9.1.6 The *Contractor* shall neither undertake to repair and/or replace any damage whatsoever to the *Work* of *Other Contractors*, or to adjoining property, nor acknowledge the same was caused or occasioned by the *Contractor*, without first consulting the *Owner* and receiving written instructions as to the course of action to be followed from either the *Owner* or the *Consultant*. However, where there is danger to life or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger.”
 - “9.1.7 The *Contractor* shall be responsible for keeping the *Work* free from trespassers and for protection of the *Work* and the public from any loss or injury directly or indirectly caused by the *Work* from the commencement of construction until *Substantial Performance of the Work*.”

3.37 GC 9.2 - TOXIC AND HAZARDOUS SUBSTANCES

- A. Amend paragraph 9.2.5.3 by asserting the following words after the words “place of the work” in line two of that paragraph:
“and no property is injured or destroyed as a result of exposure to or the presence of the toxic or hazardous substances,”
- B. Delete the word “and” at the end of paragraph 9.2.5.3.
- C. Add the word “and” at the end of paragraph 9.2.5.4.
- D. Add a new paragraph 9.2.5.5 as follows:
“take any further steps it deems necessary to mitigate or stabilize any conditions resulting from encountering toxic or hazardous substances.
- E. Add to paragraph 9.2.6 after the word “responsible”, the following new words:
“or that any toxic or hazardous substances already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the *Owner* or others,”.
- F. Amend paragraph 9.2.7.3 by inserting the following words after the word “delay” in line two of that paragraph:
“, but excluding any consequential, indirect or special losses or damages, including but not limited to loss of use, loss of productivity, loss of revenue, loss of opportunity, overhead and/or profit.”
- G. Add to paragraph 9.2.8 after the word “responsible”, the following new words:

“or that any toxic or hazardous substances already at the *Place of the Work* (and which were then harmless or stored, contained or otherwise dealt with in accordance with legal and regulatory requirements) were dealt with by the *Contractor* or anyone for whom the *Contractor* is responsible in a manner which does not comply with legal and regulatory requirements, or which threatens human health and safety or the environment, or material damage to the property of the *Owner* or others,”.

- H. Add “and the *Consultant*” after the word “*the Owner*” in subparagraph 9.2.8.4.
- I. Add a new paragraph 9.2.10 as follows:
“9.2.10 Without limiting its other obligations under this GC 9.2, the *Contractor* acknowledges that its obligations under the *Contract* include compliance with the *Environmental Programs*. The *Contractor* acknowledges that the *Owner* may suffer loss and damage should the *Contractor* fail to comply with the *Environmental Programs* and agrees to indemnify and hold harmless the *Owner* with respect to any loss or damage to which the *Owner* is exposed by the *Contractor*’s failure to comply. The *Contractor* expressly agrees that such loss and damage shall be included within the scope of the *Contractor*’s indemnity described in paragraph 12.1.1. The *Contractor* acknowledges that should it fail to comply with the *Environmental Programs*, such failure will constitute a failure to comply with the *Contract* to a substantial degree within the meaning of paragraph 7.1.2.”

3.38 GC 9.4 - CONSTRUCTION SAFETY

- A. Delete paragraph 9.4.1 in its entirety and substitute new paragraph 9.4.1:
“9.4.1 The *Contractor* shall be solely responsible for construction safety at the *Place of the Work*, and for compliance with the rules, regulations and practices required by the applicable construction health and safety legislation, the *Owner*’s health and safety regulations, guidelines, and instructions for contractors, and the *Owner*’s vaccination and/or *COVID-19* policies, as may be amended. The *Contractor* shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the *Work*. The *Contractor* shall be deemed to be and accepts the designation of “constructor” as defined in the *OHSA* for the Project, and responsibility for the obligations and liabilities associated therewith. Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner* a copy of the Notice of Project filed with the Ministry of Labour in respect of the *Work*.”
- B. Add new paragraphs 9.4.6, 9.4.7, 9.4.8, 9.4.9, 9.4.10, and 9.4.11:
“9.4.6 Prior to the commencement of the *Work*, the *Contractor* shall submit to the *Owner*:
 - .1 a current WSIB clearance certificate;
 - .2 copies of the *Contractor*’s insurance policies having application to the Project or certificates of insurance, at the option of the *Owner*;
 - .3 documentation of the *Contractor*’s in-house safety-related programs;
 - .4 a copy of the Notice of Project filed with the Ministry of Labour naming itself as “constructor” under *OHSA*.
- 9.4.7 The *Contractor* hereby represents and warrants to the *Owner* that appropriate health and safety instruction and training have been provided and will be provided to the *Contractor*’s employees, *Subcontractors* and *Suppliers*, before the *Work* is commenced. The *Contractor* also undertakes to provide such health and safety instruction and training to the *Owner*’s representatives, the *Owner*’s own forces and other contractors, should they fall under the jurisdiction of the *Contractor* as more particularly described in paragraph 9.4.1 above.
- 9.4.8 The *Contractor* shall indemnify and save harmless the *Owner*, the *Consultant* and their respective agents, officers, directors, employees, consultants, subconsultants, successors and assigns from and against any and all liability, cost, damage or loss, including legal fees and fines, related to or arising out of any and all acts or omissions of the *Contractor*, its *Subcontractors*, *Suppliers*, employees, agents or representatives which contravene the *Contractor*’s duties and obligations, as constructor, pursuant to the *OHSA* (including, without limitation, the consequences of any and all safety infractions committed by the *Contractor* under the *OHSA*), including the payment of legal fees and disbursements on a solicitor and client basis. Such indemnity shall apply to the extent to which the *Owner* is not covered by insurance, provided that the indemnity contained in this

paragraph shall be limited to costs and damages resulting directly from such infractions and shall not extend to any consequential, indirect or special damages.

- 9.4.9 Without limiting the generality of paragraph 9.4.7, the *Contractor*,
- .1 agrees to waive and release *the Owner* and its agents, officers, directors, employees, successors and assigns from any and all claims, demands, losses, costs, damages, actions, suits, or proceedings as against; and
 - .2 shall indemnify and save harmless *the Owner, Consultant* and their respective agents, officers, directors, employees, successors and assigns, from and against any and all claims, demands, losses, costs, damages, actions, suits, or proceedings by any the *Contractor's* employees, *Subcontractors*, Suppliers, and/or third parties,
- that arise out of, are caused or contributed by, or are attributable to *COVID-19*, including and without limiting the generality of the foregoing, any claims, demands, losses, costs, damages, actions, suits or proceedings arising from, caused or contributed by, or attributable to *COVID-19* outbreaks originating from or on *the Owner's* premises.
- 9.4.10 In the event that the *Owner* engages *Other Contractors* at the *Place of the Work* or performs work with its own forces, the *Owner* undertakes to include in its contracts with *Other Contractors* and/or in its instructions to its own forces the requirement that the *Other Contractors* or own forces, as the case may be, will comply with directions and instructions from the *Contractor*, as "constructor", with respect to occupational health and safety and related matters. The text of such instruction is attached to these Supplementary Conditions as Appendix 1 to these Supplementary Conditions.
- 9.4.11 All of the safety measures outlined in this agreement, or reasonably requested by the *Owner*, or implemented in order to comply with applicable law shall be at the sole expense of the *Contractor*."

3.39 GC 9.5 - MOULD

- A. Delete paragraph 9.5.3.3 in its entirety and substitute new paragraph 9.5.3.3:
- "extend the *Contract Time* for such reasonable time as the *Consultant* may recommend in consultation with the *Contractor*. If, in the opinion of the *Consultant*, the *Contractor* has been delayed in performing the *Work* and / or has incurred additional costs under paragraph 9.5.1.2, the *Owner* shall reimburse the *Contractor* for reasonable costs incurred as a result of the delay and as a result of taking those steps, but excluding any consequential, indirect or special losses or damages, including but not limited to loss of use, loss of productivity, loss of revenue, loss of opportunity, overhead and/or profit, and"

3.40 GC 10.1 - TAXES AND DUTIES

- A. Amend paragraph 10.1.2 by adding the following sentences at the end of that paragraph:
- "Except where the Specifications require otherwise, this increase in costs shall not apply where taxes and duties known before bid submission, become effective after bid submission. The *Contract Price* shall be deemed to include such increased duties and taxes. For greater certainty, the *Contractor* shall not be entitled to any mark-up for overhead or profit on any increase in such taxes and duties and the *Owner* shall not be entitled to any credit relating to mark-up for overhead or profit on any decrease in such taxes."
- B. Add new paragraphs 10.1.3, 10.1.4, 10.1.5 and 10.1.6 as follows:
- "10.1.3 Where the *Owner* is entitled to an exemption or a recovery of sales taxes, customs duties, excise taxes or Value Added Taxes applicable to the *Contract*, the *Contractor* shall, at the request of the *Owner* or the *Owner's* representative, assist with application for any exemption, recovery or refund of all such taxes and duties and all amounts recovered or exemptions obtained shall be for the sole benefit of the *Owner*. The *Contractor* agrees to endorse over to the *Owner* any cheques received from the federal or provincial governments, or any other taxing authority, as may be required to give effect to this paragraph."

“10.1.4 The *Contractor* shall maintain accurate records of equipment, material and component costs reflecting the taxes, customs duties, excise taxes and *Value Added Taxes* paid.”

“10.1.5 Any refund of taxes including, without limitation, any government sales tax, customs duty, excise tax or Value Added Tax, whether or not paid, which is found to be inapplicable or for which exemption may be obtained, is the sole and exclusive property of the *Owner*. The *Contractor* agrees to cooperate with the *Owner* and to obtain from all *Subcontractors* and *Suppliers* cooperation with the *Owner* in the application for any refund of any taxes, which cooperation shall include, but not be limited to, making or concurring in the making of an application for any such refund or exemption and providing to the *Owner* copies, or where required, originals of records, invoices, purchase orders and other documentation necessary to support such applications or exemptions or refunds. All such refunds shall either be paid to the *Owner*, or shall be a credit to the *Owner* against the *Contract Price*, in the *Owner*’s discretion.”

“10.1.6 Customs duties penalties, or any other penalty, fine or assessment levied against the *Contractor* shall not be treated as a tax or customs duty for purposes of this GC 10.1.”

3.41 GC 10.2 - LAWS, NOTICES, PERMITS, AND FEES

- A. Delete paragraph 10.2.2 in its entirety and replace it with the following:

“10.2.2 The *Owner* shall obtain and pay for permanent easements and rights of servitude. The building permit will be obtained and paid for by the *Contractor*. The *Contractor* shall be responsible to obtain and pay for all other permits, licenses or certificates necessary for the performance of the *Work* which were in force at the date of bid closing. The *Owner* shall pay any plan inspection fee charged by the Ministry of Labour.”

- B. Add to the end of paragraph 10.2.4, the following words:

“The *Contractor* shall notify the Chief Building Official or the registered code agency where applicable, of the readiness, substantial completion, and completion of the stages of construction set out in the Ontario Building Code. The *Contractor* shall be present at each site inspection by an inspector or registered code agency as applicable under the Ontario Building Code. The *Contractor* shall be present at each site inspection by an inspector or registered code agency as applicable under the Ontario Building Code”

- C. Delete from the first line of paragraph 10.2.5 the word, “The” and substitute the words:

“Subject to paragraph 1.1.3 and 1.1.4 of GC 1.1 – GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT, the”.

- D. Amend paragraph 10.2.7 by (a) deleting “bid closing” and substituting “execution of the *Contract*”, and (b) adding the following to the end of the paragraph: “, save and except for changes related to COVID-19 which are provided for under paragraph 6.5.6 of GC 6.5 - DELAYS.”

3.42 GC12.1 – READY-FOR-TAKEOVER

- A. Amend paragraph 12.1.1.1 by adding “, and all prerequisites for substantial performance under the Construction Act, RSO 1990, c C.30 have been satisfied.” after the word “*Work*”.

- B. Amend paragraph 12.1.1.4 by (a) adding “spare parts, maintenance materials, warranties, data manuals, and specifications” after the words “maintenance documents” and (b) deleting the word “immediate”.

- C. Add new paragraphs 12.1.1.9, 12.1.1.10, and 12.1.1.11:

“12.1.1.9 Local fire authority has inspected and confirmed that life safety systems are acceptable, if required by the *Contract Documents*.

12.1.1.10 Elevator inspection and approval by governing authority received by *Consultant*, if required by the *Contract Documents*.

12.1.1.11 Any other prerequisites required by the *Contract Documents*.”

- D. Amend paragraph 12.1.2 by deleting “to 12.1.1.6” and substituting “, 12.1.1.5, and 12.1.1.8”.

- E. Amend paragraph 12.1.4 by deleting “10 calendar days” and substituting “fifteen (15) *Working Days*, or such longer period as may be reasonably required in the circumstances”.

- F. Amend paragraph 12.1.6 by adding “RIGHT OF ENTRY AND ” after “GC 12.2 – ”.\

3.43 GC 12.2 RIGHT OF ENTRY AND EARLY OCCUPANCY BY THE OWNER

- A. Delete GC 12.2 EARLY OCCUPANCY BY THE OWNER in its entirety and substitute the following:

“GC 12.2 RIGHT OF ENTRY AND EARLY OCCUPANCY BY THE OWNER

12.2.1 *the Owner* shall have the right to enter or occupy the *Work* in whole or in part for the purpose of placing fittings and equipment or for other uses before Ready-for-Takeover, if, in the opinion of *Consultant* and *the Owner*, such entry or occupation does not prevent or substantially interfere with the *Contractor* in completion of the *Contract* within the *Contract Time*. Such entry or occupation shall not be considered as acceptance of the *Work* or in any way relieve the *Contractor* from responsibility to complete the *Contract* or its obligations under the *Contract*.

3.44 GC 12.3 WARRANTY

- A. Amend paragraph 12.3.1 by adding the following sentence to the end of the paragraph:

“Where the Project is phased and the Specifications instruct the *Contractor* that the *Work* will be completed in stages or phases and turned over to the *Owner* for permanent use and occupancy prior to the *Substantial Performance of the Work*, the warranty for such stage or phase shall commence, for the particular phase or stage only, on the date the *Owner* takes possession of the phase or stage for permanent use or occupancy and issues a Notice in Writing to that effect.”

- B. Delete from the first line of paragraph 12.3.2 the word, “The” and substitute the words “Subject to paragraphs 1.1.3 and 1.1.4 of GC 1.1 – GENERAL CONDITIONS OF THE STIPULATED PRICE CONTRACT, the”.

- C. Amend paragraph 12.3.6 by adding the words “, unless otherwise required by the *Contract Documents*” to the end of the third sentence.

- D. Add new paragraphs 12.3.7 and 12.3.8 as follows:

“12.3.7 Any items which are replaced under warranty or extended warranty shall be warranted from the time of such replacement for an additional period equalling the original warranty under which they were repaired or replaced.

12.3.8 During the month prior to the end of the warranty period, the *Owner*, the *Consultant* and the *Contractor* shall conduct an inspection of the *Work* and the *Contractor* shall promptly remedy any defects to faulty materials or workmanship.”

3.45 GC13.1 - INDEMNIFICATION

- A. Delete paragraphs 13.1.1 through 13.1.6 and replace them with the following:

“13.1.1 Without restricting the parties obligations to indemnify respecting toxic and hazardous substances, patent fees, and health and safety:

- .1 the *Contractor* shall indemnify and hold harmless the *Owner* and the *Consultant*, their agents and employees from and against all claims, demands, losses, costs, damages, actions, suits, or proceedings (hereinafter called “claims”), by third parties that arise out of, or are attributable to, the *Contractor*’s performance of the *Contract* provided such claims are:

- (1) attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property, and
- (2) caused by negligent acts or omissions of the *Contractor* or anyone for whose acts the *Contractor* may be liable, and
- (3) made in writing within a period of 6 years from the date of *Substantial Performance of the Work* as set out in the certificate of *Substantial Performance of the Work*, or within such shorter period as may be prescribed by any limitation statute of the province or territory of the Place of *Work*.
- (4) Except as otherwise provided in this *Contract*, the *Owner* expressly waives the right to indemnity for claims other than those stated above.

The obligation of the *Contractor* to indemnify hereunder shall be limited to \$5,000,000 per occurrence from the commencement of the *Work* until *Substantial Performance of the Work* and thereafter to an aggregate limit of \$5,000,000.

- .2 The *Owner* shall indemnify and hold harmless the *Contractor*, the *Contractor's* agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceedings arising out of the *Contractor's* performance of the *Contract* which are attributable to a lack of or defect in title or an alleged lack of or defect in title to the *Place of Work*."

3.46 GC 13.2 - WAIVER OF CLAIMS

- A. Delete paragraphs 13.2.1 through 13.2.10 and replace them with the following:
- "13.2.1 As of the date of final payment, the *Owner* expressly waives and releases the *Contractor* from all claims against the *Contractor* including without limitation those that might arise from negligence or breach of contract by the *Contractor* except for one or more of the following:
- .1 those made in writing prior to the date of final payment and still unsettled;
 - .2 those arising from the provisions of GC13.1 – INDEMNIFICATION or GC13.3 – WARRANTY;
 - .3 those arising from GC9.2 – TOXIC AND HAZARDOUS SUBSTANCES and arising from the *Contractor* bringing or introducing any toxic or hazardous substances and materials to the *Place of the Work* after the *Contractor* commences the *Work*;
 - .4 those made by Notice in Writing within a period of six years from the date of *Substantial Performance of the Work* as set out in the certificate of substantial performance, or within such shorter period as may be prescribed in any limitation statute of the province or territory of the *Place of the Work* and arising from any liability of the *Contractor* for damages resulting from the *Contractor's* performance of the *Contract* with respect to substantial defects or deficiencies in the *Work* for which the *Contractor* is proven responsible. As used herein, "substantial defects or deficiencies" means any defect or deficiency in the *Work* where the reasonable cost of repair of such defect or deficiency exceeds:
 - .1 for a *Contract Price* of \$2,000,000 or less, the sum of \$50,000, before GST;
 - .2 for a *Contract Price* of \$2,000,000 or more, the sum of \$100,000, before GST.
- 13.2.2 As of the date of certificate of *Substantial Performance of the Work*, the *Contractor* expressly waives and releases the *Owner* from all claims which it has or reasonably ought to have knowledge of that could be advanced against the *Owner* including without limitation those that might arise from the negligence or breach of contract by the *Owner* except:
- .1 those for which *Notice in Writing* was given prior to the *Contractor's* application for final payment and still unsettled; and
 - .2 those arising from the provisions of GC9.2 – TOXIC AND HAZARDOUS SUBSTANCES or GC10.3 – PATENT FEES."

3.47 PART 14 - OTHER PROVISIONS

- A. Add new **PART 14 – OTHER PROVISIONS** as follows:

GC 14.1 - OWNERSHIP OF MATERIALS

- 14.1.1 Unless otherwise specified, all materials existing at the *Place of the Work* at the time of execution of the *Contract* shall remain the property of the *Owner*. All *Work* and Products delivered to the *Place of the Work* by the *Contractor* shall be the property of the *Owner*. The *Contractor* shall remove all surplus or rejected materials as its property when notified in writing to do so by the *Consultant*.

GC 14.2 - CONSTRUCTION LIENS

- 14.2.1 In the event that a construction lien is registered against the Project by or through a *Subcontractor* or Supplier, and provided that the liens did not arise as a direct result of the failure by the *Owner* to pay the *Contractor* in accordance with the *Contract*, the *Contractor* shall, at its own expense:

- .1 within ten (10) days, ensure that any and all construction liens and certificates of action are discharged, released or vacated by the posting of security in accordance with the *Act*; and
- .2 in the case of written notices of lien, ensure that such notices are withdrawn, in writing.

14.2.2 In the event that the *Contractor* fails to comply with GC 14.2, the *Owner* may see to the removal of the construction lien or certificate of action or the withdrawal of the written notice of lien, and in that event, the *Contractor* shall be liable to the *Owner* for any and all costs and expenses, including legal costs on a full indemnity basis, associated therewith. the *Owner* shall be at liberty to set off such costs and expenses against any amount otherwise due to the *Contractor* under this *Contract*. If there is no amount owing by the *Owner* to the *Contractor*, then the *Contractor* shall reimburse the *Owner* for all of the said costs and associated expenses.”

GC 14.3 - CONTRACTOR DISCHARGE OF LIABILITIES

14.3.1 In addition to the obligations assumed by the *Contractor* pursuant to GC 3.6, the *Contractor* agrees to discharge all liabilities incurred by it for labour, materials, services, *Subcontractors* and Products, used or reasonably required for use in the performance of the *Work*, except for amounts withheld by reason of legitimate dispute and which have been identified to the party or parties, from whom payment has been withheld.

GC 14.4 - AS-BUILT DRAWINGS

14.4.1 Unless otherwise provided in the *Contract Documents*, the *Contractor* shall prepare as-built drawings and provide them to the *Consultant* for review in accordance with paragraph 12.1.1.5.

GC 14.5 - DAILY REPORTS/DAILY LOGS

14.5.1 The *Contractor* shall cause its supervisor, or such competent person as it may delegate, to prepare a daily log or diary reporting on weather conditions, work force of the *Contractor*, *Subcontractors*, Suppliers and any other forces on site and also record the general nature of Project activities. Such log or diary shall also include any extraordinary or emergency events which may occur and also the identities of any persons who visit the site who are not part of the day-to-day work force.

14.5.2 The *Contractor* shall also maintain records, either at its head office or at the job site, recording manpower and material resourcing on the Project, including records which document the activities of the *Contractor* in connection with GC 3.4, and comparing that resourcing to the resourcing anticipated when the most recent version of the schedule was prepared pursuant to GC 3.4.

GC 14.6 - NEUTRAL APPOINTING AUTHORITY

14.6.1 For purposes of the Rules the term “neutral appointing authority”, shall mean the “Appointing Committee” at ADR Chambers presiding at the time notice of the dispute is given pursuant to the *Contract*.”

GC 14.7 - PUBLIC STATEMENTS

14.7.1 The *Contractor* shall not publish, issue or make any statements or news release, electronic or otherwise, concerning the *Contract*, the *Work*, or the *Project*, without the express written consent of the *Owner*.

GC 14.9 - HOSPITAL RELATED PROVISIONS

14.9.1 The *Contractor* acknowledges that the security and safety of the patients, employees and other occupants of the existing hospital is paramount. If any of the employees of the *Contractor* or the *Subcontractors* is determined by the *Owner* to be a concern for the security or safety of such patients, employees or occupants, the *Owner* may require that the *Contractor* replace such employee.

- 14.9.2 The *Contractor* recognizes that part of the *Work* may consists of the renovation of existing buildings and structures or the addition of a structure to an existing building. The *Contractor*:
- .1 recognizes that that the provision of patient care during construction is a priority for the *Owner*. The *Contractor* shall comply with the reasonable instructions provided by the *Owner* (including, without limitation, the *Owner's* infection control practitioner) in regard to patient care and the operation and use of the hospital during the performance of the *Work*. Any costs incurred by the *Contractor* in complying with the said instructions shall be part of the *Contract Price*.
 - .2 without in any way limiting its responsibilities under this *Contract*, the *Contractor* shall take all reasonable steps to avoid interference with fire exits, building access and egress, continuity of electric power and all other utilities, to suppress dust and noise, to avoid conditions likely to propagate mould or fungus of any kind, and all other steps reasonably necessary to promote and maintain the safety and comfort of the users and occupants of such structures or adjacent structures. Without the *Owner's* prior approval, the *Contractor* shall not permit any *Worker* or *Subcontractors* to use any existing facilities including, without limitation, lavatories, toilets, entrances and parking areas other than those designated by the *Owner*.
- 14.9.3 Notwithstanding any other provision in the *Contract*, paramountcy of access must be given to emergency vehicles and no claim may be made by the *Contractor* for any delay in the performance of the *Work* as a result of any temporary lack of access to the Place of *Work* resulting from this paramountcy of access by emergency vehicles, provided that the *Owner* will use commercially reasonable efforts to avoid and to limit the duration of any temporary lack of access for this reason.
- 14.9.4 The *Owner* has the authority, but without the obligation, to stop the *Work* in any circumstance affecting the safety of life or property or otherwise may cause an unsafe condition for the operation of the existing hospital. The *Contractor* shall abide by the *Owner's* instructions to stop the *Work* and to any related instructions pertaining to the circumstance without any increase in the *Contract Price* and extension in the *Contract Time* if such circumstance was caused by the *Contractor*, *Subcontractors* or *Suppliers*.
- 14.9.5 The *Contractor* shall, and shall cause the *Subcontractors* and *Suppliers* to, comply with hospital policies and procedures including, without limitation, environmental requirements, infection control measures and safety and emergency preparedness guidelines which are or come into force (including, without limitation, those forming part of the *Contract Documents*) as such documents are amended by the *Owner* from time to time, provided that a material amendment to the hospital policies and procedures by the *Owner* after the date of the Agreement which gives rise to a significant change in the *Work* shall be dealt with in accordance PART 6 - CHANGES IN THE WORK."

END OF SUPPLEMENTARY CONDITIONS

APPENDIX 1

LANGUAGE FOR OWNER PERSONNEL OR FOR THIRD PARTY CONTRACTORS ENTERING A PROJECT SITE WHERE THE CONTRACTOR HAS ASSUMED OVERALL RESPONSIBILITY – IN CONTRACT – FOR OCCUPATIONAL HEALTH AND SAFETY

“The (trade or employee) acknowledges that the work it will perform on behalf of Kingston General Hospital (the “*the Owner*”) requires it to enter a job site which is under the total control of a [name of contractor] (the “*the Contractor*”).

The (trade or employee) acknowledges that the *Contractor* has assumed overall responsibility for compliance with all aspects of the health and safety legislation of Ontario, including all the responsibilities of the “constructor” under the Occupational Health and Safety Act (Ontario). Further, (trade or employee) acknowledges that the *Contractor* is also responsible to the *Owner* to co-ordinate and schedule the activities of our work with the work of the *Contractor*.

We agree to comply with the *Contractor* directions and instructions with respect to occupational health and safety and coordination. We acknowledge that it will be cause for termination under our contract with the *Owner* should (I/we) fail or refuse to accept the direction and instruction of the *Contractor* with respect to matters of occupational health and safety or matters related to coordination of work.

We agree to have the *Contractor* named as an additional insured on our comprehensive liability policy.”

APPENDIX 2

AMENDMENT TO RULES FOR MEDIATION AND ARBITRATION OF CONSTRUCTION INDUSTRY DISPUTES

(CCDC-40, 2018) (THE “RULES”)

This Amendment supersedes, replaces or amends the Rules, as the case may be, as outlined below.

RULES FOR MEDIATION OF CCDC 2 CONSTRUCTION INDUSTRY DISPUTES

- A. By Agreement. Delete clause 5.1 and replace it with the following:
 - B. “5.1 By Agreement . Where a party desires the appointment of a Project Mediator and gives a Notice in Writing to that effect, such notice shall include the names of two qualified individuals who are prepared to act as mediator, ranked in order of preference. Within five Working Days of receiving such a notice, the other party shall deliver a responding notice including the names of two qualified individuals who are prepared to act as mediator, ranked in order of preference. From the names submitted by the parties, the parties shall unanimously appoint a mediator.”
 - C. Appointment of Project Mediator. Add a new clause 5.5 which reads as follows:
 - D. “5.5 Formal Agreement. When the Project Mediator has been appointed, whether pursuant to clause 5.1 or clause 5.2, the parties and the mediator shall enter into an agreement in writing pursuant to which the terms and conditions of the engagement of the Project Mediator shall be set out. Such agreement shall include an undertaking by the Project Mediator to carry out the mediation pursuant to these Rules and such agreement shall specifically set out the undertaking of the Project Mediator and the parties as to “Costs of the Mediation” (Section 12) and “Privileged Process” (Section 14).”
- Representation. Amend clause 8.1 by deleting the last six words of that clause.

RULES FOR ARBITRATION OF CCDC 2 CONSTRUCTIONS INDUSTRY DISPUTES

- 1) Location of Arbitration. Add the following as a second sentence to clause 6.1:
“Failing agreement by the parties, the arbitrator may select a location for the arbitration within the jurisdiction of the Place of Work, which is convenient to both parties”.
- 2) Single Arbitrator. Delete clause 9.1 and replace it with the following:
“9.1 The arbitration shall be conducted before a single arbitrator who possesses the qualifications specified in Clause 9.5.”
- 3) Appointment Of Arbitrator. Delete Clause 9.2 in its entirety and replace it with the words, “intentionally left blank”.
- 4) Appointment of 3 Arbitrators. Delete Clause 9.4 in its entirety and replace it with, “intentionally left blank”.
- E. Appointment of Arbitrator. Add a new clause 9.13 which reads as follows:
“9.13 Where the arbitrator has been appointed pursuant to the Section 9, the parties and the arbitrator shall enter an agreement in writing setting out, at minimum, the name of the arbitrator, the undertaking of the arbitrator and the parties to conduct the arbitration pursuant to these Rules and the terms and conditions of engagement of the arbitrator including the fees to be paid and expenses to be reimbursed and any arrangements required to provide for interim payment of fees and/or expenses to the arbitrator.”

- F. Procedural Meeting. Add the following new sentence to clause 10.2:
“Such written record shall be deemed to be the procedural code for the conduct of the arbitration, subject to any further orders of the arbitrator or of the Court of competent jurisdiction.”
- G. Powers of the Arbitrator. Delete clause 11.1 and substitute the following:
“Subject to these Rules and subject to the written record described in clause 10.3, the arbitrator may conduct the arbitration in such manner as the arbitrator, acting reasonably, considers appropriate provided that in all events each party shall be treated fairly and given a full opportunity to present its case and respond to the case presented by the other party.”
- H. Exchange of Statements. Delete clause 13.1(a) and replace it with the following:
“(a) which are relevant to the issues in dispute, and..”.
- I. Disclosure. Delete clause 13.2 and replace it with the following:
“13.2 The arbitrator may order one or both parties to prepare an affidavit, within a specified time, in which such party deposes under oath that it has made a full and complete listing of documents pursuant to clause 13.1(a) where the arbitrator has reason to believe that one or both parties may not have made full and complete disclosure of the documents relevant to the issues in the arbitration.”
- J. Add a new clause 16.7 as follows:
“16.7 In the event that a party provides the statement or report of an expert witness pursuant to clause 16.1, the provisions of clauses 16.4 and 16.5 shall apply, with necessary modifications.”
- K. Hearings and Meetings. Amend clause 13.3 by adding the following language to that clause:
“..unless otherwise agreed by both parties or directed by the arbitrator.”
- L. Arbitrator Retained Experts. Add clause 16.2(c) as follows:
“(c) provide the party with a written summary of any other information, beyond that described in clauses 16.2(a) and (b), upon which the expert relied in preparing the expert’s report.”
- M. Consolidation, Conducting Together or Consecutively, or Stay of Arbitrations. Amend clause 24.1(a) by adding the following wording to that clause:
“...on the same Project,..”.

END OF

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SECTION 01 11 00 SUMMARY OF WORK

PART 1 - GENERAL

1.1 WORK OF THIS CONTRACT

- A. *Work of this Contract* comprises the following:
Kingston Health Sciences Centre - HDH - UCC - General X-Ray Room Equipment Replacement
- B. Municipal Address:
166 Brock Street, Kingston, Ontario, K7L 5G2
- C. Legal Description:
Part Park Lot 1, Selma Block, Part Lots 294 & 295, Original Survey, City of Kingston.
- D. The work for *Kingston Health Sciences Centre - HDH - UCC - General X-Ray Room Equipment Replacement* includes but is not limited to facilitate the replacement of the radiography equipment and bring the room up to current hospital standards.
- E. A list of the *Contract Documents* can be found in Article A-3 CONTRACT DOCUMENTS of the Agreement between *Owner* and *Contractor*.
- F. *Consultant* may furnish additional drawings to assist proper execution of the *Work*. These drawings will be issued for clarification only. Such drawings shall have same meaning and intent as if they were included with plans referred to in *Contract Documents*.
- G. The *Drawings* and *Specifications* shall be carefully read by the *Contractor* so that the extent and nature of the work of all trades is understood. All trades shall co-operate and work together, so that the *Work* will fit together and make a complete and satisfactory job in every detail. All work shall be done and materials supplied to complete such work in every detail to the true intent and meaning of the *Drawings*, *Specifications* and any additional details furnished as the *Work* progresses.

1.2 SCHEDULE "A" – KEY PERSONNEL

- A. Prior to commencement of *Work*, prepare and submit 'Schedule "A" – Key Personnel' identifying *Contractor's* personnel mentioned below, who will be employed/engaged in performance of the *Work*:
 - 1. Project Manager(s)
 - 2. Superintendent(s)
 - 3. Coordinator(s)
 - 4. Site Supervisor(s)
- B. Make submittal in accordance with Section 01 33 00.

1.3 KEY MILESTONE DATES:

- A. The Contractor is to meet the following key dates for the construction.
 - 1. September 3rd and 4th, 2026 – Removal of existing X-Ray Equipment
 - 2. September 7th, 2026 – Contractor to mobilize to the site.
 - 3. October 30th, 2026 – Construction complete (Occupancy Issued By City) (Ready-For-Take Over Date)
 - 4. November 13th, 2026 – Total-Completion
 - 5. November 2nd, 2026 – November 13th, 2026 – GE Equipment installation
 - 6. November 16th, 2026 – Owner Testing
 - 7. November 17th, 2026 – 20th, 2026 – Applications

1.4 DIVISION OF WORK

- A. Division of the *Work* among *Subcontractors* and *Suppliers* is solely *Contractor's* responsibility. *Consultant* and *Owner* assume no responsibility to act as an arbiter to establish subcontract limits between Sections or Divisions of the *Work*.

1.5 SPECIFICATIONS LANGUAGE AND STYLE

- A. These specifications are written in the imperative mood and in streamlined form. The imperative language is directed to *Contractor*, unless stated otherwise.
- B. Complete sentences by reading "shall", " *Contractor* shall", "shall be", and similar phrases by inference. Where a colon (:) is used within sentences and phrases, read the words "shall be" by inference.
- C. Fulfill and perform all indicated requirements whether stated imperatively or otherwise.
- D. When used in the context of a *Product*, read the word "provide" to mean "supply and install to result in a complete installation ready for its intended use".

1.6 CONTRACT DOCUMENTS FOR CONSTRUCTION PURPOSES

- A. *Owner* will supply *Contractor* with a complete set of *Contract Documents* in electronic form before commencement of the *Work*. *Contractor* may print hard copies for construction purposes as required.
- B. Unauthorized reproduction of *Contract Documents* is prohibited.

1.7 DOCUMENTS AT THE SITE

- A. Keep the following documents at *Place of the Work*, stored securely and in good order and available to *Owner* and *Consultant* in hard copy form:
 - 1. Current *Contract Documents*, including *Drawings*, *Specifications* and addenda.
 - 2. *Change Orders*, *Change Directives*, and *Supplementary Instructions*.
 - 3. Reviewed *Shop Drawings*, *Product* data and samples.
 - 4. Field test reports and records.
 - 5. Construction progress schedule.
 - 6. Meeting minutes.
 - 7. Manufacturer's certifications.
 - 8. Permits, inspection certificates, and other documents required by authorities having jurisdiction.
 - 9. Current as-built drawings.
 - 10. Material Safety Data Sheets (MSDS) for all controlled *Products*.
 - 11. ULC firestopping details as needed for performance of the *Work*.
- B. In the event that revised *Drawings* are issued after the *Work* has commenced, superseded *Drawings* are to be removed from the site.

1.8 CONTRACTOR'S USE OF PREMISES

- A. *Contractor's* access to the work areas will vary and are to be coordinated with the *Owner* prior to commencing work in each space.
- B. Use of site is limited to the areas of work unless specific locations for hoarding and storage are indicated on the documents.
- C. See Section 00 14 00 – Work Restrictions for further details of additional restrictions on the *Contractor's* use of the premises.

1.9 OWNER-SUPPLIED PRODUCTS

- A. *Owner* Responsibilities:
 - 1. Order and pay for *Owner-supplied Products* not already in *Owner's* possession.

2. Arrange and pay for delivery of *Owner-supplied Products* F.O.B. the site, within time frames required by *Contractor's* progress schedule. If delivered sooner than required by *Contractor's* latest progress schedule submitted to *Owner*, arrange and pay for delivery to a temporary storage location and subsequent delivery to the site.
 3. Advise *Contractor* in writing of the value of *Owner-supplied Products* for *Contractor's* insurance purposes.
 4. Arrange and pay for delivery to *Contractor* of reviewed *Shop Drawings*, *Product* data, samples, and manufacturer's installation instructions.
 5. Inspect deliveries jointly with *Contractor*.
 6. Submit claims for transportation damage.
 7. Arrange for replacement of damaged, defective or missing items identified at time of delivery.
 8. Arrange for manufacturer's field services.
 9. Arrange for delivery of manufacturer's warranties to *Contractor* for inclusion in operation and maintenance manual.
- B. *Contractor* Responsibilities:
1. Designate in progress schedule, time frames for delivery of *Owner-supplied Products* to the site and for receipt of related submittals. If the site is not ready to receive delivery of *Owner-supplied Products* within the time frame indicated in the latest progress schedule submitted to *Owner*, arrange and pay for delivery to a temporary storage location and subsequent delivery to the site.
 2. Review all required submittals and notify *Consultant* of any observed discrepancies or anticipated problems.
 3. Ensure that course of construction insurance is adequate to cover *Owner-supplied Products*.
 4. Receive and unload *Owner-supplied Products* at the site.
 5. Inspect deliveries jointly with *Owner*. Record and notify *Owner* and *Consultant* of shortages and visibly damaged or defective items.
 6. Handle *Owner-supplied Products* at site, including uncrating and storage. Dispose of waste materials and debris.
 7. Take appropriate precautions to protect *Owner-supplied Products* from loss or damage.
 8. Repair or replace items damaged on site.
 9. Assemble, install, connect, adjust, and finish *Owner-supplied Products* as specified.
 10. Arrange for inspections required by authorities having jurisdiction as specified.
 11. Arrange for or perform testing as specified.
 12. Workmanship warranty for installation.

1.10 OWNER-SUPPLIED-AND-INSTALLED PRODUCTS

- A. *Owner* Responsibilities:
1. Order and pay for *Owner-supplied-and-installed Products* not already in *Owner's* possession.
 2. Arrange and pay for delivery of *Owner-supplied-and-installed Products* F.O.B. the site, within time frames required by *Contractor's* progress schedule. If delivered sooner than required by *Contractor's* latest progress schedule submitted to *Owner*, arrange and pay for delivery to a temporary storage location and subsequent delivery to the site.
 3. Advise *Contractor* in writing of the value of *Owner-supplied-and-installed Products* for *Contractor's* insurance purposes.
 4. Arrange for manufacturer's field services.
 5. Arrange for delivery of manufacturer's warranties to *Contractor* for inclusion in operation and maintenance manual.
- B. *Contractor* Responsibilities:
1. Designate in progress schedule, time frames for delivery of *Owner-supplied Products* to the site and for receipt of related submittals. If the site is not ready to receive delivery of *Owner-supplied Products* within the time frame indicated in the latest progress schedule

- submitted to *Owner*, arrange and pay for delivery to a temporary storage location and subsequent delivery to the site.
2. Review all Vendor supplied information and notify *Consultant* of any observed discrepancies or anticipated problems.
 3. Ensure that course of construction insurance is adequate to cover *Owner*-supplied and installed *Products*.
 4. Take appropriate precautions to protect *Owner*-supplied *Products* from loss or damage.
 5. Repair or replace items damaged on site.
 6. Connect, adjust, and finish *Owner*-supplied and installed *Products* as specified.
 7. Arrange for inspections required by authorities having jurisdiction as specified for connections to *Owner*-supplied-and-installed *Products*.
 8. Arrange with Vendor for or perform testing as specified.
 9. Workmanship warranty for installation for connections to *Owner*-supplied-and-installed *Products*.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SUMMARY OF WORK

SECTION 01 14 00 WORK RESTRICTIONS

PART 1 - GENERAL

1.1 RESTRICTIONS ON USE OF PREMISES

- A. All contractors shall be screened when entering any Kingston Health Sciences Centre sites, and will need to have a valid hospital issued ID.
- B. Comply with smoking restrictions. Smoking is not permitted within the building and only permitted within the designated areas on the building grounds.
- C. Confine *Construction Equipment, Temporary Work*, storage of *Products*, waste products and debris, and all other construction operations to limits required by laws, ordinances, permits, and *Contract Documents*, whichever is most restrictive. Do not unreasonably encumber *Place of the Work*. The *Owner* reserves the right to remove any and all encumbrances at the *Contractor's* expense.
- D. Move stored products or equipment which interferes with operations of *Consultant, Owner* or *Other Contractors*.
- E. Obtain and pay for use of additional storage or work areas needed for operations.
- F. During the extent of the *Contract* and at any time the *Contractor's* forces are on the site or within the boundaries of the Hospital, the *Contractor* is required to comply with all Hospital policies. Violation of any aspect of any portion of any listed policy is grounds for investigation, disciplinary action of those involved, and at the discretion of the *Owner*, termination of the *Contract*. A copy of the policies and procedures is available for viewing at the office of the *Owner*.
- G. Prior to the start of the *Work*, all construction forces will be required to attend an *Owner's* orientation session. Approximate time of session is 2 hours and will include Security, Fire Safety, Health and Safety and Infection Control. This session is a requirement of the Hospital and must be completed by any personnel who wish to access the site. Personnel with a current, valid ID Badge are required to take a refresher course prior to commencing work

1.2 WORK SEQUENCE

- A. During the execution of the *Work*, the existing facility will be occupied and will remain operational at all times. The *Contractor* shall coordinate the *Work* so that the *Owner* can maintain the normal operation of the facility with little to no disturbance. All temporary partitions, fencing, hoarding and temporary exits will be required to be in place prior to commencing the *Work* and shall be constructed to meet the requirements of a Section 01 35 33 for additional infection control guidelines and procedures.

1.3 OWNER OCCUPANCY

- A. *Owner* will occupy premises during entire construction period.
- B. Cooperate with *Owner* in scheduling operations to minimize disruptions and to facilitate *Owner* usage.

1.4 RESTRICTED HOURS OF WORK

- A. *Work* may be performed during *Owner's* normal business hours which are Monday to Friday from 08:00 h to 20:00 h and Saturday – Sunday 08:00 h to 16:00 h except as otherwise noted or coordinated with the *Owner*.

- B. Any interruption involving the shutdown of any component of the existing mechanical / plumbing / electrical systems shall be completed outside of the normal business hours noted in item A. above.
- C. Allow for hours of work restrictions in the construction progress schedule.
- D. Mechanical (including fire protection work) and Electrical work in the following spaces to be completed outside of the normal business hours noted in item A. above.
 - 1. Control JM0-014-0
 - 2. Corridor JM0-095

1.5 NOISY WORK RESTRICTIONS IN OCCUPIED FACILITIES

- A. Execute the *Work* with least possible interference or disturbance to occupants, public, and normal use of premises.
- B. Schedule excessively noisy work to avoid disturbance to building occupants. Perform excessive noise generating work outside of *Owner's* business hours, [or limited hours within regular business hours as stipulated by *Owner* for areas of work above, below or adjacent to areas containing patient sleep rooms].
- C. Use powder actuated devices only with *Consultant's* written permission.
- D. From time to time, the *Contractor* may be asked to stop all work, or temporarily suspend a type of work due to the generation of noise or other disruption to the Hospital. In the event the *Owner* requests the *Contractor* to suspend or stop work and when no other work can reasonably be completed, the *Owner* will reasonably compensate the *Contractor* for the time lost. Compensation will be processed by means of a *Change Order*.

1.6 MAINTAINING LIFE SAFETY SYSTEMS IN OCCUPIED FACILITIES

- A. Maintain operational life safety systems and public access to exits in occupied areas during all stages of the *Work*.
- B. Determine nature and exact locations of existing fire and smoke sensors prior to the commencement of the *Work*. Avoid direct or indirect jarring while working in adjacent areas and exercise caution to avoid triggering these devices.
- C. Be responsible for costs incurred by *Owner* on account of false fire alarms activated as a result of the execution of the *Work* without adequate precautions.

1.7 SITE SECURITY

- A. At the end of each working day, the *Contractor* shall ensure that all access to any area of construction is locked and secure. Provide access keys to *Owner's* security personnel in case of breach in security. Any tools, materials or property of the *Owner* that is damaged or stolen, due to inadequate security of the work area, shall be replaced at no cost to the *Owner*.
- B. Where security may be reduced by the *Work*, provide temporary means to maintain security. Coordinate necessary protection with the *Owner* and submit to the *Consultant* for review prior to installation.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF WORK RESTRICTIONS

SECTION 01 25 00 SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 DEFINITION

- A. In this Section “Substitution” means a *Product*, a manufacturer, or both, not originally specified in *Contract Documents* by proprietary name but proposed for use by *Contractor* in place of a *Product*, a manufacturer, or both, specified by proprietary name.

1.2 SUBSTITUTION PROCEDURES

- A. *Contractor* may propose a Substitution wherever a *Product* or manufacturer is specified by proprietary name(s), unless there is accompanying language indicating that Substitutions will not be considered.
- B. *Contractor* may propose a Substitution wherever a *Product* or manufacturer is specified by proprietary name(s) and accompanied by language such as "or equal", "or approved equal", or other similar words. Do not construe such language as an invitation to unilaterally provide a Substitution without *Consultant*'s prior acceptance in writing. Do not order or install any Substitution without a *Supplemental Instruction* or *Change Order*.
- C. Provided a proposed Substitution submission includes all of the information specified in this Section under Submission Requirements For Proposed Substitutions, *Consultant* will promptly review and accept or reject the proposed Substitution.
- D. *Consultant* may accept a Substitution if satisfied that:
1. the proposed substitute *Product* is the same type as, is capable of performing the same functions as, interfaces with adjacent work the same as, and meets or exceeds the standard of quality, performance and, if applicable, appearance and maintenance considerations, of the specified *Product*,
 2. the proposed substitute manufacturer has capabilities comparable to the specified manufacturer, and
 3. the Substitution provides a benefit to *Owner*.
- E. If *Contractor* fails to order a specified *Product* or order a *Product* by a specified manufacturer in adequate time to meet *Contractor*'s construction schedule, *Consultant* will not consider that a valid reason to accept a Substitution.
- F. If *Consultant* accepts a Substitution and subject to *Owner*'s agreement, the change in the *Work* will be documented in the form of either a *Supplemental Instruction* or *Change Order* as specified in Section 01 26 00 – Contract Modification Procedures.
- G. If a Substitution is accepted in the form of a *Supplemental Instruction* or *Change Order*, *Contractor* shall not revert to an originally specified *Product* or manufacturer without *Consultant*'s prior written acceptance.

1.3 SUBMISSION REQUIREMENTS FOR PROPOSED SUBSTITUTIONS

- A. Include with each proposed Substitution the following information:
1. Identification of the Substitution, including product name and manufacturer's name, address, telephone numbers, and web site.
 2. Reason(s) for proposing the Substitution.
 3. A statement verifying that the Substitution will not affect the *Contract Price* and *Contract Time* or, if applicable, the amount and extent of a proposed increase or decrease in *Contract Price* and *Contract Time* on account of the Substitution.
 4. A statement verifying that the Substitution will not affect the performance [or warranty] of other parts of the *Work*.

5. Manufacturer's *Product* literature for the Substitution, including material descriptions, compliance with applicable codes and reference standards, performance and test data, compatibility with contiguous materials and systems, and environmental considerations.
6. Product samples as applicable.
7. A summarized comparison of the physical properties and performance characteristics of the specified *Product* and the Substitution, with any significant variations clearly highlighted.
8. Availability of maintenance services and sources of replacement materials and parts for the Substitution, as applicable, including associated costs and time frames.
9. If applicable, estimated life cycle cost savings resulting from the Substitution.
10. Details of other projects and applications where the Substitution has been used.
11. Identification of any consequential changes in the *Work* to accommodate the Substitution and any consequential effects on the performance of the *Work* as a whole. A later claim for an increase to the *Contract Price* or *Contract Time* for other changes in the *Work* attributable to the Substitution will not be considered.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SUBSTITUTION PROCEDURES

SECTION 01 26 00 CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SCHEDULE OF LABOUR RATES

- A. Prior to the first application for payment, submit for the *Consultant's* review a schedule of labour rates for all trades and classifications of trades, such as journeymen, apprentices, and foremen that will be employed in the *Work*. Provide a breakdown of payroll burden component of labour rates.
- B. Labour rates shall reflect the salaries, wages, and benefits paid to personnel in the direct employ of the *Contractor*, *Subcontractors*, and sub-*Subcontractors*, stated as hourly rates, that will be used when:
 - 1. preparing price quotations for *Change Orders*, and
 - 2. determining the cost of work attributable to *Change Directives*.
- C. Labour rates stated in the schedule of labour rates shall be consistent with rates that will actually be paid, and payroll burden costs that will actually be incurred, in the normal performance of the *Work*, during regular working hours. Labour rates shall not include any additional overhead and profit component.
- D. Where collective agreements apply, the labour rates shall not exceed those established by collective agreement.
- E. Obtain the *Owner's* written acceptance of the schedule of labour rates before submitting the first *Change Order* quotation.
- F. Accepted schedule of labour rates will be used solely for evaluating *Change Order* quotations and cost of performing work attributable to *Change Directives*.
- G. The *Contractor* may request amendments to the accepted schedule of labour rates if changes in the labour rates that will actually be paid, or payroll burden cost that will actually be incurred, in the normal performance of the *Work* can be demonstrated. Obtain the *Owner's* written acceptance of such changes.

1.2 SCHEDULE OF EQUIPMENT RATES

- A. Prior to the first application for payment, submit for the *Consultant's* review a schedule of equipment rates for *Contractor* owned *Construction Equipment*.
- B. Equipment rates shall reflect the rates that will be used when:
 - 1. preparing price quotations for *Change Orders*, and
 - 2. determining the cost of work attributable to *Change Directives*.
- C. Equipment rates stated in the schedule shall be consistent with local equipment rental market rates and shall not include any additional overhead and profit component.
- D. Obtain the *Owner's* written acceptance of the schedule of equipment rates before submitting the first *Change Order* quotation.
- E. Accepted schedule of equipment rates will be used solely for evaluating *Change Order* quotations and cost of performing work attributable to *Change Directives*.
- F. The *Contractor* may request amendments to the accepted schedule of equipment rates if changes in local equipment rental market rates can be demonstrated. Obtain the *Owner's* written acceptance of such changes.

1.3 VALUATION OF CHANGES BASED ON AGREED UNIT PRICES

- A. The *Consultant* may, at the outset of the *Contract* or at any other time, request the *Contractor* to submit unit prices anticipated to be required in valuing changes in the *Work*.
- B. The *Contractor* shall submit such unit prices promptly upon request.
- C. The unit prices shall be valid for a specified duration.
- D. The unit prices shall exclude all fees for overhead and profit and shall be subject to the percentage fees specified in this Section under Fees for Overhead and Profit – Change Orders.
- E. The *Consultant* will evaluate the *Contractor*'s quoted unit prices and, if accepted by the *Owner* in writing, the agreed unit prices shall be used to value subsequent proposed changes in the *Work* wherever they are applicable.

1.4 METHOD OF CONTRACT PRICE ADJUSTMENT - CHANGE ORDERS

- A. Unless otherwise agreed, the adjustment of the *Contract Price* on account of a proposed change in the *Work* shall be based on a quotation for a fixed price increase or decrease to the *Contract Price* regardless of the *Contractor*'s actual expenditures and savings.
- B. If unit prices included in the stipulated price contract are applicable to the proposed change, the adjustment of the *Contract Price* shall be based on those unit prices, to the extent they apply. If the actual quantities to which the unit prices apply vary from the estimated quantities by more than 12%, the unit prices shall be subject to negotiation.

1.5 CHANGE ORDER PROCEDURES

- A. Upon issuance by the *Consultant* to the *Contractor* of a proposed change in the *Work*, and unless otherwise requested in the proposed change or unless otherwise agreed:
 - 1. Submit to the *Consultant* a fixed price quotation for the proposed change in the *Work* within 5 days after receipt of the proposed change in the *Work*.
 - 2. If requested in the proposed change, provide a detailed breakdown of the price quotation including the following to the extent applicable, with appropriate supporting documentation:
 - a. Estimated labour costs, including hours and applicable hourly rates based on the accepted schedule of labour rates.
 - b. Estimated Product costs, including *Supplier* quotations, estimated quantities and unit prices.
 - c. Estimated *Construction Equipment* costs.
 - d. Enumeration of all other estimated costs included in the price quotation.
 - e. Estimated credit amounts for labour and *Products* not required on account of the proposed change.
 - f. Fees, not exceeding the applicable percentages for overhead and profit as specified in this Section.
 - g. Where applicable, *Subcontractor* quotations, also including a detailed breakdown of all of the above.
 - 3. Include in the quotation the increase or decrease to the *Contract Time*, if any, for the proposed change, stated in number of days.
 - 4. Include in the quotation the number of days for which the quotation is valid.
 - 5. The quotation will be evaluated by the *Consultant* and the *Owner* and, if accepted by the *Owner*, be documented in the form of a signed *Change Order*.

1.6 FEES FOR OVERHEAD AND PROFIT – CHANGE ORDERS

- A. Where the *Contractor*'s price quotation for a *Change Order* results in a net increase to the *Contract Price*, the *Contractor*'s entitlement to a fee for overhead and profit in the quotation shall be as follows, as applicable:
 - 1. For work to be performed by the *Contractor*'s own forces,
 - a. If the changes to the *Work* have a value of less than or equal to \$50,000, 10% of the *Contractor*'s price quotation before the *Contractor*'s fee is applied

- b. If the changes to the *Work* have a value greater than \$50,000, 7.5% of the *Contractor's* price quotation before the *Contractor's* fee is applied
 2. For work to be performed by a *Subcontractor*, 5% of the *Subcontractor's* price quotation including the *Subcontractor's* fee.
- B. Where a *Subcontractor's* price quotation for a *Change Order* results in a net increase to the *Subcontractor's* contract price, the *Subcontractor's* entitlement to a fee for overhead and profit in the quotation shall be as follows, as applicable:
 1. For work to be performed by the *Subcontractor's* own forces, 15% of the *Subcontractor's* price quotation before the *Subcontractor's* fee is applied.
 2. For work to be performed by a sub-*Subcontractor*, 20% of the sub-*Subcontractor's* price quotation including the sub-*Subcontractor's* fee.
- C. Where the *Contractor's* or a *Subcontractor's* price quotation for a *Change Order* results in a net decrease in price before adjustment for fees for overhead and profit, such a price quotation shall be for the net decrease without any adjustment for fees for overhead and profit.

1.7 METHOD OF CONTRACT PRICE ADJUSTMENT - CHANGE DIRECTIVES

- A. Unless the *Owner* and the *Contractor* reach an earlier agreement on the adjustment to the *Contract Price* by means of a *Change Order* that cancels the *Change Directive*, the adjustment in the *Contract Price* for change carried out by way of a *Change Directive* shall be determined as specified in the *General Conditions* of *Contract* after the change in the *Work* is completed.

1.8 CHANGE DIRECTIVE PROCEDURES

- A. If a *Change Directive* is issued for a change in the *Work* for which a proposed change was previously issued, but no *Change Order* has yet been signed, the *Change Directive* shall cancel the proposed change and any *Contractor* quotations related to that change in the *Work*.
- B. When proceeding with a change in the *Work* under a *Change Directive*, keep accurate records of daily time sheets for labour and *Construction Equipment*, and invoices for *Product* and *Construction Equipment* costs. Submit such records to the *Consultant* daily, until the *Change Order* superseding the *Change Directive* is issued.

1.9 FEES FOR OVERHEAD AND PROFIT – CHANGE DIRECTIVES

- A. The *Contractor's* entitlement to a fee for overhead and profit on the *Contractor's* expenditures and savings attributable to a *Change Directive* shall be as follows, as applicable:
 1. For work performed by the *Contractor's* own forces, 10% of the *Contractor's* net increase in costs.
 2. For work performed by a *Subcontractor*, 10% of the sum of the *Subcontractor's* net increase in costs plus the *Subcontractor's* fee.
- B. A *Subcontractor's* entitlement to a fee for overhead and profit on the *Subcontractor's* expenditures and savings attributable to a *Change Directive* shall be as follows, as applicable:
 1. For work performed by the *Subcontractor's* own forces, 15% of the *Subcontractor's* net increase in costs.
 2. For work performed by a sub-*Subcontractor*, 10% of the sum of the sub-*Subcontractor's* net increase in costs plus the sub-*Subcontractor's* fee.
- C. Where a *Change Directive* results in net savings on account of work not required to be performed and a net decrease in the *Contractor's* or *Subcontractor's* cost, the net savings to the *Contractor* or *Subcontractor* shall be calculated without any adjustment for fees for overhead and profit.
- D. When a *Change Directive* is ultimately recorded as a *Change Order*, there shall be no additional entitlement to fees for overhead and profit beyond those specified in this article.

1.10 SUPPLEMENTAL INSTRUCTIONS

- A. The *Consultant* may issue *Supplemental Instructions* to provide clarifications to the *Contract Documents*, provide additional information, or make minor variations in the *Work* not involving adjustment in the *Contract Price* or *Contract Time*.
- B. If the *Contractor* considers a *Supplemental Instruction* to require an adjustment in *Contract Price* or *Contract Time*, the *Contractor* shall within ten (10) *Working Days* of the receipt of the *Supplemental Instruction* notify the *Consultant* in writing. If the *Contractor* needs additional information to determine whether a *Supplemental Instruction* involves an adjustment of the *Contract Price* or *Contract Time*, the *Contractor* may issue a written request to the *Consultant* seeking such additional information. Upon receipt of such additional information, the *Contractor* shall, within ten (10) *Working Days* notify the *Consultant* in writing of the opinion that the *Supplemental Instruction* involves an adjustment in the *Contract Price* or the *Contract Time*. Failure to provide written notification within the time stipulated above shall be deemed an acceptance of the *Supplemental Instruction* by the *Contractor* without adjustment to the *Contract Price* or the *Contract Time*. If written notice is provided as outlined above, the *Contractor* shall not proceed with any work related to the *Supplemental Instruction* pending receipt of a *Change Order*, a *Change Directive*, or, in accordance with the dispute resolution provisions of the *General Conditions of Contract*, a *Notice in Writing* of a dispute and instructions to proceed.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF CONTRACT MODIFICATION PROCEDURES

SECTION 01 29 00 PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 SCHEDULE OF VALUES

- A. Prior to the first application for payment, submit for the *Consultant's* review a detailed schedule of values. Modify the initial schedule of values included with the Bid Form to include a further breakdown of each division as required by the *Consultant*. Obtain the *Consultant's* written acceptance of the schedule of values prior to the first application for payment.
- B. Together with the first and all subsequent applications for payment, submit updated versions of the schedule of values to indicate the values, to the date of application for payment, of work performed and *Products* delivered to *Place of the Work*.
- C. Provide the schedule of values in an electronic spreadsheet format that provides for inclusion of the following information:
 - 1. Identifying information including title and location of the *Work*, name of *Contractor*, number and date of application for payment, and period covered by the application for payment.
 - 2. A work breakdown structure that is sufficiently detailed and comprehensive to facilitate *Consultant's* evaluation of applications for payment at an appropriate level of detail. Include separate line items for closeout procedures including closeout submittals, demonstration and training, start-up and testing, and commissioning collectively valued at minimum 5% of *Contract Price*.
 - 3. Provisions for approved *Change Orders* so that the breakdown amounts indicated in the schedule of values aggregate to the current total *Contract Price*. Also provide for indicating the estimated value of *Change Directives* within the schedule of values, separately from the current total *Contract Price*.
 - 4. Include a separate line item for *Value Added Taxes* as payable for each application.
 - 5. For each item in the work breakdown structure, provide as a minimum the following information, under headings as indicated:
 - a. Breakdown Amount: A dollar amount, including an appropriate pro rata portion of *Contractor's* overhead and profit.
 - b. Performed to Date: The value of *Work* performed and *Products* delivered to *Place of the Work* up to the date of the application for payment, stated as a percentage of the *Contract Price* and in dollars.
 - c. Previously Performed: The value of *Work* performed and *Products* delivered to the *Place of the Work* for which payment has been previously certified, stated in dollars.
 - d. Current Period: The value of *Work* performed and *Products* delivered to *Place of the Work* for which *Contractor* is currently applying for payment, stated in dollars.
 - e. Balance to Complete: The value of *Work* not yet performed and *Products* not yet delivered to *Place of the Work*, stated in dollars.

1.2 CLOSEOUT SUBMITTAL VALUE

- A. *The closeout submittal documents described in this Section shall carry a value of the total value of the Contract multiplied by 0.05.* The value of these documents shall be clearly identified as a line item in the Contractor's schedule of values.
- B. Payment for closeout submittals will not be authorized until documents are received, reviewed, deemed acceptable and in the possession of the Owner.
- C. Since the maintenance of accurate, up-to-date document records have legal ramifications for the operation of the Hospital, should the Contractor fail to provide Closeout Submittal Manuals, in

the described, acceptable format, the Contractor may, at the Owner's discretion, be deemed to be unsuitable to undertake future work of the Owner.

1.3 CASH FLOW PROJECTION

- A. Prior to the first application for payment submit, for *Consultant's* review, a forecast of approximate monthly progress payments for each month of the *Contract Time*.
- B. Submit revised cash flow forecasts when required due to significant changes in rate of progress of the *Work* or significant changes in the *Contract Price* when requested by *Consultant*.

1.4 WORKERS' COMPENSATION CLEARANCE

- A. Submit proof of workers' compensation clearance with each application for payment.

1.5 STATUTORY DECLARATIONS

- A. Submit a statutory declaration in the form of CCDC 9A – Statutory Declaration of Progress Payment Distribution by *Contractor* with each application for payment except the first.

1.6 PAYMENT FOR PRODUCTS STORED OFF SITE

- A. *Owner* may, due to extraordinary circumstances and at *Owner's* sole discretion, make payments for *Products* delivered to and stored at a location other than *Place of the Work*, subject to:
 - 1. a request submitted by *Contractor* in writing, with appropriate justification, and
 - 2. whatever conditions *Owner* or *Consultant* may establish for such payments, as required to protect *Owner's* interests.

1.7 RELEASE OF HOLDBACK

- A. See General Condition 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK and associated Supplementary Conditions in 3.23 of 00 73 00 Supplementary Conditions.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF PAYMENT PROCEDURES

SECTION 01 31 19 PROJECT MEETINGS

PART 1 - GENERAL

1.1 CONSTRUCTION START-UP MEETING

- A. Promptly after *Contract* award, *Consultant* will establish the time and location of a construction start-up meeting to review and discuss administrative procedures and responsibilities. *Consultant* will notify *Contractor* at least 5 *Working Days* before the meeting.
- B. Senior representatives of *Owner*, *Consultant*, subconsultants, and *Contractor*, including *Contractor's* project manager and site superintendent, and major *Subcontractors*, shall be in attendance.
- C. *Consultant's* representative will chair the meeting and record and distribute the minutes.
- D. Agenda will include following:
 - 1. Introductions
 - 2. Administrative Procedures (meetings, communications, approvals)
 - 3. Project Team Directory
 - 4. Current Project Status (permits, certificates, etc)
 - 5. Job Site Documents
 - 6. Review of Information from Contractor (construction schedule, schedule of values, etc.)
 - 7. Site Issues (safety, orientation, IPAC, parking, loading, storage, waste, washrooms, hazardous materials)
 - 8. Construction Services and Utilities (Use of existing, shut downs, etc)
 - 9. Requirements for Pre-construction Surveys (recording existing conditions, etc)

1.2 CONSTRUCTION PROGRESS MEETINGS

- A. Schedule regular construction progress meetings for the duration of the *Work*. Frequency and schedule of meetings to be determined between *Contractor*, *Consultant*, and *Owner*, but shall occur at least biweekly, or more often as deemed necessary. *Contractor* shall prepare meeting agendas, chair the meetings, and record and distribute the minutes.
- B. Arrange for and provide physical space for meetings, unless *Owner* agrees to provide space within existing facilities.
- C. *Contractor* shall record in the meeting minutes significant decisions and identify action items and action dates by attendees or the parties they represent.
- D. *Contractor* shall distribute copies of minutes within three (3) *Working Days* after each meeting to meeting attendees and any affected parties who may not be in attendance.
- E. Ensure that *Subcontractors* attend as and when appropriate to the progress of the *Work*.
- F. Agenda for each meeting shall include the following, as a minimum:
 - 1. Approval of minutes of previous meeting.
 - 2. Work progress since previous meeting.
 - 3. Field observations, including any problems, difficulties, or concerns.
 - 4. Construction progress schedule.
 - 5. Submittals schedule.
 - 6. Proposed changes in the *Work*.
 - 7. Requests for information.
 - 8. Site safety issues.
 - 9. Infection Control issues.
 - 10. Other business.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF PROJECT MEETINGS

SECTION 01 32 00 CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies *Contractor's* responsibilities for preparation and submission of schedules and other documentation related to tracking construction progress.
- B. The purpose of submitting progress schedules is to:
 - 1. inform *Owner* and *Consultant* of actual progress versus planned progress, and
 - 2. provide assurance that scheduling issues are being proactively identified and addressed in a timely manner, and that planned progress is being maintained as closely as possible.

1.2 SCHEDULES REQUIRED

- A. Submit schedules as follows:
 - 1. Construction Phasing Schedule.
 - 2. Construction Progress Schedule.
 - 3. Submittal Schedule for Shop Drawings and Product Data.
 - 4. Submittal Schedule for Samples.
 - 5. Submittal Schedule for timeliness of Owner-furnished Products.
 - 6. Cash flow Schedule.

1.3 GENERAL SUBMISSION

- A. Submit initial format of schedules within ten (10) *Working Days* after award of *Contract*.
- B. Submit an electronic document in Portable Document Format (PDF) copy to be distributed by the *Consultant*.
- C. *Consultant* will review schedule and return reviewed copy within ten (10) days after receipt.
- D. Resubmit finalized schedule within seven (7) days after return of reviewed copy.
- E. Submit revised progress schedule with each application for payment, indicating all schedule modifications to date.
- F. Distribute copies of revised schedule to:
 - 1. Job site office.
 - 2. Subcontractors.
 - 3. Consultants.
 - 4. Owner
 - 5. Authority Having Jurisdiction.
- G. Instruct recipients to report to Contractor within ten (10) days, any problems anticipated by timetable shown in schedule.

1.4 CONSTRUCTION PROGRESS SCHEDULE

- A. Format and Content:
 - 1. Prepare schedule in the form of a Critical Path Method (CPM) Gantt chart using appropriate scheduling software.
 - a. Provide a separate bar for each major item of work trade or operation.
 - b. Split horizontally for projected and actual performance.
 - c. Provide horizontal time scale identifying each week.
 - d. Format for listings: chronological order of start of each item of work.
 - e. Identification of listings: by systems description.

2. Provide a work breakdown structure identifying key activities, work packages, and major milestones, including long delivery *Products*, inspection and testing activities, anticipated service and utility shutdown dates and durations, commissioning, preparation and review of mock-ups, shutdown or closure activities, delivery of *Owner* supplied *Products*, *Owner* performed work, demonstration and training activities, and similar items, at a sufficient level of detail to effectively manage construction progress.
 3. Indicate milestone dates for *Substantial Performance of the Work*, *Ready-for-Takeover* and *Total Completion of the Work*.
- B. Submission:
1. Prior to site mobilization, submit initial schedule to *Owner* and *Consultant* for their review and acceptance.
 2. Submit schedule via e-mail as .pdf files, and as a hard copy.
 3. *Consultant* will review format and content of initial schedule and request necessary changes, if any, within 10 *Working Days* after receipt.
 4. If changes are required, resubmit finalized initial schedule within 5 *Working Days* after return of review copy.
 5. Submit updated progress schedule monthly to *Owner* and *Consultant*, indicating actual and projected start and finish dates with report date line and progress.

1.5 SUBMITTALS SCHEDULE

- A. Format and Content:
1. Prepare schedule identifying all required *Shop Drawing*, *Product* data, sample submissions, and including samples required for testing.
 2. Prepare schedule in electronic format.
 3. Provide a separate line for each required submittal, organized by *Specifications* section names and numbers, and further broken down by individual *Products* and systems as required.
 4. For each required submittal, show planned earliest date for initial submittal and latest date for return of reviewed submittal without causing delay.
 5. Allow time in schedule for resubmission of submittals, should resubmission be necessary.
 6. Include dates when submittals delivery will be required for *Owner*-furnished products.
- B. Submission:
1. Submit initial schedule to *Consultant* within 5 *Working Days* after *Contract* award.
 2. Submit schedule via e-mail as .pdf files.
 3. *Consultant* will review format and content of initial schedule and request necessary changes, if any, within 5 *Working Days* after receipt.
 4. If changes are required, resubmit finalized schedule within 5 *Working Days* after return of review copy.
 5. Submit updated submittals schedule monthly to *Owner* and *Consultant*..

1.6 SCHEDULE MANAGEMENT

- A. A schedule submitted as specified and accepted by *Consultant* shall become the baseline schedule and shall be used as the baseline for updates.
- B. At each regular progress meeting, review and discuss current construction progress and submittals schedules with *Consultant* and *Owner*, including activities that are behind schedule and planned measures to regain schedule slippage in key areas on or near the critical path. Schedule to be updated by *Contractor* following review by *Consultant*.
- C. Activities considered behind schedule are those with start or completion dates later than the dates shown on the baseline schedule.

1.7 DAILY REPORTS/DAILY LOGS

- A. The *Contractor* shall cause its supervisor, or such competent person as it may delegate, to prepare a daily log or diary reporting on weather conditions, work force of the *Contractor*, *Subcontractors*, *Suppliers* and any other forces on site and also record the general nature of Project

activities. Such log or diary shall also include any extraordinary or emergency events which may occur and also the identities of any persons who visit the site who are not part of the day-to-day work force.

- B. The *Contractor* shall also maintain records, either at its head office or at the job site, recording manpower and material resourcing on the Project, including records which document the activities of the *Contractor* in connection with GC 3.4, and comparing that resourcing to the resourcing anticipated when the most recent version of the schedule was prepared pursuant to GC 3.4.

1.8 RECORDING ACTUAL SITE CONDITIONS ON AS-BUILT DRAWINGS

- A. Obtain a hard copy set of construction *Drawings* for the purpose of creating as-built drawings. Record information and maintain as-built drawings in clean, dry and legible condition.
- B. Clearly label each drawing as “AS-BUILT DRAWING”. Record information concurrently with construction progress. Do not conceal *Work* until required information is recorded.
- C. 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 pipes, ducts, conduits, outlets, fixtures, access panels, and appurtenances, referenced to visible and accessible features of construction.
 - 4. Field changes of dimension and detail.
 - 5. Changes made by *Change Orders* and *Supplemental Instructions*
 - 6. References to *Shop Drawings*, where *Shop Drawings* show more detail.
- D. Do not use as-built drawings for construction purposes.

1.9 PROGRESS PHOTOGRAPHS

- A. Arrange for periodic digital photography to document and provide a photographic record of the progress of the *Work*.
- B. Arrange for final photographs to be taken by a professional photographer at discretion of *Owner*.
- C. Identify each photograph by project name and date taken.
- D. Submission: Submit .jpg or .bmp format files in fine resolution via e-mail or via project web site.
- E. Do not use progress or any other *Project* photographs for promotional purposes without *Owner's* written consent.
- F. Final photograph submission shall be submitted on one or more compact disc(s) or USB flash memory drive. Identify media with project name and number. Media is to be organized in accordance of date of monthly submission, in same format. Submission of media shall form part of the Closeout Submittal manual, specified in Section 01 78 00.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF CONSTRUCTION PROGRESS DOCUMENTATION

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SECTION 01 33 00 SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 ADMINISTRATIVE

- A. Submit specified submittals to *Consultant* for review. Submit with reasonable promptness and in orderly sequence so as to not cause delay in the *Work*. Failure to submit in ample time is not considered sufficient reason for an extension of *Contract Time* or for *Product* substitutions or other deviations from the *Drawings* and *Specifications*.
- B. Where required by authorities having jurisdiction, provide submittals to such authorities for review and approval.
- C. Do not proceed with *Work* affected by a submittal until review is complete.
- D. Present *Shop Drawings*, *Product* data, and samples in SI metric units. Where items or information is not produced in SI Metric units, converted values are acceptable.
- E. Review submittals, provide verified field measurements where applicable, and affix *Contractor's* review stamp prior to submission to *Consultant*. *Contractor's* review stamp represents that necessary requirements have been determined and verified, and that the submittal has been checked and coordinated with requirements of the *Work* and *Contract Documents*.
- F. Notify *Consultant* in writing, at time of submission, identifying deviations from requirements of *Contract Documents* stating reasons for deviations.
- G. Verify field measurements and that affected adjacent work is coordinated.
- H. Submittals not meeting specified requirements will be returned with comments.
- I. Reproduction of construction *Drawings* to serve as background for *Shop Drawings* is permitted. If construction *Drawings* are used for this purpose, remove references to *Consultant*.
- J. Do not propose Substitutions or deviations from *Contract Documents* via *Shop Drawing*, *Product* data and sample submittals.
- K. *Contractor's* responsibility for errors and omissions in submission is not relieved by *Consultant's* review of submittals.
- L. *Contractor's* responsibility for deviations in submission from requirements of *Contract Documents* is not relieved by *Consultant* review.
- M. Keep one reviewed copy of each submission on site.

1.2 SHOP DRAWINGS AND PRODUCT DATA

- A. Indicate *Products*, methods of construction, and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of the *Work*.
- B. Where *Products* attach or connect to other *Products*, indicate that such items have been coordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross-references to *Drawings*, *Specifications* and other already reviewed *Shop Drawings*.
- C. Accompany submittals with a transmittal information including:
 - 1. Date.
 - 2. *Project* title and number.
 - 3. *Contractor's* name and address.
 - 4. Identification of each submittal item and quantity.
 - 5. Other pertinent data.

- D. *Shop Drawing* submittals shall include:
1. Date and revision dates.
 2. *Project* title and number.
 3. Name and address of:
 - a. Subcontractor.
 - b. Supplier.
 - c. Manufacturer.
 4. *Contractor's* stamp, date, and signature of *Contractor's* authorized representative responsible for *Shop Drawing* review, indicating that each *Shop Drawing* has been reviewed for compliance with *Contract Documents* and, where applicable, that field measurements have been verified.
 5. Details of appropriate portions of the *Work* as applicable:
 - a. Fabrication.
 - b. Layout, showing dimensions, including identified field dimensions, and clearances.
 - c. Setting or erection details.
 - d. Capacities.
 - e. Performance characteristics.
 - f. Standards.
 - g. Operating weight.
 - h. Wiring diagrams.
 - i. Single line and schematic diagrams.
 - j. Relationships to other parts of the *Work*.
- E. *Product* data submittals shall include material safety data sheets (MSDS) for all controlled Products.
- F. Submit one (1) hard copy and electronic copy of *Shop Drawings* where specified in the technical Specifications.
- G. Submit one (1) hard copy and electronic copy of *Product* data sheets or brochures where specified in the technical Specifications.
- H. Where a submittal includes information not applicable to the *Work*, clearly identify applicable information and strike out non-applicable information.
- I. Supplement standard information to include details applicable to *Project*.
- J. Allow ten (10) *Working Days* for *Consultant's* review of each submittal .
- K. If upon *Consultant's* review no errors or omissions are discovered, or if only minor corrections are required as indicated, submittal will be returned and fabrication or installation of *Work* may proceed.
- L. If upon *Consultant's* review significant errors or omissions are discovered, a so noted copy will be returned for correction and resubmission. Do not commence fabrication or installation.
- M. *Consultant's* notations on submittals are intended to ensure compliance with *Contract Documents* and are not intended to constitute a change in the *Work* requiring change to the *Contract Price* or *Contract Time*. If *Contractor* considers any *Consultant's* notation to be a change in the *Work*, promptly notify *Consultant* in writing before proceeding with the *Work*.
- N. Resubmit corrected submittals through same procedure indicated above, before any fabrication or installation of the *Work* proceeds. When resubmitting, notify *Consultant* in writing of any revisions other than those requested by *Consultant*.

1.3 SAMPLES

- A. Submit samples for *Consultant's* review in duplicate where specified in the technical *Specifications*. Label samples as to origin, *Project* name, and intended use.
- B. Deliver samples prepaid to *Consultant's* business address.

- C. Notify *Consultant* in writing of any deviations in samples from requirements of *Contract Documents*.
- D. Where a required colour, pattern or texture has not been specified, submit full range of available *Products* meeting other specified requirements.
- E. *Consultant* selection from samples is not intended to change the *Contract Price* or *Contract Time*. If a selection would affect the *Contract Price* or *Contract Time*, notify *Consultant* in writing prior to proceeding with the *Work*.
- F. Resubmit samples as required by *Consultant* to comply with *Contract Documents*.
- G. Reviewed and accepted samples will establish the standard against which installed *Work* will be reviewed.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF SUBMITTAL PROCEDURES

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SECTION 01 35 30 HEALTH AND SAFETY REQUIREMENTS

PART 1 - GENERAL

1.1 REFERENCES

- A. Canadian Standards Association (CSA)
 - 1. CSA S350-M1980 (R2003), Code of Practice for Safety in Demolition of Structures.
- B. Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990.
- C. Construction Projects - (Ontario Regulation 213/91 as last amended by O.Reg 426/21).
- D. WHMIS (Ontario Regulation 860).
- E. Ontario Regulations related to designated substances (Ontario Regulations 835-846).
- F. Canadian Labour Code - Part Two.
- G. Bill C-45, An Act to amend the Criminal Code (criminal liability of organizations).
- H. Kingston Health Sciences Centre Policies and Procedures.

1.2 MINISTRY OF LABOUR REQUIREMENTS DURING COVID-19

- A. *Contractors* shall be familiar and implement the current construction safety requirements during COVID-19 as mandated by Ministry of Labour such as, but not limited to:
 - 1. enabling greater distances between workers by staggering shifts if necessary,
 - 2. hand hygiene,
 - 3. restricting site numbers,
 - 4. limiting elevator usage,
 - 5. a focus on cleaning high-touch areas like door handles and hoists,
 - 6. tracking and monitoring workers,
 - 7. posting site sanitization, and
 - 8. work schedules.
- B. If the Ministry of Labour requirements are updated, the *Contractor* will review and amend their plan as necessary – resubmitting them to the *Owner* and *Consultant* for review.

1.3 SUBMITTALS

- A. Make submittals in accordance with Section 01 33 00.
- B. Submit site-specific Health and Safety Plan within 7 days after date of Notice to proceed and prior to commencement of *Work*. Health and Safety Plan must include:
 - 1. Site specific safety hazard assessment.
 - 2. Safety and health risk or hazard analysis for site tasks and operation found in work plan.
- C. Submit Construction Safety Checklists after completion.
- D. Submit copies of reports or directions issued by Federal and Provincial health and safety inspector.
- E. Submit copies of incident and accident reports.
- F. Submit to *Consultant* with Material Safety Data Sheets (MSDS).
- G. Submit personnel training requirements including:
 - 1. Names of personnel and alternates responsible for site safety and health, hazards present on site, and use of personal protective equipment.

- H. *Consultant* and *Owner* will review *Contractor's* site-specific Health and Safety Plan and provide comments to *Contractor* within 5 days after receipt of plan. Revise plan as appropriate and resubmit plan to *Consultant* within 5 days after receipt of comments from *Consultant*.
- I. On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.4 FILING OF NOTICE

- A. File Notice with Provincial authorities prior to commencement of *Work*.

1.5 WORK PERMIT

- A. Obtain building permit related to project prior to commencement of *Work*.

1.6 SAFETY ASSESSMENT

- A. Perform *Place of the Work* specific safety hazard assessment related to the *Project*.

1.7 MEETINGS

- A. Pre-construction meetings: attend health and safety pre-construction meeting.
- B. All site personnel are required to attend the *Owner's* Fire Safety training program prior to commencement of personnel working on the site. Approximately 1 hour per worker as required for the training session.

1.8 REGULATORY REQUIREMENTS

- A. Comply with specified standards and regulations to ensure safe operations at sites containing hazardous or toxic materials.

1.9 GENERAL REQUIREMENTS

- A. Develop written site-specific Health and Safety Plan based on hazard assessment prior to commencing *Work* and continue to implement, maintain, and enforce plan until final demobilization from *Place of the Work*. Health and Safety Plan must address *Project* specifications.
- B. Relief from, or substitution for, any portion or provision of minimum Health and Safety Guidelines specified herein, or reviewed site-specific Health and Safety Plan must be submitted to *Consultant* in writing. *Consultant* will respond in writing, either accepting or requesting improvements.

1.10 RESPONSIBILITY

- A. Be responsible for safety of persons and property on-site and for protection of persons off-site and environment to extent that they may be affected by conduct of *Work*.
- B. Comply with safety requirements of *Contract Documents*, applicable federal, provincial, and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan, and enforce compliance with employees.
- C. Duties of employers:
 - 1. An employer shall ensure that:
 - a. the prescribed equipment, materials and protective devices are provided;
 - b. the equipment, materials and protective devices provided by the employer are maintained in good condition;
 - c. the measures and procedures prescribed are carried out in the workplace;
 - d. the equipment, materials and protective devices provided by the employer are used as prescribed; and

- e. a floor, roof, wall, pillar, support or other part of a workplace is capable of supporting all loads to which it may be subjected without causing the materials therein to be stressed beyond the allowable unit stresses established under the Building Code Act.

1.11 COMMUNICATION REQUIREMENTS

- A. Comply with Ontario Health and Safety Act.
- B. Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.
- C. Provide *Consultant* with Material Safety Data Sheets (MSDS).

1.12 UNFORSEEN HAZARDS

- A. Should any unforeseen or peculiar safety-related factor, hazard, or condition become evident during performance of *Work*, immediately stop work and advise *Consultant* verbally and in writing.

1.13 HEALTH AND SAFETY CO-ORDINATOR

- A. Employ and assign to *Work*, competent and authorized representative as Health and Safety Coordinator. Health and Safety Coordinator must:
 - 1. Have minimum 2 years' site-related working experience specific to activities associated with related projects.
 - 2. Have working knowledge of occupational safety and health regulations.
 - 3. Be responsible for completing *Contractor's* Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter *Place of the Work* to perform *Work*.
 - 4. Be responsible for implementing, enforcing daily, and monitoring site-specific *Contractor's* Health and Safety Plan.
 - 5. Be on site during execution of *Work* and report directly to and be under direction of site supervisor.
 - 6. Be deemed as 'competent' as defined by the Occupational Health and Safety Act and as noted above.
 - 7. Provide proof of the above qualifications to the *Consultant*, including the name of the individual responsible for health and safety during the *Work*.

1.14 POSTED DOCUMENTS

- A. Provide the following documents, or obtain from *Consultant*, and post at *Place of the Work*:
 - 1. Safety Policy.
 - 2. Health and Safety Representative.
 - 3. General Requirements - Constructor's name.
 - 4. WSIA, Workers Safety Insurance Act.
 - 5. Ministry of Labour Orders for Province of Ontario.
 - 6. Occupational Health and Safety Act for Province of Ontario.
 - 7. Material Safety Data Sheets.
 - 8. Floor Plan.
 - 9. Notice of Project.
 - 10. Joint Health and Safety Committee Members.
 - 11. Infection Control documents; see section 01 35 33.
- B. Comply with Provincial general posting requirements.

1.15 POWDER ACTUATED DEVICES

- A. Do not use powder-actuated devices unless written permission is granted by the *Owner* and the *Consultant*.

1.16 WORK STOPPAGE

- A. Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for *Work*.
- B. Assign responsibility and obligation to Health and Safety Officer to stop or start *Work* when said Officer deems, it is necessary or advisable for reasons of health or safety. *Consultant* may also stop *Work* for health and safety considerations.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION

3.1 ACCESS TO SITE

- A. The *Owner's* Health and Safety Coordinator (OHSC) shall have full access to the *Place of the Work*. The *Contractor* shall review site-related issues with the OHSC and make any corrections as required to ensure compliance with the Infection Control Plan.

END OF HEALTH AND SAFETY REQUIREMENTS

SECTION 01 35 33

INFECTION CONTROL GUIDELINES FOR CONSTRUCTION

PART 1 - GENERAL

1.1 REFERENCES

- A. Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990 as amended 426/21.
- B. Canada Communicable Disease Report (CCDR) Construction-Related Nosocomial Infections In Patients in Health Care Facilities - Decreasing the Risk of Aspergillus Legionella and Other Infections July 2001 ISSN 1188-4169.

Web Browser at <http://www.phac-aspc.gc.ca/publicat/ccdr-rmtc/01pdf/27s2e.pdf>
- C. Health Canada Infection Control Guidelines.
- D. CSA Z317.13, Infection Control during Construction, Renovation and Maintenance of Health Care Facilities, latest edition.
- E. *Kingston Hospitals*, Infection Control Manual, Prevention of Infections, Construction, Renovation and Maintenance, Section No. IC 2-70.01.
- F. *CSA Z317.13 Infection Control during Construction, Renovation and Maintenance of Health Care Facilities*

1.2 SUBMITTALS

- A. Make submittals in accordance with Section 01 33 00.
- B. Prepare and submit site-specific Infection Control Plan within 7 days after date of Notice to Proceed and prior to commencement of *Work*. Infection Control Plan must include:
 - 1. List of equipment to be utilized to provide and monitor negative pressure within areas of construction.
 - 2. Location of exhaust penetration to the exterior and routing of ductwork.
 - 3. Identification of systems which require isolation prior to commencement of construction or modification.
 - 4. Location of temporary barriers and partitions including type of material to be used.
 - 5. Location of proposed interior routing of new building products and waste materials.
 - 6. Location of walk-off mats and tack mats.
 - 7. *Proof of course completion by the Canadian Standard Association in CSA Z317.13 Infection Control during Construction, Renovation and Maintenance of Health Care Facilities.*
- C. *Owner's* Infection Control Practitioner (ICP) will review *Contractor's* site-specific Infection Control Plan and provide comments to *Contractor* within five (5) working days after receipt of plan. Revise plan as appropriate and resubmit plan prior to commencement of *Work*.

- D. Review of *Contractor's* final Infection Control Plan should not be construed as approval and does not reduce the *Contractor's* overall responsibility for construction infection control measures.

1.3 MEETINGS

- A. Prior to commencing *Work* and between each phase of the *Project*, schedule and administer an infection control meeting with the *Owner's* Infection Control Practitioner and the *Consultant*.
- B. Infection control shall be carried as a minuted topic in all construction meetings.

1.4 PROJECT/SITE CONDITIONS

- A. In the areas of the project where the new construction connects to and disrupts existing construction in occupied areas, the *Contractor* shall employ the determined and identified infection control measures appropriate to the Construction Activity and Population Risk Group as determined by the *Owner's* Infection Control Practitioner.
- B. At all times during the completion of this *Project* the *Contractor* will be responsible for ensuring that the guidelines described herein are strictly adhered to.
- C. For the purposes of this project, the *Contractor* shall carry out Preventative Measures to the requirements of the most current version of *CSA Z317.13* as required by the Construction Activity Type.

1.5 GENERAL REQUIREMENTS

- A. Prior to commencement of *Work*, the *Owner* will provide the *Contractor* with a copy of the complete Infection Control Risk Assessment.
- B. *Contractor* to develop a written site-specific Infection Control Plan based on the Infection Control Risk Assessment prior to commencing any site *Work* and continue to implement, maintain, and enforce plan until final demobilization from site. The Infection Control Plan must address project specifications. The plan will be based on the Infection Control Risk Assessment as prepared for the project by the *Owner's* Infection Control Practitioner. A copy of the assessment for this project is included in this section for reference and information.
- C. *Consultant* or *Owner's* representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.6 RESPONSIBILITY

- A. Be responsible for adhering to the Infection Control Plan and guidelines established by the *Owner's* Infection Control Practitioners, for the safety of persons on site and for the protection of persons adjacent to site and environment, to extent that they may be affected by conduct of *Work*.
- B. Comply with safety requirements of *Contract Documents*, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Infection Control Plan and guidelines, and enforce compliance by employees.

1.7 CONTRACTOR'S INFECTION CONTROL LIAISON

- A. The *Contractor* shall employ a competent and authorized representative as Infection Control Liaison. Infection Control Liaison must:

1. Have minimum 2 years' site-related working experience specific to activities associated with related projects.
2. Have working knowledge of infection control regulations
3. Be responsible to ensure that all personnel carrying out work on site have successfully completed the *Owner's* Infection Control Training Sessions prior to the commencement of *Work*.
4. Be responsible for implementing, enforcing daily and monitoring site-specific Infection Control Plan.
5. Be on site during execution of *Work* and report directly to and be under direction of site supervisor.
6. Provide proof of the above qualifications to the *Consultant*, including the name of the individual responsible for Infection Control during the work.

1.8 POSTING OF DOCUMENTS

- A. Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with *Consultant* and *Owner*.

1.9 CORRECTION OF NON-COMPLIANCE

- A. Immediately address infection control non-compliance issues identified by *Owner's* Infection Control Practitioner or by *Consultant*.
- B. Provide *Consultant* with written report of action taken to correct non-compliance of Infection Control issues identified.
- C. In the event that non-compliance activity occurs the *Contractor* is responsible for all costs relating to the clean-up and correction of said activity.

1.10 WORK STOPPAGE

- A. *Owner's* Infection Control Practitioner may stop *Work* if non-compliance of Infection Control measures is observed.
- B. Costs associated with delays as a result of such a work stoppage shall be the responsibility of the *Contractor*.

1.11 CERTIFICATION

- A. All equipment to be used for the purposes of providing mechanical ventilation or vacuum cleaning shall be certified. Equipment shall be appropriately labeled with date certification completed and recertification shall be performed every 12 months.
- B. Once certification is complete, the equipment is to remain on site. Once equipment has left the site the equipment shall be recertified in accordance with this section.
- C. *General Contractors shall submit a Certificate of Attendance for the Fundamentals of Infection Control during Construction, Renovations or Maintenance of Health Care Facilities for Site Supervisors and Project Managers prior to mobilization.*

PART 2 - PRODUCTS

2.1 MATERIAL AND EQUIPMENT

- A. Provide a certified portable means of mechanical ventilation fan(s) and associated ductwork to provide means of exhaust from the *Place of the Work* directly to the exterior of the building. Fans are to be equipped with HEPA filtration, installed on the construction side of the temporary protection and shall be certified and labeled with date certification was completed. All ductwork in this exhaust system is to be free from any penetrations.
- B. Walk-off mats: cut or level-loop pile on rubber backing of nominal minimum size 1000 x 2000 mm.
- C. Tack mats: two-way self adhesive sticky plastic sheet as manufactured by Poly Tak or *Consultant* approved equivalent. Tack mats shall be appropriately sized such that both feet make contact with the mat on exit.
- D. Differential Pressure Gauge *with digital data recorder* shall be provided on all Type III and Type IV construction barriers in order to ensure pressure differential is maintained at 7.5 Pa (0.03 Inches WC) between the construction site and remainder of the facility.

PART 3 - EXECUTION

3.1 IMPLEMENTATION

- A. Prior to the start of work all barriers are to be inspected and approved by the *Owner's* Infection Control Practitioner. Upon completion of any work that involves the removal of temporary barriers, the area of work shall be inspected and the cleaning approved by the *Owner's* Infection Control Practitioner prior to removal of any barriers.
- B. Implement individual Infection Control measures as outlined in related sections.
- C. Place tack mats on both sides of each access route to and from construction areas. Replace mats daily or more often, as required, to ensure mats remain functional for intended purpose.
- D. At the entrance/exit to the construction zone adjacent to occupied space, install two way tack mats at entrance/exit doorway to tack dust. Change tack sheet daily or as needed.
- E. At entrance/exit to the construction zone, provide walk-off mats (minimum 6m long). Vacuum mats daily and change weekly or as needed.
- F. Prior to commencing/completing work above accessible ceiling spaces, vacuum ceiling space in the area of work to prevent distribution of dust and debris. All vacuuming shall be completed with a HEPA filter-equipped device.
- G. All mechanical ventilation fans are to be exhausted directly to the exterior of the facility at all times unless alternate method is approved by *Owner's* Infection Control Practitioner.

3.2 ACCESS TO SITE

- A. The *Owner's* Infection Control Practitioner (ICP) shall have full access to the *Place of the Work*. The *Contractor* shall review site related issues with the ICP and make any corrections as required to ensure compliance with the Infection Control Plan.

3.3 CLEANING

- A. Where cleaning is required, and not performed by the *Contractor* to the facility standards, the *Owner's* housekeeping department will conduct the cleaning and associated costs will be passed back to the *Contractor*.

TABLE 1 - PREVENTATIVE MEASURES ANALYSIS

Population risk group ¹	Construction Activity Type ²			
	Type A	Type B	Type C	Type D
Group 1	I	II	II	III/IV
Group 2	I	II	III	IV
Group 3	I	III	III/IV	IV
Group 4	I-III ³	III/IV	III/IV	IV

Notes:

1. See *Table 2* to determine the population risk. Where applicable, refer also to infection control population risk drawings included in the bid documents.
2. See *Table 3* to determine the construction activity type.
3. When the risk group is Group 4 and the construction activity is Type A, the infection prevention and control department shall be consulted to determine the appropriate preventative measure (I, II or III).

TABLE 2 – POPULATION RISK GROUPS AND GEOGRAPHICAL AREAS

Population Risk Group	Typical Areas
<i>Group 1</i> Lowest Risk	Office areas Unoccupied areas Public areas Laundry and soiled linen cleaning areas Physical plant workshops and housekeeping areas
<i>Group 2</i> Medium Risk	Patient care areas, unless listed in Group 3 and 4 Outpatient clinics (except oncology and surgery) Admission and discharge units Waiting rooms Autopsy and morgue Occupational therapy areas remote from patient care areas Physical therapy areas remote from patient care areas
<i>Group 3</i> Medium to high risk	Emergency (except trauma rooms) Diagnostic imaging Labour and birthing rooms (non-operating) Nurseries for healthy newborns Nuclear medicine Hydrotherapy Echocardiography Laboratories General medical and surgical wards Pediatrics Geriatrics Long-term care Food preparation, serving and dining areas Respiratory therapy Clean linen handling and storage areas
<i>Group 4</i> Highest risk	Intensive care units Operating rooms (including prep., induction, post anesthesia care unit and scrub areas) Anesthesia storage areas and workrooms Oncology units and outpatient clinics for cancer patients Transplant units and outpatient clinics for transplant patients Wards and outpatient clinics for patients with AIDS or other immunodeficiency diseases Dialysis units Critical care nurseries (NICU) Labour and delivery rooms

	Cardiac catheterization and angiography
	Interventional Radiology
	Cardiovascular and cardiology patient areas
	Endoscopy
	Pharmacy admixture rooms
	Sterile processing rooms
	Sterile supply areas
	Burn care units
	Animal rooms
	Trauma rooms
	Protective environment isolation rooms
	Tissue culture laboratories
	Bronchoscopy
	Cystoscopy
	Pacemaker insertion rooms
	Dental procedure rooms
	Central processing department

TABLE 3 – CONSTRUCTION ACTIVITY TYPE

<i>Type A</i>	Inspection and non-invasive activities: These include, but are not limited to, activities that require removal of ceiling tiles for visual inspection (limited to 1 tile to 50 square feet), painting (but not sanding), wall covering, electrical trim work, minor plumbing (disrupts water supply to a localized patient care area [e.g. 1 room] for less than 15 minutes), and other maintenance activities that do not generate dust or require cutting of wall or access to ceilings other than for visual inspection.
<i>Type B</i>	Small scale, short duration activities that create minimal dust (e.g., <2 hours). These include, but are not limited to, activities that require access to chase spaces, cutting of walls or ceilings where dust migration can be controlled for the installation/repairs of minor electrical work, ventilation components, telephone wires or computer cables, and sanding walls for painting or wall covering to only repair small patches. It also includes plumbing that requires distribution to the water supply of more than one patient care area (e.g. > 2 rooms) for less than 30 minutes.
<i>Type C</i>	Any work that generates moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies (e.g. counter tops, cupboards, sinks). These include, but are not limited to, activities that require sanding of walls for painting or wall covering, removal of floor-coverings, ceiling tiles and casework, new wall construction, minor duct work, or electrical work above ceilings, major cabling activities, and any activity that cannot be completed within a single work shift. It also includes plumbing that requires disruption to the water supply or more than one patient care area (e.g. > 2 rooms) for more than 30 minutes but less than 1 hour.
<i>Type D</i>	Major demolition, construction and renovation projects. These include, but are not limited to, activities that involve heavy demolition or removal of a complete cabling system and new construction requiring consecutive work shifts to complete. It also includes plumbing that results in disruption to the water supply of more than one patient care area (e.g. > 2 rooms) for more than 1 hour.

END OF INFECTION CONTROL GUIDELINES FOR CONSTRUCTION

SECTION 01 40 00 QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 REFERENCE STANDARDS

- A. "Reference standards" means consensus standards, trade association standards, guides, and other publications expressly referenced in *Contract Documents*.
- B. Where an edition or version date is not specified, referenced standards shall be deemed to be the latest edition or revision issued by the publisher at the time of bid closing. However if a particular edition or revision date of a specified standard is referenced in an applicable code or other regulatory requirement, the regulatory referenced edition or version shall apply.
- C. Reference standards establish minimum requirements. If *Contract Documents* call for requirements that differ from a referenced standard, the more stringent requirements shall govern.
- D. If compliance with two or more reference standards is specified and the standards establish different or conflicting requirements, comply with the most stringent requirement. Refer uncertainties to *Consultant* for clarification.
- E. Within the *Specifications*, reference may be made to the following standards writing, testing, or certification organizations by their acronyms or initialisms:
 - 1. AA - Aluminum Association
 - 2. ACI - American Concrete Institute
 - 3. AISC - American Institute of Steel Construction
 - 4. ANSI - American National Standards Institute
 - 5. ASME - American Society of Mechanical Engineers
 - 6. ASTM - American Society for Testing and Materials
 - 7. AWMAC - Architectural Woodwork Manufacturers Association of Canada
 - 8. AWWA - American Wire Producers Association
 - 9. CaGBC - Canadian Green Building Council
 - 10. CGSB - Canadian General Standards Board
 - 11. CISC - Canadian Institute of Steel Construction
 - 12. CPCI - Canadian Prestressed Concrete Institute
 - 13. CSA - Canadian Standards Association
 - 14. CSSBI - Canadian Sheet Steel Building Institute
 - 15. CWB - Canadian Welding Bureau
 - 16. ICEA - Insulated Cable Engineers Association
 - 17. IEEE - Institute of Electrical and Electronics Engineers
 - 18. IGMAC - Insulating Glass Manufacturers Association of Canada
 - 19. LEED - Leadership in Energy and Environmental Design
 - 20. MPP - Master Painters Institute
 - 21. MSS - Manufacturers Standardization Society of the Valve and Fittings Industry
 - 22. NAAMM - National Association of Architectural Metal Manufacturers
 - 23. NEMA - National Electrical Manufacturers Association
 - 24. NFPA - National Fire Protection Association
 - 25. NHLA - National Hardwood Lumber Association
 - 26. NLGA - National Lumber Grades Authority
 - 27. SSPC - The Society for Protective Coatings
 - 28. TTMAC - Terrazzo, Tile and Marble Association of Canada
 - 29. ULC - Underwriters' Laboratories of Canada

1.2 INDEPENDENT INSPECTION AND TESTING AGENCIES

- A. Except as otherwise specified, *Owner* will retain and pay for independent inspection and testing agencies to inspect, test, or perform other quality control reviews of parts of the *Work*.
- B. Retain and pay for inspection and testing that is for *Contractor's* own quality control or is required by regulatory requirements.
- C. Employment of inspection and testing agencies by *Contractor* or *Owner* does not relieve *Contractor* from responsibility to perform the *Work* in accordance with *Contract Documents*.
- D. Allow and arrange for inspection and testing agencies to have access to the *Work*, including access to off site manufacturing and fabrication plants.
- E. For inspection and testing required by *Contract Documents* or by authorities having jurisdiction, provide *Consultant* and inspection and testing agencies with timely notification in advance of required inspection and testing.
- F. Submit test samples required for testing in accordance with submittals schedule specified in Section 01 32 00 – Construction Progress Documentation.
- G. Provide labour, *Construction Equipment* and temporary facilities to obtain and handle test samples on site.
- H. If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by *Consultant* at no cost to *Owner*. Pay costs for retesting and/or re-inspection.

1.3 INSPECTION AND TESTING AGENCY REPORTS

- A. For inspection and testing required by *Contract Documents* or by regulatory requirements, and performed by *Contractor* retained inspection and testing agencies, submit to *Consultant* and *Owner* copies of reports. Submit within one day after completion of inspection and testing.
- B. For inspection and testing performed by *Owner* retained inspection and testing agencies, copies of inspection and testing agency reports will be provided to *Contractor*.
- C. Provide copies to *Subcontractor* of work being inspected or tested, or to the manufacturer or fabricator of material being inspected or tested.

1.4 TESTS AND MIX DESIGNS

- A. Furnish test results and mix designs as requested.
- B. The cost of tests and mix designs beyond those called for in *Contract Documents* or beyond those required by law of *Place of the Work* shall be appraised by *Consultant* and may be authorized as recoverable.

1.5 MOCK-UPS

- A. Prepare mock-ups of *Work* as specified in the technical *Specifications*. If a mock-up location is not indicated in the *Drawings* or *Specifications*, locate where directed by *Consultant*.
- B. Modify mock-up as required until *Consultant* approval is obtained.
- C. Approved mock-ups establish an acceptable standard for the *Work*.
- D. Protect mock-ups from damage until the *Work* they represent is complete.
- E. Unless otherwise specified in the technical *Specifications*, approved mock-ups forming part of the *Work* may remain as part of the *Work*.
- F. Remove mock-ups only when the *Work* they represent is complete or when otherwise directed by *Consultant*.

1.6 MILL TESTS

- A. Submit mill test certificates as requested or required by specification Sections.

1.7 EQUIPMENT AND SYSTEMS

- A. Submit adjustment, balancing and verification reports for mechanical, electrical and building equipment systems.
- B. Refer to Division 20 and 26 for definitive requirements for mechanical and electrical systems, commissioning, adjustments, balancing and testing.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF QUALITY REQUIREMENTS

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SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 - GENERAL

1.1 TEMPORARY UTILITIES - GENERAL

- A. Provide temporary utilities as specified and as otherwise necessary to perform the *Work* expeditiously.
- B. Remove temporary utilities after use.

1.2 TEMPORARY WATER SUPPLY

- A. *Owner* will provide supply of water for construction use. The *Contractor* is responsible for providing connection to existing service, as required.
- B. The *Contractor* shall be responsible for providing potable water for consumption by the workforce.

1.3 TEMPORARY HEATING AND VENTILATION

- A. Arrange and pay for temporary heating and ventilation required during construction.
- B. Vent construction heaters in enclosed spaces to the outside or use flameless type of construction heaters.
- C. Provide temporary heat for the *Work* as required to:
 - 1. Facilitate progress of *Work*.
 - 2. Protect the *Work* against dampness and cold.
 - 3. Prevent moisture condensation on surfaces, freezing, or other damage to finishes or stored *Products*.
 - 4. Maintain specified minimum ambient temperatures and humidity levels for storage, installation and curing of *Products*.
 - 5. Provide adequate ventilation to meet health regulations for safe working environment.
 - 6. After building is enclosed, maintain interior temperature of minimum 10 degrees C.
 - 7. In occupied space adjacent to construction areas, maintain an average ambient temperature of 18 degrees C.
- D. Provide temporary ventilation for the *Work* as required to:
 - 1. Prevent accumulations of fumes, exhaust, vapours, gases and other hazardous, noxious, or volatile substances in enclosed spaces, as required to maintain a safe work environment meeting applicable regulatory requirements.
 - 2. Ensure that hazardous, noxious, or volatile substances do not migrate to Owner occupied spaces.
 - 3. Dispose of exhaust materials in manner that will not result in harmful exposure to people.
 - 4. Ventilate storage spaces containing hazardous or volatile materials.
 - 5. Ventilate temporary sanitary facilities.
 - 6. Continue operation of ventilation and exhaust system after completion of work process to assure removal of harmful contaminants.
 - 7. Maintain negative pressure to the adjacent areas. Refer to Section 01 35 65 for additional requirements for negative pressure enclosures.
- E. Permanent heating system of building may be used when available. Be responsible for damage to heating system if use is permitted.
- F. On completion of *Work* for which permanent heating system is used, replace filters and clean radiation devices prior to occupancy.

- G. 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*.
- H. Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - 1. Conform to 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.
- I. Be responsible for damage to the *Work* due to failure in providing adequate heat and protection during construction.

1.4 TEMPORARY ELECTRICAL POWER AND LIGHTING

- A. Arrange and pay for temporary power and lighting required during construction. Connect to utility power supply in accordance with Canadian Electrical Code and provide meters and switching.
- B. Arrange and pay for necessary connections and disconnections of temporary power and lighting in accordance with regulatory requirements.
- C. Provide and maintain temporary lighting throughout project. Ensure level of illumination on all floors and stairs is not less than 162 lx.
- D. With prior approval of *Consultant*, and provided that guarantees are not affected, electrical power and lighting systems installed under this *Contract* may be used for Construction requirements. Make good damage to electrical system caused by use under this *Contract*. Replace lamps which have been used for more than 3 months.

1.5 TEMPORARY COMMUNICATION FACILITIES

- A. Provide and pay for temporary telephone fax and internet hook up, lines and equipment necessary for own use.

1.6 FIRE PROTECTION

- A. During performance of *Work*, provide and maintain temporary fire protection equipment required by insurance companies having jurisdiction and governing codes, regulations and bylaws.
- B. If *Work* requires de-activation of the fire alarm system, or any part thereof, a "Utility Shutdown Form" must be completed and submitted. A copy of the "Utility Shutdown Form" is included in Section 01 14 00.
- C. Provide and maintain a temporary fire alarm system through to project completion.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF TEMPORARY UTILITIES

SECTION 01 52 00 CONSTRUCTION FACILITIES

PART 1 - GENERAL

1.1 CONSTRUCTION FACILITIES - GENERAL

- A. Provide temporary construction facilities as necessary for performance of the *Work* and in compliance with applicable regulatory requirements.
- B. Maintain temporary construction facilities in good condition for the duration of the *Work*.
- C. Remove temporary construction facilities from *Place of the Work* when no longer required.

1.2 CONSTRUCTION PARKING

- A. Parking will not be permitted at *Place of the Work*. The *Contractor* is responsible to obtain and pay for parking as required.

1.3 VEHICULAR ACCESS

- A. Provide and maintain adequate access to *Place of the Work*.
- B. Existing roads at *Place of the Work* may be used for access to *Place of the Work*, provided *Contractor* assumes responsibility for any damage caused by construction traffic, and prevents or promptly cleans up any mud tracking or material spillage.

1.4 SITE OFFICES

- A. The *Owner* will arrange for a space within the facility suitable for the use by the *Contractor* as a site office for the duration of the project. The *Contractor* is required to maintain the space in as found condition and is required to repair all damage caused to the space.

1.5 SANITARY FACILITIES

- A. The *Owner* will designate a sanitary facility for the use of the *Contractor* in accordance with governing regulations and ordinances.
- B. Post notices and take such precautions as required by local health authorities.
- C. Ensure facility is maintained in sanitary condition at all times and cleaned in accordance with Section 01 74 00.

1.6 FIRE PROTECTION

- A. Provide and maintain temporary fire protection systems and equipment during construction.

1.7 USE OF EXISTING ELEVATORS

- A. Designated elevators may be used by construction personnel and for transporting *Products*. Co-ordinate use with *Owner*.
- B. Provide protective coverings for finish surfaces of cars and entrances. Assume responsibility for and make good any damage to existing elevators caused by construction personnel.
- C. The *Contractor* is responsible to ensure that posted loading is not exceeded for any reason.
- D. *Contractor* is responsible to perform maintenance service on designated elevator at end or *Project*. *Owner* to provide maintenance provider contact.

1.8 LOADING

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

- B. Do not block vehicular traffic or pedestrian access to the Hospital site while loading and unloading. Schedule delivery of *Products* shipped to loading dock with *Owner's* representative a minimum of 48 hours prior to delivery. *Owner's* operation will take precedence over that of the *Contractor*. Deliveries are not to be scheduled to take place at the loading dock between the hours of *16:00 h and 08:00 h*.

1.9 EQUIPMENT, TOOLS AND MATERIALS STORAGE

- A. Do not unreasonably encumber premises with *Products*. Confine storage of *Products* to designated areas.
- B. Provide and maintain, in a clean and orderly condition, lockable storage boxes suitable for tools, *Construction Equipment* and *Products*.
- C. Locate *Products*, not used that day on site, in a manner to cause least interference with work activities.
- D. The *Owner* is not responsible for any losses incurred by the *Contractor*.

1.10 SCAFFOLDING

- A. Provide and maintain scaffolding, ramps ladders, platforms, and other equipment required to complete the *Work*.

1.11 HOISTING

- A. Provide, operate and maintain hoists and temporary cranes required for moving of workers, materials and equipment. Make financial arrangements with *Subcontractors* for use thereof.
- B. Hoist cranes shall be operated by qualified operators.
- C. Hoisting equipment, labour and material shall be the responsibility of the *Contractor*.

1.12 PROJECT IDENTIFICATION SIGNS

- A. No signs or advertisements, other than construction signs and warning signs, are permitted on site.
- B. Signs and notices for safety and instruction shall be in both official languages. Graphic symbols shall conform to *CAN3-Z321*.
- C. Maintain approved signs and notices in good condition for duration of project, and dispose of off-site on completion of project.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF CONSTRUCTION FACILITIES

SECTION 01 56 00 TEMPORARY BARRIERS AND ENCLOSURES

PART 1 - GENERAL

1.1 BARRIERS AND ENCLOSURES - GENERAL

- A. Provide temporary barriers and enclosures necessary to protect the public and building occupants and to secure *Place of the Work* during performance of the *Work*.
- B. Comply with applicable regulatory requirements.
- C. Maintain temporary barriers and enclosures in good condition for the duration of the *Work*.
- D. Remove temporary barriers and enclosures from *Place of the Work* when no longer required.

1.2 FENCING

- A. Erect temporary security and safety site fencing, minimum 1.8 m high, using self-supporting wire fence sections enclosing entire site. Maintain site fencing in good repair until removed.
- B. Provide lockable access gates as required to facilitate construction access.

1.3 EXTERIOR HOARDING

- A. Erect temporary exterior site hoarding to comply with applicable regulatory requirements and as follows:
 - 1. Use lumber framing and, minimum 13 mm thick exterior grade plywood.
 - 2. Paint public side of hoarding in colour selected by *Consultant* with one coat primer to CGSB 1.189M and one coat exterior paint to CGSB 1.59. Maintain public side of hoarding clean and in good repair until removed.
 - 3. Provide lockable access gates for *Construction Equipment* and lockable pedestrian doors as required to facilitate construction access.
 - 4. Erect and maintain pedestrian walkways including roof and side covers, complete with pedestrian signage and electrical lighting.

1.4 WEATHER ENCLOSURES

- A. Provide weather tight enclosures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- B. Provide weather enclosures to protect floor areas where walls are not finished and to enclose work areas that require temporary heating.
- C. Design weather enclosures to withstand wind pressure and snow loading requirements.

1.5 GUARD RAILS AND BARRICADES

- A. Provide as required by governing authorities.

1.6 DUST TIGHT SCREENS

- A. Where construction activities will occur within an occupied floor area for a period of time not exceeding 24 hours and where indicated, provide dust tight screens to localize dust generating activities, and for protection of workers, finished areas of *Work* and public and in areas where the construction must be isolated from the remainder of the floor area.
- B. Dust tight screens are to be constructed using flash resistant tarpaulins on a non-combustible frame. Tarps are to be sealed to adjacent finishes and all joints to provide air tight screen. Tarps are to be sealed to undisturbed ceiling surfaces or to underside of structure above in areas where ceilings are removed.
- C. Maintain and relocate protection until such work is complete.

- D. Maintain work areas within existing occupied areas under negative pressure at all times.
- E. Where existing wall, ceiling and floor materials or finishes are damaged as a result of barrier construction, repair materials or finishes to match existing.

1.7 TEMPORARY PARTITIONS

- A. Where construction activities will occur within an occupied floor area for a period of time exceeding 24 hours and where indicated, provide insulated temporary partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public and in areas where the construction must be isolated from the remainder of the floor area.
- B. Temporary partitions are to be constructed to underside of structure above using metal studs and gypsum board construction to create a 1 hour fire separation in accordance with ULC design W408. Prime and paint partition exposed to occupied side of floor area.
- C. Provide fire-rated hollow metal doors and frames and hardware where indicated and where required to maintain path of egress. Prime and paint door and frames faces exposed to occupied side of floor area.
- D. Maintain and relocate protection until such work is complete.
- E. Maintain work areas within existing occupied areas under negative pressure at all times.
- F. Where existing wall, ceiling and floor materials or finishes are damaged as a result of barrier construction, repair materials or finishes to match existing.

1.8 ACCESS TO SITE

- A. Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.

1.9 PUBLIC TRAFFIC FLOW

- A. Do not impede public transportation and vehicle flow with construction vehicles.

1.10 FIRE ROUTES

- A. Maintain fire access routes, including overhead clearances, for use by emergency response vehicles, and access to hydrants and siamese connections.
- B. Review site restrictions, lay down areas and site access with the Authorities having Jurisdiction prior to construction start.

1.11 PROTECTION OF BUILDING FINISHES

- A. Provide necessary temporary barriers and enclosures to protect existing and completed or partially completed finished surfaces from damage during performance of the *Work*.
- B. Locations and installation schedule to be confirmed with Consultant three (3) days prior to installation.
- C. Be responsible for damage incurred due to lack of, or improper, protection.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF TEMPORARY BARRIERS AND ENCLOSURES

SECTION 01 57 00 TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 TEMPORARY CONTROLS - GENERAL

- A. Provide temporary controls as necessary for performance of the *Work* and in compliance with applicable regulatory requirements.
- B. Maintain temporary controls in good condition for the duration of the *Work*.
- C. Remove temporary controls and *Construction Equipment* used to provide temporary controls from *Place of the Work* when no longer required.

1.2 PLANT PROTECTION

- A. Protect trees and other plant material designated to remain on site where indicated on *Drawings*.
- B. Protect trees and shrubs susceptible to damage during construction by encasing with protective wood framework from grade to height of two metres.
- C. For trees designated to remain, protect roots inside dripline from disturbance or damage during excavation and grading. Avoid traffic, dumping and storage of materials over root zones.
- D. Minimize stripping of topsoil and vegetation.

1.3 DUST AND PARTICULATE CONTROL

- A. Implement and maintain dust and particulate control measures in accordance with applicable regulatory requirements.
- B. Execute *Work* by methods that minimize dust from construction operations and spreading of dust on site or to adjacent properties.
- C. Provide temporary enclosures to prevent extraneous materials resulting from sandblasting or similar operations from contaminating air beyond immediate work area.
- D. Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.
- E. Use appropriate covers on trucks hauling fine, dusty, or loose materials.

1.4 DEWATERING

- A. Provide temporary drainage and pumping as necessary to dewater excavations, trenches, foundations, and other parts of the *Work*. Maintain such areas free of water arising from groundwater or surface run-off, as required to keep them stable, dry, and protected from damage due to flooding.
- B. Maintain standby equipment necessary to ensure continuous operation of dewatering system.
- C. Do not pump water containing suspended materials or other harmful substances into waterways, sewers or surface drainage systems. Treat or dispose of such water in accordance with applicable regulatory requirements

1.5 SITE DRAINAGE

- A. Maintain grades to ensure proper site drainage.
- B. Prevent surface water runoff from leaving the site except as otherwise provided by stormwater management plan.

- C. Prevent precipitation from infiltrating or from directly running off stockpiled materials. Cover stockpiled materials with an impermeable liner during periods of work stoppage including at end of each *Working Day*.
- D. Control surface drainage from cuts and fills, from borrow and waste disposal areas, from stockpiles, staging areas, and other work areas as required to prevent erosion and sedimentation.
- E. Control surface drainage by ensuring that gutters are kept open and water is not directed across or over pavements or sidewalks, except through pipes or properly constructed troughs. Ensure that runoff from unfinished areas is intercepted and diverted to suitable outlets.

1.6 EROSION AND SEDIMENT CONTROL

- A. Minimize amount of bare soil exposed at one time. Stabilize disturbed soils as quickly as practical to minimize erosion. Remove accumulated sediment resulting from construction activity from adjoining surfaces, drainage systems, and watercourses, and repair damage caused by soil erosion and sedimentation.
- B. Provide and maintain appropriate temporary measures such as silt fences, straw bales, ditches, geotextiles, drains, berms, terracing, riprap, temporary drainage piping, sedimentation basins, vegetative cover, dikes, and other measures that may be required to prevent erosion and migration of silt, mud, sediment, and other debris.
- C. Do not disturb existing embankments or embankment protection.
- D. Periodically inspect erosion and sediment control measures to detect evidence of erosion and sedimentation. Promptly take corrective measures when necessary.
- E. If soil and debris from site accumulate in ditches or other low areas, remove accumulation and restore area to original condition.

1.7 POLLUTION CONTROL

- A. Take measures to prevent contamination of soil, water, and atmosphere through uncontrolled discharge of noxious or toxic substances and other pollutants, potentially causing environmental damage.
- B. Be prepared, by maintaining appropriate materials, equipment, and trained personnel on site, to intercept, clean up, and dispose of spills or releases that may occur. Promptly report spills and releases that may occur to:
 - 1. authority having jurisdiction,
 - 2. person causing or having control of pollution source, if known, and
 - 3. Owner and Consultant.
- C. Contact manufacturer of pollutant, if known and applicable, to obtain material safety data sheets (MSDS) and ascertain hazards involved and precautions and measures required in cleanup or mitigating actions.
- D. Take immediate action to contain and mitigate harmful effects of the spill or release.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF TEMPORARY CONTROLS

SECTION 01 61 00 COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL

- A. Provide *Products* that are not damaged or defective, and suitable for purpose intended, subject to specified requirements. If requested by *Consultant*, furnish evidence as to type, source and quality of *Products* provided.
- B. Unless otherwise specified, maintain uniformity of manufacture for like items throughout.
- C. Permanent manufacturer's markings, labels, trademarks, and nameplates on *Products* are not acceptable in prominent locations, except where required by regulatory requirements or for operating instructions, or when located in mechanical or electrical rooms.

1.2 PRODUCT OPTIONS

- A. Subject to the provisions of Section 01 25 00 –Substitution Procedures:
 - 1. Wherever a *Product* or manufacturer is specified by a single proprietary name, provide the named *Product* only.
 - 2. Wherever more than one *Product* or manufacturer is specified by proprietary name for a single application, provide any one of the named *Products*.
- B. Wherever a *Product* is specified by reference to a standard only (Indicated as “Standard of Acceptance” in Technical Specifications), provide any *Product* that meets or exceeds the specified standard. If requested by *Consultant*, submit information verifying that the proposed *Product* meets or exceeds the specified standard.
- C. Wherever a *Product* is specified by descriptive or performance requirements only (Indicated as “Basis of Design” in Technical Specifications, provide any *Product* that meets or exceeds the specified requirements. If requested by *Consultant*, submit information verifying that the proposed *Product* meets or exceeds the specified requirements.

1.3 PRODUCT AVAILABILITY AND DELIVERY TIMES

- A. Promptly upon Contract award and periodically during construction, review and confirm *Product* availability and delivery times. Order *Products* in sufficient time to meet the construction progress schedule and the *Contract Time*.
- B. If a specified *Product* is no longer available, promptly notify *Consultant*. *Consultant* will take action as required.
- C. If delivery delays are foreseeable, for any reason, promptly notify *Consultant*.
 - 1. If a delivery delay is beyond *Contractor*'s control, *Consultant* will provide direction.
 - 2. If a delivery delay is caused by something that was or is within *Contractor*'s control, *Contractor* shall propose actions to maintain the construction progress schedule for *Consultant*'s review and acceptance.

1.4 STORAGE, HANDLING, AND PROTECTION

- A. Store, handle, and protect *Products* during transportation to *Place of the Work* and before, during, and after installation in a manner to prevent damage, adulteration, deterioration and soiling.
- B. Comply with manufacturer's instructions for storage, handling and protection.
- C. Store packaged or bundled *Products* in original and undamaged condition with manufacturer's seals and labels intact. Do not remove from packaging or bundling until required in *Work*.

- D. Comply with the requirements of the workplace hazardous materials information system (WHMIS) regarding use, handling, storage, and disposal of hazardous materials, including requirements for labeling and the provision of material safety data sheets (MSDS).
- E. Store *Products* subject to damage from weather in weatherproof enclosures.
- F. Store sheet *Products* on flat, solid, supports and keep clear of ground. Slope to shed moisture.
- G. Remove and replace damaged *Products*.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF COMMON PRODUCT REQUIREMENTS

SECTION 01 71 00
EXAMINATION AND PREPARATION

PART 1 - GENERAL

1.1 SETTING OUT OF WORK

- A. Assume full responsibility for and execute complete layout of the *Work* to locations, lines and elevations indicated.
- B. Provide *Construction Equipment* needed to lay out and construct the *Work*.
- C. Supply *Construction Equipment* to facilitate *Consultant's* inspection of the *Work*.

1.2 EXAMINATION, COOPERATION AND COORDINATION

- A. *Subcontractors* are responsible to familiarize themselves with the *Contract Documents* and the work of all trades therein.
- B. *Subcontractors* shall give timely instructions and information to the *Contractor* concerning their requirements as they relate to other parts of the *Work*.
- C. Each trade shall report to the *Contractor* defects in surfaces or work prepared by other trades which affect their own, and ensure that conditions are appropriate for the carrying out of their portion of the *Work*. Commencement of the *Work* shall imply acceptance of conditions.
- D. Cooperate with the *Consultant* and *Other Contractors* employed by the *Owner*.

1.3 LINES AND LEVELS

- A. Prior to commencement of the *Work*, verify all grades, levels, lines and dimensions shown on the *Drawings* and report any errors and inconsistencies to the *Consultant*.
- B. Maintain a complete, accurate log of control and survey work as it progresses.
- C. Upon completion, complete an accurate record drawing of the completed *Project*. Submit in accordance with Section 01 78 00.

1.4 SURVEYOR QUALIFICATIONS

- A. Engage a registered land surveyor, licensed to practice in *Place of the Work*.

1.5 SURVEY SUBMITTALS

- A. Submit name and address of registered land surveyor performing survey work.
- B. Submit to *Owner* and *Consultant* the survey of the *Work* prepared and issued by a registered land surveyor as required by authorities having jurisdiction and on completion of the survey work.

1.6 SURVEY REFERENCE POINTS

- A. Locate and confirm permanent reference points prior to starting site work. Preserve and protect permanent reference points on site during construction.
- B. Do not change or relocate reference points without prior written notice to *Consultant*.
- C. Report to *Consultant* when a reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations. Require registered land surveyor to replace reference points in accordance with original survey.

1.7 SURVEY REQUIREMENTS

- A. Establish sufficient permanent benchmarks on site, referenced to established benchmarks by survey control points.

- B. Confirm that existing survey reference points are in accordance with *Owner's* survey and property limits.
- C. Establish initial lines and levels for building layout.
- D. Maintain a complete, accurate log of control and survey work as it progresses. Record locations with horizontal and vertical data in project record documents.

1.8 EXISTING UTILITIES AND STRUCTURES

- A. Before commencing the *Work*, establish location and extent of service lines in area of work and notify *Consultant* of findings.
- B. Promptly notify *Consultant* if underground utilities, structures, or their locations differ from those indicated in *Contract Documents* or in available project information. *Consultant* will provide appropriate direction.
- C. Record locations of maintained, re-routed and abandoned utility lines.

1.9 VERIFICATION OF EXISTING CONDITIONS

- A. The *Contractor* shall carefully examine the *Place of Work* and all conditions affecting the *Work* during the bidding period.
- B. Claims for extra payments due to difficulties encountered, which could have been foreseen during examination, will not be considered.
- C. Where work specified in any Section is dependent on the work of another Section or Sections having been properly completed, verify that work is complete and in a condition suitable to receive the subsequent work. Commencement of work of a Section that is dependent on the work of another Section or Sections having been properly completed, means acceptance of the existing conditions.
- D. Verify that ambient conditions are suitable before commencing the work of any Section and will remain suitable for as long as required for proper setting, curing, or drying of *Products* used.
- E. Ensure that substrate surfaces are clean, dimensionally stable, cured and free of contaminants.
- F. Notify *Consultant* in writing of unacceptable conditions.

1.10 DETAILS AND MEASUREMENTS

- A. Check and verify all dimensions wherever referring to the *Work*. Verify all dimensions when pertaining to the work of other trades with the *Subcontractor* concerned. Check dimensions and the actual material to be used on the *Work* with the various drawings and details before the *Work* commences, and report any variations to the *Consultant* for adjustment, if necessary.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF EXAMINATION AND PREPARATION

SECTION 01 73 00 EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Except where otherwise specified in technical *Specifications* or otherwise indicated on *Drawings*, comply with requirements of this Section.

1.2 CODES AND REGULATIONS COMPLIANCE

- A. Perform Work in accordance with Ontario Building Code of Canada (OBC), Ontario Fire Code (OFC), Occupational Health and Safety Act and other codes of provincial or local application, provided that in case of conflict or discrepancy, more stringent requirements apply, including all amendments made up to the bid closing date.
- B. Perform the *Work* in accordance with WHMIS regulations, the Occupational Health and Safety Act and Section 01 35 33.

1.3 MANUFACTURER'S INSTRUCTIONS

- A. Install, erect, or apply *Products* in strict accordance with manufacturer's instructions.
- B. Notify *Consultant*, in writing, of conflicts between *Contract Documents* and manufacturer's instructions where, in *Contractor's* opinion, conformance with *Contract Documents* instead of the manufacturer's instructions may be detrimental to the *Work* or may jeopardize the manufacturer's warranty.
- C. Do not rely on labels or enclosures provided with *Products*. Obtain written instructions directly from manufacturers.
- D. Provide manufacturer's representatives with access to the *Work* at all times. Render assistance and facilities for such access so that manufacturer's representatives may properly perform their responsibilities.

1.4 CONCEALMENT

- A. Conceal pipes, ducts, and wiring in floors, walls and ceilings in finished areas:
 - 1. After review by *Consultant* and authority having jurisdiction, and
 - 2. Where locations differ from those shown on *Drawings*, after recording actual locations on as-built drawings.
- B. Provide incidental furring or other enclosures as required.
- C. Notify *Consultant* in writing of interferences before installation.
- D. Electrical conduit shall not be buried in concrete structures or slabs unless indicated otherwise.

1.5 FASTENINGS - GENERAL

- A. Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials.
- B. Prevent electrolytic action and corrosion between dissimilar metals and materials by using suitable non-metallic strips, washers, sleeves, or other permanent separators to avoid direct contact.
- C. Use non-corrosive fasteners and anchors for securing exterior work and in spaces where high humidity levels are anticipated.
- D. Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage.

- E. Keep exposed fastenings to a minimum, space evenly and install neatly.
- F. Do not use fastenings or fastening methods that may cause spalling or cracking of material to which anchorage is made.

1.6 FASTENINGS - EQUIPMENT

- A. Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- B. Bolts shall not project more than one diameter beyond nuts.

1.7 FIRE RATED ASSEMBLIES

- A. When penetrating fire rated walls, ceiling, or floor assemblies, completely seal voids with fire-stopping materials, smoke seals, or both, in full thickness of the construction element as required to maintain the integrity of the fire rated assembly.

1.8 LOCATION OF EQUIPMENT, FIXTURES, OUTLETS AND DEVICES

- A. Consider location of equipment, fixtures, outlets, and devices indicated on *Drawings* as approximate.
- B. Locate fixtures, outlets, and devices to provide minimum interference, maximum usable space, and as required to meet safety, access, maintenance, acoustic, and regulatory, including barrier free, requirements, and in accordance with manufacturer's recommendations for safety, access, and maintenance.
- C. Promptly notify *Consultant* in writing of conflicting installation requirements for fixtures, outlets, and devices. If requested, indicate proposed locations and obtain approval for actual locations.
- D. Inform *Consultant* of impending installation and obtain his approval for actual location.
- E. Submit field drawings to indicate relative position of various services and equipment when required by the *Consultant*.

1.9 PROTECTION OF COMPLETED WORK AND WORK IN PROGRESS

- A. Adequately protect parts of the *Work* completed and in progress from any kind of damage.
- B. Promptly remove, replace, clean, or repair, as directed by *Consultant*, work damaged as a result of inadequate protection.
- C. Do not load or permit to be loaded any part of the *Work* with a weight or force that will endanger the safety or integrity of the *Work*.

1.10 REMEDIAL WORK

- A. Notify *Consultant* of, and perform remedial work required to, repair or replace defective or unacceptable work. Ensure that properly qualified workers perform remedial work. Coordinate adjacent affected work as required.
- B. Restore *Work* with new *Products* in accordance with requirements of *Contract Documents*.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF EXECUTION

SECTION 01 73 29 CUTTING AND PATCHING

PART 1 - GENERAL

1.1 REQUEST FOR CUTTING, PATCHING AND REMEDIAL WORK

- A. Submit written request in advance of cutting, coring, or alteration which affects or is likely to affect:
 - 1. Structural integrity of any element of the *Work*.
 - 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 other contractors.
 - 6. Warranty of *Products* affected.
- B. Include in request:
 - 1. Identification of *Project*.
 - 2. Location and description of affected work, including drawings or sketches as required.
 - 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 other contractors.
 - 7. Written permission of affected other contractors.
 - 8. Date and time work will be executed.

1.2 PRODUCTS

- A. Unless otherwise specified, when replacing existing or previously installed *Products* in the course of cutting and patching work, use replacement *Products* of the same character and quality as those being replaced. Use materials whose installed performance will equal or surpass that of existing materials.
- B. Where applicable, comply with *Specifications* for type *Work* to be performed.
- C. If an existing or previously installed *Product* must be replaced with a different *Product*, submit request for substitution in accordance with Section 01 25 00 - Substitution Procedures.

1.3 PREPARATION

- A. Inspect existing conditions in accordance with Section 01 71 00 - Examination and Preparation.
- B. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.
- C. Before start of *Work*, obtain and pay for all permits required by all authorities having jurisdiction and notify all interested utilities companies.
- D. Obtain approval of Owner and authorities having jurisdiction for *Work* which affects existing exit-ways, exit stairs, means of egress, or access to, or exit from, areas.
 - 1. Review with and obtain approval of authorities for any temporary construction which affects such areas.
- E. Provide supports to ensure structural integrity of surroundings; provide devices and methods to protect other portions of the *Work* from damage.
- F. Protect existing construction during cutting and patching to prevent damage
- G. Provide protection from elements for areas that may be exposed by uncovering work.
- H. Before proceeding, meet at *Place of the Work* with parties involved in cutting and patching, including mechanical and electrical trades.

1. Review areas of potential interference and conflict.
 2. Coordinate procedures and resolve potential conflicts before proceeding.
- I. After uncovering existing conditions for *Work*, inspect conditions affecting installation of new *e*.

1.4 EXISTING UTILITIES

- A. When breaking into or connecting to existing services' utilities, execute the *Work* at times directed by local governing authorities, with a minimum of disturbance to the *Work*, pedestrian and vehicular traffic, and ongoing *Owner* operations. When traffic is disrupted, provide signmen.
- B. Where the *Work* involves breaking into or connecting to existing building services, complete and submit a "Request for Utility Shut-down" form for any interruptions to building services, for necessary interruptions of mechanical or electrical service throughout the course of the *Work*. A copy of the form and procedures for its use and completion, are included in this Section.
- C. Where unknown services are encountered, immediately advise *Consultant* and confirm findings in writing.
- D. Remove abandoned service lines within two feet of structures, unless indicated otherwise. Cap or otherwise seal lines at cut-off points as instructed by *Consultant* and to suit code requirements.
- E. Avoid cutting existing utilities, pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until alternate provisions have been provided.
- F. Maintain excavations free of water.
- G. Keep duration of interruptions to a minimum.
- H. Carry out interruptions after regular working hours of occupants, preferably on weekends, unless *Owner's* prior written approval is obtained.
- I. Protect and maintain existing active services. Record location of services, including depth, on as-built drawings.
- J. Construct or erect barriers in accordance with Section 01 56 00 - Temporary Barriers and Enclosures as required to protect pedestrian and vehicular traffic.

1.5 CUTTING, PATCHING, AND REMEDIAL WORK - GENERAL

- A. Cutting of openings into new or existing structural members, other than those indicated, is strictly prohibited, unless authorized in writing by the *Consultant*.
- B. Items to be salvaged and delivered to *Owner* shall be carefully removed and properly stored in an area easily accessible for removal by *Owner*.
- C. The cutting and patching required for individual trades shall be the responsibility of the *Contractor*.
- D. Ensure that all cutting and patching is completed in an acceptable manner without delay and to correct found deficiencies.
- E. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- F. Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
- G. Do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

- H. Do not cut and patch construction exposed on exterior or in occupied spaces in a manner that would, in *Consultant's* opinion, reduce the building's aesthetic or visual qualities. Do no cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction which was cut and patched in a visually unsatisfactory manner.
- I. Coordinate and perform the *Work* to ensure that cutting and patching work is kept to a minimum.
- J. Perform cutting, fitting, patching, and remedial work to make the affected parts of the *Work* come together properly and complete the *Work*.
- K. Provide openings in non-structural elements of the *Work* for penetrations of mechanical and electrical work.
- L. Refer to mechanical and electrical *Specifications* for details re: removal, capping and other alterations including but not limited to conduit, wiring, fixtures, ducts, piping and other service lines.
- M. Perform cutting by methods to avoid damage to other work
- N. Provide proper surfaces to receive patching, remedial work, and finishing.
- O. Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
- P. Ensure that cutting, patching, and remedial work does not jeopardize manufacturers' warranties.
- Q. Cut rigid materials using masonry saw or core drill. Do not use pneumatic or impact tools without *Consultant's* prior approval.
- R. Refinish surfaces to match adjacent finishes. For continuous surfaces refinish to nearest intersection. For an assembly, refinish entire unit.
- S. Fit work to pipes, sleeves, ducts, conduit, and other penetrations through surfaces with suitable allowance for deflection, expansion, contraction, acoustic isolation, and firestopping, while maintaining airtightness.
- T. Maintain fire ratings of fire rated assemblies where cutting, patching, or remedial work is performed. Completely seal voids or penetrations of assembly with firestopping material to full depth or with suitably rated devices.

1.6 CUTTING IN CONCRETE CONSTRUCTION

- 1.7 Where coring, cutting or drilling of existing roof and floor slabs is required to complete the scope of work, the *Contractor* is required to verify the location of each core, cut or drill and verify the location of buried or concealed services by means of Ferro scanning or ultra-sound scanning slabs. Confirm location of findings with *Consultant* and *Owner* prior to coring, cutting or drilling. Provide a minimum of 72 hours written notice to the *Owner* prior to the scheduled core, cut or drill. Obtain the written approval of the *Owner* prior to start of any cutting, coring or drilling.
- 1.8 During the cutting, coring and drilling operations the *Contractor* shall have representatives on site including the site superintendent, mechanical, plumbing and electrical subcontractor representatives.
- 1.9 The *Contractor* is to be aware of the extreme risks associated with the use of x-ray technology for scanning of existing assemblies. The use of this type of scan on hospital property is strictly prohibited. The use of this type of scan without the consent of the *Owner* may result in the termination of the *Contract* and possible legal action by the affected parties.

1.10 CUTTING IN STEEL FRAME AND METAL DECK CONSTRUCTION

- A. Do not cut nor drill holes in webs and flanges of columns, beams, purlins, and joists without prior written approval of *Consultant*.
 - 1. When approval is obtained, comply with requirements and instructions of Architect and provide reinforcing at such locations when required.

- B. When openings are cut into metal decks having cast-in-place concrete slab over metal deck:
 - 1. No reinforcing of holes is required for circular openings or sleeves up to diameter and for rectangular openings having no side dimension greater than .
 - 2. Reinforce openings between and 300mm with 0.9mm, 20ga flat steel sheet 300mm greater in dimension than opening. Fusion weld to top surface of deck at each corner and on each side midway between corners.
 - 3. Do not cut openings greater than 300mm without written approval and direction from *Consultant*.
- C. When openings are cut into metal roof decks that have no concrete cast-in-place (except lightweight insulating cementitious roof fill) over deck obtain written approval and direction from *Consultant*.

1.11 CUTTING – FIRE SEPARATION ALTERATIONS

- A. Maintain all existing fire separations for the duration of the *Work*.
- B. Provide fire and smoke penetration sealants at alterations and repairs in accordance with Section 07 84 00.
- C. Provide continuous, solid framing, blocking or masonry around service penetrations through fire separations in accordance with the fire penetration sealant design to maintain the continuity of the fire separation.
- D. Inspect and provide *Work* necessary to ensure a continuous smoke seal where indicated to existing walls within the *Place of the Work*.

1.12 CUTTING – MECHANICAL AND ELECTRICAL ALTERATIONS

- A. Refer to mechanical and electrical documents. Provide all cutting and patching for access to execute service alterations. Conceal capped services or remove back to main unless specifically noted otherwise.
- B. Repair adjacent construction or surfaces disturbed as a result of alterations.

1.13 CUTTING TO ACCOMMODATE DEMOLITION AND REMOVALS

- A. Execute cutting neatly and carefully, no larger than necessary, employing workers skilled in the erection of the part of the *Work*, or the part of the existing building being cut.
- B. Maintain integrity and continuity of fire separations at all times. Provide smoke and fire seals at cut parts of the *Work*, equal to existing.
- C. Saw-cut floors, walls and ceilings accurately. Provide openings no larger than necessary to accommodate new work. Core drill circular holes in concrete. Accurately cut new holes for mechanical and electrical devices and fixtures and for other recessed items.

1.14 REMOVAL OF FLOORING AND PREPARATION OF SUBSTRATE

- A. Remove flooring and adhesive/setting bed materials completely, down to structural substrate unless otherwise noted.
- B. Grind high spots and scrape substrate to a smooth, level surface. Remove any ridges or trowel marks.
- C. Fill new and existing depressions, dished areas, low spots, voids, gaps, cracks, joints, holes and other substrate defects with skim coat and self-leveling topping to achieve a flat substrate t within the following tolerances. All materials used to prep the substrate must be compatible with finish floor adhesives etc.
 - 1. 3mm total maximum deviation + and – along a 3000mm straight edge applied omni-directionally over the entire floor area.
- D. Provide skim coats, primers and bonding agent slurries to neutralize residue adhesives and setting beds and to provide a suitable substrate to received scheduled flooring type.

1.15 REMOVAL OF MASONRY WALLS AND TERRAZZO FLOOR BASES

- A. Remove masonry walls and terrazzo floor bases completely back to structural substrate.
- B. Remove sufficient material to provide a depression for leveling toppings to achieve flat substrate to receive new finishes.
- C. Terrazzo floor base shall be removed completely in association with wall demolition as shown on drawings. Terrazzo floor base removal shall include the provision for and supply of concrete infill and cementitious topping as required to provide a level surface for new finish floor.
- D. Where existing masonry walls are indicated to be removed, ensure adjacent walls are braced securely and all structural and decorative elements removed to the underside of the structure above.

1.16 REMOVAL OF CONCRETE TOPPINGS AND TERRAZZO AND/OR EPOXY FLOORING

- A. Remove concrete toppings and terrazzo flooring completely back to structural substrate.
- B. Remove all loose material and provide bonding agent to adhere new concrete infill to receive new finish flooring.
- C. Remove terrazzo or epoxy flooring to a sufficient depth to provide a depression for leveling topping to be flush with surrounding floor slab. All new material to be compatible with existing substrate and with new finish floor.
- D. In locations where terrazzo or epoxy floor is indicated for removal, include provision for supply and installation of concrete infill, accessories and cementitious leveling compound to provide a level surface for new finish floor. If, at the direction of the *Consultant*, any terrazzo or epoxy flooring remains, the surface is to be rendered porous prior to the application of leveling compound, adhesives, primers or other preparation for new finish floor.

1.17 MATCHING AND PATCHING

- A. Where items are removed from existing walls, ceilings, floors or partitions to remain, repair wall, ceiling, floor or partition disturbed by removal.
- B. Where walls, ceilings, floors or partitions are removed, repair abutting walls, ceilings or floors disturbed by removal.
- C. Where existing construction is cut, removed or otherwise disturbed to permit installation of new *Work*, match and patch existing disturbed construction.
- D. Use methods and materials similar in appearance, and equal in quality to areas or surfaces being repaired.
- E. Restore *Work* which has been cut or removed; install new products to provide completed *Work* in accord with requirements of *Contract Documents*.
- F. Patch work to match existing work and adjacent surfaces.
- G. Re-finish entire surfaces as necessary to provide an even finish to match adjacent finishes.
 - 1. Continuous surfaces; to nearest intersection or break in surface such as inside or outside corner or minimum 1525mm horizontally beyond patched area and full height of wall, whichever is nearest.
 - 2. Assembly - entire refinishing.
- H. In existing areas remove and replace existing ceilings and finishes for installation of *Work* of other trades. Locations may not be identified on architectural drawings. Refer to mechanical and electrical documents for coordination of locations.
 - 1. If existing ceiling can not be satisfactorily reinstalled, replace with like materials and construction.
 - 2. Replace damaged construction with like materials.

1.18 PATCHING ADJACENT TO DEMOLITION AREAS

- A. After cutting is completed, patch and re-finish existing surfaces to remain t the nearest break in surface such as inside and outside corners or a minimum 1525mm 5FT horizontally and full height of walls from floor to ceiling.
- B. Patch parts of *Work* to match adjacent construction and finishes unless otherwise specified or indicated on drawings.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF CUTTING AND PATCHING

SECTION 01 74 00 CLEANING AND WASTE MANAGEMENT

PART 1 - GENERAL

1.1 REGULATORY REQUIREMENTS

- A. Comply with applicable regulatory requirements when disposing of waste materials.
- B. Obtain permits from authorities having jurisdiction and pay disposal fees where required for disposal of waste materials and recyclables.

1.2 GENERAL CLEANING REQUIREMENTS

- A. Provide adequate ventilation during use of volatile or noxious substances. Do not rely on building ventilation systems for this purpose.
- B. Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- C. Prevent cross-contamination during the cleaning process.
- D. In occupied spaces, vacuum cleaning of area of work to be done utilizing HEPA filter equipped vacuum.
- E. Notify the *Consultant* of the need for cleaning caused by *Owner* or *Other Contractors*.
- F. Before applying for *Substantial Performance of the Work*, the *Contractor* shall remove waste products and debris, other than that resulting from the work of the *Owner*, *Other Contractors*, or their employees, and shall leave the *Place of the Work* clean and suitable for use or occupancy by the *Owner*.

1.3 POLLUTION CONTROL

- A. Control emissions from equipment and plant to local authorities emission requirements.
- B. Prevent dust and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- C. Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Wet down dusty materials prior to moving them through the existing building or cover with wet drape to prevent dust from tracking through building spaces.

1.4 PROGRESSIVE CLEANING AND WASTE MANAGEMENT

- A. Maintain the *Work* in a tidy and safe condition, free from accumulation of waste materials and construction debris.
- B. Fires and burning of rubbish at *Place of the Work* is not permitted.
- C. Burying rubbish and waste materials at *Place of the Work* is not permitted.
- D. Provide and pay for on-site clearly marked waste containers for collection of waste materials, recyclables and debris.
- E. Remove waste materials and recyclables from work areas, separate, and deposit in designated containers at end of each *Working Day*. Collect packaging materials for recycling or reuse.
- F. Remove waste materials and recyclables from *Place of the Work* daily. When removing waste through occupied areas, cover waste container with a wet drape.
- G. Sort separate materials to be reused/recycled into specified sort areas.

- H. Store volatile waste in covered metal containers and remove from premises at end of each *Working Day*.
- I. Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.
- J. Clean interior building areas prior to start of finish work and maintain free of dust and other contaminants during finishing operations.
- K. Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly finished surfaces nor contaminate building systems.
- L. Clear snow and ice from public sidewalks as required to comply with applicable municipal regulatory requirements.

1.5 FINAL CLEANING

- A. Remove from *Place of the Work* surplus *Products*, waste materials, recyclables, *Temporary Work*, and *Construction Equipment* not required to perform any remaining work.
- B. Standards include, but are not limited to:
 - 1. Floors and baseboards are to be free of construction material, stains, visible dust and streaks.
 - 2. Walls, ceilings and doors are to be free of visible dust, gross soils, streaks and handprints.
 - 3. All horizontal surfaces are to be free of visible dust and streaks. This includes, but is not limited to, furniture, window ledges, overhead lighting, phones, picture frames, carpets, etc.
 - 4. Bathroom fixtures, including toilets, sinks, tubs and showers, are to be free of streaks, soil and stains.
 - 5. Mirrors and windows are to be free of visible dust and streaks.
 - 6. Dispensers are to be free of dust.
- C. Standards will be achieved through the following processes:
 - 1. Wet mopping of floors.
 - 2. Wet dusting of walls and horizontal surfaces.
 - 3. Use of special products for glass, chrome and plastic to leave streak free.
 - 4. Final vacuuming, using a power head and a HEPA filter equipped vacuum that will not generate dust.
 - 5. Water and general purpose disinfecting solutions must be changed when they become cloudy or cause streaking on cleaned surfaces.
- D. The Contractor will use chemical and products which are currently in use by the facility. A list of these chemicals and products will be available from the Owner and may change at any time without notice. It is the Contractor's responsibility to be aware of and use the chemicals and products which are in use at the time cleaning operations commence. Information available will include:
 - 1. Local supplier.
 - 2. Name and order number of chemical or product.
 - 3. Area of facility where chemical or product is currently in use.
 - 4. Dilution of chemical or product acceptable to facility.
 - 5. Finish and material for which chemicals or products are to be used.
 - 6. Variations from products listed will not be accepted without prior written approval from Environmental Services or the Owner's Infection Control Practitioner.
- E. Lock or otherwise restrict access to each room or area after completing final cleaning in that area.
- F. Re-clean as necessary areas that have been accessed by *Contractor's* workers prior to *Owner* occupancy.
- G. Vacuum clean and dust exposed wall, floor, and ceiling surfaces, behind grilles, louvers, heating registers and screens, ducts, fans, blowers and coils if units were operated without filters during construction.

- H. Clean mechanical, electrical, and other equipment. Replace filters for mechanical equipment if equipment is used during construction.
- I. Wax, seal, shampoo or prepare floor finishes as recommended by manufacturer and in coordination with the *Owner*.
- J. Clean interior window glass and frames.
- K. Make good any damage caused by the completion of the *Work*, outside the *Place of the Work*, including necessary cleaning.
- L. Upon completion of cleaning operations, close off area to all but authorized personnel.
- M. Upon completion of final cleaning, remove cleaning equipment, excess materials and debris from building and site.

1.6 WASTE MANAGEMENT AND DISPOSAL

- A. Dispose of waste materials and recyclables at appropriate municipal landfills and recycling facilities in accordance with applicable regulatory requirements.
- B. Do not burn or bury waste materials at *Place of the Work*.
- C. Do not dispose of volatile and other liquid waste such as mineral spirits, oil, paints and other coating materials, paint thinners, cleaners, and similar materials together with dry waste materials or on the ground, in waterways, or in storm or sanitary sewers. Collect such waste materials in appropriate covered containers, promptly remove from *Place of the Work*, and dispose of at recycling facilities or as otherwise permitted by applicable regulatory requirements.
- D. Cover or wet down dry waste materials to prevent blowing dust and debris.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF CLEANING AND WASTE MANAGEMENT

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SECTION 01 77 00 CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 READY-FOR-TAKEOVER

- A. The prerequisites to attaining *Ready-for-Takeover* of the *Work* are described in the General Conditions of the *Contract*.

1.2 INSPECTION AND REVIEW BEFORE READY-FOR-TAKEOVER

- A. *Contractor's* Inspection: Before applying for the *Consultant's* review to establish *Ready-for-Takeover* of the *Work*:
1. Ensure that the specified prerequisites to *Ready-for-Takeover* of the *Work* are completed.
 2. Conduct an inspection of the *Work* to identify defective, deficient, or incomplete work.
 3. Prepare a comprehensive and detailed list of items to be completed or corrected.
 4. Provide an anticipated schedule and costs for items to be completed or corrected.
- B. *Consultant's* Review: Upon receipt of the *Contractor's* application for review, together with the *Contractor's* list of items to be completed or corrected, the *Consultant* will review the *Work*. The *Consultant* will advise the *Contractor* whether or not the *Work* is *Ready-for-Takeover* and will provide the *Contractor* with a list of items, if any, to be added to the *Contractor's* list of items to be completed or corrected. Provide the *Consultant* with a copy of the *Contractor's* revised list.
- C. *Consultant's* Review: Upon receipt of the *Contractor's* application for review, together with the *Contractor's* list of items to be completed or corrected, the *Consultant* and the *Contractor* shall arrange a mutually satisfactory agreed date and time to jointly review the *Work*. The *Consultant* will advise the *Contractor* whether or not the *Work* is *Ready-for-Takeover*. Add additional items, if any, to the *Contractor's* list of items to be completed or corrected. Provide the *Consultant* with a copy of the revised list.
- D. Maintain the list of items to be completed or corrected and promptly correct or complete defective, deficient and incomplete work. The *Contractor's* inspection and *Consultant's* review procedures specified above shall be repeated until the *Work* is *Ready-for-Takeover* and no items remain on the *Contractor's* list of items to be completed or corrected.
- E. When the *Consultant* determines that the *Work* is *Ready-for-Takeover*, the *Consultant* will notify the *Contractor* and the *Owner* in writing to that effect.

1.3 PREREQUISITES TO FINAL PAYMENT

- A. After *Ready-for-Takeover* of the *Work* and before submitting an application for final payment in accordance with the General Conditions of Contract:
1. Correct or complete all remaining defective, deficient, and incomplete work.
 2. Remove from the *Place of the Work* all remaining surplus *Products*, *Construction Equipment*, and *Temporary Work*.
 3. .3 Perform final cleaning and waste removal necessitated by the *Contractor's* work performed after *Ready-for-Takeover*, as specified in Section 01 74 00 – Cleaning and Waste Management.

1.4 SUBSTANTIAL PERFORMANCE OF THE WORK

- A. The prerequisites to, and the procedures for, attaining substantial performance of the *Work*, or similar such milestone as provided for in the lien legislation applicable to the *Place of the Work*, shall be:
1. Independent of those for attaining *Ready-for-Takeover* of the *Work*, and
 2. In accordance with the lien legislation applicable to the *Place of the Work*.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF CLOSEOUT PROCEDURES

SECTION 01 78 00 CLOSEOUT SUBMITTALS

PART 1 - GENERAL

1.1 OPERATION AND MAINTENANCE MANUAL

- A. Prepare a comprehensive operation and maintenance manual, in the language of the *Contract*, using personnel qualified and experienced for this task.
- B. Submit an initial draft of the operation and maintenance manual for *Consultant's* review. If required by *Consultant's* review comments, revise manual contents and resubmit for *Consultant's* review. If required, repeat this process until *Consultant* accepts the draft manual in writing.
- C. Submit final version to *Consultant* in hard copy and electronic format. Provide one hard copy and two digital copies on separate storage devices.
- D. Pay costs of transportation of submissions.

1.2 OPERATION AND MAINTENANCE MANUAL FORMAT

- A. Organize data in the form of an instructional manual.
- B. Binders: vinyl, hard covered, three (3) D-rings, loose leaf, letter size, with spine and face pockets.
- C. When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- D. Cover: Identify each binder with typed or printed title "Project Record Documents", name of *Project* or facility, and subject matter of contents.
- E. Arrange content by systems, under Section numbers and sequence of Table of Contents.
- F. Provide tabbed fly leaf for each separate *Product* or system, with typed description of *Product* and major component parts of equipment.
- G. Text: Manufacturer's printed data, or typewritten data.
- H. Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- A. Provide digital copy of Operation and Maintenance Manual in PDF format, organized in same form as binders, on single USB memory stick.
- B. Provide electronic copy of Shop *Drawings* in manual as scaled CAD files in .dwg format on CD-ROM or USB flash drive.

1.3 OPERATION AND MAINTENANCE MANUAL – GENERAL CONTENT

- A. Table of contents for each volume.
- B. Introductory information including:
 - 1. Title of *Project*.
 - 2. Date of manual submission.
 - 3. Complete contact information for *Consultant*, subconsultants, other consultants, and *Contractor*, with names of responsible parties.
 - 4. Schedule of *Products* and systems indexed to content of volume.
- C. For each *Product* or system, include complete contact information for *Subcontractors*, *Suppliers* and manufacturers, including local sources for supplies and replacement parts.

- D. *Product* Data: mark each sheet to clearly identify specific products, options, and component parts, and data applicable to installation. Delete or strike out inapplicable information. Supplement with additional information as required.
- E. Typewritten text: as required to supplement *Product* data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 40 00.
- F. Reviewed *Shop Drawings*.
- G. Drawings: supplement *Product* data to illustrate relations of component parts of *Products* and systems, to show control and flow diagrams.
- H. Permits, certificates, letters of assurance and other relevant documents issued by or required by authorities having jurisdiction.
- I. Warranties.
- J. Operating and maintenance procedures, incorporating manufacturer's operating and maintenance instructions, in a logical sequence.
- K. Training materials as specified in Section 01 79 00 - Demonstration and Training.

1.4 OPERATION AND MAINTENANCE MANUAL - EQUIPMENT AND SYSTEMS CONTENT

- A. 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.
- B. Panel Board Circuit Directories: provide electrical service characteristics, controls, and communications.
- C. Include installed colour coded wiring diagrams.
- D. 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.
- E. Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Provide installed control diagrams by controls manufacturer.
- K. Provide *Contractor's* coordination drawings, with installed colour coded piping diagrams.
- L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- N. Include testing and balancing reports.
- O. Include additional content as specified in technical *Specifications* sections.

1.5 OPERATION AND MAINTENANCE MANUAL - PRODUCTS AND FINISHES CONTENT

- A. Include *Product* data, with catalogue number, options selected, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured *Products*.
- B. Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Include an outline of requirements for routine and special inspections and for regular maintenance to ensure that on-going performance of the building envelope will meet the initial building envelope criteria.
- D. Include additional content as specified in technical *Specifications* sections.

1.6 OPERATION AND MAINTENANCE MANUAL - WARRANTIES CONTENT

- A. Obtain warranties and bonds, executed in duplicate by warrantors within ten days after completion of the applicable item of work. Except for items put into use with *Owner's* permission, leave date for beginning of time of warranty blank until the date of *Substantial Performance of the Work* is determined. Co-execute when required. Retain warranties and bonds until time specified for submittal.
- B. Separate each warranty with index tab sheets keyed to Table of Contents listing.
- C. List each warrantor with complete contact information.
- D. Verify that documents are in proper form and contain full information. Ensure that warranties are for the correct duration and are in *Owner's* name.

1.7 CONTRACTOR'S AS-BUILT DRAWINGS

- A. Create one set of comprehensive as-built documents. Record information on set of black line, opaque drawings, and in the copy of Project Manual provided by *Consultant*.
- B. Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- C. Record information concurrently with construction progress. Do not conceal work until required information is recorded.
- D. *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 *Drawings*.
 - 7. References to related *Shop Drawings* and modifications.
- E. Project Manual: 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*.
- F. Other documents: maintain manufacturer's certifications, inspection certifications, field test records required by individual and specifications sections.
- G. Prior to *Substantial Performance of the Work*, submit one set of completed as-built documents for review by the *Consultant*.

- H. Following review and acceptance of as-built documents by the *Consultant*, transfer information to CAD drawings and Project Manual. Submit completed record documents for use by the *Owner*.

1.8 PROJECT RECORD DRAWINGS

- A. Transfer all information marked up on the as-built drawings during the progress of the *Work* to a master set of record drawing files provided by *Consultant*, in PDF electronic format.
- B. Mark revised drawings as "RECORD DRAWINGS".
- C. Submit completed record drawings in hard copy and electronic form to *Owner* and *Consultant*. Provide one (1) hard copy set.
- D. In addition to requirements in General Conditions, maintain at the site for *Consultant* one record copy of:
 - 1. *Drawings*.
 - 2. *Project Manual*.
 - 3. *Addenda*.
 - 4. *Supplemental Instructions*.
 - 5. *Change Orders* and other modifications to the *Contract*.
 - 6. Reviewed *Shop Drawings*, *Product* data, and samples.
 - 7. Field test records.
 - 8. Inspection certificates.
 - 9. Manufacturer's certificates.
- E. Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- F. Label record documents and files in accordance with section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- G. Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- H. Keep record documents and samples available for inspection by *Consultant*.

1.9 SPARE PARTS, MAINTENANCE MATERIALS, AND SPECIAL TOOLS

- A. Supply spare parts, maintenance materials, and special tools in quantities specified in technical *Specifications* sections.
- B. Ensure spare parts and maintenance materials are new, not damaged nor defective, and of same quality, manufacturer, and batch or production run as installed *Products*.
- C. If requested, furnish evidence as to type, source and quality of products provided.
- D. Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- E. Provide tags for special tools identifying their function and associated *Product*.
- F. Deliver to and store items at location directed by *Owner* at *Place of the Work*. Store in original packaging with manufacturer's labels intact and in a manner to prevent damage or deterioration.
- G. Remove and replace damaged *Products* at own expense and to satisfaction of the *Consultant*.
- H. Obtain receipt for delivered products and submit prior to final payment.
- I. Catalogue all items and submit to *Consultant* an inventory listing organized by *Specifications* section. Include *Consultant* reviewed inventory listing in operation and maintenance manual.

PART 2 - PRODUCTS NOT USED

PART 3 - EXECUTION NOT USED

END OF CLOSEOUT SUBMITTALS

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SECTION 02 41 99 DEMOLITION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 01 71 00 – Examination and Preparation
- B. Section 01 74 00 – Cleaning and Waste Management
- C. Section 02 61 33 – Designated Substance Report

1.2 REFERENCES

- A. Canadian Standards Association (CSA International)
 - 1. CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.

1.3 SUBMITTALS

- A. Submit *Shop Drawings* in accordance with Sections 01 33 00.
- B. Before proceeding with demolition of load bearing walls or of other walls and where required by authority having jurisdiction submit for review by *Consultant* shoring and underpinning drawings prepared by qualified professional engineer registered or licensed in the Province of Ontario, showing proposed method.

1.4 SITE CONDITIONS

- A. Review "Designated Substance Report" and take precautions to protect environment.
- B. Should material resembling spray or trowel-applied asbestos or other designated substance listed as hazardous be encountered, stop work, take preventative measures, and notify *Consultant* immediately.
 - 1. Do not proceed until written instructions have been received from *Consultant*.
- C. Notify *Consultant* before disrupting building access or services.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 PREPARATION

- A. Inspect area of work with *Consultant* and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- B. Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- C. Notify and obtain approval of utility companies before starting demolition.
- D. Disconnect, cap, plug or divert, as required, existing public utilities within the property where they interfere with the execution of the work, in conformity with the requirements of the authorities having jurisdiction. Mark the location of these and previously capped or plugged

services on the site and indicate location (horizontal and vertical) on the record drawings.
Support, shore up and maintain pipes and conduits encountered.

1. Immediately notify *Consultant* and utility company concerned in case of damage to any utility or service, designated to remain in place.
2. Immediately notify the Engineer should uncharted utility or service be encountered, and await instruction in writing regarding remedial action.

3.2 PROTECTION

- A. Prevent movement, settlement, or damage to adjacent structures, utilities, landscaping features and parts of building to remain in place. Provide bracing and shoring required.
- B. Keep noise, dust, and inconvenience to occupants to minimum.
- C. Protect building systems, services and equipment.
- D. Provide temporary dust screens, covers, railings, supports and other protection as required.
- E. Do *Work* in accordance with Section 01 35 30.

3.3 SALVAGE

- A. Refer to demolition drawings and specifications for items to be salvaged for reuse.
- B. Remove items to be reused, store as directed by *Consultant*, and re-install under appropriate section of specification.

3.4 SITE REMOVALS

- A. Remove items as indicated.

3.5 DEMOLITION

- A. Remove parts of existing building to permit new construction. Sort waste materials into appropriate piles for reuse and recycling.
- B. Trim edges of partially demolished building elements to tolerances as defined by *Consultant* to suit future use.

3.6 DISPOSAL

- A. Dispose of removed materials, to appropriate recycling facilities and reuse facilities except where specified otherwise, in accordance with authority having jurisdiction.
- B. See also Section 01 74 00.

END OF DEMOLITION

SECTION 02 61 33 DESIGNATED SUBSTANCES REPORT

PART 1 - GENERAL

1.1 REGULATORY REQUIREMENTS

- A. A Designated Substances Report for this site has been completed by the *Owner* to fulfill the requirements under Section 30 of the Ontario Occupational Health and Safety Act, Revised Statutes of Ontario, 1990, Chapter 0.1 as amended by O. Reg. 631/94. The Designated Substances are identified in the Occupational Health and Safety Act O. Reg. 213/91 as amended by O. Reg. 426/21.
- B. The disturbance of asbestos materials on construction projects is controlled by Ontario Regulation 278/05.
- C. The revised Regulation of Ontario (1990), Regulation 843 as amended by Ontario Regulation 109/04 (formerly Ontario Ministry of Labour Regulation 536/81) under the Occupational Health and Safety Act outlines the requirement to control airborne lead in industrial establishments. Exposure levels and respiratory protection in this regulation also apply to construction projects at a workplace where workers are likely to be exposed to lead.
- D. The revised Regulation of Ontario (1990), Regulation 845 as amended by Ontario Regulation 606/05 (formerly Ontario Ministry of Labour Regulation Respecting Silica 769/83) which amends the Occupational Health and Safety Act, outlines the requirement to control airborne silica in industrial establishments. Exposure levels and respiratory protection in this regulation also apply to construction projects at a workplace where workers are likely to be exposed to lead.
- E. All *Contractors* requesting bids from *Subcontractors* shall provide the required information to *Subcontractors*.

1.2 VALIDITY DATE

- A. A designated substances survey for the *Place of the Work* has been conducted. Information provided is based on previous site visits to the building and sample information obtained from *Owner's* reports. Since that time, designated substances may have been removed from or added to the project area.
- B. Prior to beginning work confirm with *Owner* that additional designated substances have not been brought to the *Place of the Work*.
- C. Due to the nature of building demolition, some inherent limitations exist as to the possible thoroughness of the designated substance survey. The survey did not include the demolition of floors, floor finishes, plaster ceilings or walls or other areas to examine concealed conditions. In addition, the survey does not refer to substances that may be present in the day-to-day usage of specialized equipment.
- D. There is a possibility that materials may exist which could not reasonably be identified within the scope of this assessment, or which were not apparent during the site visit.

1.3 OCCUPATIONAL HEALTH AND SAFETY ACT

- A. The following is an amendment to Bill 208 "An act to amend the Occupational Health and Safety Act, The Workers' Compensation Act" subsequently identified as amendment 18a. The following outlines the responsibilities of each party of the *Contract* as it relates to amendment 18a.

- B. Duty of *Owner*: Before beginning a project, the *Owner* shall determine whether any designated substances are present at the *Place of the Work* and shall prepare a list of all designated substances that are present at the site.
 - 1. Tenders: If any work on a *Project* is tendered, the person issuing the tenders shall include, as part of the tendering information, a copy of the list referred to in subsection (1).
 - 2. Idem: An *Owner* shall ensure that a prospective constructor of a project on the *Owner's* property has received a copy of the list referred to in subsection (1) before entering into a binding contract with the constructor.
- C. Duty of Constructors: The constructor for a project shall ensure that each prospective contractor and subcontractor for the project has received a copy of the list referred to in subsection (1) before the prospective contractor or subcontractor enters into a binding contract for the supply of work on the project.
 - 1. Liability: An *Owner* who fails to comply with this section is liable to the constructor and every contractor and subcontractor who suffers loss or damages as the result of the subsequent discovery on the *Project* of a designated substance that the *Owner* ought reasonably to have known of but that was not on the list prepared under subsection (1).
 - 2. Idem: A constructor who fails to comply with this section is liable to every contractor and subcontractor who suffers any loss or damages as the result of the subsequent discovery on the project of a designated substance that was on the list prepared under subsection (1).
 - 3. WHMIS Inventory is available from the *Owner* through the office of the *Consultant*

PART 2 - DESIGNATED SUBSTANCES

2.1 REPORTS

- A. The report is entitled "*Hazardous Building Materials Assessment*" prepared for *Kingston Health Sciences Centre* as completed by *Pinchin Ltd.* and is included within this Project Manual and available for viewing at the office of the *Owner* at the *Kingston Health Sciences Centre Planning Office* located at *24 Barrie Street, Kingston, Ontario.*
- B. It is the *Contractor's* responsibility to be aware of the contents of the report.

PART 3 - EXECUTION NOT USED

END OF DESIGNATED SUBSTANCES REPORT

SECTION 05 45 23 EQUIPMENT SUPPORT SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Work Included: Provide medical equipment support system including but not limited to following:
 - 1. Continuous slot, bolted metal framing channel system designed to support medical equipment.
 - 2. Structural attachments.
 - 3. Associated fittings and hardware.

1.2 DEFINITIONS

- A. Site Dimensions: Actual dimensions measured on site and used by fabricator to construct required assemblies.
- B. Established Dimensions: Dimensions derived from drawings or that can be reasonably determined from adjacent construction where actual dimensions required by components fabricated in this section are not available; dimensions to have suitable tolerances so that assemblies can be adjusted on site to fit actual site dimensions.

1.3 REFERENCES

- A. Reference Standards:
 - 1. American Society for Testing of Materials (ASTM International):
 - a. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - b. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - c. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
 - 2. Canadian Standards Association (CSA Group):
 - a. CAN/CSA S16 - Limit States Design of Steel Structures.
 - b. CSA S832 - Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings.
 - c. CSA Z8000 - Canadian health care facilities.

1.4 SUBMITTALS

- A. Action Submittals:
 - 1. Product Data:
 - a. Submit manufacturer's literature and data sheets for each type of material provided under this Section for Project.
 - b. Ensure data sheets provide required information including detailed instructions for installing as well as maintaining, preserving, and keeping materials in clean and safe conditions.
 - c. Provide adequate warning of maintenance practices or cleaning agents detrimental to specified materials.
 - 2. Shop Drawings: Provide shop drawings including the following:
 - a. Indicate complete system including plans, sections, and details.
 - b. Indicate design loadings including equipment vertical and horizontal loadings.
 - c. Locate all center point/Iso-centers of equipment off of finished wall lines.

- d. Indicate manufactured parts by catalog numbers, fabricated parts, fasteners, and hardware.
 - e. Indicate layout of framing and supports, anchorages, size, and spacing of fastenings, reinforcing channels, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
 - f. Indicated thicknesses and steel grade of materials and zinc coating designations.
 - g. Do not commence fabrication prior to Consultant's review of Shop Drawings.
- B. Contractor Design Engineer's Criteria:
1. Provide Contractor Contracted Design Engineer's design in accordance with Section 01 35 73.
 2. Retain Professional Engineer, registered in province of Work, to design details and connections of steel equipment supports, and ascertain that following will comply with requirements of Building Code and Contract Documents:
 - a. Selection and design of connections not detailed on Contract Documents.
 - b. Fabrication of components.
 - c. Erection of work of this section.

1.5 QUALITY ASSURANCE

- A. Pre-Construction Meetings: Schedule and conduct pre installation conference at project site in accordance with Section 01 31 19 with Contractor, Subcontractor responsible for fabrication and erection, Subcontractor responsible for finish painting, and Consultant to verify project requirements, fabricator's installation instructions, and manufacturer's warranty requirements.
- B. Coordination:
1. Anchorages: Provide setting drawings, templates, and directions for installing anchorages including sleeves, concrete inserts, anchor bolts, and items with integral anchors that are embedded in concrete or masonry and deliver to site in time for installation.
 2. Fabrication schedule with construction progress to avoid delaying work.
 3. Coordinate with Contractor so that site dimensions correspond to established dimensions.
 4. Engage fabricator who utilizes registered professional engineer to prepare calculations, shop drawings, and other structural data for steel joists and connections not shown on drawings that comply with requirements of this Section.
 5. Retain registered professional engineer to ascertain and report fabrication and erection of work meets specific design criteria for materials referenced by Related Requirements.
- C. Regulatory Requirements: Provide design, materials, and fabrication to CSA S16[, CSA S136] and Canadian Welding Bureau certification requirements including the following:
1. Fabricator certified by CWB to CSA W47.1, Division 1 or 2.1.
 2. Perform welding review to CSA W178.1 and CSA W178.2.
 3. Perform resistance welding to CSA W55.3.
 4. Perform fusion welding to CSA W59.
 5. Fabricator will only be permitted to subcontract or sublet work of fabrication or installation to another CWB certified company.
 6. Installer must be CWB certified where they are directly subcontracted by [Contractor] [Subcontractor] to same requirements as fabricator.
- D. Qualifications: Provide proof of qualifications:
1. Manufacturers: Provide Products for Work of this Section by manufacturer with minimum 10 years' experience in manufacture of such materials
 2. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in application of Products, systems and assemblies specified and with approval and training of Product manufacturers.
- E. Single Source Responsibility: Ensure primary materials provided in this Section are obtained from 1 source by single manufacturer and secondary materials are obtained from sources recommended by primary materials manufacturers.

- F. Welding:
 - 1. Provide welding to CSA W59-M performed by fabricator and mechanics fully approved by Canadian Welding Bureau as specified herein.
 - 2. Certificates: Ensure inspection and testing company is certified by Canadian Welding Bureau, in Category 1, Buildings, under CSA W178.1.
 - 3. Ensure welding inspectors and supervisors are certified by Canadian Welding Bureau to CSA W178.2, to minimum level 2 certification.
- G. Payment for specified works performed by inspection and testing company will be made from cash allowance specified in Division 1. Provide access for inspection to all places where work is manufactured, stockpiled, or installed.
- H. Preconstruction Testing: Allow appointed inspection and testing company to carry out shop inspection to verify:
 - 1. Structural materials and paints conform to Specifications.
 - 2. Fabrication erection and welding conform to Specifications and dimensioned Shop Drawings.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 01 73 00 and as follows:
 - 1. Comply with material manufacturer's ordering instructions and lead time requirements to avoid delays.
 - 2. Provide materials stamped and identifiable by manufacturer and part number (where appropriate). Do not use or accept materials that appear damaged, distressed, unidentifiable or rusted.
 - 3. Handle and store medical support system framing to ensure no damage or corrosion is caused to stored or erected works, or to adjacent construction.
 - 4. Protect architecturally exposed framing during fabrication, handling, storage, and erection to prevent marring of surfaces exposed to view, by marking, bending, denting, or coarse grinding.
 - 5. Protect materials from corrosion with factory applied finish.
 - 6. Provide paintable PVC closure strips at rails exposed in finished construction.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Product Manufacturers:
 - 1. Hilti.
 - 2. Unistrut Canada.
- B. Substitutions: [Allowed as follows:] [Not Allowed.]
 - 1. Procedures During Bid Period: Refer to Section 00 26 00.
 - 2. Procedures During Construction: Refer to Section 01 25 13.

2.2 DESIGN AND PERFORMANCE REQUIREMENTS

- A. Provide factory-formed, field-assembled, modular equipment support system designed for attachment to either steel or concrete building structure, to serve as support for variety of building components.
- B. Architectural Drawings and details are diagrammatic and are only intended to show design concept, aesthetics, interfacing requirements, configuration, components, and arrangements. They are not intended to identify or solve completely problems of thermal and structural movements, assembly framing, engineering design, fixings, and anchorages.
- C. Ceiling Direct Mounting Channel Systems: Single channels consisting of 41 mm 1-5/8-inch cold- formed channel rails flush with finished ceiling and extending wall to wall unless otherwise noted on Drawings. Design rails to be parallel to path of travel of equipment.

- D. Design all systems to CAN/CSA S16 and CAN/CSA S136.
- E. Seismic Performance: Design work of this Section to withstand seismic motions determined in accordance with requirements of Ontario Building Code and CAN/CSA S832.
 - 1. All building components to be assigned seismic risk index, R, based on methodology outlined in CSA S832 and any components with risk rating of Moderate or greater to be seismically restrained.
- F. Design medical support system to support suspended equipment including but not limited to following:
 - 1. Ceiling-mounted clinical equipment in Clinical Equipment List.
- G. Design loadings and rotational requirements: In accordance with each equipment manufacturer's specification.
- H. Deflection of Framing Members: At maximum design loadings, ensure deflection in either plane does not exceed 1.5 mm 0.06-inch or L/720 of span, whichever is less.
- I. Design work to withstand within acceptable deflection limitations, variations from plumb in vertical and horizontal lines, its own weight, forces applied by movements of building structure and attached adjacent components and maximum design loads. Coordinate loads with actual equipment selection prior to fabrication and construction.
- J. Design system with rails parallel to the path of travel of equipment. Locate rail centers as required by equipment manufacturer and allow continuous attachment along any point on rail.
- K. Do not permit medical support system framing and connections to encroach on clearance lines required for installation of work of other Sections. Coordinate layout to accommodate mechanical and electrical services, framing members and suspended equipment locations.
- L. Design all systems with adequate bracing in all four directions for lateral loading.

2.3 MATERIALS

- A. Structural Shapes, Plates, etc.: New material conforming to CSA G40.20 and CSA G40.21, Grade 300W.
- B. Steel Tubing: To ASTM A501/A501.

2.4 COMPONENTS

- A. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Width of Channels: Minimum 41 mm 1 5/8-inch.
 - 2. Depth of Channels: As required to meet load capacities for supported equipment.
 - 3. Continuous slot width: 22 mm 7/8-inch.
 - 4. Material: Galvanized steel, ASTM A653/A653M, structural steel, Grade 33 (Grade 230), with G90 (Z275) coating; minimum 2.78 mm (12 ga) 0.109-inch nominal thickness.
 - 5. Finish: Hot dip galvanized.
- B. Fittings: Manufactured from steel meeting requirements of ASTM A575, ASTM A576, ASTM A36/A36M or ASTM A635/A635 as applicable to meet design requirements. Ensure all fittings are galvanized to ASTM A123/A123M. Minimum fitting thickness: 6 mm 1/4-inch.
- C. Channel Nuts: fabricated from steel conforming to ASTM A1011/A1011, SS, Grade 33.
- D. Bolts and Fasteners: minimum SAE Grade 5, electro-galvanized finish. Threaded Rod Grade B7.

2.5 FABRICATION

- A. Fabricate work of this Section with members square, straight, plumb, and true; joints accurately and tightly fitted; intersecting members in true, flush planes; fasteners concealed.
- B. Fabricate, fit, and assemble work in shop in greatest extent possible. Where shop fabrication is not possible, make trial assembly in shop.

- C. Provide hangers, rods, bars, bolts, anchors, brackets, rivets, bearing plates and bracing, fitting, drilling, stopping, soldering, as required for complete assembly.
- D. Insulate dissimilar metals to prevent galvanic corrosion.
- E. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- F. Support Structure: Locate support members at ceiling as indicated on Contract Documents. Ceiling rails to consist of adequate structural members mounted back-to-back on continuous-slotted channel. Ensure spacing allows installation of standard modular ceiling fixtures and equipment. Design support structure to ensure medical equipment can be attached at any point of support system.
- G. Ceiling Anchorage: Whenever possible, provide attachment to structure above by means of indirect attachment to building's structural framing with any necessary additional support required.
- H. Vertical Supports: Rails and ceiling anchorage to be connected by series of vertical channel drops; sized to suit loading conditions. Vertical supports to Provide for both basic and micro vertical adjustment.
- I. Fabrication Tolerances: Fabricate medical support system within tolerance of +/- 1.0 mm 3/64-inch, and with abutting ends of members at same level.

2.6 FINISHES

- A. Finish cold-formed channel and/or fitting members in accordance with one of the following standards:
 - 1. Electro-Galvanized: Electrolytically zinc coated conforming to ASTM B633 Type III SC 1.
 - 2. Hot dip galvanized: Zinc coated by hot-dipped process prior to roll forming. Minimum G90 coating conforming to ASTM A653/A653.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions: Verify actual site dimensions and location of adjacent materials prior to commencing work. Notify Consultant in writing of any conditions which would be detrimental to installation. Commencement of work implies acceptance of previously completed work.

3.2 PREPARATION

- A. Where new work connects to existing construction, determine site conditions and dimensions accurately in field. Report any necessary adjustment.
- B. As far as practical, install all supports to work around structural framing, mechanical ductwork, electrical lighting fixtures, and plumbing or other obstructions. Ensure requirements are fully coordinated prior to installation.

3.3 INSTALLATION

- A. Install system in accordance with manufacturer's instructions, MFMA-103 and in accordance with equipment manufacturer's recommendations to allow continuous attachment along any point on rail.
- B. Erect work of this Section plumb, square, true and level. Securely anchor work of this Section and rivet, weld, or bolt to structural framing of building. Where secured to concrete, provide bolts for setting in concrete. Provide expansion bolt supports to masonry.

- C. Install wall moulding on Ceiling Channel Grids and Ceiling Direct Mounting Channel Systems in rooms to receive lay-in ceiling tile where applicable.
- D. Shear off TEK screws on inside of ceiling channel for equipment mounting block installation.
- E. Provide snap-in closure strips, color to match ceiling grid, into exposed rails in finished construction after equipment has been installed, unless otherwise indicated.
- F. Provide necessary fitting, setting, and cutting required in connection with fitting of work of this Section to other parts of Work.

3.4 CLEANING

- A. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in field to shop; make required alterations and refinish entire unit or provide new units.
- B. Protect finishes of from damage during construction period. Remove temporary protective coverings at time of Substantial Performance of Work.

END OF SECTION

SECTION 06 10 00 ROUGH CARPENTRY

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 06 40 00 – Architectural Casework
- B. Section 09 22 16 – Non-Structural Metal Framing

1.2 REFERENCES

- A. American Society for Testing and Materials International (ASTM)
 - 1. ASTM A 123/A 123M-09, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - 2. ASTM A 653/A 653M-10, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. Canada Green Building Council (CaGBC)
 - 1. LEED Canada-NC Version 3.0-2009, LEED (Leadership in Energy and Environmental Design): Green Building Rating System Reference Package For New Construction and Major Renovations.
- C. Canadian Standards Association (CSA International)
 - 1. CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
 - 2. CSA O121-08, Douglas Fir Plywood.
 - 3. CSA O141-05 (R2009), Softwood Lumber.
 - 4. CSA O151-09, Canadian Softwood Plywood.
 - 5. CSA-O325-07, Construction Sheathing.
- D. Forest Stewardship Council (FSC)
 - 1. FSC-STD-01-001-V4-0, FSC Principle and Criteria for Forest Stewardship.
 - 2. FSC-STD-20-002-V2-1, Structure and Content of Forest Stewardship Standards V2-1.
 - 3. FSC Accredited Certified Bodies.
- E. Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - 1. Material Safety Data Sheets (MSDS).
- F. National Lumber Grades Authority (NLGA)
 - 1. Standard Grading Rules for Canadian Lumber, latest edition.

1.3 QUALITY ASSURANCE

- A. Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- B. Plywood identification: by grade mark in accordance with applicable CSA standards.
- C. Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

PART 2 - PRODUCTS

2.1 LUMBER MATERIAL

- A. Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:

1. CAN/CSA-O141.
 2. NLGA Standard Grading Rules for Canadian Lumber.
- B. Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
1. S2S is acceptable for concealed blocking only.
 2. Board sizes: "Standard" or better grade.
 3. Dimension sizes: "Standard" light framing or better grade.
 4. Post and timbers sizes: "Standard" or better grade.

2.2 PANEL MATERIALS

- A. Douglas fir plywood: to CSA O121, standard construction.
- B. Canadian softwood plywood (CSP): to CSA O151, standard construction.
- C. Poplar Plywood: to CSA O153, standard construction, urea-formaldehyde free.
- D. Plywood, OSB and wood based composite panels: to CAN/CSA-O325.

2.3 ACCESSORIES

- A. Nails, spikes and staples: to CSA B111.
- B. Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.
- C. Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fiber plugs, and as recommended for purpose by manufacturer.
- D. Explosive actuated fastening devices are not permitted unless previously approved by the Owner in writing.

2.4 FINISHES

- A. Galvanizing: to ASTM A 653/A 653M, use galvanized fasteners for exterior work, interior highly humid areas and where fastening treated lumber.

2.5 WOOD PRESERVATIVE

- A. Surface-applied wood preservative: clear, copper naphthenate or 5% pentachlorophenol solution, water repellent preservative.
- B. Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Treat surfaces of material with wood preservative, before installation.
- B. Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.
- C. Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- D. Treat material as indicated and as follows:
1. Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.
 2. Wood furring for blocking on outside surface of exterior precast, masonry and concrete walls.
 3. Wood sleepers supporting wood subflooring over concrete slabs in contact with ground or fill.

3.2 INSTALLATION

- A. Comply with requirements of NBC, supplemented by the following paragraphs.
- B. Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding and other work as required.
- C. Align and plumb faces of furring and blocking to tolerance of 1:600.
- D. Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- E. Install wood cants, fascia backing, nailers, curbs and other wood supports as required and secure using galvanized steel fasteners.
- F. Install wood backing, dressed, tapered and recessed slightly below top surface of roof insulation for roof hopper.
- G. Install sleepers as indicated.
- H. Use caution when working with particle board. Use dust collectors and high quality respirator masks.

3.3 ERECTION

- A. Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.
- B. Countersink bolts where necessary to provide clearance for other work.

3.4 SCHEDULES

- A. Provide electrical equipment backboards for mounting electrical equipment as indicated. Use 19 mm thick plywood on 19 x 38 mm furring around spacing, perimeter and at maximum 300 mm intermediate.

END OF ROUGH CARPENTRY

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SECTION 06 40 00 ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Wood Casework
 - 2. Solid Surface countertops
 - 3. Solid Surface window sills
 - 4. Solid Surface Panels
 - 5. Hardware typically furnished by the casework manufacturer
 - 6. Shelving
 - 7. Factory finishing
- B. Excluding:
 - 1. Metal support brackets and fittings that are part of the building structure
 - 2. Plumbing, electrical fixtures, and telephone equipment.

1.2 RELATED SECTIONS

- A. Section 06 10 00 – Rough Carpentry

1.3 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. ANSI A208.2-2009, Medium Density Fiberboard (MDF) for Interior Applications.
- B. American Society for Testing and Materials International (ASTM)
 - 1. ASTM E 1333-10, Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
 - 2. ASTM D 2832-92(R2005), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
 - 3. ASTM D 5116-10, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
- C. Architectural Woodwork Manufacturers Association of Canada (AWMAC) and Architectural Woodwork Institute (AWI)
 - 1. Architectural Woodwork Quality Standards Illustrated, current edition.
- D. Canadian General Standards Board (CGSB)
 - 1. CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- E. Canadian Standards Association (CSA International)
 - 1. CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.
 - 2. CSA O121-08, Douglas Fir Plywood.
 - 3. CSA O141-05 (R2009), Softwood Lumber.
 - 4. CSA O151-09, Canadian Softwood Plywood.
 - 5. CSA-O325-07, Construction Sheathing.
 - 6. CSA O112 Series-M1977 (R2006), Standards for Wood Adhesives.
- F. National Electrical Manufacturers Association (NEMA)
 - 1. ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates.
- G. National Hardwood Lumber Association (NHLA)
 - 1. Rules for the Measurement and Inspection of Hardwood and Cypress, latest edition.

- H. National Lumber Grades Authority (NLGA)
 - 1. Standard Grading Rules for Canadian Lumber, latest edition.

1.4 SUBMITTALS

- A. Provide Submittal submissions: in accordance with Section 01 33 00.
- B. Shop Drawings:
 - 1. Indicate details of construction, profiles, jointing, fastening and other related details.
 - a. Scales: profiles 1:50, details 1:10.
 - 2. Indicate plans and elevations, materials, surface grain directions, profiles, assembly methods, joint details, fastening methods, accessories, hardware, compliance with specified fire retardant treatment, preservative treatments, and schedule of finishes.
 - 3. Indicate locations of service outlets in casework, typical and special installation conditions and connections, attachments, anchorage and location of exposed fastenings.
- C. Samples:
 - 1. When appropriate, provide two samples of veneer on substrate 300 mm x 300 mm compete with hardwood edging to match illustrating expected range of component finish colour and/or grain
 - 2. Provide duplicate colour samples of *solid surface* for colour selection. Sample shall include example of finished edging and typical joint.
 - 3. Provide duplicate colour samples of *engineered resin* for colour selection. Sample shall include example of finished edging and typical joint.
 - 4. Provide duplicate samples of laminated plastic joints, edging, cutouts and post-formed profiles.
 - 5. Provide samples of each hardware item that will be visible at exposed surfaces when the job is complete
 - 6. The sample shall bear identification of the project, architect or designer, general contractor, woodwork manufacturer, items to which the finish applies and the system utilized to attain the finish.
- D. Mock-Ups:
 - 1. Shop-prepare one typical base cabinet unit, complete with all hardware and applied finishes and install on site at designated location for Consultant's review.
 - 2. If approved by the Consultant, the accepted unit will establish the base minimum for acceptable work.
 - 3. If rejected, remove mock-up unit and replace with unit acceptable to Consultant.

1.5 QUALITY ASSURANCE

- A. Perform work in accordance with **PREMIUM** Grade quality.
- B. Work in this section shall comply with the specified Grade(s) of Work and Section(s) of the current edition of the Architectural Woodwork Standards.
- C. Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- D. Plywood, particleboard, OSB and wood based composite panels in accordance with CSA and ANSI standards.
- E. Qualifications:
 - 1. Woodwork manufacturer with no less than 5 years of production experience similar to a specific project, whose qualifications indicate the ability to comply with the requirements of this Section.
 - 2. The woodwork manufacturer must have at least one project in the past 5 years where the value of the woodwork was within 20 percent of the cost of woodwork for this Project.
- F. Single Source Responsibility: A single manufacturer shall provide and install the work of described in this Section.

1.6 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00.
- B. Deliver materials only when the project is ready for installation and the general contractor has provided a clean storage area.
 - 1. Delivery of architectural millwork shall be made only when the area of operation is enclosed, all plaster and concrete work is dry and the area broom clean
 - 2. Maintain indoor temperature and humidity within the range recommended by the Architectural Woodwork Standards for the location of the project.

1.7 SCHEDULING

- A. Coordinate fabrication, delivery, and installation with the general contractor and other applicable trades.

1.8 GUARANTEE

- A. The millwork fabricator shall guarantee cabinetwork against warpage, opening of joints, shrinkage, and similar defects for a period of two (2) years from the Date of Substantial Completion.

1.9 EXTENDED WARRENTY

- A. The millwork fabricator shall supply from the manufacturers of the plastic laminate and the melamine panels standard written warranties against delamination or surface degradation under normal usage for a period of two (2) years from the Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. **Lumber** shall be in accordance with the Architectural Woodwork Standards Grade specified for the product being fabricated. Moisture Content shall be 6% to 12% for boards up to 2" (50.8 mm) inch nominal thickness, and shall not exceed 19% for thicker pieces.
 - 1. *Trim, edging and other solid members* exposed to view, as noted on the drawings:
 - 2. Species: *Clear Maple*
- B. **Softwood Lumber** for Concealed Work (blocking and furring): AWMAC/AWI QSI - Section 100 Grade 3, of quality suitable for opaque finish;
 - 1. Cabinet Frame and Internal Construction(concealed):
 - a. Species: *Eastern or Northern Pine*.
 - b. Species *Yellow poplar, Yellow Birch, Basswood or equivalent "whitewood"*.
- C. **Veneers:** shall be in accordance with the Architectural Woodwork Standards requirements for their use and the Grades
- D. **Cores:** shall be particleboard meeting the requirements of Architectural Woodwork Standards.
- E. **Mat-Formed Wood Particleboard:** UF-free, to ANSI-A208.1, Grade M-2, minimum density 641 kg/m³.
- F. **Hardboard:** UF-free, to ANSI-A135.4, Class 1 (tempered), thickness as indicated.
- G. **Medium Density Fiberboard (MDF):** UF-free, to ANSI-A208.2, Grade 130, density 769 kg/m³, thickness as indicated.
- H. **Plastic Laminate:** shall meet the requirements of the Architectural Woodwork Standards for its intended use.
 - 1. Plastic Laminate shall be from a single manufacturer.

2. Acceptable manufacturers:
 - a. *Wilsonart International*
 - b. *Formica Corporation*
 - c. *Nevamar Company*

I. Solid Surface Panels and Solid Surface Countertop:

1. Solid surface panels and countertops shall be from a single manufacturer.

J. Edgeband:

1. The same species and cut as the exposed surfaces. Refer to the drawings for thickness.

2.2 ADHESIVES

- A. Adhesives used shall be *type I*
- B. Contact Adhesive: to CAN/CGSB-71.19 and CAN/CGSB-71.20.
- C. Hot Melt Adhesive: of approved manufacturer.
- D. Resorcinol Adhesive: to CSA-O112.6 or O112.7.
- E. Sealer: water-resistant sealer or glue.

2.3 ACCESSORIES

- A. Draw Bolts: Industry standard, cadmium plated, self-tightening type for use in panel and countertop jointing.
- B. Nails and staples: to CSA-B111, plain finish.
- C. Wood screws: to CSA-B35.4, cadmium plated.
- D. Sealant: to Section 07 92 00

2.4 HARDWARE

- A. All cabinet hardware shall meet or exceed the requirements of CAN/CGSB-69.25-M90.
- B. **Hinges:** shall be 110 degree opening, concealed type, self dampening, incorporating a self closing feature. Mounting to provide three-way adjustment in door alignment, with appropriate mounting plates equivalent to;
 1. *Blum 110degree 71B3790 with Mounting plate 174H7100I*
 2. Consultant approved equivalent
- C. **Pulls:** Stainless steel pulls by *Richelieu* as specified by Consultant.
 1. Product number: *3487*
 2. Length:
 - a. *867mm c.c., 947mm* total length
 - b. *410mm c.c., 490mm* total length
 - c. *257mm c.c., 337mm* total length
 3. Finish Colour: *170*
- D. **Door and Drawer Bumpers:** self-adhesive pads for doors and drawers, positioned to contact the cabinet frame when door or drawer is closed;
 1. Acceptable product: equivalent to *Richelieu Martin #MP5312-11*.
- E. **Shelf Supports:** as detailed;
 1. Pilaster Standards and Supports: 20.6mm wide x 4.76mm deep x full height of cabinet, 1.06mm, zinc-coated steel; equivalent to *#255* recessed, shelf standards by *Knape & Vogt* with *#256R* shelf supports.
 - a. Colour: *White*
- F. **Locks:**

1. For Cabinet Doors: *BP140301140* as distributed by *Richelieu*; keyed as directed by Consultant.
 - a. Finish: *Chrome*
 2. Keying
 - a. Cabinet locks to be keyed to Owners existing system in accordance with CAN/CGSB-69.27-93.
 - b. Provide keys in duplicate for every lock in this Contract.
 - c. Stamp keying code numbers on keys and cylinders.
 3. Locks shall be installed on cabinet doors to MW125.7, MW125.8, MW125-9A and MW125-9B.
- G. **Drawer Slides:** Steel ball bearing, bottom mount full extension drawer slides for box application; with integrated mechanism preventing drawer slam.
1. Zinc finish
 2. minimum 38kg capacity.
 3. Length to suit drawer.
 4. Acceptable product:
 - a. *3132EC Accuride Eclipse* as provided by *Richelieu*
- H. **Grommet:**
1. Size: 60mm diameter
 2. Material: Stainless Steel
 3. Acceptable Product: *D032030* as provided by, *Richelieu*
 4. *Provide (3) grommet at each workstation. Final location by Consultant*
- I. **Keyboard Tray:**
1. Standard of Acceptance: Fellows *8017801* Designer Suites Compact Keyboard Tray.
 2. Colour: Black.
- J. **Standoffs:**
1. 25mm diameter barrel, height varies;
 2. 25mm diameter Cap with threaded rod to suit application;
 3. Pressure fit washers;
 4. Standoff system to suit Chroma, Engineered Resin;
 5. Allow for (6) standoffs per individual letter. Final location to be confirmed;
 6. Acceptable Manufacturer:
 - a. 3form, INC.

2.5 FABRICATION

A. Wood Casework Construction:

1. Casework shall meet the requirements of the Architectural Woodwork Standards *Premium Grade*
2. Casework shall be Architectural Woodwork Standards CONSTRUCTION TYPE *A*, *frameless* and cabinet and door INTERFACE STYLE *1*, *overlay*.
3. Exposed Surfaces shall be *low pressure decorative laminate*
4. Exposed interior surfaces shall be *High Pressure laminate*.
5. Semi-exposed surfaces shall be *low pressure decorative laminate*.
6. Doors, drawer fronts, and false fronts shall be *flush overlay*.
 - a. Edgeband at doors, drawer fronts, and false fronts shall be *clear maple veneer*

B. Finish:

1. To be from a single manufacturer.
 - a. Exposed Surfaces:
 - 1) Base Colour: *Natural Maple as manufactured by Formica*

- b. Exposed Interior Surfaces:
 - 1) Base Colour/Finish: White Melamine
- C. **Drawers:**
 - 1. Drawers shall meet the requirements of the AWS for the Grade or Grades specified.
- D. **Solid Surface Panel (SSP), Solid Surface Countertops and Solid Surface Window Sills:**
 - 1. Solid surface Fabrications
 - a. Acceptable Manufacture:
 - 1) *Hanex* as manufactured by *Hanwha Surfaces*.
 - 2) Thickness: *13mm* for counters, backsplashes and wall panels
 - 3) Colour: *To be Selected by Consultant from full colour range of Brionne and Bellissimo Collections*
 - 4) Back splashes shall be *butt joint*. Refer to drawings for heights.
 - 5) Exposed edges shall be *polished*. Refer to drawings for further details.
- E. **Shelving:** AWS Custom Grade, as amended by the following;
 - 1. Construction: HPDL - to match Exposed panel products.
 - 2. Core: veneer core, *particleboard 19 mm* thickness for spans up to 700, *25 mm* thickness for longer spans.
 - 3. Panel Edge Band: *6mm Clear Maple*.
 - 4. Provide adjustable shelves in all cabinets, set shelf standards flush with surface of gables unless shown or called for otherwise. Set shelf brackets within cabinets flush with underside of shelf.
 - 5. Provide solid hardwood dropped front edges as shown.
- F. **Hardware:** Provide the following special hardware requirements:
 - 1. Cupboard and Cabinet Doors Hinges:
 - a. Match product quality and manufacturer specified and provide hinge product(s) to suit cupboard and cabinet door thicknesses where they change to suit door heights and dimensions.
 - b. For doors over 900 mm to 1600 mm high provide three hinges.
 - c. For doors over 1600 mm to 2000 mm high provide four hinges.
 - d. For doors over 2000 mm to 2400 mm high provide five hinges.
- G. **Factory Finishing:**
 - 1. All products provided in this Section shall be factory finished using Architectural Woodwork Standards finish system *12*.
 - 2. Finish shall be AWS *Premium* Grade.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify the adequacy and proper location of any required backing or support framing.
- B. Verify that mechanical, electrical, plumbing, and other building components affecting work in this Section are in place and ready.

3.2 INSTALLATION

- A. Install all work in conformance with the Architectural Woodwork Standards, latest edition
 - 1. Installation shall conform to the AWS Grade of the items being installed.

- B. All work shall be secured in place, square, plumb, and level.
- C. All work abutting other building components shall be properly scribed.
- D. Mechanical fasteners used at exposed and semi-exposed surfaces, excluding installation attachment screws and those securing cabinets end to end, shall be countersunk.
- E. Equipment cutouts shown on plans shall be cut by the installer

3.3 FASTENING

- A. Provide all fastenings, anchors, and accessories required for installation of this work.
- B. Keep exposed fastenings to a minimum; evenly spaced, and uniformly arranged.
- C. Supply adequate instructions and/or templates and if necessary supervise installation where fastening or accessories are required to be built into work of other trades.
- D. Adhesives as per manufactures recommendation.

3.4 HARDWARE INSTALLATION

- A. Neatly mortise and fit finishing hardware. Cut mortises straight and sharp without ragged edges and sized accurately to accommodate hardware. Where mortising and application has not been done in a first class manner, such work must be replaced.
- B. Schedule
 - 1. Hinges: minimum two (2) per door panel, three (3) where doors exceed 1200mm in height.
 - 2. Door and Drawer Bumpers: minimum two (2) per panel.
 - 3. Cabinet Locks: As shown on the drawings. Where locked panel is one of a pair, install interior top and bottom surface bolts to opposite panel.

3.5 ADJUSTING & TOUCHING UP

- A. Before completion of the installation, the installer shall adjust all moving and operating parts to function smoothly and correctly.
- B. All nicks, chips, and scratches in the finish shall be filled and retouched. Damaged items that cannot be repaired shall be replaced.

3.6 CLEANING

- A. Upon completion of installation, the installer shall clean all installed items of pencil and ink marks and broom clean the area of operation, depositing debris in containers provided by the general contractor
- B. Clean millwork and cabinet work inside cupboards and drawers and all outside surfaces.
- C. Remove excess glue from surfaces.

3.7 PROTECTION

- A. Protect millwork and cabinet work from damage until project is turned over to the client.

END OF SECTION

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SECTION 06 47 00
PLASTIC LAMINATE

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 06 40 00 - Architectural Woodwork.

1.2 REFERENCES

- A. American National Standards Institute (ANSI)
 - 1. ANSI A208.2-2009, Medium Density Fiberboard (MDF) for Interior Applications.
- B. American Society for Testing and Materials International, (ASTM)
 - 1. ASTM D 2832-92(R2005), Standard Guide for Determining Volatile and Nonvolatile Content of Paint and Related Coatings.
 - 2. ASTM D 5116-10, Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
- C. Canadian General Standards Board (CGSB)
 - 1. CAN/CGSB-71.20-M88, Adhesive, Contact, Brushable.
- D. Canadian Standards Association (CSA International)
 - 1. CSA O112 Series-M1977 (R2006), Standards for Wood Adhesives.
 - 2. CSA O121-08, Douglas Fir Plywood.
 - 3. CSA O141-05 (R2009), Softwood Lumber.
 - 4. CSA O151-09, Canadian Softwood Plywood.
- E. National Electrical Manufacturers Association (NEMA)
 - 1. ANSI/NEMA LD-3-05, High-Pressure Decorative Laminates.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00.
- B. Samples:
 - 1. Submit samples in accordance with Section 01 33 00.
 - 2. Submit duplicate samples of joints, edging, cutouts and post-formed profiles.
- C. Manufacturer's Instructions:
 - 1. Submit manufacturer's installation instructions.
- D. Closeout Submittals:
 - 1. Provide maintenance data for laminate work for incorporation into manual specified in Section 01 78 00.

1.4 QUALITY ASSURANCE

- A. Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

- B. Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- C. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Storage and Protection:
 - 1. Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00.
 - 2. Maintain relative humidity between 25 and 60% at 22 degrees C during storage and installation.

PART 2 - PRODUCTS

2.1 MANUFACTURER

- A. Acceptable manufactures:
 - 1. *Wilsonart International*
 - 2. *Nevamar Company*
 - 3. *Formica Corporation*

2.2 MATERIALS

- A. Product Description: Decorative surface papers, impregnated with melamine resins, bonded under heat and pressure to kraft papers impregnated with phenolic resins.
- B. **Laminated plastic for flatwork:** to NEMA LD 3.
 - 1. Type: General purpose.
 - 2. Grade: HGS
 - 3. Thickness: 1.2mm
 - 4. Pattern and Finish: To be determined by Consultant. Selected from manufacturer's full range of available selections.
- C. **Laminated plastic for postforming work:** to NEMA LD 3.
 - 1. Type: Postforming.
 - 2. Grade: HGP
 - 3. Thickness: 1.0mm
 - 4. Pattern and Finish: To be determined by Consultant. Selected from manufacturer's full range of available selections.
- D. **Laminated plastic for backing sheet:** to NEMA LD 3.
 - 1. Type: Backer.
 - 2. Grade: BKL.
 - 3. Size: not less than 0.5 mm thick or same thickness as face laminate.
 - 4. Colour: same colour as face laminate by same manufacturer as face laminate.
- E. **Laminated plastic for liner:** to NEMA LD 3.
 - 1. Type: Cabinet Liner.
 - 2. Grade: CLS.
 - 3. Size: not less than 0.02" thick
 - 4. Colour: white. Specific colour is to be selected by consultant
- F. Plywood core as outlined in Section 06 40 00.
- G. Laminated plastic adhesive: contact adhesive to CAN/CGSB-71.20.
- H. Sealer: water resistant sealer or glue acceptable to laminate manufacturer.

- I. Sealants in accordance with Section 07 92 00.
- J. Draw bolts and splines: as recommended by fabricator.

2.3 FABRICATION

- A. Comply with NEMA LD 3, Annex A.
- B. Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- C. Ensure adjacent parts of continuous laminate work match in colour and pattern.
- D. 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 2440 mm. Keep joints 600 mm from sink cutouts.
- E. Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.
- F. 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 mitre laminate edges.
- G. Apply laminate backing sheet to reverse side of core of plastic laminate work.
- H. Apply laminated plastic liner sheet to interior of cabinetry where indicated.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. 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

- A. Install work plumb, true and square, neatly scribed to adjoining surfaces.
- B. Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction.
- C. Use draw bolts and splines in countertop joints. Maximum spacing 450 mm on centre, 75 mm from edge. Make flush hairline joints.
- D. Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamfer edges and seal exposed core.
- E. At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant.

3.3 PROTECTION

- A. 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

- A. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- B. Perform care and cleaning with NEMA LD 3, Annex B.

- C. Remove traces of primer, caulking, epoxy and filler materials; clean doors and frames .

END OF PLASTIC LAMINATE

SECTION 07 84 00 FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes through penetration firestopping and smoke-seal systems for penetrations through following fire resistance rated assemblies, including both empty openings and openings containing penetrating items:
 - 1. Floors.
 - 2. Walls and partitions.
 - 3. Smoke barriers.
 - 4. Construction enclosing compartmentalized areas.
- B. This Section includes fire resistive joint systems for the following:
 - 1. Floor to floor joints.
 - 2. Floor to wall joints.
 - 3. Head of wall joints.
 - 4. Wall to wall joints.
 - 5. Joints between perimeter edge of fire resistance rated floor assemblies and back of curtainwall system.
- C. This specification section provides requirements for Rated Systems or systems requiring Engineered Judgements:
 - 1. Use of materials that have not been tested in system or that cannot obtain engineered judgement will not be acceptable for use on this Project.
 - 2. Materials having only ULC label will not be acceptable for use on this Project, unless supporting documentation is provided indicating its use in listed assembly.
- D. Related Requirements:
 - 1. Division 03, Concrete.
 - 2. Section 04 22 00 – Concrete Unit Masonry.
 - 3. Division 05, Structural Steel Framing.]
 - 4. Section 07 81 16 – Spray-Applied Fire Protection.
 - 5. Section 07 81 23 – Intumescent Fire Protection.
 - 6. Section 09 22 16 – Non-Structural Metal Framing.
 - 7. Section 09 29 00 – Gypsum Board.
 - 8. Division 21 – Fire Suppression: Coordination of pipes and pipe fittings and other materials penetrating fire resistance rated assemblies.
 - 9. Division 22 – Plumbing: Coordination of pipes and pipe fittings and other materials penetrating fire resistance rated assemblies.
 - 10. Division 23 – Heating, Ventilation and Air Conditioning: Coordination of ductwork and other materials penetrating fire resistance rated assemblies.
 - 11. Division 25 – Integrated Automation: Coordination conduit, wiring, communications cabling, cable trays, and other materials penetrating fire resistance rated assemblies.
 - 12. Division 26 – Electrical: Coordination conduit, wiring, communications cabling, cable trays, and other materials penetrating fire resistance rated assemblies.
 - 13. Division 27 – Communications: Coordination conduit, wiring, communications cabling, cable trays, and other materials penetrating fire resistance rated assemblies.
 - 14. Division 28 – Electronic Safety and Security: Coordination conduit, wiring, communications cabling, cable trays, and other materials penetrating fire resistance rated assemblies.

1.2 REFERENCES

- A. Reference Standards:

1. American Society for Testing and Materials (ASTM International):
 - a. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
 - b. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems.
 - c. ASTM E1966 - Standard Test Method for Fire Resistive Joint Systems.
 - d. ASTM E2174 - Standard Practice for On Site Inspection of Installed Fire Stops.
2. Canadian Standards Association (CSA Group):
 - a. CSA Z8000 - Canadian health care facilities.
3. Underwriters Laboratories of Canada (cUL/ULC):
 - a. ULC Guide No. 40 U19 - Firestop Systems.
 - b. CAN/ULC 101 - Standard Methods of Fire Endurance Tests of Building Construction and Materials.
 - c. CAN/ULC S114 - Standard Method of Test for Determination of Non-Combustibility in Building Materials.
 - d. ULC S115 - Fire Tests of Firestop Systems.
 - e. ULC 702.1 - Standard for Mineral Fibre Thermal Insulation for Buildings, Part 1: Material Specification.
 - f. ULC 702.2 - Mineral Fibre Thermal Insulation for Buildings, Part 2: Application Guidelines.
 - g. List of Equipment and Materials.
4. Underwriters Laboratories Inc. (ULI):
 - a. ANSI/UL 1479 - Standard for Fire Tests of Through Penetration Firestops.
5. National Fire Protection Agency (NFPA):
 - a. NFPA 251 - Standard Methods of Tests of Fire Endurance of Building Construction and Materials.

1.3 SUBMITTALS

- A. Action Submittals:
 1. Product Data: Submit manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site; include manufacturer's printed instructions for installation.
- B. Informational Submittals:
 1. Not later than thirty (30) calendar days following Award of Contract, submit schedule listing surfaces or components to which firestopping and smoke seals are applied, and indicating manufacturer's firestopping and smoke seal systems, required materials, and detailed installation procedures for review by Consultant.
 2. Determine thickness of applied materials from tests of assemblies identical to assembly to be protected where possible, conducted in accordance with reference standards listed above.
 3. Determine system from available engineering studies, or correspondence with labelling agency indicating effect of differences on fire separation of assembly where assembly is protected but does not correspond exactly to tested assembly; confirm acceptance of system by local authorities having jurisdiction in writing.
 - a. Use same system and material as would be required for tested assembly with similar conditions where assembly includes conditions which do not correspond to those included in any previously tested assembly and for which no relevant engineering information is available.

1.4 QUALITY ASSURANCE

- A. Ensure work under this section is performed by single dedicated firestop installation company with qualifications as noted below.
- B. Manufacturer's direct representative (not agent or distributor) to be on site during initial inspection of firestop systems to train appropriate contractor personnel in proper selection and installation procedures.
 1. Manufacturer to have Fire Protection Specialist on staff.

- C. All work to be of highest quality according to best trade practice and in strict accordance with manufacturer's printed trade specifications, by approved specialist firestopping caulking firm employing only skilled tradesmen.
- D. Qualifications: Provide proof of qualifications:
 - 1. Ratings: Assemblies containing materials to be in accordance with assemblies tested and approved by agencies acceptable to authority having jurisdiction.
 - 2. Materials: Provide materials having fire test response characteristics in accordance with requirements specified.
 - 3. Installer: Apply firestopping and smoke-seal materials or systems specified in this Section using fully experienced applicators trained by manufacturer, using proper equipment in strict accordance with manufacturer's instructions.
 - 4. Source Responsibility: Obtain through penetration firestop and joint systems, for each kind of penetration and construction condition indicated, from single source of installation responsibility.
- E. Pre-Construction Meeting: Arrange pre-construction meeting in accordance with Section 01 31 19 and as follows:
 - 1. Meeting to be attended by Contractor, Subcontractor responsible for firestopping, subcontractors affected by work of this Section, and Consultant.
 - 2. Meeting will discuss requirements for engineered judgements, site conditions, coordination issues, and single source responsibility for application of firestop systems; either by Contractor or by specialty firestop applicator.
- F. Coordination: Coordinate construction of openings and penetrating items and verify that firestopping and smoke seals systems are installed according to specified requirements and as follows:
 - 1. Coordinate sizing of sleeves, openings, core drilled holes or cut openings to accommodate firestopping and smoke-seals systems.
 - 2. Leave firestopping and smoke seals or joint system installations that will become concealed behind other construction open until Consultant and building inspector, if required by authorities having jurisdiction, have examined each installation.
 - 3. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
 - 4. Coordinate sizing of sleeves, opening, core-drilled holes or cut openings to accommodate through-penetration firestop systems.
 - 5. Schedule installation of firestopping after completion of penetrating item installation but prior to covering or concealing of openings.
 - 6. Coordinate colour of exposed firestopping material with scheduled finishes. Review with Consultant if not indicated.

1.5 SITE CONDITIONS

- A. Install firestopping and smoke-seals materials only when areas in which they are scheduled are closed in and protected from dampness.
- B. Do not install firestopping materials that contain flammable solvents.
- C. Ambient Conditions: Install firestopping and smoke-seals systems when ambient or substrate temperatures are within temperature and moisture limits permitted by firestopping and smoke-seals system manufacturers or when substrates are not wet due to rain, frost, condensation, or other causes.
- D. Ventilate firestopping and smoke-seals systems in accordance with manufacturer's written instructions by natural means or forced air circulation where natural means are not adequate.

1.6 WARRANTY

- A. Manufacturer Warranty: Firestop manufacture to provide written two (2) year warranty to owner, guaranteeing performance of installed firestop material as designed and tested; any defect in material will be replaced at no cost to owner.
- B. Installer Warranty: Installer of firestop material to provide written warranty to owner guaranteeing quality of installation meets requirements set in manufacturers written instructions and tested system for minimum of two (2) years. Any deficiencies found in installed firestop will be repaired or replaced at no cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Product Manufacturers:
 - 1. A/D Fire Protection Systems, Inc.
 - 2. Passive Fire Protection Partners Firestop Systems, Inc.
 - 3. Hilti Canada Ltd.
 - 4. Johns Manville Fire protection Systems.
 - 5. Nuco Self Seal Firestopping Products.
 - 6. Roxtec.
 - 7. STI Specified Technologies, Inc.
 - 8. 3M Canada Inc.
 - 9. Tremco Ltd.
- B. Forming Materials:
 - 1. Thermafiber.
 - 2. Roxul Inc.
- C. Single Source: Obtain firestop systems for each type of penetration and construction condition only from single manufacturer.
- D. Substitutions: [Allowed as follows:] [Not Allowed.]
 - 1. Procedures During Bid Period: Refer to Section 00 26 00.
 - 2. Procedures During Construction: Refer to Section 01 25 13.

2.2 DESIGN REQUIREMENTS

- A. Performance Requirements:
 - 1. Manufacturer to design proprietary assemblies to withstand listed ratings in accordance with Building Code, Underwriters Laboratories Canada, and authorities having jurisdiction, and as follows:
 - a. Provide through penetration firestop and joint systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire resistance rating of assembly penetrated:
 - 1) Fire resistance rated load bearing walls, including partitions, with fire protection rated openings.
 - 2) Fire resistance rated non load bearing walls, including partitions, with fire protection rated openings.
 - 3) Fire resistance rated floor assemblies.
 - b. F-Rated Systems: Provide through penetration firestop systems with F-ratings indicated, as determined by ULC S115 or ASTM E814, but not less than that equaling or exceeding fire resistance rating of constructions penetrated.
 - 1) Minimum Fire (F) Rating for firestop assemblies not to be less than 1-HR.
 - c. T-Rated Systems: For the following conditions, provide through penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per by ULC S115 or ASTM E814, where systems protect penetrating items exposed to potential contact with adjacent materials:

- 1) Penetrations located outside wall cavities.
- 2) Penetrations located outside fire resistive shaft enclosures.
- 3) Penetrations located in construction containing fire protection rated openings.
- 4) Penetrating items larger than 100 mm 4-inch diameter nominal pipe or 100 cm² 15.5-square-inches in overall cross-sectional area.
- 5) Minimum T-Rating of Firestop assemblies in walls may equal zero.
- d. Firestopping and Smoke-seals Systems Exposed to View: Systems exposed to view, traffic, moisture, and physical damage; provide products that after curing do not deteriorate when exposed to these conditions both during and after construction, and as follows:
 - 1) Provide moisture resistant through penetration firestop systems for piping penetrations for plumbing and wet pipe sprinkler systems.
 - 2) Provide firestopping and smoke-seals systems capable of supporting floor loads involved either by installing floor plates or by other means for floor penetrations with annular spaces exceeding 100 mm 4-inches in width and exposed to possible loading and traffic.
 - 3) Provide firestopping and smoke-seals systems not requiring removal of insulation for penetrations involving insulated piping.
 - 4) Provide products with flame spread ratings of less than 25 and smoke developed ratings of less than 50 for firestopping and smoke-seals and joint systems exposed to view.
 - 5) Provide colour of exposed firestopping in coordination with exposed finishes.
- e. Fire Resistance of Joint Systems: Assembly ratings and movement capabilities indicated, but with assembly ratings not less than that equaling or exceeding fire resistance rating of constructions in which joints are located.

2.3 FIRESTOPPING AND SMOKE-SEALS

- A. Compatibility: Provide firestopping and smoke-seals systems that are compatible with one another, with substrates forming openings, items penetrating firestopping and smoke-seals systems, as demonstrated by firestopping and smoke-seals system manufacturer based on testing and site experience, and as follows:
 1. Service penetration assemblies: Certified by ULC to ULC S115 and listed in ULC Guide No. 40 U19.
 2. Service penetration firestopping and smoke-seals components: Certified by ULC-to-ULC S115 and listed in ULC Guide No. 40 U19.13, under Label Service of ULC.
 3. Fire resistance rating of installed firestopping and smoke-seals assembly not less than fire resistance rating of surrounding floor and wall assembly.
 4. Firestopping and Smoke-Seals at openings intended for ease of re-entry such as cables: elastomeric seal; do not use cementitious or rigid seal at such locations.
 5. Firestopping and Smoke-Seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal; do not use cementitious or rigid seal at such locations. Exemption to fire dampers.
- B. Accessories: Provide components for each firestopping and smoke-seals system that are needed to install fill materials and to comply with Paragraph above. Use only components specified by firestopping and smoke-seals system manufacturer and approved by qualified testing and inspecting agency for firestopping and smoke-seals systems indicated. Accessories include the following items:
 1. Permanent forming, damming, and backing materials, including:
 - a. Slag or rock wool fibre insulation.
 - b. Sealants used in combination with other forming, damming, or backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire rated form board.
 - d. Fillers for sealants.
 2. Temporary forming materials.
 3. Substrate primers.

4. Collars.
 5. Steel sleeves.
 6. Primers: to manufacturer's recommendation for specific material, substrate, and end use.
 7. Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
 8. Metal fire stop: Commercial galvanized steel, to ASTM A1008/A1008M, zinc coating 260 g/m², minimum metal core thickness 0.912 mm.
 9. Steel Deck Moulded Flute Inserts: One piece moulded mineral fibre flute inserts, sized for steel deck profiles, for placement at top of fire rated wall assemblies:
 - a. Acceptable Product: Hilti CP777 Speed Plugs.
- C. Labels: Peel and stick labels printed with the following information:
1. ATTENTION: FIRE RATED ASSEMBLY. DO NOT MODIFY
 2. Name of firestopping manufacturer.
 3. Names of products used.
 4. Hour Rating of Assembly.
 5. Manufacturers standard detail number or Engineered Judgement identifier; ULC or cULUS Number.
 6. Date of installation.
 7. Name of installing Subcontractor.
 8. Contact telephone number for repair or replacement of firestopping materials.

2.4 FILL MATERIALS

- A. General:
1. Provide firestopping and smoke-seals systems containing types of fill materials indicated in Firestopping and Smoke-seals System Schedule in Paragraph below by reference to types of materials described in this Article.
 2. Fill materials are those referred to in directories of referenced testing and inspecting agencies as fill, void, or cavity materials.
 3. Firestopping products to have ability to provide minimum of STC 55 and have Volatile Organic Compound (VOC) of less than 250 g/L.
 4. Firestopping and smoke seal systems to be tested to ULC S115 and be comprised of asbestos free materials and systems capable of maintaining effective barrier against flame, smoke, and gases, and not to exceed opening sizes for which they are intended for ratings as indicated on drawings.
- B. Cast in Place Firestopping and Smoke-seals Devices: Factory assembled devices for use in cast in place concrete floors and consisting of outer metallic sleeve lined with intumescent strip, radial extended flange attached to one end of sleeve for fastening to concrete formwork, and neoprene gasket.
- C. Latex Sealants: Single component latex formulations that after cure do not re emulsify during exposure to moisture.
- D. Firestopping and Smoke-seals Devices: Factory assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrating item.
- E. Cable Penetration Devices: Cables passing through fire-rated floors or walls to pass through fire-rated cable pathway devices made from intumescent material that adjusts automatically to cable additions or subtractions.
1. Premanufactured intumescent blocks, as follows:
 - a. Roxtec Intumescent Blocks.
 - b. Hilti CFS-BL Intumescent Blocks.
 2. Premanufactured sleeves, consisting of adjustable core, and as follows:
 - a. Specified Technologies EZ-Path Fire Rated Pathway.
 - b. Hilti CP 653 Speed Sleeves.
 3. Premanufactured cable management system, consisting of system of intumescent inserts and adjustable cores, and as follows:

- a. Roxtec Preformed Fire Stopping Systems.
- F. Intumescent Pads, Wall Opening Protective Materials: Intumescent, non-curing pads or inserts for protection of electrical panels, switch and receptacle boxes, medical gas outlets and valve boxes, film illuminators, and other items recessed in face of fire rated walls.
- G. Intumescent Composite Sheets: Rigid panels consisting of aluminum foil faced elastomeric sheet bonded to galvanized steel sheet.
- H. Intumescent Putties:
 - 1. Non hardening dielectric, water resistant putties containing no solvents, inorganic fibres, or silicone compounds.
 - 2. Firestop putty to be installed at gap between wire, cabling, or both, exiting open end of conduit, where conduit penetrates one or both sides of smoke or fire rated wall assembly.
- I. Intumescent Spray Foam: Expanding spray in place intumescent foam sealant.
- J. Intumescent Wrap Strips: Single component intumescent elastomeric sheets with aluminum foil on one side.
- K. Mortars: Prepackaged, dry mixes consisting of blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form non-shrinking, homogeneous mortar.
- L. Pillows/Bags: Re-enterable, non-curing, heat expanding pillows/bags consisting of glass fibre cloth cases filled with combination of mineral fibre, water insoluble expansion agents, and fire-retardant additives.
- M. Silicone Foams: Multi component, silicone based liquid elastomers that, when mixed, expand and cure in place to produce flexible, non-shrinking foam.
- N. Silicone Sealants: Moisture curing, single component, silicone based, neutral curing elastomeric sealants of grade indicated below:
 - 1. Grade for Horizontal Surfaces: Pourable (self levelling) formulation for openings in floors and other horizontal surfaces.
 - 2. Grade for Vertical Surfaces: non sag formulation for openings in vertical and other surfaces.
 - 3. Guaranteed not to re-emulsify if subjected to wetting or standing water.
- O. Fire Rated HVAC Retaining Angles: Steel angle system with integral intumescent firestop gasket for use on steel HVAC ducts.
- P. Firestop Plugs: re-enterable foam rubber plug impregnated with intumescent material capable of expanding minimum 10 times with expansion beginning at 177 deg C for use in blank openings and cable sleeves.
- Q. Fire Rated T Rating Collar Device: Louvered steel collar system with synthetic aluminized polymer coolant wrap installed on metallic pipes where T Ratings are required by applicable building codes.
- R. Fire Rated Cable Grommet: Molded two-piece grommet made from plenum grade polymer with foam inner core for sealing cable penetrations up to 14 mm diameter.
- S. Fire-Rated Closet Flange Gasket: Molded single component intumescent gasket for use beneath closet flange in floor applications.
- T. All-Weather Coatings: Multicomponent silicone based liquid elastomers that when mixed expand and cure in place to produce flexible non-shrinking foam.
- U. Fire-rated Expansion Control: Refer to Section 07 95 13 and 07 95 14, if applicable.

2.5 MIXING

- A. For those products requiring mixing before application, comply with firestopping and smoke-seals system manufacturer's written instructions for accurate proportioning of materials, water (if

required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

2.6 FIRE-RESISTIVE JOINT ASSEMBLIES – GENERAL

- A. Where joint will be exposed to elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications comply to ASTM C920.
- B. Head-of-Wall Assemblies:
 - 1. Use at top of fire-rated and smoke barrier walls and partitions where they abut floor structures above.
 - 2. Select systems with D designation, rated for dynamic movement capability.
 - 3. Select systems that can accommodate deflection of structure above.
 - 4. Maximum Leakage for Fire-resistive Joints in Smoke Barriers: 5 CFM or less per linear foot as tested to CAN/ULC S-115.
 - 5. Sound-control walls and smoke partitions which are not stipulated to include fire-resistance rating. Seal with acoustical sealant, specified in Section 09 29 00.
 - 6. Minimum F and T ratings:
 - a. Minimum fire rating for firestop assemblies in walls to equal that of wall, but not less than 1-HR.
 - b. Minimum temperature rating of firestop assemblies in walls may equal zero.

2.7 EXISTING FIRE RATED PARTITIONS

- A. Concealed Conditions:
 - 1. Existing fire / smoke rated partitions indicated to remain are to be repaired and made good to meet indicated fire rating and to be smoke tight.
 - 2. Existing openings, damaged sections of partitions and penetrations, above ceiling or otherwise concealed and not created by work identified on contract documents are to be repaired with like materials, consisting of firestop systems or gypsum board assemblies, as applicable and suited to size of opening.
- B. Acceptable Systems:
 - 1. Metal stud and drywall partitions: Select system from UL HW-D-0000 Series.
 - 2. Concrete and Masonry Walls: Select system from UL HW-D-1000 Series.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces, components, materials to receive firestopping and smoke-seals material; report any conditions that would detrimentally affect application of material or proper firestopping and smoke-seals of system.
- B. Commence Work when conditions of surfaces and working conditions are suitable. No installation is to proceed unless review and return of shop drawings has been completed.
- C. Verify service lines are in place, tested and approved where penetration sealants or caulking are required.
- D. Verify that proper blocking, framing (using non-combustible materials) are properly installed and prepared to receive firestopping and smoke-seals. Notify Consultant in writing of any deficiencies affecting proper performance of firestopping and smoke-seals, do not proceed until deficiencies are corrected.
- E. Prepare surfaces in contact with firestopping and smoke-seals materials and smoke seals to manufacturer's instructions.
- F. Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier where applicable.

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

3.2 PREPARATION

- A. Provide and maintain masking, drop cloths and polyethylene coverings for such surfaces to protect them during installation operations where adjacent finished floors, walls and similar surfaces are exposed.
- B. Provide complete enclosures and human protective devices when installing or mixing hazardous materials.
- C. Surfaces to be free of oil, grease, dirt, loose paint, mill scale or any other matter that could impair bond, including paint.
- D. Prime surfaces as required.
- E. Make provisions for natural ventilation during and after application of firestopping and smoke-seals, sealant, or caulking; circulate interior air by use of temporary circulators or exhaust fans in enclosed areas or areas lacking openings for natural ventilation.
- F. Schedule installation of CAST-IN-PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
- G. Schedule installation of DROP-IN firestop devices after placement of concrete but before installation of pipe penetration. Diameter of sleeved or cored hole to match listed system for device.

3.3 APPLICATION

- A. Apply firestopping and smoke-seals materials in strict accordance with manufacturer's printed instructions, accepted and approved tested assemblies, and approved details.
- B. Apply firestopping and smoke-seals materials/systems to maintain fire separations in project as indicated on drawings.
- C. Seal holes or voids made by through penetrations, poke through termination devices, and unpenetrated openings or joints and verify continuity and integrity of fire separation are maintained.
- D. Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- E. Tool or trowel exposed surfaces to neat finish.
- F. Remove excess compound promptly as work progresses and upon completion.
- G. Place self-sticking labels on permanent surface adjacent to firestopping or smoke-seal installation.

3.4 CLEANING

- A. After completion of firestopping and smoke-seals work, remove equipment and clean exposed wall and floor areas to remove excess materials, spatter.

3.5 SYSTEM SCHEDULE

- A. Design and provide through penetration firestopping and smoke-seals as follows for:
 - 1. Systems with No Penetrating Items: Select one or more of following fill materials:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Intumescent foam blocks or boards.
 - e. Intumescent spray foam.

2. Systems for Metallic Pipes, Conduit, or Tubing: Select one or more of following fill materials:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Intumescent foam blocks or boards.
 - e. Intumescent spray foam.
3. Systems for Non-metallic Pipe, Conduit, or Tubing: Select one or more of following fill materials:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Intumescent wrap strips.
 - e. Firestopping and Smoke-seals device.
 - f. Intumescent spray foam.
4. Re-enterable and Cable Managed Systems for Electrical, and Data and Communications Cables:
 - a. Where electrical devices are placed on opposite sides of wall, and are 610 mm 2 feet, apart measured horizontally, install intumescent pads of back of devices in approved manner or maintain continuity of rated barrier within wall cavity surrounding recessed item.
 - b. Provide re-enterable products specifically designed for removal and re-installation at openings within walls and floors designed to accommodate voice, data, and video cabling:
 - 1) Prefabricated Firestop Sleeve (Hilti).
 - 2) Preformed Intumescent Blocks (Roxtec).
 - 3) Prefabricated Cable Pathways (EZ-Path).
5. Systems for Electrical, and Data and Communications Cables: Select one or more of the following fill materials:
 - a. Latex sealant.
 - b. Silicone sealant.
 - c. Intumescent putty.
 - d. Silicone foam.
 - e. Prefabricated Firestop Sleeve (Hilti).
 - f. Preformed Intumescent Blocks (Roxtec).
 - g. Prefabricated Cable Pathways (EZ-Path).
 - h. Intumescent foam blocks or boards.
 - i. Intumescent spray foam.
6. Systems for Cable Trays: Select one or more of the following fill materials:
 - a. Latex sealant.
 - b. Intumescent putty.
 - c. Silicone foam.
 - d. Pillows/bags.
 - e. Intumescent foam blocks or boards.
7. Systems for Insulated Pipes: Select one or more of the following fill materials:
 - a. Latex sealant.
 - b. Intumescent putty.
 - c. Silicone foam.
 - d. Intumescent wrap strips.
 - e. Intumescent foam blocks or boards.
 - f. Intumescent spray foam.
8. Systems for Miscellaneous Electrical Penetrations: Select one or more of the following fill materials:
 - a. Latex sealant.
 - b. Intumescent putty.

- c. Intumescent foam blocks or boards.
 - d. Intumescent spray foam.
- 9. Systems for Miscellaneous Mechanical Penetrations: Select one or more of the following fill materials:
 - a. Latex sealant.
 - b. Intumescent foam blocks or boards.
 - c. Intumescent spray foam.
- 10. Systems for Groupings of Penetrations: Select one or more of the following fill materials:
 - a. Latex sealant.
 - b. Intumescent wrap strips.
 - c. Firestopping and Smoke-seals device.
 - d. Intumescent composite sheet.
 - e. Intumescent foam blocks or boards.
 - f. Intumescent spray foam.
- B. Design and provide joint firestopping and smoke-seals as follows for:
 - 1. Floor to Floor, Fire Resistive Joint System: Provide materials to meet the following criteria:
 - a. Assembly Rating: As indicated on Drawing.
 - b. Nominal Joint Width: As indicated on Drawing.
 - c. Movement Capabilities: Compression and extension.
 - 2. Floor to Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:
 - a. Assembly Rating: As indicated on Drawing.
 - b. Nominal Joint Width: As indicated on Drawing.
 - c. Movement Capabilities: Confirm, compression, extension, or horizontal shear.
 - 3. Head of Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:
 - a. Assembly Rating: As indicated on Drawing.
 - b. Nominal Joint Width: As indicated on Drawing.
 - c. Movement Capabilities: Compression and extension.
 - 4. Wall to Wall, Fire Resistive Joint System: Provide materials to meet the following criteria:
 - a. Assembly Rating: As indicated on Drawing.
 - b. Nominal Joint Width: As indicated on Drawing.
 - c. Movement Capabilities: Compression and extension.
- C. Design and provide perimeter fire containment firestopping and smoke-seals as follows for:
Perimeter Fire Containment System: Provide materials to meet the following criteria:
 - 1. Integrity Rating: As indicated on Drawing.
 - 2. Insulation Rating: As indicated on Drawing.
 - 3. Linear Opening Width: As indicated on Drawing.

3.6 STANDARD DETAILS

- A. Submit manufacturer's listed assembly drawings and Engineered Judgements for standard details and include additional on-site conditions which may not be covered by manufacturer's standard details.
- B. Verify site conditions and dimensions for compliance with manufacturers details including:
 - 1. Minimum and maximum joint widths.
 - 2. Type and thickness of fire rated construction.
- C. Use manufacturer's approved alternate details where site conditions do not comply with standard details submitted for review.
- D. Submit manufacturer's Engineered Judgements where alternate details do not match site conditions in accordance with IFC Guidelines for Evaluating Firestop Systems Engineering Judgments.

END OF SECTION

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SECTION 07 92 16 INTERIOR JOINT SEALANTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Definition:
 - 1. Words “calk” and “caulking” mean sealant work.
 - 2. “Interior wet areas” means toilets, showers, kitchens and similar areas where sealant is subject to moisture.
- B. Seal joints which would otherwise permit penetration of moisture or air, unless sealant work is specifically required under other sections.
- C. Work included: Provide sealants as follows:
 - 1. Joints at penetrations of walls, floors and decks by piping and other services and equipment not requiring firestopping.
 - 2. Between cabinets, casework, countertops and back splashes where adjacent to walls.
 - 3. Between cabinets / casework and flooring.
 - 4. Joints between dissimilar materials, to provide visually acceptable closures.
 - 5. Other joints where caulking, or sealant is indicated.

1.2 QUALITY ASSURANCE

- A. Sealant materials:
 - 1. Sealant specification: ASTM-C920 Type S or M, Grade-NS, minimum Class-25.
 - 2. Sealant testing: ASTM-C510; ASTM-C711; ASTM-C719 Class-25, Grade-N; ASTM-C792; ASTM-C793; ASTM-C910.
 - 3. Sealant use: ASTM-C1193.
 - 4. Installer approved by manufacturer.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Sealant Schedule with the following information:
 - a. Generally describe locations requiring sealants (i.e. Brick to Alum Window).
 - b. List type of sealant to be used, and name of product proposed.
 - c. Include a blank column on schedule for colors.
 - d. Upon review, Architect to complete Color Column.
- B. Samples:
 - 1. Cured sample of each color for color selection (submit with Sealant Schedule).
- C. Contract Closeout Information:
 - 1. Warranty.

1.4 JOB CONDITIONS

- A. Environmental Limitations:
 - 1. Do not proceed with installation of joint sealants under following conditions:
 - a. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 DEGF.
 - b. When joint substrates are wet.
- B. Joint-Width Conditions:
 - 1. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

- C. Apply only to joints free of material which may inhibit bond.
- D. Apply to cementitious materials only when thoroughly cured and dry.

1.5 WARRANTY

- A. Provide written warranty that sealant work will remain free of defects for a period of 2 years:
 - 1. Failure of water tightness constitutes defect.
 - 2. Remove defective work and materials and replace with new work and materials.
 - 3. Repair other work damaged as a result of defective sealant work at no additional expense to Owner.
 - 4. Warranty signed by Installer and/or Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Acceptable manufacturers:
 - 1. Polyurethane sealants:
 - a. Base:
 - 1) Tremco.
 - b. Optional:
 - 1) Sonneborn/ChemRex.
 - 2) Sika.
 - 2. Other manufacturers desiring approval comply with Section 00 21 13.

2.2 SEALANTS - GENERAL

- A. General:
 - 1. Provide colors matching materials being sealed.
 - 2. Where sealant is not exposed to view, use manufacturer's standard color which has best performance.
 - 3. Use non-sag sealant in vertical and horizontal joints.
 - 4. Use self-leveling in horizontal joints.
 - 5. Before use of sealant, investigate its compatibility with surfaces, fillers and other materials in joint system.
 - 6. Use only compatible materials.
 - 7. Obtain sealants from manufacturers who will provide manufacturers' field service representatives at project site for purpose of advising and instructing installers.
 - a. Provide such services, at no expense to Owner.
- B. Polyurethane Sealants:
 - 1. Refer to Sealant Selection Guide for types required.
 - 2. VOC content no greater than 250 g/L.

2.3 MISCELLANEOUS MATERIALS

- A. Joint cleaner, primer, bond breaker:
 - 1. As recommended by sealant manufacturer.
- B. Backer Rod:
 - 1. Rod stock of polyethylene, polyethylene jacketed polyurethane foam, or other flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer to:
 - a. Control joint depth.
 - b. Break bond of sealant at bottom of joint.
 - c. Provide proper shape of sealant.

PART 3 - EXECUTION

3.1 SEALANT USAGE GUIDELINES

Guide to Sealant Types - INTERIOR				
Location	Materials	Sealant Type	Base Product	Remarks / Exceptions
Interior (General)	Window Sills / Stools	Product specified in Section 12 34 00 (100 PCT silicone by Color Rite)		
	Cabinets and Casework to wall			
	Countertops and Backsplashes			
	Sinks in Countertops			
	Interior Alum Doors and Window Frame Perimeters	Multi-part Polyurethane, chemically curing, epoxidized	Tremco "Dymerc 240FC"	--
	Hollow Metal Door and Window Frames	Siliconized Acrylic Latex (paintable)	Tremco "Tremflex 834 IN	Exception: Where sealant will not be subsequently painted, and white color will not be visually compatible with adjacent finishes: Use "Dymerc 240FC" of matching color.
	Acoustical Sealant Joints at top and bottom terminations of Interior Walls	Specified In Section 09 29 00 (and in Section 07 84 00 where fire-rated)		
Interior Flatwork	Control Joints in Concrete Floors in Mechanical Rooms and other "un-finished" spaces	Multi-part Polyurethane	Tremco "THC 900 / 901 IN	Exception: Where subject to continual water emersion; use "Vulkem 45 or 245 IN
	Stone and Precast Flooring			
Interior Wet Areas	Porcelain, Ceramic Tile, Metals, and surfaces with Epoxy Paints	Silicone; Air cure	Tremco "Tremsil 200 IN	--
General Notes: 1. The above shall be use as a "guide" to selection of appropriate sealant types. 2. Optional sealant products shall offer same number of color choices as the Base Product listed. 3. All of the conditions and materials listed may not necessarily apply to subject project. 4. Not all project conditions may be addressed on above table; Refer also to other specification sections and install sealants where called for by other sections. 5. The above is intended to be an overall guide. Additional conditions and materials may be required on subject project. Notify Architect if additional Guidance is required to select unlisted items. 6. Materials and Conditions "conventionally" occur on Exterior but used on Interior of this project may not be listed on this Table. Refer to Exterior Guide (Section 07 92 13) for appropriate sealant type. i.e. If project calls for Brick Masonry on interior: Refer to Section 07 92 13 for type of Sealant to be used.				

3.2 PREPARATION

- A. Clean joints.
- B. Where finish coating or covering is to be applied to surface (e.g., paint, wall covering, glazed coating), wait until such coating or covering has been applied before installing sealant.

3.3 INSTALLATION -GENERAL

- A. General:
 1. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
 2. Make joints water and air tight.
 3. Make depth of sealant not more than one-half width of joint, but in no case less than 1/4 IN.
 4. Install correctly sized backer rods.
 5. Apply bond breaker as required or recommended by sealant manufacturer.

- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 - 1. Do not leave gaps between ends of sealant backings.
 - 2. Do not stretch, twist, puncture, or tear sealant backings.
 - 3. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
- C. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 - 1. Place sealants so they directly contact and fully wet joint substrates.
 - 2. Completely fill recesses in each joint configuration.
 - 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Prime joint surfaces as recommended by sealant manufacturer for conditions:
 - 1. Limit application to surfaces to receive sealants.
 - 2. Mask off adjacent surfaces.
- F. Sub-caulk joints without suitable backstop, to proper depth.
- G. Tool sealants using sufficient pressure to fill voids.
- H. Upon completion, leave caulking smooth and even.
- I. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.
- J. Hollow Metal Door Frames:
 - 1. Seal frames to wall.
 - 2. Seal frames to floor substrates and hard floor finishes (do not seal to previously installed carpet and similar finishes.)
 - 3. Seal hairline gaps where stops and rabbets of frame members intersect.

END OF SECTION

SECTION 08 71 00 DOOR HARDWARE

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 08 11 00 - Steel Doors and Frames.
- B. Section 08 12 16 – Interior Aluminum Door and Window Frames
- C. Section 08 14 10 - Flush Wood Doors.
- D. Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.2 REFERENCES

- E. Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).
 - .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction: standard hardware location dimensions, or as indicated for special conditions.
- B. CAN CSA B-651-04 Accessible Design for the Built Environment.
- C. American National Standards Institute / Builders Hardware Manufacturers Association:
 - .1 ANSI/BHMA A156.1-2006
Butts and Hinges.
 - .2 ANSI/BHMA A156.4-2008
Door Controls - Closers.
 - .3 ANSI/BHMA A156.5-2010
Auxiliary Locks & Associated Products.
 - .4 ANSI/BHMA A156.6-2010
Architectural Door Trim.
 - .5 ANSI/BHMA A156.8-2010
Door Control - Overhead Stops and Holders
 - .6 ANSI/BHMA A156.13-2005
Mortise Locks and Latches, Series 1000.
 - .7 ANSI/BHMA A156.16-2008
Auxiliary Hardware.
 - .8 ANSI/BHMA A156.18-2006
Materials and Finishes.
 - .9 ANSI/BHMA A156.22-2005
Door Gasketing and Edge Seal Systems.
 - .10 ANSI/BHMA A156.26-2006
Continuous Hinges.
 - .11 ANSI/BHMA A156.31-2001
Electric Strikes and Frame Mounted Actuators

1.3 SUBMITTALS

- A. Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheets indicating hardware proposed, including ANSI function where ANSI used in this specification, grade, type, series, BHMA finish, fire label listing, in accordance with Section 01 33 00 – submittal Procedures.

- B. Samples:
 - .1 Submit samples of each type of hardware specified in accordance with Section 01 33 10 – Submittal Procedures.
 - .2 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
 - .3 After approval samples will be returned for incorporation in the Work.
- C. Hardware List:
 - .1 When preparing the Finishing Hardware schedule to submit for approval, it is the Hardware Supplier's responsibility to review specifications and drawings, confirming quantities and detailing, reporting any errors and/or omissions to the Consultant. "Extras" will not be considered nor accepted for necessary changes as a result of the Hardware Supplier's neglect.
 - .2 "Extras" will be invoiced at no more than 30% off Manufacturer's current list price. "Credits" will be issued at no less than 70% off Manufacturer's current list price.
 - .3 Submit a typewritten Finishing Hardware schedule in accordance with Section 01 33 10 – Submittal Procedures.
 - .4 Indicate specified hardware, including make, model, base material, function, size, finish and other pertinent information.
- D. Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- E. Closeout Submittals:
 - .1 Provide operation, maintenance data, parts list and manufacturer's instructions for each type of locksets, fire exit hardware, door closers and door holders for incorporation into manual specified in Section 01 33 10 – Submittal Procedures.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - .1 Use hardware for doors in fire separations and exit doors certified by a Canadian Certification organization accredited by Standards Council of Canada.
 - .2 All fire and life safety codes shall be met as required by the authority having jurisdiction.
 - .3 Use lock and latchsets with lever handles meeting requirements of CAN/CSA- B651, Barrier Free Design, unless specified otherwise.
- B. Pre-installation Meetings:
 - .1 Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.
- C. It shall be clearly understood that within the terms of this Subcontract, the Hardware Supplier is bound not just as a supplier, but as a Subcontractor and is responsible for the supply of Project services relative to project co-ordination, supervision and inspection.
- D. No claims for extra money will be entertained if such claims are from lack of co- ordination between the Hardware Subcontractor and any other Subcontractor. Ensure that Work of other Subcontractors, as it proceeds, will accommodate the installation of hardware.

- E. Attend site meetings as requested by the Contractor.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Packing, Shipping, Handling and Unloading:
 - .1 Deliver, store, handle and protect materials in accordance with Section 01 33 10 – Submittal Procedures.
 - .2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- B. Storage and Protection:
 - .1 Store finishing hardware in locked, clean and dry area.

1.6 WASTE DISPOSAL AND MANAGEMENT

- A. Separate and recycle waste materials in accordance with Section 01 00 10 – General Instructions.
- B. Remove from site and dispose of all packaging materials at appropriate recycling facilities.
- C. Dispose of all packaging material in appropriate on-site bin for recycling in accordance with site waste management program.

1.7 MAINTENANCE

- A. Extra Materials:
 - .1 Provide maintenance materials in accordance with Section 01 00 10 – General Instructions
 - .2 Supply two sets of wrenches for locksets and door closers.

PART 2 - PRODUCTS

2.1 HARDWARE ITEMS

- A. Only door hardware certified to ANSI/BHMA standards is acceptable for use on this project.
- B. Use one manufacturer's products only for all similar items.

2.2 DOOR HARDWARE

- A. Butts and Hinges shall comply with ANSI/BHMA A156.1
 - .1 Supply 1-1/2 pair per door leaf for doors up to 2285mm in height. Supply one additional hinge for each additional 762mm of height or fraction thereof. Doors, 45mm thickness, up to 914mm in width, supply 114mm high hinges; over 914mm to 1220mm, supply 127mm high hinges.
 - .2 A8112 - steel base metal, full mortise, exposed anti-friction ball bearing, grade 2, standard weight.
 - .3 Hinges listed are by Hager.
Stanley equivalents are acceptable.

Hager
BB1279

Stanley
FBB179

- B. Mortise Locks and Latches, Series 1000 shall comply with ANSI/BHMA A156.13
- .1 Heavy duty mortise type. Series 1000, grade 1. Lever design to be tubular (121mm long), 76mm overall projection, with end returning to 13mm from face of door. 65mm diameter round wrought roses. Provide dust boxes behind all strikes.
 - .2 Schlage heavy duty mortise "L" series. 03B lever design. No alternates.
 - .3 Functions as specified.
- C. Cylinders shall comply with ANSI/BHMA A156.5
- .1 Best Lock interchangeable core.
- D. Electric Strikes shall comply with ANSI/BHMA A156.31
- .1 Von Duprin heavy duty series 6000. All stainless steel construction.
- E. Door Controls - Closers shall comply with ANSI/BHMA A156.4
- .1 Heavy duty. Full rack and pinion hydraulic action. Cast iron cylinder body. Adjustable spring power and back check. Plastic cover.
 - .2 PT4F (DEL) - delayed action.
 - .3 LCN 4041 and 1461 series listed. No alternates.
 - .4 Actuators: Camden Door Controls
- F. Architectural Door Trim. Armor and kick plates shall comply with ANSI/BHMA A156.6
- .1 1.27mm material thickness. Type 304 stainless steel.
Height as specified x length to suit.
 - .2 Protection plates listed are by Standard Metal Hardware Manufacturing Ltd..
CBH, Gallery and Hager equivalents are acceptable.
- | | | | |
|----------------|--------|---------|-------|
| Standard Metal | C.B.H. | Gallery | Hager |
| K10A | 903 | 80A | 190S |
- G. Door Control - Overhead Stops and Holders to ANSI/BHMA A156.8
- .1 All listed degrees of opening should be reviewed and confirmed before preparation and/or installation.
 - .2 Glynn-Johnson heavy duty overhead concealed "100" series
- H. Floor / Wall stops shall comply with ANSI/BHMA A156.16
- .1 Cast brass or bronze material except where specified zinc die cast..
 - .2 Rear portion of heavy duty one piece cast floor stops shall have a stud to prevent rotation.
Rise to suit door undercut.
 - .3 Wall stops shall have a metal back plate secured to wall with (2) screws and shields.
Housing and rubber insert fits over back plate and is secured with inconspicuous set screw.
No screws or holes shall be visible on face of bumper.
 - .4 Floor and wall stops listed are by Standard Metal Hardware Manufacturing Ltd.
CBH equivalents are acceptable. Mount at lever level.
- | | |
|----------------|--------|
| Standard Metal | C.B.H. |
| S120 | 120 |

- I. Sliding door hardware :
 - .1 Complete system by door supplier with mortise lock listed in this Section
- J. Exit Devices
 - .1 Von Duprin "98" series. No substitutes.
 All break-away #996L lever trim to be 03 design to match mortise locks.
- K. Flush Bolts
 - .1 Fire labeled where specified.

Glynn Johnson	Standard Metal	Gallery	Hager
FB458	F65	401	282D
- L. Magnetic Locks:
 - .1 Magnetic Door Holder
 - a) Floor Mounted
 - b) Manufacture: Camden Door Controls
 - c) Model: Magnetic Door Holder Floor Mount CX-955-DH-FL
 - .2 Coordinate electrical connections with electrical documents.
- M. Door Security
 - .1 Manufacturer: *All components to be provided by Siemens and installed by electrical trades*
 - .2 Supply and install all devices re
 - .2 Provide all required conduit, pull boxes and back boxes to suit equipment shown
 - .3 All boxes and conduit to be concealed
 - .4 Include for all necessary programming
 - .5 Coordinate with Div 26 for additional electrical requirements.
 - .6 The following shall be provided to suit card swipes shown on drawings and schedules

Input Module (16 Inputs)	6FL7820-8CB10
SiPass ACC Controller	S54507-C22-A1
SiPass 8 Door Extension	6FL7820-8AD20
Eight Reader Interface	S24246-A2500
Altronix Power Supply -	AL1024ULXPD16

2.3 FASTENINGS

- A. All hardware is to be installed using manufactures' supplied fasteners. Failure to comply may void warranties and applicable licensed labels. Self tapping/tek screws will not be acceptable on this project.
- B. Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- C. Exposed fastening devices to match finish hardware.
- D. Protection plates are to be supplied complete with self adhesive tape.

2.4 KEYING

- A. All locks to c/w both temporary and permanent cylinder cores and shall be keyed into an existing "Best Lock" factory interchangeable core keying system as follows:
 - construction master keyed
 - master keyed
 - keyed alike or different as required
 - permanent cores to be 7 pin uncombined.
- B. Provide temporary brass construction cores and keys during the construction period. The cost of all cylinders, cores and keys shall be included in this section.

Supply (4) Construction master keys
Supply (2) Control keys
Supply (3) Master keys per group
Supply (3) Change keys per lock.

- C. All permanent cylinders and keys are to be delivered directly to the Owner.
- D. The Hardware Supplier is to ensure all cylinders are supplied with cams / tailpieces suitable for specified lock functions. Supply all compression rings, trim collars and blocking rings to suit.
- E. The Contractor is responsible for providing locks and cylinders as required for his own use during the period of construction.

2.5 FINISHES

- A. Materials and Finishes shall comply with ANSI/BHMA A156.18

Hinges	630	stainless steel metal, satin
	652	satin chromium plating on steel
Locksets	626	satin chromium plated
Cylinders	626	satin chromium plated
Electric Strikes	630	stainless steel, satin
Door Closers	689	powder coat aluminum
Protection Plates	630	stainless steel, satin
Overhead Stops	630	stainless steel, satin
Floor/ Wall Stops	626	satin chrome

2.6 ABBREVIATIONS

ALD	aluminum door
ALF	aluminum door frame
PSF	pressed steel frame
HMD	hollow metal door
SCWD	solid core wood door
LH	left hand
RH	right hand
LHR	left hand reverse
RHR	right hand reverse
EX	existing
HR/FR	hour fire rated
T.B.	through bolt

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- A. Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions and data sheets.
- B. When requested, furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- C. Furnish manufacturer's instructions for proper installation of each hardware component.

3.2 INSTALLATION

- A. Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association, or as indicated for special conditions.
- B. Only tradesmen competent in the installation of Finishing Hardware shall be used for this purpose. Qualification would require a minimum (5) years experience in commercial application. The installer shall adjust, clean and make good all installation of Finishing Hardware to the satisfaction of the Consultant.
- C. The Contractor is responsible for ensuring the door preps for cylinder holes are aligned properly with mortise locks. The Contractor is to use his own "try-out cylinders prior to the installation of the permanent cylinders. Any holes found to be misaligned will be rectified by the Contractor.
- D. Section 26 00 00 (Electrical) to provide backboxes, conduits c/w pull wires and power supply for hard wired access control systems and related hardware.
- E. Protection plates are to be installed 1.59mm maximum up from the bottom edge of door push side. On single doors install in the centre of the door equally spaced to clear between the frame jamb stops.
- F. Contractor to ensure walls are properly blocked to prevent future damage wherever wall stops are to be used.

3.3 ADJUSTING

- A. Adjust door hardware for optimum, smooth operating condition, safety and for weather tight closure.
- B. Lubricate hardware, operating equipment and other moving parts.
- C. Adjust door hardware to provide tight fit at contact points with frames.

3.4 CLEANING

- A. Perform cleaning after installation to remove construction and accumulated environmental dirt.
- B. Clean hardware with damp cloth and approved non-abrasive cleaner. Polish hardware in accordance with manufacturer's instructions.
- C. Remove protective material from hardware items where present.
- D. Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.5 DEMONSTRATION

- A. Maintenance Staff Briefing:
 - .1 Brief maintenance staff regarding:
 - .1 Proper care, cleaning and general maintenance of projects complete hardware.
 - .2 Description, use, handling, and storage of keys.
 - .3 Use, application and storage of wrenches for locksets and door closers.

- .2 Demonstrate operation, operating components, adjustment features and lubrication requirements.

3.6 INSPECTIONS

- A. The Hardware Supplier consultant whose name is written on the cover sheet shall make periodic site inspections during installation of hardware to ensure that all hardware supplied is being applied in accordance with specifications, details and Consultant's directions. Inform the Contractor and the Consultant in writing of such inspections, pointing out errors, omissions, etc.; so that same may be corrected.
- B. The Hardware Supplier will contact product representatives (locksets and door closers) who will also make inspections during construction to ensure the proper installation and adjustment of their products. Final inspection to be carried out by the Hardware Supplier consultant whose name is written on the cover sheet and Product Representative. Representative to provide written certification that hardware has been installed and adjusted as intended.

3.7 SCHEDULE

- A. The following is a list of hardware to be used to define the required standards on this project. Any deviation from the hardware scheduled shall be replaced with the proper hardware at the Hardware Supplier' expense. Acceptable alternates as listed.

ITEM #1

1	SGLE EXISTING DOOR JM0-084	Corridor JM0-095 to X-RAY JM0-084	LH
	1220 x 2134 x 45		
	TYPE HMD/HMF		

1	EA	MAGNETIC DOOR HOLDER FLOOR MOUNT	
		CX-955-DH-FL	630

NOTE:

1. Existing door and hardware to remain.
2. Coordinate with electrical drawings for electrical connections and requirements.
3. Door holder to be connected to the fire alarm to release upon activation of the fire alarm. Refer to electrical drawings.

END OF DOOR HARDWARE

SECTION 09 21 16 GYPSUM BOARD ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 09 22 16 – Non-structural Metal Framing
- B. Section 09 91 23 – Interior Painting
- C. Section 10 26 00, Wall and Door Protection Specialties

1.2 REFERENCES

- A. Aluminum Association
 - 1. Designation for Aluminum Finishes.
- B. American Society for Testing and Materials International, (ASTM)
 - 1. ASTM C 36/C 36M-03e1, Specification for Gypsum Wallboard.
 - 2. ASTM C 79/C 79M-04a, Standard Specification for Treated Core and Non-treated Core Gypsum Sheathing Board.
 - 3. ASTM C 442/C 442M-04e1, Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.
 - 4. ASTM C 473-10 Standard Test Methods for Physical Testing of Gypsum Panel Products.
 - 5. ASTM C 475-01, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - 6. ASTM C 630/C 630M-03e1, Specification for Water-Resistant Gypsum Backing Board.
 - 7. ASTM C 840-08, Specification for Application and Finishing of Gypsum Board.
 - 8. ASTM C 954-10, Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - 9. ASTM C 1002-07, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - 10. ASTM C 1178/C 1178M-08, Specification for Glass Mat Water-Resistant Gypsum Backing Board.
 - 11. ASTM C 1396/C 1396M-09a, Standard Specification for Gypsum Board.
- C. Underwriters' Laboratories of Canada (ULC)
 - 1. CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.
- B. Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.
- C. Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

1.4 SITE ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.
- B. Apply board and joint treatment to dry, frost free surfaces.

- C. Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All gypsum products and accessories are to be of single manufacturer.
1. Acceptable manufacturers:
 - a. *Canadian Gypsum Company, Inc.*
 - b. *Georgia Pacific Corporation.*
 - c. *CertainTeed*
 - d. *Lafarge North America*
- B. **Standard board:** to ASTM C 36/C 36M Type X thickness indicated, 1200 mm wide x maximum practical length, ends square cut, edges beveled
1. Acceptable material:
 - a. *Sheetrock Brand Gypsum Panels as manufactured by CGC*
 - b. *Consultant approved equivalent.*
- C. Abuse-Resistant Gypsum Wallboard:
1. Thickness: 5/8" IN with fire resistant core at rated assemblies.
 2. Surface Abrasion: ASTM C126
 3. Indentation Resistance: ASTM D4977
 4. Soft Body Impact: ASTM D5420
 5. Hard Body Impact: ASTM E695
 6. Upgrade metal studs to 20 GA minimum where used with ARGWB.
 7. Finish as recommended by wallboard manufacturer.
 8. Base Product: Extreme Abuse by CertainTeed.
 - a. Optional Product:
 - 1) *Sheetrock VHI Mold Tough Panel by CGC*
 - 2) *ToughRock Abuse Resistant Gypsum Board by Georgia Pacific.*
- D. **Fire resistant board:** to ASTM C 36/C 36M thickness indicated, 1200 mm wide x maximum practical length, ends square cut, edges beveled
1. Acceptable material:
 - a. *Sheetrock FIRECODE Type X Panels as manufactured by CGC*
 - b. *Consultant approved equivalent.*
- E. **Water-resistant board:** to ASTM C 630/C 630M , Type X thickness indicated, 1200 mm wide x maximum practical length, ends square cut, edges beveled
- F. Drywall furring channels: 0.5 mm core thickness galvanized steel channels for screw attachment of gypsum board.
- G. Resilient drywall furring: 0.5 mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- H. Steel drill screws: to ASTM C 1002.
- I. *Non-Ferrous screw fasteners to be used in MRI 125.15*
- J. Casing beads, corner beads, control joints and edge trim: to ASTM C 1047, metal, zinc-coated by hot-dip process, 0.5 mm base thickness, perforated flanges, one piece length per location.
1. Acceptable products:
 - a. *Bailey Metal Products Limited*
 - b. *Consultant approved equivalent.*
 2. *Non-Ferrous casing beads to be used in MRI 125.15*

- K. Expansion beads: Rigid PVC meets ASTM D3678-97, D1784-03, C1047-99, Class A Flame spread and Smoke develop (ASTM E84-10)
 - 1. Acceptable material:
 - a. *Trim-Tex drywall product, sizes and type as noted on drawings.*
 - b. *Consultant approved equivalent.*
- L. “Z” Type Aluminum Reveal molding:
 - 1. Acceptable product:
 - a. *DRMZ* as manufactured by *Fry Reglet Corporation*.
 - b. Reveal width: $\frac{1}{2}$ ”
 - c. Depth: to suit gypsum board thickness
 - d. Material: Extruded Aluminum.
 - e. Finish: Clear Coat Aluminum
- M. “F” Type Aluminum Reveal molding:
 - 1. Acceptable product:
 - a. *DRMF* as manufactured by *Fry Reglet Corporation*.
 - b. Reveal width: $\frac{1}{2}$ ”
 - c. Depth: to suit gypsum board thickness
 - d. Material: Extruded Aluminum.
 - e. Finish: Clear Coat Aluminum
- N. Sealants: in accordance with Section *07 92 00*.
- O. Joint compound: to ASTM C 475, asbestos-free.

PART 3 - EXECUTION

3.1 ERECTION

- A. Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.
- B. Do application of gypsum sheathing in accordance with ASTM C 1280.
- C. Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C 840 except where specified otherwise.
- D. Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- E. Install work level to tolerance of 1:1200.
- F. Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers and grilles.
- G. Install 19 x 64 mm furring channels parallel to, and at exact locations of steel stud partition header track.
- H. Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- I. Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- J. Install wall furring for gypsum board wall finishes in accordance with ASTM C 840, except where specified otherwise.

- K. Furr openings and around built-in equipment, cabinets and access panels on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- L. Furr duct shafts, beams, columns, pipes and exposed services where indicated.

3.2 APPLICATION

- A. Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.
- B. Apply single layer gypsum board to metal furring or framing using screw fasteners. Maximum spacing of screws 300 mm on centers, unless specified otherwise by manufacturer's literature.
 - 1. Single-Layer Application:
 - a. Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C 840.
 - b. Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
- C. Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- D. Install gypsum board with face side out.
- E. Do not install damaged or damp boards.
- F. Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.3 INSTALLATION

- A. Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150mm on centre.
- B. Install casing beads around perimeter of suspended ceilings.
- C. Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.
- D. Splice corners and intersections together and secure to each member with 3 screws.
- E. Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- F. Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:
 - 1. Levels of finish:
 - a. Level 0: No taping, finishing or accessories required.
 - b. Level 1: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
 - c. Level 2: Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - d. Level 3: Embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

- e. Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
- f. Level 5: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
- G. Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- H. Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.
- I. Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- J. Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- K. Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- L. Mix joint compound slightly thinner than for joint taping.
- M. Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- N. Allow skim coat to dry completely.
- O. Remove ridges by light sanding or wiping with damp cloth.
- P. Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.
- Q. Install Z reveals at all aluminum door frames and as noted on the drawings.*

END OF GYPSUM BOARD ASSEMBLIES

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SECTION 09 22 16 NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Non-Structural Metal Framing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. General:
 - 1. Manufacturer shall be a member of either Certified Steel Stud Association (CSSA), Steel Stud Manufacturers Association (SSMA) or Steel Framing Industry Association (SFIA).
- B. Reference Standards:
 - 1. ASTM Reference Standards:
 - a. ASTM C645: Standard Specification for Nonstructural Steel Framing Members.
 - b. ASTM A653: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - c. ASTM C754: Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
 - d. ASTM A1003: Standard Specification for Steel Sheet, Carbon, Metallic- and – Nonmetallic-Coated for Cold-Formed Framing Members.
- C. Seismic Design: comply with Ontario Building Code, Section 4.1.8.17 and requirements of Authorities Having Jurisdiction.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Provide copies of manufacturer's specifications and installation instructions for each type of material and accessory required.
 - a. Include data required to show specification compliance.

PART 2 - PRODUCTS

2.1 SUPPORT SYSTEMS FOR GYPSUM CEILINGS/BULKHEADS

- A. Stud-Framed Ceiling/Soffit Systems:
 - 1. C-shaped studs or joists; roll-formed from corrosion-resistant galvanized steel that conforms to ASTM C645.
 - 2. Galvanized Coating: ASTM A653, G40.
 - 3. Minimum Frame Member Depth: 3-5/8 IN minimum, unless otherwise indicated.
 - a. Use wider stud sections if ceiling span and support requires.
 - 4. Minimum flange width: 1-1/4 IN.
 - 5. Minimum stud thickness: 33 MIL.
 - 6. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.
- B. Tie Wire:
 - 1. Material: ASTM A641, Class 1 zinc coating, soft temper.
 - 2. Minimum Diameter (single-strand): 62 mils (14 GA).

3. Minimum Diameter (double-strand): 42 mils (18 GA).
- C. Wire Hangers:
 1. Material: ASTM A641, Class 1 zinc coating, soft temper.
 2. Minimum Diameter: 97 mils (12 GA).
- D. Anchors in Concrete:
 1. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E488 or ASTM E1512 as applicable.
 2. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.
 3. Material: Carbon-steel components zinc plated to comply with ASTM-B633, Class Fe/Zn 5 (0.005 MM) for Class SC 1 service condition.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine supporting structure and conditions under which system will be installed.
- B. Correct conditions detrimental to proper installation.
- C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

- A. General:
 1. Layout and install metal framing accurate to dimensions indicated in drawings.
 2. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.
 - a. Gypsum Board Assemblies: Comply with additional requirements in ASTM C840 relative to framing installation.
 3. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
 4. Install bracing at terminations in assemblies.
 5. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
 6. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
 7. Extend framing full height to structural supports.
 - a. Continue framing around ducts and similar items which penetrate partitions.
 8. Utilize slip-type head track assemblies where framing extends to overhead structural supports.
 - a. Configure to resist lateral loads while accommodating deflection of overhead building superstructure without inducing axial loading on partition framing.
- B. Align stud knockouts to facilitate running of wires and conduit.

3.3 GRID SUSPENSION SYSTEMS:

1. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces.
2. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
3. Install suspension systems that are level to within 1/8 IN in 12 FT measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

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SECTION 09 51 13 ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 RELATED SECTIONS:

- A. Section *09 53 00* - Acoustical Suspension.

1.2 REFERENCES

- A. American Society for Testing and Materials International (ASTM)
 - 1. ASTM C 423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
 - 2. ASTM E 1264-08e1, Standard Classification for Acoustical Ceiling Products.
 - 3. ASTM E 1477-98a(2008), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.
- B. Canadian Standards Association (CSA International)
 - 1. CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- C. Department of Justice Canada (Jus)
 - 1. Canadian Environmental Protection Act (CEPA), latest edition, c. 33.
 - 2. Transportation of Dangerous Goods Act (TDGA), latest edition, c. 34.
- D. Underwriter's Laboratories of Canada (ULC)
 - 1. CAN/ULC-S102-03, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

- A. Submit samples in accordance with Section *01 33 00*.
- B. Submit duplicate samples of each type of acoustical units.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Fire-resistance rated floor/ceiling and roof/ceiling assembly: certified by Canadian Certification Organization accredited by Standards Council of Canada.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Protect on site stored or installed absorptive material from moisture damage.
- B. Store extra materials required for maintenance, where directed by Consultant.

1.6 EXTRA MATERIAL

- A. Provide extra materials of acoustic units in accordance with Section *01 78 00*.
- B. Provide acoustical units amounting to *1* full boxes for each pattern and type required for project.
- C. Ensure extra materials are from same production run as installed materials.
- D. Clearly identify each type of acoustic unit, including colour and texture.
- E. Deliver to Consultant, upon completion of the work of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Type ACT1:
 - a. Mineral Fibre, wet formed
 - b. Vinyl laminated face
 - c. Sealed back and edges
 - d. Surface texture: Smooth
 - e. No pattern
 - f. Edge Profile: square lay-in
 - g. Size: 24"x48"x3/4"
 - h. Type IV, Form 2, Pattern GH with film laminate surface finish
 - i. Class 100: Type X
 - j. Class A fire resistance/flame spread
 - k. NRC: N/A
 - l. CAC: 40
 - m. Acceptable Products:
 - 1) *Clean Room ClimaPlus – item 56091, as manufactured by Canadian Gypsum Company, Inc.,*
 - 2) *Clean Room VL #870 as manufactured by Armstrong World Industries, Inc.*
 - 3) *or consultant approved equivalent.*

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not install acoustical panels and tiles until work above ceiling has been inspected by Consultant and Authority Having Jurisdiction.

3.2 INSTALLATION

- A. Install acoustical panels and tiles in ceiling suspension system.

3.3 APPLICATION

- A. Install acoustical units as indicated on Reflected Ceiling Plan.
- B. Scribe acoustic units to fit adjacent work. Butt joints tight and terminate edges with moulding.

3.4 INTERFACE WITH OTHER WORK

- A. Coordinate with Section *09 53 00*.
- B. Coordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

END OF ACOUSTICAL PANEL CEILINGS

SECTION 09 53 00 ACOUSTICAL SUSPENSION

PART 1 - GENERAL

1.1 RELATED SECTIONS

- A. Section 09 51 13 – Acoustical Panel Ceilings.

1.2 REFERENCES

- A. American Society for Testing and Materials International (ASTM)
 - 1. ASTM C 635/C 635M-07, Standard Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
 - 2. ASTM C 636/C 636M-08, Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

1.3 DESIGN REQUIREMENTS

- A. Maximum deflection: 1/360th of span to ASTM C 635 deflection test.

1.4 SUBMITTALS

- A. Provide submittals in accordance with Section 01 33 00.
- B. Submit shop drawings in accordance with Section 01 33 00.
 - 1. Submit reflected ceiling plans for special grid patterns as indicated.
 - 2. Indicate lay-out, insert and hanger spacing and fastening details, splicing method for main and cross runners, location of access splines and acoustical unit support at ceiling fixture lateral bracing and accessories.
- C. Provide samples in accordance with Section 01 33 00.
 - 1. Submit one representative model of each type ceiling suspension system.
 - 2. Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store and handle materials in accordance with Section 01 61 00.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All ceiling suspension components are to be of single manufacturer.
- B. Intermediate duty system to ASTM C 635.
- C. Basic materials for suspension system: commercial quality cold rolled steel.
- D. Type ACT1:
 - 1. Suspension system: non fire rated, made up as follows:
 - a. Two directional exposed tee bar grid with factory applied closed cell gaskets for controlled environment rooms.
 - 2. Track Width: 15/16"

3. Wall Angle: *US28CE with C-8 Hold-down Clips*
4. Colour: *Flat White*
5. Provide hold down clips : *L15*
6. Acceptable material:
 - a. *USG DONN® Brand DXACE Acoustical Suspension System, as manufactured by Canadian Gypsum Company, Inc.*
 - b. *Optional:*
 - 1) *CertainTeed*
 - 2) *Armstrong*
- E. Hanger wire: galvanized soft annealed steel wire:
 1. 3.6 mm diameter for access tile ceilings.
- F. Hanger inserts: purpose made.
- G. Accessories: splices, clips, wire ties, retainers and wall moulding, to complement suspension system components, as recommended by system manufacturer.

PART 3 - PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- A. Installation: in accordance with ASTM C 636 except where specified otherwise.
- B. Install suspension system to manufacturer's instructions.
- C. Do not erect ceiling suspension system until work above ceiling has been inspected by Consultant and Authority Having Jurisdiction.
- D. Secure hangers to overhead structure using attachment methods recommended by manufacturer as acceptable to Consultant.
- E. Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.
- F. Lay out system according to reflected ceiling plan.
- G. Ensure suspension system is coordinated with location of related components.
- H. Install wall moulding to provide correct ceiling height.
- I. Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers, grilles, speakers, etc.
- J. Support at light fixtures and diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture. Support in a manner that will not restrict the removal of ceiling tiles once in place.
- K. Interlock cross member to main runner to provide rigid assembly.
- L. Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- M. Finished ceiling system to be square with adjoining walls and level within 1:1000.

END OF ACOUSTICAL SUSPENSION

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SECTION 09 65 16 RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Resilient Sheet Flooring as indicated, in accordance with provisions of the Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM E 84-03, Standard Test Method for Surface Burning Characteristics of Building Materials.
 - 2. ASTM E 662-03, Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials.
 - 3. ASTM F 1913-04, Standard Specification for Rubber Sheet Floor Covering Without Backing
- B. Canadian Environmental Protection Act: (CEPA)

1.3 SAMPLES

- A. Submit samples in accordance with Section 01 33 00.
- B. Submit duplicate 300x300mm sample pieces of sheet material.

1.4 SUBMITTALS

- A. Project information:
 - 1. Certification of installer qualifications.
 - 2. Seaming Diagram.
 - 3. Coving Details
- B. Contract closeout information:
 - 1. Maintenance data.
 - 2. Letter stating extra material has been delivered.
 - 3. Warranty.

1.5 EXTRA MATERIALS

- A. Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 01 78 00.
- B. Provide 10m² of each colour, pattern and type of flooring required for project for maintenance use.
- C. Extra material to be in one piece and from same production run and installed materials.
- D. Clearly identify each roll of sheet flooring and each container of adhesive.

1.6 QUALITY ASSURANCE AND REGULATORY REQUIREMENTS

- A. Select an installer who is competent in the installation resilient sheet flooring, including heat-welded seams.

- B. If required, provide types of flooring and accessories supplied by one manufacturer, including leveling and patching compounds, and adhesives.

1.7 WARRANTY

- A. Manufacturer: Written warranty on product against manufacturer's defects and wear exceeding 10 percent for a period of 5 years.
- B. Installer: Written warranty on installation against loss of bond to substrate and seam separation for a period of 5 years.

PART 2 - PRODUCTS

2.1 RESILIENT SHEET FLOORING

- A. Must meet or exceed all applicable governmental and industrial safety and performance standards
- B. Must be manufactured and transported in such a manner that all steps of the process, including the disposal of waste products arising there from, will meet the requirements of all applicable governmental acts, bylaws and regulations including for facilities located in Canada, the Fisheries Act and the Canadian Environmental Protection Act (CEPA).
- C. Sheet Vinyl: (sheet flooring – slip resistant – Homogeneous non-layered and non-backed)
 - 1. Manufactured to exceed the requirements of ASTM F 1913, complete with wear surface.
 - 2. Colour as selected by Consultant
 - a. Base Colour: *873 Light Beige Gray*
 - 3. Thickness: 2.00mm
 - 4. Acceptable Product:
 - a. *iQ Optima as manufactured by Tarkett*
 - b. Consultant approved equivalent.
- D. Vinyl Weld Rod: solid colour
 - 1. Intended for heat welded seams
 - 2. Color: as by the Consultant from standard colors available
 - 3. Acceptable Product:
 - a. Vinyl Weld Rod: *as manufactured by Tarkett*
- E. Integral Base: (IB): sheet vinyl, continuous, complete with support fillet at floor to wall transition.
 - 1. Thickness: 2.03mm
 - 2. Height: 150mm
 - 3. Lengths: minimum of 2400mm
 - 4. Colours: base colour to match adjacent colour of adjacent sheet vinyl
 - 5. Acceptable Product:
 - a. manufacturer of integral sheet vinyl base must be the same as that for sheet vinyl floor material. Cove support fillet: *CFS-00-A as manufactured by Johnsonite.*

2.2 MATERIALS AND ACCESSORIES

- 1. Vinyl flooring must not be manufactured or formulated with cadmium (Cd), Chromium (Cr), lead (Pb), mercury (Hg) or nickel (Ni)
- 2. Must not contain >0.01% by weight of arsenic (As)
- 3. Must not contain >1% by weight of tin (Sn)
- 4. Must not be manufactured or formulated with short-chained chlorinated paraffin waxes (C=13) or nonyl phenol.
- 5. Must not contain or be manufactured with materials derived from species listed on the Convention on International Trade in Endangered Species (CITES)
- 6. Primers and Adhesives:

- a. Waterproof, of types recommend by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.
7. Sub-floor filler and leveler: as recommended by flooring manufacturer.
8. Provide resilient edge strips: To be of equal gauge to the flooring, homogeneous vinyl or rubber composition, with lip to extend under floor finish, provide units of maximum available length to minimize the number of joints, tapered edge, with color to match with the flooring, or as selected by the Consultant from standard colors available.
 - a. Color: as by the Consultant from standard colors available
 - b. Acceptable products, *SLT-XX-B as manufactured by Tarkett*, or consultant approved equivalent.
9. Provide transition/reducing strips tapered to meet abutting materials.
10. Cove base cap:
 - a. Color: as by the Consultant from standard colors available
 - b. Acceptable product, *SCC-XX-B as manufactured by Tarkett*.
11. External corner protectors; type recommended by flooring manufacturer.
12. Edging to floor penetrations: stainless steel, type recommended by flooring manufacturer.
13. Sealer and wax: type recommended by resilient flooring material manufacturer for material type and location.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine substrate and conditions under which flooring is to be installed.
 1. Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.
 2. Verify limits of moisture and alkalinity are within levels tolerated by Cushioned Sheet Vinyl Flooring manufacturer and setting materials manufacturer.
- B. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

- A. Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler compatible with substrate and sheet flooring materials.
- B. Remove paint, varnish, oils, release agents, sealers, and waxes. Remove residual adhesives as recommended by the flooring manufacturer. Remove curing and hardening compounds not compatible with the adhesives used, as indicated by a bond test or by the compound manufacturer's recommendations for flooring. Avoid organic solvents.
- C. Perform subfloor moisture testing in accordance with ASTM F 1869, "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" and Bond Tests as described in publication F-5061, "*Tarkett Guaranteed Installation System*," to determine if surfaces are dry; free of curing and hardening compounds, old adhesive, and other coatings; and ready to receive flooring. Relative humidity shall not exceed 80%. On installations where both the Percent Relative Humidity and the Moisture Vapor Emission Rate tests are conducted, results for both tests shall comply with the allowable limits listed above. Do not proceed with flooring installation until results of moisture tests are acceptable. All test results shall be documented and retained.
- D. Perform pH tests on concrete floors regardless of their age or grade level. All test results shall be documented and retained.
- E. Clean floor and apply filler to provide smooth surface for new sheet flooring. Trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler has cured and dried.

1. For rooms containing Imaging equipment, level the floor to
- F. Remove or treat old adhesives to prevent residual from bleeding through to new flooring and interfering with the bonding of new adhesives.
- G. Seal concrete slab to resilient flooring as per manufacturer's written direction.

3.3 INSTALLATION

- A. Provide a high ventilation rate, with maximum outside air, during installation and for 48-72hrs after installation. If possible, vent directly to the outside. Do not let contaminated air recirculate through a district or whole building air distribution system. Maintain extra ventilation for at least one month following building occupation.
- B. To minimize emissions from adhesives, use water based, solvent free styrene-butadiene-rubber adhesive for linoleum. Butadiene exposure may cause eye and nose irritation, headaches, dizziness and vomiting.
- C. Apply adhesive uniformly using recommended application method. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- D. Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.
- E. Lay flooring to provide a minimum number of seams. Avoid cross seams, filler pieces, and strips. Match edges for color shading and pattern at the seams in compliance with the manufacturer's recommendations.
- F. Adhere flooring to the subfloor without cracks, voids, raising and puckering at the seams. Roll with a 100-pound (45.36 kilogram) roller in the field areas. Hand-roll flooring at the perimeter and the seams to assure adhesion. Refer to specific rolling instructions of the flooring manufacturer.
- G. Scribe, cut, and fit or flash cove to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.
- H. Install feature strips and floor markings where indicated. Fit joints tightly.
- I. Install flooring wall to wall before the installation of floor-set cabinets, casework, furniture, equipment, movable partitions, etc. Extend flooring into toe spaces, door recesses, closets, and similar openings as shown on the drawings.
- J. Continue flooring through areas to receive movable type partitions without interrupting floor pattern.
- K. Terminate flooring at centerline of door in openings where adjacent finish or colour is dissimilar.
- L. Install metal edge strips or resilient edge strips at unprotected or exposed edges where flooring terminates.
- M. Where new flooring materials are scheduled to be installed to match existing, provide material of same characteristics of existing materials.
- N. If required, install flooring on pan-type floor access covers. Maintain continuity of color and pattern within pieces of flooring installed on these covers. Adhere flooring to the subfloor around covers and to covers.
- O. Install flooring with adhesives, tools, and procedures in strict accordance with the manufacturer's written instructions. Observe the recommended adhesive trowel notching, open times, and working times.
- P. Prepare heat-welded seams with special routing tool supplied for this purpose and heat weld with vinyl welding rod in seams. Use methods and sequence of work in conformance with written

instructions of the flooring manufacturer. Finish all seams flush and free from voids, recesses, and raised areas.

- Q. Provide integral flash cove wall base where shown on the drawings, including cove fillet support strip and top edge cap trim. Heat-weld seams as specified for those on the floor.

3.4 CLEANING

- A. Remove excess adhesive from floor, base and wall surfaces without damage.
- B. Clean, seal and wax floor and base surface to flooring manufacturer's printed instructions.

3.5 PROTECTION

- A. Protect new floors from time of final set of adhesive until final inspection.
- B. Prohibit traffic on floor for 48hrs after installation.

END OF SECTION

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SECTION 09 91 23 INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Interior Painting, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Definitions:
 - 1. "Paint" and "painting" refer to applied coatings.
 - 2. Finished room or space: Room or space indicated to receive a finish in the room finish schedule.
 - 3. Finished room or space: Room or space indicated to receive a finish in Section 09 06 00 - Room Finish Schedule.
- Mechanical work: Work included in Mechanical Specification Divisions.
- 4. Electrical work: Work included in Electrical Specification Divisions.
- B. Work included:
 - 1. Interior surfaces in finished rooms or spaces, unless indicated not to be painted or indicated to be painted under other sections.
 - 2. Mechanical and electrical work:
 - a. Interior mechanical and electrical equipment not completely factory finished.
 - b. In finished rooms and spaces: Exposed ductwork, piping, insulated piping, conduit, busways, raceways, and associated accessories.
 - c. All new firehose cabinets and electrical panels that are installed with a factory primed finish.
- C. Environmental Standards:
 - 1. Green Seal GS-11, Paints.
 - 2. Green Seal GS-03, Anti-Corrosive Paints.
 - 3. South Coast Air Quality Management District, Rule 1113, VOC content limits for Clear Wood Finishes, Floor Coatings, Stains and Shellacs.
 - 4. ASTM D2486-89, Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints.
 - 5. ASTM D2805-88, Standard Test Method for Hiding Power of Paints by Reflectometry.
- D. Standard of Acceptance.
 - 1. Walls: no defects visible from a distance of 3 FT-0 IN at 90 DEG to surface.
 - 2. Ceilings and bulkheads: No defects visible from floor at 45 DEG to surface when viewed using final lighting source.
 - 3. Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.3 SUBMITTALS

- A. Product Data:
 - 1. Manufacturer's data for each paint type to be applied indicating conformance to specifications.
 - 2. MSDS.
 - a. Organize submittals by Application (Eg. Ceilings, Walls, Door Frames, etc.)
- B. Samples:

1. Three 216mm X 280mm 8 1/2 IN x 11 IN samples of each color and finish as specified in the Room Finish Schedule.

C. Contract Closeout Information:

1. Maintenance data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Provide paint as product of one manufacturer as far as possible.
- B. Paint, stain, and coating systems listed are Sherwin Williams unless noted otherwise.
 1. Use comparable performance, environmental, and aesthetic requirements for paints by Optional manufacturers.
 2. Colour selections to be determined by consultant after contract award. Allow 10 Base and 15 Accent colours.
 3. Use MPI rating for comparison.
- C. Paints shall not contain cadmium or lead.
- D. Paints:

Dulux Paints "Lifemaster" Colour SW 7029 Agreeable Gray and door frames is colour Jogging Path if applicable. HDH site uses Dulux paints so we match their in house inventory. We are only painting walls affected by our work.

 1. Base:
 - a. Dulux Lifemaster
- E. Other manufacturers desiring approval comply with Section 01 25 13.

2.2 MATERIALS

- A. Paints: As Scheduled in Part 3.
 1. Unscheduled items: Bring to the attention of Architect.
 2. Colors: As selected by Architect after Contract Award, and as indicated in Mechanical and Electrical specification.
- B. Gloss range: As indicated for the Paint Systems, when measured in accordance with ASTM-D523:
 1. Flat: Below 15, at 85-degrees.
 2. Eggshell: Between 5 and 20, at 60-degrees.
 3. Satin: Between 15 and 35, at 60-degrees.
 4. Semi-gloss: Between 30 and 65, at 60-degrees.
 5. Gloss: More than 65, at 60-degrees.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Review other sections in which primers are provided to ensure compatibility of the total system for various substrates. On request, furnish information on characteristics of finish materials to ensure use of compatible primers. Notify the Consultant about anticipated problems using the materials specified over substrates primed by others.
- B. Examine surfaces carefully for defects which cannot be corrected and may prevent satisfactory results.
- C. Commencement of work in a specific area constitutes acceptance of surfaces, and responsibility for performance.

3.2 SURFACES NOT TO BE PAINTED

- A. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.
- B. Moving parts of valves, operating units, mechanical and electrical parts, such as valve and damper operators, sending devices, motor and fan shafts.
- C. Code labels, such as UL, FM that are mylar or flat (non-embossed) plates.
 - 1. Embossed plates and labels stamped into frames to be painted will remain readily visible and convenient for identification by Authority Having Jurisdiction.
- D. Equipment identification or rating plates.
- E. Items having complete factory finish with exception of:
 - 1. Electrical panels.
 - 2. Control cabinets.
 - 3. Similar surfaces in finished areas.

3.3 PREPARATION - GENERAL

- A. Ensure that surfaces are clean and dry.
- B. Ensure that surfaces are free of foreign materials which will affect adhesion or appearance.
- C. Remove any organic matter and neutralize surface.
- D. Eliminate efflorescence before painting.
- E. Before painting, test surfaces with moisture meter. Do not commence painting operations until moisture level of substrate material is within manufacturer's accepted limits.

3.4 MATERIAL PREPARATION

- A. Mix and prepare materials per manufacturer's recommendations.
- B. Stir, agitate or blend materials to produce a mixture of uniform density as required for application of materials.

3.5 PREPARATION - FERROUS METAL SURFACES AND HOLLOW METAL

- A. Remove rust, loose mill scale, welding slag, dirt, oil, grease and other substances in accordance with MPI requirements.
- B. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
- C. Touch up damaged shop coats.
- D. For surfaces with touched up shop coat, omit first coat.
- E. Hollow metal frame joints at intersections of rabbets, stops, and soffit joints:
 - 1. Neatly fill corner seam with painter's caulk prior to painting.
- F. New frames supplied with pre-drilled holes that are not required for specific installation, fill holes, sand smooth and prep for new paint finish.

3.6 PREPARATION - GALVANIZED METAL SURFACES AND NONANODIZED ALUMINUM

- A. Follow requirements of MPI.
- B. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.

3.7 PREPARATION - GYPSUM WALLBOARD

- A. Repair minor irregularities left by finishers.
- B. Exercise care to avoid raising nap of paper.
- C. Apply prime coat.
- D. Notify gypsum wallboard finisher to repair and refinish areas which indicate defects after application of primer.
- E. Re-prime refinished areas.

3.8 PREPARATION – CONCRETE AND MASONRY

- A. Repair minor defects.
- B. Remove oil from concrete by washing with xylol.
- C. Block Filler:
 - 1. Apply to masonry to fill pinholes and minor surface defects, and to prime surface for topcoat.
 - 2. Apply by brush, roller or sprayer.
 - a. Where spray-applied: Back-roll with roller or squeegee.
 - 3. Minimum Nominal Thickness: 10 MIL DFT.
 - a. Comply with manufacturer's recommended coverage rates for conditions encountered.
 - 4. Provide complete cover with recommended coating system.
- D. Obtain architect's approval of finish for surfaces to receive high build glazed coatings.

3.9 APPLICATION - GENERAL

- A. Paint surfaces as specified in paragraphs "Schedule - Interior Paint Systems".
- B. Provide complete coverage to hide.
 - 1. When color or undercoats show through, apply additional coats at no additional cost until paint film is of uniform finish and color.
- C. Employ individuals skilled in this trade.
- D. Mix and apply as recommended by manufacturer.
- E. Do not apply succeeding coats until Consultant has reviewed Prime coat.
- F. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items, or provide ample in place protection.
- G. Upon completion of painting, carefully replace removed items and/or remove protection.
- H. Apply materials under adequate illumination.
- I. Evenly spread and smoothly flow on for full, smooth cover.
- J. Ensure that coats are dry before recoating.
- K. Touch up suction or hot spots in plaster, gypsum wallboard, concrete block, and concrete before painting.
- L. Touch up abraded areas of shop prime coats before subsequent coats are applied.
- M. Back prime wood trim with penetrating sealer.

3.10 APPLICATION - INTERIOR

- A. Finish door edges same as faces of doors.

- B. Finish closets, semi-exposed surfaces behind grilles, radiation, etc., to match nearest adjoining surface.

3.11 PROTECTION AND CLEANUP

- A. Protect adjacent work against damage by painting and finishing work.
- B. Clean, repair or replace, and repaint damaged work as directed by Consultant.
- C. Provide "WET PAINT" signs.
- D. Remove temporary protective wrappings, after completion of operations.
- E. Clean paint spattered surfaces.
- F. Use care not to damage finished surfaces.
- G. Remove surplus materials, scaffolding and debris.
- H. Leave areas broom clean.

3.12 SCHEDULE - INTERIOR PAINT SYSTEMS

- A. Gypsum wallboard and plaster surfaces, ceilings:
 - 1. Acrylic (PT), Gloss Level 1 (Flat):
 - a. Dulux Lifemaster:
 - 1) Primer coat: Dulux Lifemaster Primer;
 - 2) Intermediate coat: Dulux Lifemaster acrylic Eg-Shel;
 - 3) Topcoat: Dulux Lifemaster acrylic Eg-Shel;
- B. Metal doors and frames:
 - 1. Waterborne Acrylic, Gloss Level 5 Semi gloss:
 - a. Sherwin Williams:
 - 1) Primer coat: Dulux Lifemaster Primer;
 - 2) Intermediate coat: Dulux Lifemaster acrylic Eg-Shel;
 - 3) Topcoat: Dulux Lifemaster acrylic Eg-Shel;
- C. Concrete and concrete block walls:
 - 1. Acrylic (PNTL), Gloss Level 3 Eggshell:
 - a. Dulux Lifemaster:
 - 1) Primer coat: Dulux Lifemaster Primer;
 - 2) Intermediate coat: Dulux Lifemaster acrylic Eg-Shel;
 - 3) Topcoat: Dulux Lifemaster acrylic Eg-Shel;

END OF SECTION

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SECTION 13 49 00
RADIATION PROTECTION

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Submit shop drawings, product data and samples in accordance with Section 01 33 00.
- B. Submit product data and installation instructions for each product specified.

1.2 DELIVERY AND STORAGE

- A. Deliver and store equipment to the project site Storage using methods recommended by the manufacturer and in accordance with Section 01 61 00.
- B. Prior to installation, inspect equipment to ensure it is not damaged. Replace damaged equipment to the acceptance of the Consultant.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Lead sheet lining: cast or rolled pure sheet lead to ASTM B 749-03 (Standard Specification for Lead and Lead Alloy Strip, Sheet, and Plate Products), thickness: 1.6mm

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Patch and repair all existing lead as required due to new work. Provide a minimum overlap on all edges as recommended by the manufacturer.

END OF SECTION

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DIVISION 20

MECHANICAL COMMON WORK RESULTS

Section 20 05 05	Mechanical Work General Instructions
Section 20 05 10	Basic Mechanical Materials and Methods
Section 20 05 15	Seismic Control and Restraint
Section 20 05 25	Mechanical Insulation
Section 20 05 35	Demolition and Revision Work
Section 20 05 50	Testing, Adjusting and Balancing

DIVISION 21

FIRE SUPPRESSION

Section 21 13 00	Fire Protection Sprinkler System

DIVISION 22

PLUMBING

Section 22 11 00	Domestic Water Piping and Specialties
Section 22 13 00	Drainage and Vent Piping and Specialties
Section 22 43 00	Healthcare Plumbing Fixtures and Fittings

DIVISION 23

HEATING, VENTILATING AND AIR CONDITIONING

Section 23 08 03	HVAC System Cleaning
Section 23 20 00	HVAC Piping and Pumps
Section 23 30 00	HVAC Air Distribution
Section 23 36 00	Air Terminals Units

DIVISION 25

INTEGRATED AUTOMATION

Section 25 05 00	Energy Monitoring and Control Systems (EMCS)
Section 25 05 05	Automatic Control Systems

END OF SECTION

1 GENERAL

1.01 REFERENCES

- .1 Division 00 and Division 01 apply to and are a part of this Section.

1.02 APPLICATION

- .1 This Section specifies requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Division 00 or 01 to take precedence, as confirmed with Owner and reviewed with Consultant prior to Bid submission.
- .2 Be responsible for advising product vendors of requirements of this Section.

1.03 DEFINITIONS

- .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
- .2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
- .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
- .4 "provision" or "provide" (and tenses of "provide") – means supply and install complete.
- .5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.
- .6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer's supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers' assistance to Contractor.
- .7 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, and remove obsolete materials; patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Owner and reviewed with Consultant.
- .8 "barrier-free" – means when applied to a building and its facilities, that building and its facilities can be approached, entered and used by persons with physical or sensory disabilities in accordance with requirements of local governing building code.
- .9 "BAS" – means building automation system; "BMS" – means building management system; "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same.
- .10 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.

- .11 "OSHA" and "OHSA" – stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.
- .12 "Mechanical Divisions" – typically, refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.
- .13 "Electrical Divisions" – typically, refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.
- .14 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.
- .15 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.04 DOCUMENTS

- .1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.
- .2 Specification is typically generally arranged in coordination with guidelines of Construction Specifications Institute/Canadian Specifications Canada (CSI/CSC) 50 Division MasterFormat.
- .3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.
- .4 Review Drawings and Specifications in conjunction with documents of other Divisions and, where applicable, Code Consultant's report.
- .5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Mechanical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.
- .6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.
- .7 Drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, offsets, fittings, transformations and similar products required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.

- .8 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.
- .9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa.
- .10 Starter/motor control centre (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements prior to Bid submission. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.
- .11 If there is conflict or discrepancy between, among or within any provisions of Contract Documents, provisions establishing higher quality, manner or method of performing the Work, using more stringent standards, prevails, with intent that provisions which produce higher quality with higher levels of safety, reliability, durability, performance and service prevails.
- .12 Generally, documents govern in following order:
 - .1 Specification.
 - .2 Drawings of larger scale.
 - .3 Drawings of smaller scale.
 - .4 Drawings of later date when scale of drawings is same.
- .13 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, notify Consultant.
- .14 Drawings and Specifications have been prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by Consultant to any other party.

1.05 EXAMINATION OF DOCUMENTS AND SITE

- .1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.
- .2 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.
- .3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.06 WORK STANDARDS

- .1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.
- .2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Owner and reviewed with Consultant.
- .3 Supplementary mandatory specification and requirements to be used in conjunction with project include but are not limited to following:
 - .1 Air-Conditioning, Heating and Refrigeration Institute (AHRI);
 - .2 Air Movement and Control Association (AMCA);
 - .3 American Iron and Steel Institute (AISI);
 - .4 American National Standards Institute (ANSI);
 - .5 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);
 - .6 American Society of Mechanical Engineers (ASME);
 - .7 American Society of Testing and Materials (ASTM);
 - .8 American Water Works Association (AWWA);
 - .9 Associated Air Balance Council (AABC);
 - .10 Building Industry Consulting Services, International (BICSI);
 - .11 Canadian Gas Association (CGA);
 - .12 Canadian General Standards Board (CGSB);
 - .13 Canadian Standards Association (CSA);
 - .14 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
 - .15 Electrical Safety Authority (ESA);
 - .16 Electronic Industries Association (EIA);
 - .17 Factory Mutual Systems (FM);
 - .18 Illuminating Engineering Society (IES);
 - .19 Institute of Electrical and Electronic Engineers (IEEE);
 - .20 International Standards Organization (ISO);

- .21 Intertek's Electrical Testing Labs (ETL);
 - .22 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);
 - .23 National Building Code of Canada (NBC);
 - .24 National Electrical Manufacturers Association (NEMA);
 - .25 National Environmental Balancing Bureau (NEBB);
 - .26 National Fire Protection Association (NFPA);
 - .27 National Standards of Canada;
 - .28 NSF International;
 - .29 Occupational Health and Safety Act (OHSA);
 - .30 Ontario Building Code (OBC);
 - .31 Ontario Electrical Safety Code (OESC);
 - .32 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);
 - .33 Technical Standards and Safety Authority (TSSA);
 - .34 Thermal Insulation Association of Canada (TIAC);
 - .35 Underwriters' Laboratories of Canada (ULC);
 - .36 Workplace Hazardous Materials Information System (WHMIS);
 - .37 Safety Data Sheets by product manufacturers;
 - .38 local utility inspection permits;
 - .39 Codes, standards, and regulations of local governing authorities having jurisdiction;
 - .40 additional codes and standards listed in Trade Sections;
 - .41 Owner's standards.
- .4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.
 - .5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.
 - .6 Unless otherwise specified, install equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions. Notify Consultant in writing of conflicts between Contract Documents and manufacturer's instructions.

- .7 Work is to be performed by journeyperson who perform only work that their certificates permit, or by apprentices under direct on site supervision of experienced journeyperson. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.
- .8 Journeyperson are to have a copy of valid trade certificates available at site for review with Consultant at any time.
- .9 Experienced and qualified superintendent is to be on-site at times when work is being performed.
- .10 Protect existing areas above, below and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and reviewed with Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these areas. If services that are required to be maintained run through areas of renovations, provide necessary protection to services or reroute, in coordination with Owner and Consultant. Include for required premium time work to meet these requirements.
- .11 Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used by Owner on a 24 hours basis or over various hours, coordinate hours of work with Owner on a regular basis to suit Owner's schedule. Execute work at times confirmed with and agreed to by Owner and reviewed with Consultant, so as not to inconvenience Owner's occupation or in any way hinder Owner's use of building. Include for required premium time work to meet these requirements.
- .12 Coordinate work inspection reviews and approvals with governing inspection department to ensure construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.
- .13 Properly protect equipment and materials on site from damage and defacement due to elements and work of trades, to satisfaction of Owner and reviewed with Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.
- .14 Mechanical piping system work, including equipment, must comply with requirements of local technical standards authorities and CSA B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products are to bear a Canadian Registration Number (CRN) number.
- .15 Electrical items associated with mechanical equipment are to be certified and bear stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.

1.07 HEALTHCARE FACILITY STANDARDS

- .1 Comply with following standards:
 - .1 CSA Z317.1, Special Requirements for Plumbing Installations in Health Care Facilities.
 - .2 CSA Z317.2, Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Health Care Facilities.

- .3 CSA Z317.10, Handling of Health Care Waste Materials .
- .4 CAN/CSA Z317.13, Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities.
- .5 CSA Z7396.1 Medical Gas Pipeline Systems - Part 1 Pipelines for Medical Gases, Medical Vacuum, Medical Support Gases, and Anaesthetic Gas Scavenging Systems.
- .6 CSA Z8000, Canadian Health Care Facilities.
- .7 CAN/CSA Z8001, Commissioning of Health Care Facilities.
- .2 Prepare a list of areas of the work where infection control procedures are to be in force and review list and procedures with healthcare facility's Infection Control Officer or a designated healthcare facility representative prior to commencing work in aforementioned areas. As work proceeds, ensure infection control procedures are being maintained.
- .3 Comply with healthcare facility's latest policies and procedures regarding infection prevention and decontamination measures during work of project. Refer to additional requirements of Division 01.

1.08 PERMITS, CERTIFICATES, APPROVALS AND FEES

- .1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.
- .2 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work. If any defect, deficiency or non-compliant is found in work by inspection, be responsible for costs of such inspection, including any related expenses, making good and return to site, until work is passed by governing authorities.
- .3 Obtain and submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable.
- .4 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.

1.09 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

- .1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer or structural engineer, are to be legally qualified to practice professional engineering in the Place of the Work, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.
- .2 Retained engineer's professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.

- .3 Unless otherwise specified in Division 00 or 01, liability insurance requirements are as follows:
 - .1 coverage is to be a minimum of \$1,000,000.00 CDN inclusive of any one occurrence;
 - .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;
 - .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;
 - .4 retained consultants are to ascertain that sub-consultants employed by them carry insurance in the form and limits specified above;
 - .5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner's Consultant, and Municipal Authorities as required prior to commencement of aforementioned consultant's services.

1.10 WORKPLACE SAFETY

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials. Submit WHMIS SDS (Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.
- .2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces" and any other applicable Ministry of Labour requirements.
- .3 If at any time during course of existing building work, hazardous materials other than those identified in Documents and pertaining to Project Scope of Work, are encountered or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without approval from Owner and reviewed with Consultant.

1.11 PLANNING AND LAYOUT OF WORK

- .1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.
- .2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, as coordinated prior to start of Work with each trade and with Owner and reviewed with Consultant, to suit specific project requirements, order of right of way for services to be as follows:
 - .1 piping requiring uniform pitch;
 - .2 piping 100 mm (4") dia. and larger;
 - .3 large ducts (main runs);

- .4 cable tray and bus duct;
 - .5 conduit 100 mm (4") dia. and larger;
 - .6 piping less than 100 mm (4") dia.;
 - .7 smaller branch ductwork;
 - .8 conduit less than 100 mm (4") dia..
- .3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.
- .4 Do not use Contract Drawing measurements for prefabrication and layout of piping, sheet metal work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.
- .5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or 1/4"=1' 0") of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, engineering drawings for this use. Contractors' interference drawings are to be distributed among other Trade Contractors. Submit drawings to Consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.
- .6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.
- .7 Locate shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings, for easy access for servicing and/or removal. Relocate products which do not meet this location requirement to accessible location, at no additional cost.
- .8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.

- .9 Where drawings indicate that acoustic tile ceiling is being suspended below structural ceiling, coordinate design of framework used to support suspended ceiling, diffusers, and other Divisions components that are mounted within or through ceiling. Do not mount devices to suspended ceiling. Secure and mount to ceiling slab above. Seal ceiling openings to maintain required fire rating.

1.12 COORDINATION OF WORK

- .1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include but not be limited to following:
 - .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;
 - .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;
 - .3 depth and routing of excavation required for work, and requirements for bedding and backfill;
 - .4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.
- .2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.
- .3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building, subject to available space as confirmed with Owner and reviewed with Owner, and protected from elements.
- .4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. In coordination with Owner and review with Consultant, relocate equipment which does not meet this requirement.
- .5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.13 PRODUCTS

- .1 Order products (equipment and materials) in a timely manner to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is unacceptable reason to request for use of other suppliers or substitutions.
- .2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer's authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new.

- .3 Products are to comply with applicable respective Canadian standards, and typically with Canadian Standards Association (CSA) approvals and/or Underwriters Laboratories of Canada (ULC) listings markings. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada ULC / cUL listed for use in Canada. Other certification organizations accredited by Standards Council of Canada to approve electrical equipment may be acceptable subject to approval from local governing electrical authority and review with Consultant. Applicable products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards enforced by local governing authorities.
- .4 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.
- .5 Products scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Where acceptable manufacturers are listed, first name listed is base specified company. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product. If acceptable manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.
- .6 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Above conditions supplement and are not to supersede any specification conditions with regards to substitutions or failure to supply product as per issued documents.
- .7 Listing of a product as "acceptable" does not imply automatic acceptance by Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.

- .8 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.
- .9 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other requirements of base specified product and is equivalent or better than base specified product. When requested by Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of Consultant. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of approved equal product. There must be no increase in Contract price due to Consultant's rejection of proposed equivalent product.
- .10 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to Consultant for review. Failure of submission of these documents to Consultant in a timely manner to allow for review will result in base specified product to be supplied at Consultant's discretion, at no additional cost to Contract.
- .11 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are approved by Owner and reviewed in writing with and recommended for acceptance by Consultant.
- .12 Substitutions will not be considered by Consultant during Bid period unless:
 - .1 permitted by Owner;
 - .2 directions and submission areas are provided on Bid Form;
 - .3 or formally requested in writing a minimum of 10 working days prior to Bid closing date.

- .13 When issued with Documents, complete and submit as directed, Appendix - List of Acceptable Manufacturers and Suppliers, or when directed by Consultant submit separate list of proposed manufacturers and suppliers.
- .14 Any proposed changes to list of manufacturers initiated by Contractor after award of Contract may be considered by Consultant at Consultant's discretion, with any additional costs for such changes if approved by Owner and reviewed with and recommended by Consultant, and costs for review, to be borne by Contractor.
- .15 Whenever use of product other than based specified products or named as acceptable is being supplied, allow sufficient time for processing of product submissions and time for Consultant's review, such that there will not be significant impact on contract time or work schedule.

1.14 SHOP DRAWINGS

- .1 At start-up meeting, review with Consultant products to be included in shop drawing submission. Prepare and submit list of products to Consultant for review.
- .2 Submit electronic copies of shop drawings unless otherwise directed by Consultant. Coordinate exact requirements with Consultant.
- .3 Submit for review, drawings showing detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to Consultant for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:
 - .1 product literature cuts;
 - .2 equipment data sheets;
 - .3 equipment dimension drawings;
 - .4 system block diagrams;
 - .5 sequence of operation;
 - .6 connection wiring schematic diagrams;
 - .7 functionality with integrated systems.
- .4 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.
- .5 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.
- .6 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted.

- .7 Consultant to review shop drawings and indicate review status by stamping shop drawing copies as follows:
 - .1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing;
 - .2 "REVISE & RESUBMIT" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.
- .8 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each and every shop drawing or product data sheet submitted:

"THIS REVIEW BY CONSULTANT IS FOR SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAILED DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR. CONSULTANT'S REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR COORDINATION OF WORK OF SUB-TRADES."
- .9 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system are to be submitted together.
- .10 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.
- .11 Do not order product until respective shop drawing review process has been properly reviewed with Consultant.
- .12 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.
- .13 Refer to specific requirements in other Sections.

1.15 ENGINEERED SUBMITTALS

- .1 Submittals for items required to be sealed by a professional engineer (engineered) are to be duly prepared, sealed, and signed under direct control and supervision of a qualified professional engineer licensed in jurisdiction of the work. Professional engineer is to conform to requirements specified in this Section in article entitled Requirements for Contractor Retained Engineers.
- .2 Engineered submittals are to include, but not be limited to, following:
 - .1 complete CAD layout drawings indicating equipment, piping schematic, pipe routing and sizing, zones, devices, wiring schematics, and any other pertinent data;
 - .2 listing of design data used to determine system layout and sizing;

- .3 complete copies of design calculations and listing of design data used in preparing calculations;
 - .4 list detailing standards, codes, regulations, etc. adhered to when designing system;
 - .5 items as noted in other Sections of the Specification.
- .3 Professional engineer responsible for engineered submittals is to perform periodic field reviews, including review of associated mock-ups where applicable, at locations wherever work as described by engineered submittal is in progress, during fabrication and installation of such work, and submit a field review report after each visit. Submit field review reports to Consultant and authorities having jurisdiction as required.
 - .4 Field reviews are to be at intervals as necessary and appropriate to progress of work described by engineered submittal to allow engineer to be familiar with progress and quality of such work and to determine if work is proceeding in general conformity with Contract Documents including reviewed shop drawings and design calculations.
 - .5 Upon completion of work as described by engineered submittal, professional engineer responsible for preparation of engineered submittal and for performing periodic field reviews is to prepare and submit to Consultant and, if applicable, authorities having jurisdiction, a letter certifying that work has been supplied and installed in accordance with requirements of Contract Documents, authorities having jurisdiction and engineered submittal.

1.16 EQUIPMENT LOADS

- .1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to Consultant, via shop drawing submissions, prior to construction.
- .2 Where given choice of specific equipment, actual weight, location and method of support of equipment may differ from those assumed by Consultant for base design. Back-check equipment loads, location, and supports, and include necessary accommodations.
- .3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Review locations of equipment with Consultant prior to construction.

1.17 OPENINGS

- .1 Supply opening sizes and locations to Consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.
- .2 No openings are permitted through completed structure without written approval from Owner and reviewed with Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Consultant for review, well in advance of doing work.
- .3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless otherwise directed by Owner and reviewed with Consultant, do not leave any openings unprotected and unfinished overnight.

1.18 SCAFFOLDING, HOISTING AND RIGGING

- .1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval from Owner and reviewed with Consultant.
- .2 Use scaffolds in such a manner as to interfere as little as possible with work of other trades.
- .3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Owner and reviewed with Consultant. No supports, clips, brackets or similar devices are to be welded, bolted or otherwise affixed to any finished member or surface without approval from Owner and review with Consultant.
- .4 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

1.19 CHANGES IN THE WORK

- .1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity or type of work from that required by Contract Documents, prepare and submit to Consultant for review, a quotation detailing proposed cost for executing change or revision.
- .2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.
- .3 If overhead and profit percentages are not specified in Division 00 or 01, but allowable under Contract as reviewed with Consultant prior to contract signing, then allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.
- .4 Unless otherwise specified in Divisions 00 or 01, following additional requirements apply to all quotations submitted:
 - .1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;
 - .2 material costs are not to exceed those published in local estimating price guides;
 - .3 mechanical labour unit costs are to be in accordance with Mechanical Contractors Association of America Labor Estimating Manual, less 25%;
 - .4 electrical labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at difficult level, less 25%;
 - .5 costs for journeyman and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;
 - .6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary;
 - .7 costs for rental tools and/or equipment are not to exceed local rental costs;

- .8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;
- .9 quotations, including those for deleted work, to include a figure for any required change to Contract time.
- .5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.
- .6 Make requests for changes or revisions to work in writing to Consultant and, if accepted by Owner, Notice of Change or Change Directive to be issued.
- .7 Do not execute any change or revision until written authorization for the change or revision has been obtained from Consultant.

1.20 PROGRESS PAYMENT BREAKDOWN

- .1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.
- .2 Payment breakdown is subject to Owner's approval and Consultant's review and recommendations. Progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including testing, adjusting and balancing, system testing and verification, and project closeout submittals.
- .3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as indicated on progress draw.

1.21 NOTICE FOR REQUIRED FIELD REVIEWS

- .1 Whenever there is a requirement for Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 7 working days' notice in writing to Consultant.
- .2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.
- .3 Do not conceal work until Consultant advises that it may be concealed.
- .4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.22 PRELIMINARY TESTING

- .1 When directed by Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.

- .2 When, in Consultant's opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.
- .3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.
- .4 When, in Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.23 TEMPORARY SERVICES

- .1 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.

1.24 MAINTAINING EQUIPMENT PRIOR TO ACCEPTANCE

- .1 Maintain equipment in accordance with manufacturer's instructions prior to start-up, testing and commissioning.
- .2 Employ a qualified millwright to check and align shafts, drives, and couplings on all base mounted split coupled motor driven equipment.
- .3 Where equipment lubrication fittings are not easily accessible, extend the fittings to accessible locations using copper or aluminium tubing.
- .4 All filters are to be new upon Substantial Performance of the Work. This is in addition to any spare filters specified.

1.25 CLEANING

- .1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Owner and Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.
- .2 Clean equipment and devices installed as part of this project.

1.26 RECORD AS-BUILT DRAWINGS

- .1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version reviewed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant.
- .2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date at all times, and ensure set is always available for periodic review. As-built set is also to include the following:

- .1 dimensioned location of inaccessible concealed work;
 - .2 locations of control devices with identification for each;
 - .3 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;
 - .4 for fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings;
 - .5 location of piping system air vents;
 - .6 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.
- .3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Consultant for review. Make necessary revisions to drawings as per Consultant's comments, to satisfaction of Consultant.
- .4 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Consultant. Save drawings as AutoCAD files and in pdf format and such that each drawing is not x-referenced but as complete drawing.
- .5 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with software release version reviewed with Consultant.
- .6 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with Consultant.
- .7 Requirements regarding medical gas piping system as-built record drawings are as follows:
- .1 obtain from Owner, existing medical gas piping record drawings and, on a day-to-day basis, record alteration work and new work, including location of concealed piping, and, if a drawing disc is available, update disc using compatible CAD software, in accordance with requirements of CAN/CSA Z7396.1.

1.27 OPERATING AND MAINTENANCE MANUALS

- .1 For each item of equipment for which a shop drawing is required (except for simple equipment), supply minimum 3, project specific, indexed copies of equipment manufacturers' operating and maintenance (O & M) manuals. Review exact quantity of manuals with Consultant. Consolidate each copy of data in an identified hard cover three "D" ring binder. Each binder to include:
 - .1 front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;

- .2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;
- .3 equipment manufacturer's authorized contact person name, telephone number and company website;
- .4 Table of Contents sheet, and corresponding index tab sheets;
- .5 copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "Reviewed As Noted" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "Reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;
- .6 operating data as follows:
 - .1 pressure test reports, and certificates issued by governing authorities;
 - .2 description of each system and its controls;
 - .3 control schematics for equipment/systems including building environmental controls;
 - .4 wiring and connection diagrams;
 - .5 if applicable, BAS architecture and required operating data;
 - .6 description of operation of each system at various loads together with reset schedules and seasonal variances;
 - .7 operation instruction for each system and each component;
 - .8 description of actions to be taken in event of emergencies and/or equipment failure;
 - .9 valve tag schedule, and flow diagrams to indicate valve locations.
- .7 maintenance data as follows:
 - .1 operation and trouble-shooting instructions for each item of equipment and each system;
 - .2 schedules of tasks, frequency, tools required, and estimated task time;
 - .3 recommended maintenance practices and precautions including warnings of any maintenance practice that will damage or disfigure equipment/systems;
 - .4 complete parts lists with numbers.
- .8 performance data as follows:
 - .1 equipment and system start-up data sheets;

- .2 equipment performance verification test results, and final commissioning report;
- .3 final testing, adjusting and balancing reports.
- .9 copies of warranties;
- .10 items requested specifically in Section Articles.
- .2 Generally, binders are not to exceed 75 mm (3") thick and not to be more than 2/3 full.
- .3 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner's building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.
- .4 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O&M Manual and submit to Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.
- .5 Provide 2 digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to Consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as reviewed with Consultant and enhanced with bookmarks and internal document links.

1.28 COMMISSIONING

- .1 After successful start-up and prior to Substantial Performance of the Work, commission the mechanical work. Commissioning work is the process of Contractor demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, as further described below.
 - .1 Retain services of a testing, adjusting, and balancing agency to perform testing and balancing of mechanical system air/fluid flows and capacities, prior to operational performance testing. Refer to Section entitled Testing, Adjusting and Balancing.
 - .2 Test, adjust and operate equipment and systems after start-up but before functional performance testing, to confirm operations are in accordance with requirements of Contract Documents. Verify modes and sequences of control and monitoring, interlocks, and responses to emergency conditions. Complete commissioning data sheets to document successful operational performance testing.
 - .3 Repeat successful operational performance testing with completed commissioning data sheet documentation in the presence of Consultant and Owner to validate and verify equipment and systems are complete in all respects, function correctly, and are ready for acceptance.
 - .4 Submit final commissioning data sheets, TAB reports as specified in Section entitled Testing, Adjusting and Balancing, project closeout documents, and other required submittals.

1.29 PROJECT CLOSEOUT SUBMITTALS

- .1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:
 - .1 O & M Manuals;
 - .2 as-built record drawings and associated data;
 - .3 extended warranties for equipment as specified;
 - .4 operating test certificates, i.e. Sprinkler Test Certificate;
 - .5 final commissioning report and TAB report;
 - .6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;
 - .7 other data or products specified.
- .2 Refer to additional requirements in Division 01.

1.30 FINAL INSPECTION

- .1 Submit to Consultant, written request for final inspection of systems. Include written certification that:
 - .1 deficiencies noted during job inspections have been completed;
 - .2 field quality control procedures have been completed;
 - .3 systems have been tested and verified, balanced and adjusted, and are ready for operation;
 - .4 maintenance and operating data have been completed and submitted to, reviewed with Consultant and accepted by Owner;
 - .5 tags and nameplates are in place and equipment identifications have been completed;
 - .6 clean-up is complete;
 - .7 spare parts and replacement parts specified have been provided, as confirmed by Owner and reviewed with Consultant;
 - .8 as-built and record drawings have been completed and submitted to and reviewed with Consultant and accepted by Owner;
 - .9 Owner's staff has been instructed in operation and maintenance of systems;
 - .10 commissioning procedures have been completed.

2 PRODUCTS

2.01 NOT USED

3 EXECUTION

3.01 NOT USED

END OF SECTION

1 GENERAL

1.01 APPLICATION

- .1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Mechanical Divisions. It is intended as a supplement to each Section and is to be read accordingly.
- .2 Advise product vendors of requirements of this Section.

1.02 SUBMITTALS

- .1 Submit shop drawings/product data sheets for:
 - .1 electric motors (submit with equipment they are associated with).
- .2 Submit weight loads for selected equipment (upon request).
- .3 Submit copy of architectural reflected ceiling plan drawings and elevation drawings to indicate proposed access door locations.
- .4 Submit any other submittals specified in this Section or other Sections of Mechanical Divisions.

2 PRODUCTS

2.01 FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Firestopping and smoke seal system materials for mechanical penetrations through fire rated construction are specified in Division 07 and work will be included as part of work of Division 07.

2.02 PIPE ESCUTCHEON PLATES

- .1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with matching screws for attachment to building surface, each plate sized to completely cover pipe sleeve or building surface opening, and to fit tightly around pipe or pipe insulation.

2.03 PIPING HANGERS AND SUPPORTS

- .1 Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to following requirements:
 - .1 unless otherwise specified, ferrous hanger and support products are to be electro-galvanized;
 - .2 hangers and supports for insulated piping are to be sized to fit around insulation and insulation jacket.
- .2 Hangers and supports for horizontal suspended piping as follows:
 - .1 adjustable steel clevis hanger – MSS Type 1;

- .2 adjustable swivel ring band hanger – MSS Type 10;
- .3 Supports for horizontal pipe on vertical surfaces as follows:
 - .1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
 - .2 heavy-duty steel pipe clip – MSS Type 26;
 - .3 single steel pipe hook – Myatt Fig. 156;
 - .4 epoxy coated steel pipe stays are not permitted.
- .4 Floor supports for vertical risers as follows:
 - .1 copper tubing riser clamp – MSS Type 8;
 - .2 heavy-duty steel riser clamp – MSS Type 8.
- .5 Supports for vertical piping on vertical surfaces as follows:
 - .1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
 - .2 heavy-duty steel pipe bracket or soil pipe bracket – MSS Type 26;
 - .3 extension split pipe clamp – MSS Type 12;
 - .4 epoxy coated steel pipe stays are not permitted.
- .6 Special hangers and supports for various applications as follows:
 - .1 for sections of piping connected to vibration isolated equipment – hangers and supports as specified above but complete with MSS Type 48 spring cushions;
 - .2 for plastic piping – generally as specified above but in accordance with pipe manufacturer's recommendations;
 - .3 for fire protection piping – generally as above but ULC listed and/or FM approved, and in accordance with Chapter requirements of NFPA Standard applicable to piping system;
 - .4 for bare horizontal copper piping – generally as above but factory vinyl coated to prevent direct copper/steel contact;
 - .5 for bare copper vertical piping – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate pipe from clamp;
 - .6 insulation protection shields to and including 40 mm (1-½") dia. – MSS Type 40 galvanized steel shields with ribs to keep shield centred on hanger.
- .7 Hanger rods are to be electro-galvanized carbon steel (unless otherwise specified), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit loading in accordance with Table 3 in MSS SP-58, but minimum 9.5 mm (3/8") diameter.
- .8 Acceptable manufacturers are:

- .1 E. Myatt & Co. Inc.;
- .2 Anvil International Inc.;
- .3 Empire Industries Inc.;
- .4 Hunt Manufacturing Ltd.;
- .5 Unistrut Canada Ltd.;
- .6 Nibco Inc. "Tolco";
- .7 Taylor Pipe Supports.

2.04 ACCESS DOORS

- .1 Access doors to be provided under work of Division 08 by General Trades Contractor.
- .2 Coordinate with Mechanical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services, where possible, be accessible from common access door. Coordinate work to ensure same common location access doors are not supplied by more than one Division.
- .3 Size access doors to suit the concealed work for which they are supplied, and wherever possible they are to be of standard size for all applications, but minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.
- .4 Access doors in fire rated construction are to be ULC listed and labelled and of a rating to maintain fire separation integrity.
- .5 Identify on reflected ceiling plans and wall elevation drawings, coordinated locations of proposed access door locations and submit to Consultant for review.

2.05 SPRINKLER PROTECTION

- .1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:
 - .1 factory constructed by respective equipment manufacturers;
 - .2 constructed from non-combustible materials (sheet steel);
 - .3 enamel painted to match equipment;
 - .4 surfaces and edges filled/sanded smooth prior to painting;
 - .5 supported from equipment with structural steel rods/metal framing or other method approved by Consultant;
 - .6 structural support finish painted to match shield.
- .2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.

- .3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketing and/or waterproof sealant to prevent water from entering enclosure.
- .4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.
- .5 Above requirements are additional minimum "sprinkler protection" (or sprinkler proof) standards for equipment specified as NEMA 1, 2 or 12.
- .6 Obtain CSA approval where required by local governing authorities.

2.06 MECHANICAL WORK IDENTIFICATION MATERIALS

- .1 Equipment nameplates are to be minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2-½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Additional requirements are as follows:
 - .1 unless otherwise specified or required, each nameplate is to be white, complete with bevelled edges and black engraved wording to completely identify equipment and its use with no abbreviations;
 - .2 wording is generally to be as per drawings, i.e. Fan EF-1, and is to include equipment service and building area/zone served, but must be reviewed with Consultant prior to engraving;
 - .3 supply stainless steel screws for securing nameplates in place;
 - .4 nameplates for equipment suspended above floor level or generally not within easy viewing from floor level are to be increased in size so as to be easily readable from floor level.
- .2 Valve tags are to be coloured, 40 mm (1-½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match piping identification colour, each complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording, i.e.:

VALVE V12
200 mm (8")
CHILL. WATER
NORMALLY OPEN
- .3 Standard pipe identification to be Smillie McAdams Summerlin Ltd., Brady or Primark Manufacturing Inc. vinyl plastic with indoor/outdoor type vinyl ink lettering and directional arrows, as follows:
 - .1 for pipe less than or equal to 150 mm (6") diameter, coiled type snap-on markers of a length to wrap completely around pipe or pipe insulation;
- .4 Identification wording and colours for pipe identification materials are to be as follows:

PIPE SERVICE	IDENTIFICATION COLOUR	LEGEND
domestic cold water	green	DOM. COLD WATER
domestic hot water supply	green	DOM. HW SUPPLY
domestic hot water recirculation	green	DOM. HW RECIRC.
tempered domestic water	green	TEMP. DOM. WATER
sanitary drainage	green	SAN.
plumbing vent	green	SAN. VENT
fire protection standpipe	red	F.P. STANDPIPE
fire protection sprinklers	red	F.P. SPRINKLER
heating water supply	yellow	HTG. WTR. SUPPLY
heating water return	yellow	HTG. WTR. RETURN

- .5 Colours for pipe identification legends and directional arrows are to be as follows:

IDENTIFICATION COLOUR	LEGEND & ARROW COLOUR
yellow	black
green	white
red	white

- .6 Medical gas piping identification materials and requirements are specified in Section entitled Medical Gas Piping Systems.
- .7 Duct identification is to be custom made Mylar stencils with 50 mm (2") high lettering to accurately describe duct service, i.e. "AHU-1 SUPPLY", complete with a directional arrow, and coloured ink with ink pads and roller applicators. Ink colour is generally to be black but must contrast with lettering background.

3 EXECUTION

3.01 GENERAL PIPING AND DUCTWORK INSTALLATION REQUIREMENTS

- .1 Unless otherwise specified, locate and arrange horizontal pipes and ducts above or at ceiling on floors, arranged so that under consideration of all other work in area, maximum ceiling height and/or usable space is maintained. If required to maintain ceiling heights, reroute and/or resize ductwork, as reviewed with Consultant and with Owner approval.
- .2 Unless otherwise specified, install work concealed in finished spaces, and concealed to degree possible in partially finished and unfinished spaces. Refer to and examine Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas. Walls which are painted are considered finished.
- .3 Install pipes and ducts parallel to building lines and to each other.
- .4 Neatly group and arrange exposed work.

- .5 Locate work to permit easy access for service or maintenance as required and/or applicable. Locate valves, dampers and any other equipment which will or may need maintenance or repairs and which are to be installed in accessible construction so as to be easily accessible from access doors. Where valves, dampers and similar piping or ductwork accessories occur in vertical services in shafts, pipe spaces or partitions, locate accessories at floor level.
- .6 Make connections between pipes of different materials using adapters suitable for application. Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe.
- .7 Comply with equipment and material manufacturer's installation instructions unless otherwise specified herein or on drawings, and unless such instructions contradict governing codes and regulations.
- .8 Carefully clean ducts, pipe and fittings prior to installation. Temporarily cap or plug ends of pipe, ducts and equipment which are open and exposed during construction.
- .9 Install piping and ductwork which are to be insulated, to have sufficient clearance to permit insulation and finish to be applied continuously and unbroken around pipe or duct, except for ductwork at fire barriers, terminate insulation at each side of duct fire damper.
- .10 Inspect surfaces and structure prepared by other trades before performing work. Verify surfaces or structure to receive work has no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing to Consultant. Installation of work will constitute acceptance of such surfaces as being satisfactory.
- .11 Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both, is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean piping prior to being concealed.
- .12 For factory applied finishes, repaint or refinish surfaces damaged during shipment and installation. Quality of repair work is to match original finish. This requirement also applies to galvanized finishes.
- .13 Provide screwed unions or flanges in piping connections to equipment and in regular intervals in long (in excess of 12 m [40']) piping runs to permit removal of sections of piping.
- .14 Unless otherwise specified and except where space limitations do not permit, piping elbows are to be long radius. Eccentric reducers are to be installed with straight side at top of piping.

3.02 PIPE JOINT REQUIREMENTS

- .1 Do not make pipe joints in walls or slabs.
- .2 Ream piping ends prior to making joints.
- .3 Properly cut threads in screwed steel piping and coat male threads only with Teflon tape or paste, or an equivalent thread lubricant. After pipe has been screwed into fitting, valve, union, or piping accessory, not more than 2 pipe threads are to remain exposed.

- .4 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove scale and oxide from bevels and leave smooth and clean. Use factory made welding tees or welding outlet fittings for piping branches off mains. Do not use shop or site fabricated fittings unless written approval has been obtained.
- .5 Welded joints are to be made by CWB certified licensed journeyman welders qualified in accordance with CSA B51, Boiler Pressure Vessel and Pressure Piping Code, and who are in possession of a proper certificate of qualification for each procedure to be performed. Each weld is to be identified with the welder's identification symbol, and welds are not to be concealed until welder making joints has inspected them for quality assurance. Electrodes are to be in accordance with CSA W48 Series, Electrodes, and requirements of CAN/CSA W117.2, Safety in Welding, Cutting and Allied Processes are to be followed.
- .6 Unless otherwise specified, make flanged joints with Garlock 5500 or approved equal gasket materials to suit the application, and bolts and nuts. Bolts are not to be longer than length necessary to screw nut up flush to end of bolt. Bolts used for flanged connections in piping with a working pressure of 690 kPa (100 psi) and greater are to be ASTM A-193 Grade B-7, with heavy hexagon nuts to ASTM A-194 CL-2H. Provide suitable washers between each bolt head and flange and between each nut and flange.
- .7 A random check by Consultant at Consultant's option, of bolted flanged connections may be made to verify flanged connections are properly mated with no shear force acting on bolts. When such random check is made, supply labour to disconnect and reconnect selected flanged joints. If improperly mated joints are found, remove and reinstall affected piping so flanges mate properly. If improperly mated joints are found, additional joints may be checked, and be responsible for repair of any other improper joints discovered.
- .8 Unless otherwise specified make soldered joints in copper piping using flux suitable for and compatible with type of solder being used. Clean outside of pipe end and inside of fitting, valve, or similar accessory prior to soldering.
- .9 Joints in medical gas system piping are to be silver brazed in accordance with requirements of CAN/CSA Z7396.1.
- .10 Install mechanical joint fittings and couplings in accordance with manufacturer's instructions.
- .11 Grooves are to be rolled. Make arrangements with coupling and fitting manufacturer for shop and/or site instructions and demonstrations as required, and adhere to manufacturer's instructions with respect to pipe grooving, support, type of gasket required, anchoring and guiding grooved piping system.
- .12 If pressure crimped couplings and fittings are used, ensure gaskets are fully compatible with piping fluid, and valves and piping accessories are suitable. Use only fitting manufacturer supplied crimping equipment. Comply with manufacturer's latest published specification, instructions, and recommendations with respect to pipe, coupling, and fitting preparation and installation, and support, anchoring and guiding of piping system.
- .13 Solvent weld PVC piping in 2 parts, primer stage and cementing stage, in accordance with manufacturer's recommendations, ASTM D2855, and CSA requirements.
- .14 Install PVC piping with gasketed joints in accordance with manufacturer's current published specifications, instructions and recommendations, and CSA requirements.

3.03 INSTALLATION OF PIPE ESCUTCHEON PLATES

- .1 Provide escutcheon plates suitably secured over exposed piping passing through finished building surfaces. Finished building surface is any surface with a factory finish or that receives a site applied finish.
- .2 Install plates so they are tight against building surface concerned, completely covering pipe sleeves and/or openings, except where waterproof sleeves extend above floors, in which case fit plate tightly around sleeve.

3.04 INSTALLATION OF FASTENING AND SECURING HARDWARE

- .1 Provide fastening and securing hardware required for mechanical work to maintain installations attached to structure or to finished floors, walls and ceilings in a secure and rigid manner capable of withstanding dead loads, live loads, superimposed dead loads, and any vibration of installed products.
- .2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.
- .3 Where floor, wall or ceiling construction is not suitable to support loads, provide additional framing or special fasteners to ensure proper securement to structure that is to support the products. Provide reinforcing or connecting supports where required to distribute loading to structural components.
- .4 Obtain written consent from Owner and review with Consultant, before using explosive actuated fastening devices. If consent is obtained, comply with requirements of CAN/CSA Z166.1 and CAN/CSA Z166.2.

3.05 INSTALLATION OF PIPE HANGERS AND SUPPORTS

- .1 Provide required pipe hangers and supports.
- .2 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting pipe. Unless otherwise shown or specified, hang or support pipes from structure only.
- .3 For insulated pipe, size hanger or support to suit diameter of insulated pipe and install hanger or support on outside of insulation and insulation finish.
- .4 Support requirements for underground piping are as follows:
 - .1 support underground pipe, unless otherwise specified, on a well compacted bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind, or on compacted material as specified;
 - .2 ensure bedding and supports for underground pipes are flat and true and allowances are made for pipe hubs, couplings, or other protrusions so no voids are left between pipe and bedding.

- .5 Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for suspended pipe less than or equal to 25 mm (1") dia. are to be clevis type or adjustable ring type, and hangers for suspended pipe greater than or equal to 40 mm (1-½") dia. are to be adjustable clevis type.
- .6 Space hangers and supports in accordance with following:
- .1 cast iron pipe – hang or support at every joint with maximum 2.4 m (8') spacing;
- .2 plastic pipe – conform to pipe manufacturer's recommended support spacing;
- .3 copper and steel pipe – hang or support at spacing in accordance with following schedule:

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
to 25 mm (1")	2.4 m (8')	1.8 m (6')
40 mm (1-½")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2-½")	3.6 m (12')	3.0 m (10')
75 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3-½")	3.6 m (12')	3.6 m (12')
100 mm (4")	4.2 m (14')	3.6 m (12')
250 mm (10")	6.0 m (20')	
300 mm (12")	6.7 m (22')	

- .4 flexible grooved pipe/coupling joint piping – as above but with not less than one hanger or support between joints.
- .7 Where pipes change direction, either horizontally or vertically, provide a hanger or support on horizontal pipe not more than 300 mm (12") from elbow, and where pipes drop from tee branches, support tees in both directions not more than 50 mm (2") on each side of tee.
- .8 When pipes with same slope are grouped and a common hanger or support is used, space hanger or support to suit spacing requirement of smallest pipe in group and secure pipes in place on common hanger or support.
- .9 Unless otherwise shown or specified, support vertical piping by means of supports specified in Part 2 of this Section, spaced in accordance with following:
- .1 support vertical pipes at maximum 3 m (10') intervals or at every floor, whichever is lesser;
- .2 for sections of vertical piping with a length less than 3 m (10'), support pipe at least once;

- .3 for vertical cast iron plain end pipe (mechanical joint type), secure riser or pipe clamp around pipe under a flange integral with pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support;
- .4 for vertical steel pipe risers in excess of 3 m (10'), weld shear lugs to pipe to carry load;
- .5 for vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between riser clamps and floor.
- .10 Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between pipe and ferrous hanger. Each wall or floor clamp for vertical bare copper piping is to be isolated from pipe by means of strips of flexible rubber inserts. Use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.
- .11 For insulated horizontal piping less than or equal to 40 mm (1-½") diameter, provide galvanized steel insulation protection shields between insulation and hanger or support. Install shields immediately after pipe is insulated.
- .12 Do not support piping from steel deck without written consent from Owner and review with Consultant.

3.06 SUPPLY OF ACCESS DOORS

- .1 Supply access doors to give access to mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on drawings.
- .2 Before commencing installation of mechanical work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange mechanical work to suit.
- .3 Access doors will be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.
- .4 Wherever possible, access doors to be of a standard size for each application. Review exact dimensions and minimum size restrictions with Consultant prior to ordering.
- .5 Group piping and ductwork to ensure minimum number of access doors is required.
- .6 Submit a sample of each proposed access door for review with Consultant, prior to ordering.
- .7 Coordinate with Electrical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services should, where possible, be accessible from common access door. Coordinate work to ensure common location access doors are not supplied by both Mechanical Divisions and Electrical Divisions.

3.07 INSTALLATION OF VALVES

- .1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification where valves are specified, however, regardless of locations shown or specified, following requirements apply:
 - .1 provide shut-off valves to isolate systems, at base of vertical risers, in branch take-offs at mains and risers on floors, to isolate equipment, to permit work phasing as required, and wherever else required for proper system operation and maintenance;
 - .2 install shut-off valves with handles upright or horizontal, not inverted, and located for easy access;
 - .3 unless otherwise specified, provide a check valve in discharge piping of each pump;
 - .4 valve sizes are to be same as connecting pipe size;
 - .5 valves are to be permanently identified with size, manufacturer's name, valve model or figure number and pressure rating, and wherever possible, valves are to be product of same manufacturer;
 - .6 for valves in insulated piping, design of valve stem, handle and operating mechanism is to be such that insulation does not have to be cut or altered in any manner to permit valve operation.

3.08 MECHANICAL WORK IDENTIFICATION

- .1 Identify new exposed piping and ductwork as per Part 2 of this Section in locations as follows:
 - .1 at every end of every piping or duct run;
 - .2 adjacent to each valve, strainer, damper and similar accessory;
 - .3 at each piece of connecting equipment;
 - .4 on both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified;
 - .5 at 6 m (20') intervals on pipe and duct runs exceeding 6 m (20') in length;
 - .6 at least once in each room, and at least once on pipe and duct runs less than 6 m (20') in length.
- .2 Unless otherwise specified identify new concealed piping and ductwork as per Part 2 of this Section in locations as follows:
 - .1 at points where pipes or ducts enter and leave rooms, shafts, pipe chases, furred spaces, and similar areas;
 - .2 at maximum 6 m (20') intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room;
 - .3 at each access door location;
 - .4 at each piece of connected equipment, automatic valve, etc.

- .3 Provide an identification nameplate for equipment provided as part of this project, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate nameplates in the most conspicuous and readable location.
- .4 Tag valves and prepare a valve tag chart in accordance with following requirements:
 - .1 attach a valve tag to each new valve, except for valves located immediately at equipment they control;
 - .2 prepare a computer printed valve tag chart to list tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed);
 - .3 if an existing valve tag chart is available at site, valve tag numbering is to be an extension of existing numbering and new valve tag chart is to incorporate existing chart;
 - .4 frame and glaze one copy of chart and, unless otherwise directed, affix to a wall in each main Mechanical and/or Equipment Room;
 - .5 include a copy of valve tag chart in each copy of operating and maintenance instruction manuals;
 - .6 hand an identified CD of valve tag chart to Owner at same time O&M Manuals are submitted.
- .5 Where shut-off valves, control dampers, sensors, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in ceiling panel material, or stickers equal to Brady "Quick Dot" on ceiling grid material to indicate locations of items. Unless otherwise specified, ceiling tack or sticker colours are to be as follows:
 - .1 HVAC piping valves and equipment: yellow
 - .2 fire protection valves and equipment: red
 - .3 plumbing valves and equipment: green
 - .4 HVAC ductwork dampers and equipment: blue
 - .5 control system hardware and equipment: orange
- .6 Finish painting of exposed mechanical work is specified in Division 09 and is part of the work of Division 09.

3.09 PIPE LEAKAGE TESTING

- .1 Before piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test piping for leakage.

- .2 Tests are to be witnessed by Consultant and/or Owner's representative, and, where required, representatives of governing authorities. Give ample notice (minimum 7 working days) of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.
- .3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.
- .4 Gravity Drainage and Vent Piping
 - .1 Test piping in accordance with local governing building code.
 - .2 After fixtures and fittings are set and pipes are connected to building drain or drains, turn on water into pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Perform smoke test if required by local governing authorities.
- .5 Domestic Water Piping
 - .1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for minimum of 2 hours.
- .6 Sprinkler System Piping
 - .1 Test system piping in accordance with requirements of NFPA No. 13, "Installation of Sprinkler Systems", and in accordance with any additional requirements of governing authorities.
- .7 Heat Transfer (HVAC) System Piping
 - .1 Test piping with cold water at pressure of 1035 kPa (150 psi) for minimum of 2 hours.
- .8 Medical Gas System Piping
 - .1 Perform leakage and flow tests for piping using oil-free compressed air or oil-free dry nitrogen in accordance with requirements of CAN/CSA Z7396.1.
- .9 Following requirements apply to all testing:
 - .1 ensure piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing;
 - .2 temporarily remove or valve off piping system specialties or equipment which may be damaged by test pressures prior to pressure testing systems, and flush piping to remove foreign matter;
 - .3 when testing is carried out below highest level of particular system, increase test pressure by the hydrostatic head of 7 kPa (1 psi) for every 600 mm (24") below high point;
 - .4 include for temporary piping connections required to properly complete tests;
 - .5 piping under test pressure is to have zero pressure drop for length of test period;

- .6 make tight leaks found during tests while piping is under pressure, and if this is impossible, remove and refit piping and reapply test until satisfactory results are obtained;
- .7 where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions;
- .8 perform tests in reasonably sized sections so as to minimize number of tests required;
- .9 in addition to leakage tests specified above, demonstrate proper flow throughout systems including mains, connections and equipment, as well as proper venting and drainage, and include for any necessary system adjustments to achieve proper conditions.

3.10 ELECTRICAL WIRING WORK FOR MECHANICAL WORK

- .1 Coordinate requirements and responsibilities for electrical wiring with Electrical Division 26 Contractor. Provide low voltage control wiring not provided under work of Division 26.
- .2 Unless otherwise specified or indicated, following electrical wiring work for mechanical equipment will be done as part of electrical work:
 - .1 "line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from starters or disconnects to equipment;
 - .2 "line" side power wiring to individual wall mounted starters, and "load" side wiring from starters to equipment;
 - .3 "line" side power wiring to pre-wired power and control panels and variable frequency drives (VFD), and "load" side power wiring from the panels and VFD's to equipment;
 - .4 provision of receptacles for plug-in equipment;
 - .5 provision of disconnect switches for motors in excess of 9 m (30') from starter location, or cannot be seen from starter location, and associated power wiring;
 - .6 motor starter interlocking in excess of 24 volts;
 - .7 wiring from motor winding thermistors in motors 30 HP and larger to motor starter contacts;
 - .8 120 volt power connections to electrical receptacles integral with small ceiling exhaust fans, including wiring through light switches or speed controllers;
 - .9 120 volt wiring connections to lighting fixture/switch combinations integral with air handling units;
 - .10 120 volt wiring connections to duplex receptacles integral with air handling unit control panels.
- .3 Mechanical wiring work not listed above or specified herein or on drawings to be done as part of electrical work is to be installed in conduit and is to be done as part of mechanical work in accordance with wiring requirements specified for electrical work.

3.11 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS

- .1 Coordinate shut-down and interruption to existing mechanical systems with Owner. Refer to requirements specified in Division 01.
- .2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform Owner and Consultant in writing minimum 7 working days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent. Shutdowns of some essential services may require additional advance notification time.
- .4 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down, ensure materials and labour required to complete the work for which shut-down is required are available at site.
- .5 Pipe freezing may be used to connect new piping to existing piping without draining existing piping. Pipe freeze equipment is to be equal to "NORDIC FREEZE" equipment supplied by Mag Tool Inc. (1-800-661-9983) or Rigid Tool Co. RIGID "SuperFreeze".
- .6 Confirm any methods of procedures with Owner and review with Consultant prior to start of work.

3.12 EQUIPMENT BASES AND SUPPORTS

- .1 Unless otherwise specified or indicated on drawings, set floor mounted equipment on minimum 100 mm (4") high reinforced concrete housekeeping pads 200 mm (8") clear of equipment on each side and end, or a minimum of 200 mm (8") from centreline of equipment anchor bolts to edge of the base, whichever is larger. Conform to following requirements:
 - .1 supply dimensioned drawings and equipment base templates, and provide anchor bolts for proper setting and securing of equipment on pads;
 - .2 place anchor bolts during concrete pour and be responsible for required levelling, alignment, and grouting of equipment;
 - .3 as a minimum, use wire mesh reinforcement, however, for pads for large heavy equipment, use reinforcement as per structural drawing details.
- .2 For equipment not designed for base mounting, where required, provide welded, cleaned and prime coat painted structural steel stands or supports conforming to following requirements:
 - .1 provide stands and supports, except those for small equipment, designed by a structural engineer registered in jurisdiction of the work, and submit stamped and signed design drawings with calculations as shop drawings for review;
 - .2 flange bolt steel stands to concrete housekeeping pads;
 - .3 seismically restrained stands and supports in accordance with applicable requirements.

3.13 CONCRETE WORK FOR MECHANICAL EQUIPMENT BASES/PADS

- .1 Concrete work required for mechanical equipment bases/pads will be provided as part of concrete work of Division 03.
- .2 Exactly locate bases/pads at site and be present during concrete pour to ensure anchor bolts, inserts, plates and similar hardware are not damaged or dislodged.

3.14 CUTTING, PATCHING AND CORE DRILLING

- .1 Cutting and patching of existing building surfaces required for mechanical work, including core drilling walls and slabs for piping, will be done as part of another Division of the work and is excluded from mechanical work.
- .2 Accurately and carefully mark out location and extent of cutting or drilling required and coordinate with trade(s) performing the work. Location and size of cut or drilled openings must be approved by Consultant before work commences, and cut or drilled openings must not be larger than is absolutely necessary for installation of pipe, duct, etc., and insulation where necessary.
- .3 Ensure openings in fire rated construction are firestopped and sealed in accordance with requirements of article entitled Firestopping and Smoke Seal Materials in this Section. Ensure openings are not left open overnight unless approved by Owner and reviewed with Consultant.

3.15 PACKING AND SEALING CORE DRILLED PIPE OPENINGS

- .1 Pack and seal void between pipe opening and pipe or pipe insulation for length of opening as follows:
 - .1 non-fire rated interior construction – pack with mineral wool and seal both ends of opening with non-hardening silicone base caulking compound to produce a water-tight seal;

3.16 CLEANING MECHANICAL WORK

- .1 Refer to cleaning requirements specified in Division 01.
- .2 Clean mechanical work prior to application for Substantial Performance of the Work.
- .3 Include for vacuum cleaning interior of air handling units and ductwork systems.

3.17 CONNECTIONS TO OTHER EQUIPMENT

- .1 Carefully examine Contract Documents during bidding period and include for mechanical work piping and/or ductwork connections to equipment requiring such connections.

3.18 EQUIPMENT AND SYSTEM START-UP

- .1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections and in accordance with following requirements:

- .1 submit a copy of each equipment/system manufacturer's start-up report sheet to Consultant for review, and incorporate any comments made by Consultant, Owner or Commissioning Agent, as applicable;
- .2 under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit to Consultant complete set of start-up documentation sheets signed by manufacturer/supplier and Contractor;

3.19 INTEGRATED SYSTEMS TESTING

- .1 Perform testing of integrated systems and equipment in accordance with CAN/ULC-S1001.
- .2 Engage respective systems or equipment vendors or trades to be onsite during inspection and testing work to perform adjustments or remedial work to correct issues identified by inspection and testing work.

END OF SECTION

1 GENERAL

1.01 APPLICATION

- .1 This Section specifies seismic control and restraint requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.02 SEISMIC CONSULTANT

- .1 Provide services of an experienced Seismic Consultant who is a registered professional engineer licensed in the jurisdiction of the work and a member in good standing of a Professional Engineers Association in the jurisdiction of the work.
- .2 Seismic Consultant is to:
 - .1 determine proper seismic hazard level, design, recommend, and review proposed mechanical work seismic restraint shop, placement and securing drawings, and sign and stamp drawings prior to submittal for review as specified below;
 - .2 supervise installation of mechanical work seismic restraint and, when work is complete, certify in writing that seismic restraint work has been installed in accordance with signed, stamped and reviewed drawings;
 - .3 prepare and submit to Municipality and authorities having jurisdiction, on a form approved by Municipality and authorities having jurisdiction, at the beginning of seismic restraint work and when work is complete, original signed and sealed Letters of Assurance for design, installation and field review of seismic restraint work.

1.03 SUBMITTALS

- .1 Obtain required equipment information and submit manufacturer's shop drawings/product data sheets for restraining devices and steel bases. Include placement data, and details of attachment to both equipment and structure meeting requirements of forces involved. Product data sheets and drawings are to be signed and stamped by Seismic Consultant referred to above.
- .2 Submit copies of Seismic Consultant's Letters of Assurance as specified above.
- .3 Submit copies of Seismic Consultant and seismic control manufacturer's certification letters as specified in Part 3 of this Section.
- .4 If requested, submit samples of seismic restraint materials for review.
- .5 Submit minimum one hard copy and electronic pdf version of documents.

1.04 QUALITY ASSURANCE

- .1 Seismic restraints are to be designed by a registered professional engineer as specified above, and are to be installed by qualified tradesmen under supervision of and to the approval of the design engineer.
- .2 Unless otherwise specified, seismic control and restraints are to be designed in accordance with local governing code requirements, ANSI/SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, SMACNA/ASHRAE Service Restraint Applications CD-ROM, and P.P.I.C. Manual Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems, all of which are to form a part of this Section.
- .3 Seismic control and restraints for fire protection piping and equipment are to be in accordance with NFPA requirements. When specified and/or required, design is also to include Factory Mutual requirements.
- .4 Restraint products must be tested in independent testing laboratory, or certified by Seismic Consultant, to confirm restraint products meet requirements of this Section, i.e. dynamic ultimate limit load state as required by local governing code, "Fail Safe" design, etc. If tests are carried out to represent a restraint type, test is to be valid for full load range of restraint. Submit such tests or certification when requested.
- .5 Seismic control and restraint product manufacturers are to provide required assistance during installation, and, when installation is complete, submit written reports listing any deficiencies to installation.

2 PRODUCTS

2.01 GENERAL

- .1 Isolation, anchors, bolts, bases, restraints, etc., are to be designed to withstand without failure or yielding, dynamic G load as specified in local governing code for seismic zone in which building is located. Design loads are ultimate limit state loads (1.5 times working load) acting through the centre of gravity of the anchored or restrained equipment. "Fail Safe" designs are acceptable.
- .2 For both isolated and non-isolated floor mounted equipment, i.e. tanks, heat exchangers, boilers, etc., design and provide anchors and bolts to withstand, without failure or yielding, a dynamic ultimate limit state load as defined in local governing code, of the greater of 0.3 g or as required by local governing codes and standards, applied horizontally through centre of gravity.
- .3 Where impact forces may be significant, use ductile materials.
- .4 Seismic restraining devices factory supplied with equipment are to meet requirements of this Section.
- .5 Acceptable manufacturers are:
 - .1 Mason Industries Inc.;
 - .2 Kinetics Noise Control;
 - .3 Vibro-Acoustics Ltd;

- .4 Price Industries Inc.

2.02 SLACK CABLE RESTRAINTS

- .1 Aircraft cable galvanized slack cable restraints meeting current requirements of local governing building code, sized to suit the application and complete with required cable ties, anchor hardware (selected for a load equal to twice the weight of the equipment), and similar connection accessories.

2.03 ANCHOR BOLTS

- .1 Equal to Mason Industries type SAB seismic anchor bolts.

2.04 FLEXIBLE PIPING CONNECTIONS

- .1 Flexible piping connectors are to be supplied with seismic restraint materials. Where flexible connections are not specified with piping in other Sections they are to be equal to Mason Industries twin sphere, non-metallic connectors with hose lengths preset in strict accordance with manufacturer's instructions and to approval of Seismic Consultant, each rated for continuous operation at 1725 kPa at 87.7°C (250 psi at 190°F) or 1380 kPa at 121°C (200 psi at 250°F), and complete with:
 - .1 nylon tire cord reinforced EPDM body;
 - .2 ductile iron reinforcing ring and ductile iron screwed or flanged connections as required and to suit piping system operating pressure.

2.05 VIBRATION ISOLATION PRODUCTS

- .1 Refer to Section entitled Mechanical Vibration Control.

3 EXECUTION

3.01 INSTALLATION OF SEISMIC RESTRAINT MATERIALS

- .1 Provide seismic restraint for mechanical equipment, piping, and ductwork, including diffusers, grilles, etc., as per requirements of current edition of local governing building code and this Section of the Specification.
- .2 Following Mechanical Components Restraint Guide is to be used as a general guide only to establish appropriate restraint methods, hardware, and attachments, however, due to differences in construction, size, weight, and configuration of different manufacturer's equipment and variety of ways and means that equipment and components can be installed, specific restraint methods are to be confirmed in the field. Seismic restraint materials and methods are to be reviewed and approved by Seismic Consultant.

MECHANICAL COMPONENT RESTRAINT GUIDE

ITEM	TYPE OF RESTRAINT	MIN. NO. OF RESTRAINTS	NOTES
Grilles, Registers, Diffusers	SCR	4	Where not bolted to duct (i.e. in tee-bar ceilings)
Airflow Control Valves	SCR	4	Where suspended
Piping	SCR TSR	As required	As per Specification
Ductwork	SCR TSR	As required	As per Specification

LEGEND	
SCR	Slack cable restraint (bolted to structure)
SNBR	Seismic snubber (bolted to structure)
TSR	Threaded support rod (bolted or clamped to structure)
BTSLPR	Bolt to sleeper (sleeper bolted to structure)
BTHP	Bolt to concrete housekeeping pad (pad to be keyed to structure)
CSSB	Custom steel shoe base (bolted to structure)
BTRC	Bolt to roof curb (roof curb bolted to roof structure)

- .3 Provide structural steel bases for equipment unless equipment manufacturer certifies direct attachment capabilities.
- .4 Space restraints under equipment so minimum distance between adjacent corner restraints is at least equal to the height of the centre of gravity of equipment. Include height of centre of gravity on shop drawings, otherwise, design for increased forces on supports and submit design calculations with shop drawings. Chillers are to meet this requirement.
- .5 Install floor mounted isolated equipment on 100 mm (4") high concrete housekeeping pads with at least 200 mm (8") clearance between drilled inserts and edges of pads. Ensure housekeeping pads are keyed to structure to resist seismic displacement.
- .6 Requirements pertaining to seismic control work are as follows:
 - .1 execute seismic control and restraint work in accordance with drawing details, reviewed shop drawings, ANSI/SMACNA Seismic Restraint Manual, PIPC Manual: Guidelines for Seismic Restraints of Mechanical Systems and Plumbing Piping Systems, and National Uniform Seismic Installation Guidelines (NUSIG);
 - .2 seismic control systems are to work in all directions;
 - .3 fasteners and attachment points are to resist same maximum load as the seismic restraint;

- .4 drilled or power driven anchors and fasteners are not permitted;
- .5 no equipment, equipment supports or mounts are to fail before failure of structure;
- .6 supports of cast iron or threaded pipe are not permitted;
- .7 seismic control measures are not to interfere with integrity of firestopping;
- .8 equipment is to be bolted to structure, and bolts are to be fitted with isolation washers;
- .9 number, size, type, and installation of anchor bolts are to be as recommended by anchor bolt manufacturer and seismic design consultant;
- .10 where more than a 3 mm (1/8") differential exists between an anchor or attachment bolt diameter, an anchor and attachment point hole, or an isolator gap attachment bolt and equipment anchor attachment hole, pack air gap with Mason type 0.5 FastSteel reinforced epoxy putty;
- .11 hung equipment and pipe hangers are to be fitted with a means of preventing upward movement, and non-isolated equipment and pipe hanger rods are to be fitted with oversized steel washers and nuts above and below hanger or equipment attachment point, locked tight to prevent uplift of equipment or hanger;
- .12 where suspended equipment hanger rod length exceeds 50 rod diameters between structure and equipment attachment point, reinforce rods with angle iron to prevent bending due to uplift forces;
- .13 seismic control measures are not to jeopardize noise and vibration isolation systems, and 6 mm (1/4") to 9 mm (3/8") clearance during normal operation of equipment and systems is to be provided between seismic restraint and equipment;
- .14 where hold-down bolts for seismic restraint equipment penetrate roofing membranes coordinate with roofing trade for installation of pitch pockets/"gum cups" and sealing compound to maintain water-tight integrity of roof;
- .15 where friction type clamps are used for support of equipment and connecting services, secure clamps to steel work by means of welding or other positive means to prevent slippage or loosening of clamps due to seismic forces.
- .7 Provide slack cable restraint assemblies for:
 - .1 medical gas piping 25 mm (1") dia. and larger;
 - .2 horizontal and vertical piping 65 mm (2-1/2") dia. and larger;
 - .3 ductwork and duct mounted equipment;
 - .4 isolated and non-isolated ceiling hung fans, tanks, equipment, etc.;
- .8 Installation requirements for slack cable restraints include following:
 - .1 connect slack cable restraints to ceiling hung equipment in such a way that axial projection of wires passes through centre of gravity of the equipment;

- .2 orient restraint wires on ceiling hung equipment at approximately 90° to each other (in plan), and tie back to ceiling slab at an angle not exceeding 45° to slab;
- .3 install cables using appropriate grommets, shackles, and other hardware to ensure alignment of restraints and to avoid bending cables at connection points, and, where feasible, wrap cables directly around pipes as opposed to using collars;
- .4 for piping systems, provide transverse slack cable restraints at a maximum spacing of 12.5 m (40'), and longitudinal restraints at 25 m (80') maximum spacing, or as limited by anchor/slack cable performance;
- .5 for piping less than 250 mm (10") dia., reduce transverse restraint spacing to 6 m (20'), and note that smaller piping may be rigidly tied to larger piping for restraint, but not reverse;
- .6 vary adjacent spacing of restraints on a piping run by 10% to 30% to avoid coincident resonance;
- .7 transverse bracing for one pipe section may also act as longitudinal bracing for piping connected perpendicular to it if bracing is installed within 600 mm (24") of elbow or tee, and if connected piping is same or smaller dia., and note that branch lines are not to be used to restrain main lines;
- .8 provide flexibility in piping joints or sleeves where piping penetrates building seismic or expansion joints;
- .9 wherever possible, support weight of vertical piping risers at a point or points above the centre of gravity of riser, and provide lateral guides at top and bottom of riser, and at intermediate points not to exceed the transverse spacing specified above for horizontal pipes, with guide clearance not exceeding 3 m (10');
- .10 install restraints at least 50 mm (2") clear of other equipment and services;
- .11 adjust restraint cables such that they are not visibly slack, or such that flexibility is approximately 40 mm (1-½") under thumb pressure for a 1.5 m (5') cable length, with an equivalent ratio for other cable lengths, and adjust clearance of cable strap/spacer piece restraints so as not to exceed 6 mm (0.23");
- .12 provide transverse and axial restraints within 4 m (12') of a vertical bend;
- .13 at steel trusses, connect to top chords at panel points and follow truss manufacturer's instructions;
- .14 diffusers and grilles mounted in T-bar ceilings or which are not positively secured to ductwork or structure are to be fitted with slack cable restraints to prevent them from falling in the event the ceiling T-bar grid is displaced;
- .15 do not bridge vibration isolators with slack cable restraints;
- .16 other approved restraint systems are conventional pipe guides, rigid restraint where piping passes through a block or concrete wall, or a cable strap and spacer piece attached to structure and used where piping is adjacent to a wall and conventional slack cable restraints cannot be used.

3.02 INSTALLATION OF FLEXIBLE PIPING CONNECTORS

- .1 Supply flexible piping connectors for connections (including plumbing) to seismically restrained equipment. Hand connectors to appropriate piping trade at site for installation.

3.03 SITE INSPECTION AND LETTERS OF CERTIFICATION

- .1 When seismic control products have been installed, arrange for seismic control product manufacturer and Seismic Consultant to examine installation of seismic control products and to certify in writing (separate letters) that products have been properly installed in accordance with local governing codes and regulations, and recommendations and instructions. Seismic Consultant is to apply his professional stamp to letter.

END OF SECTION

1 GENERAL

1.01 APPLICATION

- .1 This Section specifies insulation requirements common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly.

1.02 DEFINITIONS

- .1 "concealed" – means mechanical services and equipment above suspended ceilings, in non-accessible chases, in accessible pipe spaces, and furred-in spaces.
- .2 "exposed" – means exposed to normal view during normal conditions and operations.
- .3 "mineral fibre" – includes glass fibre.
- .4 "mineral wool" – includes rock wool and slag wool.
- .5 "domestic water" or "potable water" – means piping extended from building Municipal supply main.

1.03 SUBMITTALS

- .1 Submit a product data sheet for each insulation system product. Include identification that product has also been tested to CAN/ULC S102.

1.04 QUALITY ASSURANCE

- .1 Mechanical insulation is to be applied by a licensed journeyman insulation mechanic, or by an apprentice under direct, daily, on-site supervision of a journeyman mechanic.
- .2 Do not apply insulation unless leakage tests have been satisfactorily completed.
- .3 Ensure surfaces to be insulated are clean and dry.
- .4 Ensure ambient temperature is minimum 13°C (55°F) for at least 1 day prior to application of insulation, and for duration of insulation work, and relative humidity is and will be at a level such that mildew will not form on insulation materials.
- .5 Insulation materials must be stored on site in a proper, dry storage area. Any wet insulation material is to be removed from site.

2 PRODUCTS

2.01 FIRE HAZARD RATINGS

- .1 Unless otherwise specified, insulation system materials inside building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with ULC S102, Surface Burning Characteristics of Building Materials and Assemblies.

2.02 THERMAL PERFORMANCE

- .1 Unless otherwise specified, thermal performance of insulation is to meet or exceed values given in Tables entitled Minimum Piping Insulation Thickness Heating and Hot Water Systems and Minimum Piping Insulation Thickness Cooling Systems, as stated in ANSI/ASHRAE/IES Standard 90.1 version referenced in Ontario Building Code.

2.03 PIPE INSULATION MATERIALS

- .1 Horizontal Pipe Insulation at Hangers and Supports
 - .1 Equal to Belform Insulation Ltd. "Koolphen K-Block" insulated pipe support inserts consisting of minimum 150 mm (6") long, pre-moulded, rigid, sectional phenolic foam insulation (of same thickness as adjoining insulation) with a reinforced foil and kraft paper vapour barrier jacket and a captive galvanized steel saddle.
- .2 Pre-Moulded Mineral Fibre
 - .1 Rigid, sectional, sleeve type insulation to ASTM C547, with a factory applied vapour barrier jacket.
 - .2 Acceptable products are:
 - .1 Johns Manville Inc. "Micro-Lok AP-T Plus";
 - .2 Knauf Fiber Glass "Pipe Insulation" with "ASJ-SSL" jacket;
 - .3 Manson Insulation Inc. "ALLEY K APT";
 - .4 Owens Corning "Fiberglas" Pipe Insulation.
- .3 Blanket Mineral Fibre
 - .1 Blanket type roll insulation to ASTM C553, 24 kg/m³ (1-½ lb/ft³) density, with a factory applied vapour barrier facing.
 - .2 Acceptable products are:
 - .1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;
 - .2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;
 - .3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;
 - .4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

2.04 DUCTWORK SYSTEM INSULATION MATERIALS

- .1 Semi-Rigid Mineral Fibre Board
 - .1 Roll form insulation to ASTM C1393, consisting of cut strips of rigid mineral board insulation glued to an aluminium foil and kraft paper facing.
 - .2 Acceptable products are:
 - .1 Multi-Glass Insulation Ltd. "Multi-Flex MKF";

- .2 Owens Corning Pipe and Tank Insulation;
- .3 Johns Manville Inc. Pipe and Tank Insulation "Micro-Flex".
- .2 Blanket Mineral Fibre
 - .1 Blanket type roll form insulation to ASTM C553, 24 kg/m³ (1-½ lb/ft³) density, 40 mm (1-½") thick, with a factory applied vapour barrier facing.
 - .2 Acceptable products are:
 - .1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;
 - .2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;
 - .3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;
 - .4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

2.05 INSULATING COATINGS

- .1 Equal to Robson Thermal Manufacturing Ltd. insulating coatings as follows:
 - .1 anti-condensation coating, "No Sweat-FX";
 - .2 thermal insulating coating, "ThermaLite".

2.06 INSULATION FASTENINGS

- .1 Duct Insulation Fasteners
 - .1 Weld-on 2 mm (3/32") diameter zinc coated steel spindles of suitable length, complete with minimum 40 mm (1-½") square plastic or zinc plated steel self-locking washers.
- .2 Tape Sealant
 - .1 Equal to 3M 1520-CW self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match surface being sealed.
- .3 Mineral Fibre Insulation Adhesive
 - .1 Clear, pressure sensitive, brush consistency adhesive, suitable for a temperature range of -20°C to 82°C (-4°F to 180°F), compatible with type of material to be secured, and WHMIS classified as non-hazardous.
- .4 Lagging Adhesive
 - .1 White, brush consistency, ULC listed and labelled, maximum 25/50 fire/smoke rated in accordance with ULC S102, lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.
- .5 Screws
 - .1 No. 10 stainless steel sheet metal screws.

2.07 INSULATION JACKETS AND FINISHES

- .1 Canvas Jacket Material
 - .1 ULC listed and labelled, 25/50 fire/smoke rated, roll form, minimum 170 g (6 oz.).
- .2 Roll Form Sheet and Fitting Covers
 - .1 Minimum 15 mm (½") thick white PVC, maximum 25/50 fire/smoke rated tested in accordance with ULC S102, complete with installation and sealing accessories. Acceptable products are:
 - .1 Johns Manville Inc. "Zeston" 300;
 - .2 Proto Corp. "LoSMOKE".

3 EXECUTION

3.01 GENERAL INSULATION APPLICATION REQUIREMENTS

- .1 Unless otherwise specified, do not insulate following:
 - .1 factory insulated equipment and piping;
 - .2 heating piping within radiation unit enclosures, including blank filler sections of enclosures;
 - .3 heating piping in soffits and/or overhang spaces and connected to bare element radiation in spaces;
 - .4 branch potable water piping located under counters to serve counter mounted plumbing fixtures and fittings, except barrier-free lavatories;
 - .5 exposed chrome plated potable water angle supplies from concealed piping to plumbing fixtures and fittings, except barrier-free lavatories;
 - .6 heated liquid system pump casings, valves, strainers and similar accessories;
 - .7 heating system expansion tanks;
 - .8 fire protection pump casings;
 - .9 manufactured expansion joints and flexible connections;
 - .10 acoustically lined ductwork and/or equipment;
 - .11 factory insulated flexible branch ductwork;
 - .12 fire protection system water storage tanks;
 - .13 piping unions, except for unions in "cold" category piping.
- .2 Install work generally in accordance with TIAC National Insulation Standards Manual except conform to manufacturer's instructions and recommendations, and requirements specified in this Section.

- .3 Install insulation directly over pipes and ducts, not over hangers and supports.
- .4 Install piping insulation and jacket continuous through pipe openings and sleeves.
- .5 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.
- .6 For insulation thicknesses greater than or equal to 75 mm (3"), provide double layer of insulation to achieve required insulation thickness and stagger joint locations.
- .7 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect insulation jacketing from condensation at its junction with metal.
- .8 Insulate, vapour seal, and finish seismic restraints, braces, anchors, hanger rods, and similar hardware directly connected to "cold" piping and/or equipment, for a distance of 300 mm (12") clear of adjacent pipe or equipment finish, to match piping and/or equipment insulation.
- .9 When insulating vertical piping risers 75 mm (3") diameter and larger, use insulation support rings welded directly above lowest pipe fitting, and thereafter at 4.5 m (14.7') centres and at each valve and flange. Insulate in accordance with Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.
- .10 Where existing insulation work is damaged as a result of mechanical work, repair damaged insulation work to Project work standards.
- .11 Where mineral fibre rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover exposed end of insulation with a purpose made PVC cover on "cold" piping, and with canvas jacket material on "hot" piping.
- .12 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.
- .13 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in insulation and provide a suitable grommet in the opening.

3.02 INSULATION FOR HORIZONTAL PIPE AT HANGERS AND SUPPORTS

- .1 At each hanger and support location for piping 50 mm (2") diameter and larger to be insulated, except where roller hangers and/or supports are required, and unless otherwise specified, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield. Supply insulation sections to piping installers for installation as pipe is erected.

3.03 PIPE INSULATION REQUIREMENTS – MINERAL FIBRE

- .1 Insulate following pipe inside building and above ground with mineral fibre insulation of thickness indicated:
 - .1 domestic cold water piping, less than 100 mm (4") dia. – 25 mm (1") thick;

- .2 domestic cold water piping, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;
 - .3 domestic hot water piping, less than 40 mm (1-½") dia. – 25 mm (1") thick;
 - .4 domestic hot water piping, greater than or equal to 40 mm (1½") dia. – 40 mm (1-½") thick;
 - .5 tempered domestic water piping, supply and return, less than 40 mm (1-½") dia. – 25 mm (1") thick;
 - .6 tempered domestic water piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;
 - .7 hot water heating piping, supply and return, less than 40 mm (1-½") dia. – 40 mm (1-½") thick;
 - .8 hot water heating piping, supply and return, greater than or equal to 40 mm (1-½") dia. – 50 mm (2") thick;
- .2 Secure overlap flap of sectional insulation jacket tightly in place. Cover section to section butt joints with tape sealant.
 - .3 Insulate fittings with sectional pipe insulation mitred to fit tightly, and cover butt joints with tape sealant, or, alternatively, wrap fittings with blanket mineral fibre insulation to a thickness and insulating value equal to sectional insulation, secure in place with adhesive and/or wire, and cover with PVC fitting covers.
 - .4 Unless otherwise specified, insulate unions, valves, strainers, and similar piping system accessories in "cold" piping with cut and tightly fitted segments of sectional pipe insulation with joints covered with tape sealant, or, alternatively, wrap piping union, valve, strainer, etc., with blanket mineral fibre and cover with PVC covers as for paragraph above.
 - .5 Terminate sectional insulation approximately 50 mm (2") from flange or coupling on each side of flange or coupling. Cover flange or coupling with a minimum 50 mm (2") thickness of blanket mineral fibre insulation wide enough to butt tightly to ends of adjacent sectional insulation. Secure blanket insulation in place and cover with a purpose made PVC coupling cover.
 - .6 Take special care at concealed water rough-in piping at plumbing fixtures to ensure piping is properly insulated. If necessary due to space limitations, use 12 mm (½") thick sectional pipe insulation in lieu of 25 mm (1") thick insulation.
 - .7 Insulate seismic restraint hardware such as hanger rods, braces, anchors, etc., directly connected to "cold" category piping and equipment for a distance of 300 mm (12") from piping or equipment with insulation and finish to match pipe or equipment insulation. Coat seismic restraint hardware for a distance of 300 mm (12") from the termination of insulation with Robson Thermal "NO-SWEAT-FX" water based anti-condensation coating.

3.04 DUCTWORK INSULATION REQUIREMENTS – MINERAL FIBRE

- .1 Insulate following ductwork systems inside building and above ground with mineral fibre insulation of thickness indicated:

- .1 supply air ductwork outward from fans, except for supply ductwork exposed in area it serves – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;
 - .2 any other ductwork, casings, plenums or sections specified or detailed on drawings to be insulated – thickness as specified.
- .2 Provide rigid board type insulation for casings, plenums, and exposed rectangular ductwork. Provide blanket type insulation for concealed round, oval or rectangular ductwork. Provide semi-rigid mineral fibre board type insulation for exposed round or oval ducts.
- .3 Liberally apply adhesive to surfaces of exposed rectangular ducts and/or casings. Accurately and neatly press insulation into adhesive with tightly fitted butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom and side surfaces. Secure and seal joints with 75 mm (3") wide tape sealant. Additional installation requirements as follows:
 - .1 at trapeze hanger locations, install insulation between duct and hanger;
 - .2 provide drywall type metal corner beads on edges of ductwork, casings and plenums in equipment rooms, service corridors, and any other area where insulation is subject to accidental damage, and secure in place with tape sealant.
- .4 Liberally apply adhesive to surfaces of concealed rectangular or oval ductwork, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom surfaces. Secure and seal joints with 75 mm (3") tape sealant. At each trapeze type duct hanger, provide a 100 mm (4") wide full length piece of rigid mineral fibre board insulation between duct and hanger.
- .5 Accurately cut sections of insulation to fit tightly and completely around exposed and concealed round or oval ductwork. Liberally apply adhesive to surfaces of duct, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Seal joints with tape sealant. At duct hanger locations install insulation between duct and hanger. At each hanger location for concealed ductwork where flexible blanket type insulation is used, provide a 100 mm (4") wide full circumference strip of semi-rigid board type duct insulation between duct and hanger.
- .6 Insulation application requirements common to all types of rigid ductwork are as follows:
 - .1 at duct connection flanges, insulate flanges with neatly cut strips of rigid insulation material secured with adhesive to side surfaces of flange with a top strip to cover exposed edges of the side strips, then butt the flat surface duct insulation up tight to flange insulation, or, alternatively, increase insulation thickness to depth of flange and cover top of flanges with tape sealant;
 - .2 installation of fastener pins and washers is to be concurrent with duct insulation application;
 - .3 cut insulation fastener pins almost flush to washer and cover with neatly cut pieces of tape sealant;
 - .4 accurately and neatly cut and fit insulation at duct accessories such as damper operators (with standoff mounting) and pitot tube access covers;

- .5 prior to concealment of insulation by either construction finishes or canvas jacket material, patch vapour barrier damage by means of tape sealant.

3.05 APPLICATION OF INSULATING COATINGS

- .1 Apply, in accordance with manufacturer's instruction, insulating coatings to following bare metal surfaces:
 - .1 paint bare metal surfaces clear of "cold" piping and/or equipment insulation for a distance of from 300 mm (12") to 600 mm (24") clear of pipe or equipment insulation, with "No Sweat-FX" anti-condensation coating;
 - .2 paint bare metal surfaces associated with mechanical systems with an operating temperature 60°C (140°F) with "ThermaLite" insulating coating.
- .2 Apply coatings with a brush. Remove any splatter or excess coating from adjacent surfaces.

END OF SECTION

1 GENERAL

1.01 APPLICATION

- .1 This Section specifies requirements, criteria, methods and execution for mechanical demolition work that are common to one or more mechanical work Sections, and it is intended as a supplement to each Section and is to be read accordingly.

2 PRODUCTS

Not Used

3 EXECUTION

3.01 DISCONNECTION AND REMOVAL OF EXISTING MECHANICAL WORK

- .1 Where indicated on drawings, disconnect and remove existing mechanical work, including hangers, supports, insulation, etc. Disconnect at point of supply, remove obsolete connecting services and make system safe. Cut back obsolete piping behind finishes and cap water-tight unless otherwise specified.
- .2 Scope and extent of demolition or revision work is only generally indicated on drawings. Estimate scope, extent and cost of work at site during bidding period site visit(s). Claims for extra costs for demolition work not shown or specified but clearly visible or ascertainable at site during bidding period site visits will not be allowed.
- .3 If any re-design is required due to discrepancies between mechanical drawings and site conditions, notify Consultant who will issue a Site Instruction. If, in the opinion of Consultant, discrepancies between mechanical drawings and actual site conditions are of a minor nature, required modifications are to be done at no additional cost.
- .4 Where existing mechanical services extend through, or are in an area to serve items which are to remain, maintain services in operation. Include for rerouting existing services concealed behind existing finishes and which become exposed during renovation work, so as to be concealed behind new or existing finishes.

3.02 HAZARDOUS WASTE

- .1 Be advised that items such as drainage sumps, catch basins, interceptors, and the like may contain unidentified hazardous waste and caution is to be taken when disconnecting and removing these items.
- .2 If hazardous waste not listed in Specification is found, notify Owner and Consultant immediately and await directions.

3.03 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS

- .1 Co-ordinate shut-down and interruption to existing mechanical systems with Owner. Refer to requirements specified in Division 01.
- .2 Upon award of contract, submit a list of anticipated shut-down times and their maximum duration.

- .3 Prior to each shut-down or interruption, inform Owner in writing 5 business days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent.
- .4 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down, ensure materials and labour required to complete the work for which shut-down is required are available at site.

END OF SECTION

1 GENERAL

1.01 APPLICATION

- .1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.02 DEFINITIONS

- .1 “Agency” – means agency to perform testing, adjusting and balancing work.
- .2 “TAB” – means testing, adjusting and balancing to determine and confirm quantitative performance of equipment and systems and to regulate specified fluid flow rate and air patterns at terminal equipment, e.g., reduce fan speed, throttling, etc.
- .3 “hydronic systems” – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system.
- .4 “air systems” – includes outside air, supply air, return air, exhaust air, and relief air systems.
- .5 “flow rate tolerance” – means allowable percentage variation, minus to plus, of actual flow rate values in Contract Documents.
- .6 “report forms” – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form permanent record to be used as basis for required future testing, adjusting and balancing.
- .7 “terminal” – means point where controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
- .8 “main” – means duct or pipe containing system’s major or entire fluid flow.
- .9 “submain” – means duct or pipe containing part of the systems’ capacity and serving 2 or more branch mains.
- .10 “branch main” – means duct or pipe servicing 2 or more terminals.
- .11 “branch” – means duct or pipe serving a single terminal.

1.03 SUBMITTALS

- .1 Within 30 days of work commencing at site, submit name and qualifications of proposed testing and balancing agency in accordance with requirements of article entitled Quality Assurance below.
- .2 Submit sample test forms, if other than those standard forms prepared by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB), are proposed for use.

- .3 Submit a report by Agency to indicate Agency's evaluation of mechanical drawings with respect to service routing and location or lack of balancing devices. Include set of drawings used and marked-up by Agency to prepare report.
- .4 Submit a report by Agency after each site visit made by Agency during construction phase of this Project.
- .5 Submit a draft report, as specified in Part 3 of this Section.
- .6 Submit a final report, as specified in Part 3 of this Section.
- .7 Submit a testing and balancing warranty as specified in Part 3 of this Section.
- .8 Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

1.04 QUALITY ASSURANCE

- .1 Employ services of an independent testing, adjusting, and balancing agency meeting qualifications specified below, to be single source of responsibility to test, adjust, and balance building mechanical systems to produce design objectives. Agency is to have successfully completed testing, adjusting and balancing of mechanical systems for a minimum of 5 projects similar to this Project within past 3 years, and is to be certified as an independent agency in required categories by one of following:
 - .1 AABC - Associated Air Balance Council;
 - .2 NEBB - National Environmental Balancing Bureau.
- .2 Testing, adjusting and balancing of complete mechanical systems is to be performed over entire operating range of each system in accordance with 1 of following publications:
 - .1 National Standards for a Total System Balance published by Associated Air Balance Council;
 - .2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by National Environmental Balancing Bureau;
 - .3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

2 PRODUCTS

Not Used

3 EXECUTION

3.01 SCOPE OF WORK

- .1 Perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of fluid quantities of mechanical systems as required to meet design specifications and comfort conditions, and recording and reporting results.
- .2 Mechanical systems to be tested, adjusted and balanced include:

- .1 TAB of heating systems is to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
- .2 TAB of cooling systems is also to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine".
- .3 TAB of air handling systems is to include equipment and ductwork air temperatures, capacities and flows.
- .4 Following existing systems, revised as part of mechanical work, are to be tested, adjusted and balanced as for new systems:
 - .1 Existing heating branch flow and temperature measurements before construction and adjustments as noted on the plans.

3.02 TESTING, ADJUSTING AND BALANCING

- .1 Conform to following requirements:
 - .1 as soon as possible after award of Contract, Agency is to carefully examine a white print set of mechanical drawings with respect to routing of services and location of balancing devices, and is to issue a report listing results of the evaluation;
 - .2 set of drawings examined by Agency is to be returned with evaluation report, with red line mark-ups to indicate locations for duct system test plugs, and required revision work such as relocation of balancing devices and locations for additional devices;
 - .3 after review of mechanical work drawings and specification, Agency is to visit site at frequent, regular intervals during construction of mechanical systems, to observe routing of services, locations of testing and balancing devices, workmanship, and anything else that will affect testing, adjusting and balancing;
 - .4 after each site visit, Agency is to report results of site visit indicating date and time of visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing;
 - .5 testing, adjusting and balancing is not to begin until:
 - .1 building construction work is substantially complete and doors have been installed;
 - .2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then successfully performance tested.
 - .6 mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing;
 - .7 obtain copies of reviewed shop drawings of applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences;

- .8 Agency is to walk each system from system "head end" equipment to terminal units to determine variations of installation from design, and system installation trades will accompany Agency;
 - .9 Agency is to check valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment;
 - .10 wherever possible, Agency is to lock balancing devices in place at proper setting, and permanently mark settings on devices;
 - .11 Agency is to leak test ductwork as specified in Section entitled HVAC Air Distribution in accordance with requirements of SMACNA "HVAC Air Duct Leak Test Manual", coordinate work with work of aforementioned Sections, provide detailed sketch(es) to Sheet Metal Contractor and Consultant identifying ductwork not in accordance with acceptable leakage values specified in aforementioned Sections, and retest corrected ductwork;
 - .12 Agency is to balance systems with due regard to objectionable noise which is to be a factor when adjusting fan speeds and performing terminal work such as adjusting air quantities, and should objectionable noise occur at design conditions, Agency is to immediately report problem and submit data, including sound readings, to permit an accurate assessment of noise problem to be made;
 - .13 Agency is to check supply air handling system mixing plenums for stratification, and where variation of mixed air temperature across coils is found to be in excess of $\pm 5\%$ of design requirements, Agency is to report problem and issue a detail sketch of plenum baffle(s) required to eliminate stratification;
 - .14 Agency is to perform testing, adjusting and balancing to within $\pm 5\%$ of design values, and make and record measurements which are within $\pm 2\%$ of actual values;
 - .15 for air handling systems equipped with air filters, test and balance systems with simulated 50% loaded (dirty) filters by providing a false pressure drop;
 - .16 test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 2.8°C (5°F) wet bulb temperature of maximum summer design condition, and within 5.5°C (10°C) dry bulb temperature of minimum winter design condition, and take final temperature readings during seasonal operation.
- .2 Prepare reports as indicated below.
- .1 Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in same manner specified for final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
 - .2 Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports. Use units of measurement (SI or Imperial) as used on Project Documents.

- .3 Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, 3-ring binders. Provide binding edge labels with project identification and a title descriptive of contents. Provide completed reports in PDF format for Consultant review. Divide contents of binder into divisions listed below, separated by divider tabs:
 - .1 General Information and Summary;
 - .2 Air Systems;
 - .3 Hydronic Systems;
- .4 Agency is to provide following minimum information, forms and data in report:
 - .1 inside cover sheet to identify Agency, Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of instrumentation used for procedures along with proof of calibration;
 - .2 remainder of report is to contain appropriate forms containing as a minimum, information indicated on standard AABC or NEBB report forms prepared for each respective item and system;
 - .3 Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying equipment, terminals, and accessories;
 - .4 Agency is to include report sheets indicating building comfort test readings for all rooms.
- .3 After final testing and balancing report has been submitted, Agency is to visit site with Contractor and Consultant to spot check results indicated on balancing report. Agency is to supply labour, ladders, and instruments to complete spot checks. If results of spot checks do not, on a consistent basis, agree with final report, spot check procedures will stop and Agency is to then rebalance systems involved, resubmit final report, and again perform spot checks with Contractor and Consultant.
- .4 When final report has been accepted, Contractor is to submit to Owner, in name of Owner, a certificate equal to AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition, Contractor is to submit a written extended warranty from Agency covering one full heating season and one full cooling season, during which time any balancing problems which occur, with exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by Agency and reported on to Owner, and if it is determined that problems are a result of improper testing, adjusting and balancing, they are to be immediately corrected without additional cost to Owner.
- .5 After acceptance of final report, Agency is to perform post testing and balancing site visits in accordance with following requirements:
 - .1 post testing and balancing site visits are to be made:
 - .1 once during first month of building operation;

- .2 once during third month of building operation;
- .3 once between fourth and tenth months in a season opposite to first and third month visit.
- .2 during each return visit and accompanied by Owner's representative, Agency is to spot rebalance terminal units as required to suit building occupants and eliminate complaints;
- .3 Agency is to schedule each visit with Contractor and Owner, and inform Consultant;
- .4 after each follow-up site visit, Agency is to issue to Contractor and Consultant a report indicating any corrective work performed during visit, abnormal conditions and complaints encountered, and recommended corrective action.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings/product data sheets to regulatory authority for review and approval prior to submitting to Consultant. Conform to following requirements:
 - .1 submit shop drawings/product data sheets for products specified in this Section except pipe and fittings;
 - .2 submit complete CAD layout drawings indicating source of water supply with test flow and pressure, "head-end" equipment piping schematic, pipe routing and sizing, and zones, all signed and sealed by a qualified professional mechanical engineer registered in jurisdiction of the work as specified below;
 - .3 submit copies of calculations, including hydraulic calculations, stamped and signed by same engineer who signs layout drawings, and a listing of design data used in preparing calculations, system layout and sizing, including occupancy-hazard design requirements;
- .2 Submit a complete sprinkler system test certificate as specified in Part 3 of this Section.
- .3 Sprinklers are to be identified on drawings and product submittals, and be specifically identified by manufacturer's listed model or series designation. Trade names and other abbreviated listings are unacceptable.

1.02 QUALITY ASSURANCE

- .1 Fire protection sprinkler system work is to be in accordance with following codes and standards:
 - .1 NFPA 13, Standard for the Installation of Sprinkler Systems;
 - .2 CSA B137.2, Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications;
 - .3 CSA B137.3, Rigid Polyvinylchloride (PVC) Pipe for Pressure Applications;
 - .4 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless;
 - .5 ASTM A135, Standard Specification for Electric-Resistance-Welded Steel Pipe;
 - .6 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service;
 - .7 ASTM A536, Standard Specification for Ductile Castings;
 - .8 ASTM A795, Standard Specification for Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use;
 - .9 ANSI/ASME B16.4, Grey Iron Threaded Fittings (Classes 125 and 250);
 - .10 CAN/CSA B64.10, Backflow Preventers and Vacuum Breakers.

- .2 Fire protection sprinkler work is to be performed by a sprinkler company who is a member in good standing of Canadian Automatic Sprinkler Association. Site personnel are to be licensed in jurisdiction of the work and under continuous supervision of a foreman who is experienced fire protection system installer and journeyman pipe fitter licensed in jurisdiction of the work.
- .3 Check and verify dimensions and conditions at site and ensure work can be performed as indicated. Coordinate work with trades at site and accept responsibility for and cost of making adjustments to piping and/or spacing to avoid interference with other building components.
- .4 Verify working condition of existing sprinkler system equipment which has direct interface with project work and is to remain. Replace with new equipment where necessary.
- .5 System components must be ULC listed and labelled.
- .6 Grooved couplings, and fittings, valves and specialties are to be products of a single manufacturer. Grooving tools are to be of same manufacturer as grooved components.
- .7 Castings used for coupling housings, fittings, valve bodies, etc., are to be date stamped for quality assurance and traceability.

1.03 DESIGN REQUIREMENTS

- .1 Design fire protection sprinkler work in accordance with NFPA 13 and local Provincial Standards, and, where required, local building and fire department requirements and standards of Owner's Insurer. If water supply flow and pressure test data is not available, conduct Municipal main water flow and pressure tests at nearest fire hydrant to obtain criteria to be used in system design. Include hydrant location and flow and pressure test data with system design calculations.
- .2 Include for a qualified mechanical professional engineer registered and licensed in the jurisdiction of the work to design the fire protection sprinkler work. Refer to Section entitled Mechanical Work General Instructions for requirements regarding Contractor retained engineers.
- .3 Sprinkler/System Occupancy – Hazard Design requirements: In accordance with NFPA 13 occupancy-hazard density requirements, unless otherwise specified.

2 PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

- .1 Pipe, fittings and joints are to be as follows, with exceptions as specified in Part 3 of this Section:
 - .1 Schedule 40 Steel – Grooved Coupling Joints
 - .1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with grooved ends and mechanical fittings and couplings, Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005 or approved equal, rigid coupling joints. Strap type outlet fittings such as Victaulic "Snap-Let" are not acceptable.
 - .2 Schedule 40 Steel – Screwed and Welded Joints

- .1 Schedule 40 mild black carbon steel, ASTM A53, Grade B. Screwed piping complete with Class 125 cast iron screwed fittings to ANSI/ASME B16.4. Welded piping complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, long sweep pattern wherever possible.
- .3 Schedule 10 Steel – Grooved Coupling Joints
 - .1 Schedule 10 mild black carbon steel, ASTM A53, Grade B, complete with grooved ends and fittings and couplings, Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005, or approved equal, rigid coupling joints.
- .4 Schedule 10 Steel – Screwed Joints
 - .1 Schedule 10 mild black carbon steel, ASTM A53, Grade B, complete with mill or site threaded ends, Class 125 cast iron screwed fittings to ANSI/ASME B16.4, and screwed joints.
- .5 Standard Mechanical Couplings: Equal to Victaulic
 - .1 Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets are to be pressure-responsive synthetic rubber, grade to suit intended service, conforming to ASTM D-2000. Mechanical coupling bolts are to be zinc plated (ASTM B-633) heat treated carbon steel track head conforming to ASTM A-449 and ASTM A-183. Couplings are to comply with ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.
 - .2 Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads are to be used to provide system rigidity and support and hanging in accordance NFPA-13. Couplings are to be fully installed at visual pad-to-pad offset contact. Couplings that require exact gapping of bolt pads at specific torque ratings are not permitted.
 - .3 Flexible Type: Use in locations where vibration attenuation and stress relief are required; Victaulic Style 177 (Quick-Vic™) or approved equal, flexible coupling.

2.02 SPRINKLER HEADS

- .1 Sprinkler heads, unless otherwise specified, are to be as scheduled in Part 3 of this Section.
- .2 Sprinkler body is to be die-cast, with hex-shaped wrench boss integrally cast into sprinkler body to reduce risk of damage during installation. Wrenches are to be provided by sprinkler manufacturer that directly engages wrench boss.
- .3 For locations where corrosive resistant coatings are required, body is to be coated with ULC listed and FM approved anti-corrosion VC-250 coating (silver colouring).
- .4 Sprinkler heads for healthcare facilities are to be quick response type.
- .5 Recessed sprinkler heads in finished areas are to be chrome plated unless otherwise specified. Concealed sprinkler head ceiling plates are to match ceiling colour.

- .6 Where exposed pendent heads occur in areas with suspended ceilings, they are to be complete with chrome plated escutcheon plates. Similarly, sidewall heads with concealed piping are to be complete with chrome plated escutcheon plates.
- .7 Sprinkler heads which are exposed in areas where they may be subject to damage are to be complete with wire guards, chrome plated where in finished areas.
- .8 Escutcheons and guards are to be listed, supplied, and approved for use with sprinkler by sprinkler manufacturer.
- .9 Sprinkler heads located in areas or over equipment where high ambient temperature is present are to be, unless otherwise specified, 93°C (200°F) heads. Other heads, unless otherwise specified or required, are to be 68°C (155°F) rated.
- .10 Acceptable manufacturers are:
 - .1 Victaulic Co.;
 - .2 Tyco Fire Suppression & Building Products;
 - .3 The Viking Corporation;
 - .4 The Reliable Automatic Sprinkler Co.

3 EXECUTION

3.01 MONITORING OF SYSTEMS

- .1 Daily monitor and supervise existing sprinkler system serving renovated areas to ensure that each respective system is left in proper operating condition at end of each working day. Include for but not be limited to performing following:
 - .1 Under presence of Owner's representative, check each morning and evening (start and end of work) of each day, sprinkler system to ensure that it is in proper working condition;
 - .2 If portions of sprinkler system is not in proper working order, provide temporary provisions subject to approval of local fire authority or local governing authority, to ensure that proper sprinkler coverage is provided and/or provide supervisory personnel to monitor areas where sprinkler system is not operational;
 - .3 Document and sign off with Owner's representative signing off also, each respective daily check condition;
 - .4 Ensure that work to sprinkler system does not affect portion of system serving areas outside of renovation areas.

3.02 DEMOLITION

- .1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.03 PIPING INSTALLATION REQUIREMENTS

- .1 Provide required sprinkler system piping.

- .2 Perform piping work in accordance with requirements of NFPA 13, governing regulations, and "Reviewed" shop drawings.
- .3 Piping, unless otherwise specified, is as follows:
 - .1 for piping inside building and above ground except as noted below – Schedule 40 grooved end black steel with Victaulic or equal fittings and coupling joints, or, for piping to and including 50 mm (2") diameter, screwed fittings and joints, or, for piping 65 mm (2-½") diameter and larger, welding fittings and welded joints;
 - .2 for piping downstream of "head end" alarm valve(s) and equipment – Schedule 10 or "Lightwall" black steel pipe with Victaulic or equal fittings and coupling joints or screwed fittings and joints;
- .4 Exceptions to piping requirements specified above are as follows:
 - .1 dry pipe zone steel piping, fittings, unions, couplings and flanges are to be galvanized;
 - .2 wet zone steel piping, fittings, unions, couplings and flanges for sprinkler work exposed to weather either inside or outside building (including parking garages), are to be galvanized;
 - .3 PVC piping is not to be used above grade;
 - .4 ferrous pipe hangers, supports, and similar hardware used for galvanized steel piping are to be electro-galvanized.
- .5 Pipe sizes, pipe routing, sprinkler head quantities and locations, and layout of work shown on drawings are to assist during Bid period. Ensure adequate head coverage, head quantities and pipe sizing as specified in Part 1 of this Section. Do not reduce size of sprinkler main or re-route main unless reviewed with Consultant and accepted by Owner.
- .6 Install grooved joints in accordance with manufacturer's latest installation instructions. Grooved ends are to be clean and free from indentations, projections and roll marks. Gaskets are to be moulded and produced by coupling manufacturer, and verified as suitable for intended service. Have factory-trained representative from mechanical joint manufacturer provide on-site training in proper use of grooving tools and installation of grooved piping products. Have factory-trained representative periodically review product installation and ensure best practices are being followed. Remove and replace any improperly installed products.
- .7 Clean pipe, fittings, couplings, flanges and similar components after erection is complete. Wire brush clean any ferrous pipe, fitting, coupling, flange, hanger, support and similar component which exhibit rust and carefully coat with suitably coloured primer.
- .8 When sprinkler work is complete, test system components and overall system(s) and submit completed test certificate and other documentation in accordance with Chapter 8 of NFPA 13.

3.04 INSTALLATION OF SPRINKLER HEADS

- .1 Provide required sprinkler heads in accordance with following schedule:

APPLICATION	SPRINKLER HEAD TYPE
Rooms/areas with a suspended ceiling	Victaulic V38/V39 or Tyco Series RFII "Royal Flush II" concealed pendent
Rooms/areas without a suspended ceiling	Victaulic V27 or Tyco Series TY-FRB pendent

- .2 Sprinkler head manufacturers indicated on schedule are for type indication purposes. Acceptable manufacturers are listed in Part 2 of this Section.
- .3 Provide quick response type sprinkler heads for healthcare facilities.
- .4 Coordinate sprinkler head locations with drawings, including architectural reflected ceiling plan drawings, and, where applicable, electrical drawings. Coordinate sprinkler head locations in areas with suspended ceilings with location of lighting, grilles, diffusers, and similar items recessed in or surface mounted on ceiling as per reflected ceiling plans. In areas with lay-in tile, centre sprinkler head both ways in lay-in tile wherever possible. Confirm locations prior to roughing-in.
- .5 Maintain maximum headroom in areas with no ceilings.
- .6 Provide guards for heads where they are subject to damage.
- .7 Provide high temperature heads in equipment rooms and similar areas over heat producing or generating equipment.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings and product data sheets for products specified in Part 2 of this Section except for pipe, fittings, and chlorine.
- .2 Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance of the Work. Submit certification details of laboratory.

1.02 QUALITY ASSURANCE

- .1 Domestic water piping and valves are in accordance with following codes, regulations and standards (as applicable):
 - .1 applicable local codes and regulations;
 - .2 ASTM F1960, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing;
 - .3 CAN/CSA B125.1, Plumbing Supply Fittings;
 - .4 CAN/CSA B125.3, Plumbing Fittings;
 - .5 CAN/CSA B137 Series, Thermoplastic Pressure Piping Compendium;
 - .6 CAN/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies;
 - .7 CAN/ULC S101, Fire Endurance Tests of Building Construction and Materials;
 - .8 NSF/ANSI 14, Plastics Piping System Components and Related Materials;
 - .9 NSF/ANSI 61, Drinking Water System Components – Health Effects;
 - .10 NSF/ANSI 372, Drinking Water System Components – Lead Content.

2 PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

- .1 Hard Copper - Solder Joint
 - .1 Type "L" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints using Canada Metal Co "SILVABRITE 100 lead-free solder for cold water pipe, and 95% tin/ 5% Antimony or "SILVABRITE 100" solder, for other services, or approved equal.

2.02 SHUT-OFF VALVES

- .1 Ball Valves
 - .1 Class 600, 4140 kPa (600 psi) WOG rated, lead-free, full port ball type valves.

- .2 Forged brass body with solder ends, forged brass cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat. and removable lever handle.
- .3 Valves in insulated piping are to be complete with stem extensions.
- .4 Acceptable manufacturers are:
 - .1 Toyo Valve;
 - .2 Milwaukee Valve;
 - .3 Kitz Corporation;
 - .4 Apollo Valves;
 - .5 Watts Canada.
- .2 Butterfly Valves - Flanged Joint
 - .1 Lead free, non-corrosive, minimum 1200 kPa (175 psi) cold water pressure rated, resilient seated butterfly valves.
 - .2 With coated cast ductile iron lug type body, 300 series stainless steel shaft, 300 series stainless steel disc, and EPDM seat.
 - .3 Suitable for domestic water bubble-tight dead-end service with valve in position and either side of connecting piping removed.
 - .4 Butterfly valves to and including 100 mm (4") dia. are equipped with lever handles. Butterfly valves larger than 100 mm (4") dia. are equipped with worm gear operators.
 - .5 Acceptable manufacturers are:
 - .1 Crane-Jenkins;
 - .2 Kitz Corporation;
 - .3 Apollo Valves;
 - .4 Watts Canada.
- .3 Butterfly Valves: Grooved End
 - .1 Victaulic Series 608N, for copper pipe rated to 2068 kPa (300 psi) and be both bi-directional and dead-end service capable to full rated pressure. Body of brass castings and disc of aluminum-bronze casting. Seat material is Grade P fluoroelastomer. UL Classified in accordance with ANSI/NSF 61 for ambient 30°C (86°F) and hot 82°C (180°F) potable water service and ANSI/NSF 372. With lever lock handle and gear type operators as required for intended applications.

- .2 Victaulic Series 461, for stainless steel pipe rated to 2068 kPa (300 psi) and be both bi-directional and dead-end service capable to full rated pressure. Body and disc of stainless steel. Seat material is Grade P fluoroelastomer or EDPM to suit intended applications. UL Classified in accordance with ANSI/NSF 61 for ambient 30°C (86°F) and hot 82°C (180°F) potable water service and ANSI/NSF 372. With lever lock handle and gear type operators as required for intended applications.

2.03 CHECK VALVES

- .1 Horizontal
 - .1 Lead-free, Class 125, bronze, 1380 kPa (200 psi) WOG rated horizontal swing type check valves with solder ends.
 - .2 Bronze body, cap and disc holder.
 - .3 PTFE disc
 - .4 Acceptable manufacturers are:
 - .1 Toyo Valve;
 - .2 Milwaukee Valve;
 - .3 Kitz Corporation;
 - .4 Apollo Valves.
- .2 Vertical
 - .1 Lead-free, 1725 kPa (250 psi) WOG rated, silent type, spring loaded, vertical lift check valve with soldering ends.
 - .2 Cast bronze body, cap disc holder and phosphor bronze spring.
 - .3 Acceptable manufacturers are:
 - .1 Toyo Valve;
 - .2 Milwaukee Valve;
 - .3 Kitz Corporation;
 - .4 Apollo Valves.

2.04 DRAIN VALVES

- .1 Lead free, minimum 2070 kPa (300 psi) water rated, 20 mm ($\frac{3}{4}$ ") dia., straight pattern full port bronze ball valves.
- .2 Threaded outlet suitable for coupling connection of 20 mm ($\frac{3}{4}$ ") dia. garden hose, and a cap and chain.
- .3 Acceptable manufacturers are:

- .1 Crane -Jenkins;
- .2 Kitz Corporation;
- .3 Apollo Valves;
- .4 Milwaukee Valve;
- .5 Dahl Bros.

2.05 CHLORINE

- .1 Sodium hypochlorite to AWWA B300.

2.06 WATER HAMMER ARRESTORS

- .1 Jay R. Smith 5000 Series, water hammer arrestors with following features:
 - .1 piston type, sealed, lead free, stainless steel construction;
 - .2 or upright vertical installations;
 - .3 factory pre-charged and sealed, pressurized compression chamber;
 - .4 welded nesting-type expansion bellows surrounded by non-toxic mineral oil;
 - .5 male treaded nipple connection.
- .2 Acceptable manufacturers are:
 - .1 Jay R. Smith;
 - .2 Precision Plumbing Products;
 - .3 Or approved equal.

3 EXECUTION

3.01 DEMOLITION

- .1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 PIPING INSTALLATION REQUIREMENTS

- .1 Provide required domestic water piping. Install piping in accordance with local governing codes and standards and for special piping, also follow manufacturer instructions to suit intended applications.
- .2 Piping, unless otherwise specified, is as follows:
 - .1 for pipe inside building and aboveground in sizes to 100 mm (4") dia: Type "L" hard copper with solder joints or Type "L" hard copper with pressure coupled mechanical joints.

- .3 Slope piping so it can be completely drained.
- .4 Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe or equipment.

3.03 INSTALLATION OF SHUT-OFF AND CHECK VALVES

- .1 Refer to Part 3 of Section entitled Basic Mechanical Materials and Methods.
- .2 For shut off valves installed on solder joint copper piping up to and including 75 mm (3") diameter, provide ball type valves, and for flanged joints copper or stainless steel piping larger than 75 mm (3") diameter provide butterfly type valves.

3.04 INSTALLATION OF DRAIN VALVES

- .1 Provide drain valve at bottom of domestic water piping risers, at other piping low points, and wherever else shown.
- .2 Locate drain valves so they are easily accessible.

3.05 INSTALLATION OF WATER HAMMER ARRESTORS

- .1 Provide accessible water hammer arrestors in domestic water piping in locations as follows:
 - .1 in headers at groups of plumbing fixtures;
 - .2 at top of risers;
 - .3 at ends of long horizontal runs of piping;
 - .4 in piping connecting solenoid valves or equipment with integral solenoid valves;
 - .5 wherever else shown or required by local governing codes and standards.
- .2 Install each unit in piping tee either horizontally or vertically in path of potential water shock, in accordance with manufacturer instructions and details.

3.06 FLUSHING AND DISINFECTING PIPING

- .1 Flush and disinfect domestic water piping after leakage testing is complete.
- .2 Isolate new piping from existing piping prior to flushing and disinfecting procedures.
- .3 Flush piping until foreign materials are removed and flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.
- .4 When flushing is complete, disinfect piping with solution of chlorine in accordance with AWWA C601.
- .5 When disinfecting is complete, submit water samples to certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit copy of test results and fill systems.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings.
- .2 Submit a copy of plumbing inspection certificate prior to application for Substantial Performance of the Work.

2 PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

- .1 Copper - Solder Joint
 - .1 Type DWV hard temper to ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.
- .2 Cast Iron
 - .1 Class 4000 cast iron pipe, fittings, and mechanical coupling joints to CAN/CSA B70.

2.02 SHUT-OFF AND CHECK VALVES

- .1 Shut-off Valves
 - .1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass body, blowout-proof stem, chrome plated solid brass ball, solder or screwed ends as required, and removable lever handle.
 - .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 5049A or Fig. 5044A;
 - .2 Milwaukee Valve Co. #BA-155 or #BA -125;
 - .3 Kitz Corporation Code 58 or Code 59;
 - .4 Victaulic Co. of Canada Ltd. Series 722;
 - .5 Apollo Valves # 77-100 or # 77-200;
 - .6 Watts Industries (Canada) Inc. #FBVS-3C.
- .2 Check Valves
 - .1 Class 125, bronze, 1725 kPa (250 psi) WOG rated vertical lift check valve with solder or screwed ends as required, and, for horizontal piping, Class 125, bronze 1380 kPa (200 psi) WOG rated swing check valves with solder or screwed ends.
 - .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 231 or Fig. 236 or Fig. 237;

- .2 Milwaukee Valve Co. #1510 or #510;
- .3 Kitz Corporation Code 36 or Code 22 or Code 23.

2.03 CLEANOUTS

- .1 Horizontal Piping
 - .1 TY pipe fitting with an extra heavy brass plug screwed into the fitting.
- .2 Vertical Piping
 - .1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, "BARRETT" type cast iron cleanout tees, each gas and water-tight and complete with a bolted cover.
- .3 Urinal(s)
 - .1 Wall access cleanout assemblies, each complete with a tapered plug, threaded brass insert, urethane rubber seal, and polished stainless steel access cover with vandal-proof stainless steel securing screw.
 - .2 Acceptable products are:
 - .1 Watts Industries (Canada) Ltd. #CO-590-RD;
 - .2 Jay R. Smith #SQ4-1819;
 - .3 Zurn #ZSS-1666-1;
 - .4 Mifab #C1440-RD.

3 EXECUTION

3.01 DEMOLITION

- .1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 DRAIN AND VENT PIPING INSTALLATION REQUIREMENTS

- .1 Provide required drainage and vent piping. Pipe, unless otherwise specified, as follows:
 - .1 for pipe inside building and aboveground in sizes less than or equal to 65 mm (2-½") dia. – type DWV copper;
 - .2 for pipe inside building and aboveground in sizes greater than or equal to 75 mm (3") dia. – Class 4000 cast iron;
- .2 Unless otherwise specified, slope horizontal drainage piping aboveground in sizes to and including 75 mm (3") dia. 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") dia. and larger 25 mm (1") in 2.4 m (8').

- .3 Install and slope underground drainage piping to inverts or slopes indicated on drawings to facilitate straight and true gradients between points shown. Verify available slopes before installing pipes.
- .4 Unless otherwise specified, slope horizontal branches of vent piping down to fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').
- .5 Extend vent stacks up through roof generally where shown but with exact locations to suit site conditions and in any case a minimum of 3 m (10') from fresh air intakes. Terminate vent stacks a minimum of 330 mm (13") above roof (including roof parapets) in vent stack covers. Where not shown on drawings, route vent piping from source to building exterior as required in order to satisfy local governing codes and authority. Coordinate vent routing with other building services and ensure there is no architectural impact.
- .6 Provide cast brass dielectric unions at connections between copper pipe and ferrous pipe or equipment.

3.03 INSTALLATION OF SHUT-OFF AND CHECK VALVES

- .1 Provide a shut-off valve and a check valve in discharge piping of each drainage pump.
- .2 Locate valves so they are easily accessible without the use of ladders or other such devices.

3.04 INSTALLATION OF CLEANOUTS

- .1 Provide cleanouts in drainage piping in locations as follows:
 - .1 in building drain or drains as close as possible to inner face of outside wall, and, if a building trap is installed, locate cleanout on downstream side of building trap;
 - .2 at or as close as practicable to the foot of each drainage stack;
 - .3 at maximum 15 m (50') intervals in horizontal pipe 100 mm (4") dia. and smaller;
 - .4 at maximum 30 m (100') intervals in horizontal pipe larger than 100 mm (4") dia.;
 - .5 wherever else shown on drawings.
- .2 Cleanouts are to be same diameter as pipe in piping to 100 mm (4") dia., and not less than 100 mm (4") dia. in piping larger than 100 mm (4") dia.
- .3 Where cleanouts in vertical piping are concealed behind walls or partitions, install cleanouts near floor and so cover is within 25 mm (1") of the finished face of the wall or partition.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

- .1 Submit product data sheets (fixture cuts) for all plumbing fixtures and fittings, including accessories.
- .2 Submit fixture manufacturer's standard colour charts for fixtures where colours are available but a particular colour is not specified.

2 PRODUCTS

2.01 GENERAL RE: PLUMBING FIXTURES AND FITTINGS

- .1 Existing lavatory is to be removed and reinstalled.
- .2 Fixtures and fittings, where applicable, are to be in accordance with requirements of CAN/CSA-B45 Series, General Requirements for Plumbing Fixtures, including supplements, ASME A112.1.18.1/CSA B125.1, Plumbing Supply Fittings, and CAN/CSA-B125.3, Plumbing Fittings.
- .3 Barrier-free fixtures and fittings are to be in accordance with governing Code requirements.
- .4 Unless otherwise specified, fittings and piping exposed to view are to be brass, chrome plated and polished.
- .5 Fixture carriers are to be suitable in all respects for the fixture they support and construction in which they are located.
- .6 Exposed supplies for fixtures which do not have supply trim/fittings with integral stops, i.e. lavatories, are to be solid chrome plated brass angle vales with screwdriver stops for public areas, wheel handle stops for private areas, flexible stainless steel risers, and stainless steel or chrome plated steel escutcheons, all arranged and sized to suit fixture.

2.02 CAULKING

- .1 General Electric Series SCS-1200 Silicone Construction Sealant or Dow Corning 780 silicone rubber sealant with primers as recommended by sealant manufacturer. Caulking colour(s) for coloured fixtures other than white, if any, will be selected by Consultant from sealant manufacturer's standard colour range.
- .2 Caulking in Mental Health areas shall be pick proof.

3 EXECUTION

3.01 DEMOLITION

- .1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS

- .1 Provide required plumbing fixtures and fittings.

- .2 Where new fixtures and fittings are to be connected to existing piping, include for required piping revisions.
- .3 Connect plumbing fixtures and fittings with piping sized in accordance with drawing schedule. Refer to manufacturer's published connection (rough-in) requirements. Where manufacturer requires piping connection larger than shown below, provide piping accordingly:

FIXTURE AND/OR FITTING	DRAIN SIZE MM (IN.)	VENT SIZE MM (IN.)	DHW SIZE MM (IN.)	DCW SIZE MM (IN.)	TEMP WATER SIZE MM (IN.)
Lavatories (Electronic Faucet)	40 (1-½)	32 (1-¼)	15 (½)	15 (½)	15 (½)

- .4 Confirm exact location of plumbing fixtures and trim prior to roughing-in. Refer to architectural plan and elevation drawings.
- .5 When installation is complete, check and test operation of each fixture and fitting. Adjust or repair as required.
- .6 For barrier-free fixtures, comply with mounting height and other requirements of governing Code(s).
- .7 Locate control panels for electronic faucets under lavatories and recessed into wall. Coordinate panel installations with electrical trade who will provide 115 volt power wiring to panels. Install flexible conduit (supplied with box) and extend cord from faucet through the flexible conduit to control box. Connect hot and cold water piping to mixing valve in each box, and tempered water piping from each mixing valve to faucet. Set mixing valve maximum temperature limit stops to 43°C (110°F) after domestic water systems (hot and cold) are complete. Ensure each programmable controller is properly programmed and water off after deactivation is set for 3 seconds.

3.03 CAULKING AT PLUMBING FIXTURES AND FITTINGS

- .1 Caulk around plumbing fixtures and fittings where they contact walls, floors, and any other building surface.
- .2 Clean areas/surfaces to be caulked and prime in accordance with sealant manufacturer's instructions. Where damage to a building surface may occur, mask surface to prevent damage and ensure a clean exact edge to caulking bead.
- .3 Apply caulking using a gun with proper size and shape of nozzle and force sealant into joints to ensure good surface contact and a smooth and even finished bead of sealant.
- .4 If joints have been masked sealant may be tooled in a continuous stroke to obtain complete void filling. Remove masking tape immediately after tooling and before sealant begins to skin.

END OF SECTION

PART 1 GENERAL

1.1 QUALIFICATIONS

- .1 The HVAC system cleaning contractor shall be a certified member of the National Air Duct Cleaners Association (NADCA), or shall maintain membership in a nationally recognized non-profit industry organization dedicated to the cleaning of HVAC systems.
- .2 The HVAC system cleaning contractor shall have a minimum of one (1) Air System Cleaning Specialist (ASCS) certified by NADCA on a full time basis, or shall have staff certified by a nationally recognized certification program and organization dedicated to the cleaning of HVAC systems.
- .3 A person certified as an ASCS by NADCA, or maintaining an equivalent certification by a nationally recognized program and organization, shall be responsible for the total work herein specified.
- .4 The HVAC system cleaning contractor shall submit records of experience in the field of HVAC system cleaning as requested by the Consultant. Proposals shall only be considered from firms which are regularly engaged in HVAC system maintenance with an emphasis on HVAC system cleaning and decontamination.
- .5 The HVAC system cleaning contractor shall possess and furnish all necessary equipment, materials and labor to adequately perform the specified services.
 - .1 The contractor shall assure that its employees have received safety equipment training, medical surveillance programs, individual health protection measures, and manufacturer's product and material safety data sheets (MSDS) as required for the work, and as described by this specification. Contractors shall comply with applicable national safety codes and standards.
 - .2 The contractor shall maintain a copy of all current MSDS documentation and safety certifications at the site at all times, as well as comply with all other site documentation requirements of applicable OSHA programs and this specification.
 - .3 Contractor shall submit to the owner all Material Safety Data Sheets (MSDS) for all chemical products proposed to be used in the cleaning process.

1.2 STANDARDS

- .1 Perform the services specified hereinafter in accordance with current published standards of the National Air Duct Cleaners Association (NADCA).
- .2 All terms in this Specification shall have their meaning defined as stated in NADCA Standards.
- .3 NADCA Standards must be followed with no modifications or deviations.
- .4 Applicable Standards
 - .1 National Air Duct Cleaners Association (NADCA): "ACR-2002, Assessment, Cleaning & Restoration of HVAC Systems," 2001.
 - .2 National Air Duct Cleaners Association (NADCA): "Understanding Microbial Contamination in HVAC Systems," 1996.
 - .3 National Air Duct Cleaners Association (NADCA): "Introduction to HVAC System Cleaning Services," 2002.
 - .4 National Air Duct Cleaners Association (NADCA): Standard 05 "Requirements for the Installation of Service Openings in HVAC Systems," 1997.

- .5 Underwriters' Laboratories (UL): UL Standard 181.
- .6 American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE): Standard 62-89, "Ventilation for Acceptable Indoor Air Quality".
- .7 Environmental Protection Agency (EPA): "Building Air Quality," December 1991.
- .8 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA): "HVAC Duct Construction Standards - Metal and Flexible," 1985.
- .9 North American Insulation Manufacturers Association (NAIMA): "Cleaning Fibrous Glass Insulated Air Duct Systems," 1993.

1.3 SCOPE OF WORK

- .1 Remove all visible surface contaminants and deposits from within the following.
 - .1 All new and existing supply, return and exhaust ductwork from point of connection to diffusers/grilles within project space, as indicated on drawings.

1.4 HEALTH AND SAFETY

- .1 Comply with applicable federal, provincial, and local requirements for protecting the safety of the contractor's employees, building occupants, and the environment.
- .2 No processes or materials shall be employed in such a manner that they will introduce additional hazards into occupied spaces.
- .3 All debris removed from the HVAC System shall be disposed of in accordance with applicable federal, provincial and local requirements.

PART 2 PRODUCTS Not Applicable

PART 3 EXECUTION

3.1 INSPECTIONS AND SITE PREPARATIONS

- .1 Prior to the commencement of any cleaning work, perform a visual inspection of the HVAC system to determine appropriate methods, tools, and equipment required to satisfactorily complete with project. The cleanliness inspection should include representative areas of the HVAC system components and ductwork.
- .2 The cleanliness inspection shall be conducted without negatively impacting the indoor environment through excessive disruption of settled dust, microbial amplification or other debris. In cases where contamination is suspected, and/or in sensitive environments where even small amounts of contaminant may be of concern, environmental engineering control measures should be implemented.
- .3 Damaged system components found during the inspection shall be documented and brought to the attention of the owner.
- .4 Conduct a site evaluation, and establish a specific, coordinated plan which details how each area of the building will be protected during the various phases of the project.
- .5 Qualified personnel should perform the HVAC cleanliness inspection to determine the need for cleaning. At minimum, such personnel should have an understanding of HVAC system design, and experience in utilizing accepted indoor environmental sampling practices, current industry HVAC cleaning procedures, and applicable industry standards.

3.2 CLEANING REQUIREMENTS

- .1 Debris removed during cleaning shall be collected and precautions must be taken to ensure that Debris is not otherwise dispersed outside the HVAC system during the cleaning process.
- .2 Where the Particulate Collection Equipment is exhausting inside the building, HEPA filtration with 99.97% collection efficiency for 0.3-micron size (or greater) particles shall be used. When the Particulate Collection Equipment is exhausting outside the building, Mechanical Cleaning operations shall be undertaken only with Particulate Collection Equipment in place, including adequate filtration to contain Debris removed from the HVAC system. When the Particulate Collection Equipment is exhausting outside the building, precautions shall be taken to locate the equipment down wind and away from all air intakes and other points of entry into the building.
- .3 Measures shall be employed to control odors and/or mist vapors during the cleaning process.
- .4 Cleaning methods shall be employed such that all HVAC system components must be Visibly Clean as defined in applicable standards (see NADCA Standards). Upon completion, all components must be returned to those settings recorded just prior to cleaning operations.
- .5 Dampers and any air-directional mechanical devices inside the HVAC system must have their position marked prior to cleaning and, upon completion, must be restored to their marked position.
- .6 The contractor shall utilize service openings, as required for proper cleaning, at various points of the HVAC system for physical and mechanical entry, and inspection.
 - .1 Utilize the existing service openings already installed in the HVAC system where possible.
 - .2 Other openings shall be created where needed and they must be created so they can be sealed in accordance with industry codes and standards.
 - .3 Closures must not significantly hinder, restrict, or alter the airflow within the system.
 - .4 Closures must be properly insulated to prevent heat loss/gain or condensation on surfaces within the system.
 - .5 Openings must not compromise the structural integrity of the system.
 - .6 Construction techniques used in the creation of openings should conform to requirements of applicable building and fire codes, and applicable NFPA, SMACNA, and NADCA Standards.
 - .7 Cutting service openings into flexible duct is not permitted. Flexible duct shall be disconnected at the ends as needed for proper cleaning and inspection.
 - .8 All service openings capable of being re-opened for future inspection or remediation shall be clearly marked and shall have their location reported to the owner in project report documents.
- .7 Remove and reinstall ceiling sections to gain access to HVAC systems during the cleaning process.
- .8 Clean all air distribution devices.
- .9 Create service openings in the system as necessary in order to accommodate cleaning of otherwise inaccessible areas. Mechanically clean all duct systems to remove all visible contaminants, such that the systems are capable of passing Cleaning Verification Tests (see NADCA Standards).

3.3 METHODOLOGY

- .1 The HVAC system shall be cleaned using Source Removal mechanical cleaning methods designed to extract contaminants from within the HVAC system and safely remove contaminants from the facility. Select Source Removal methods that will render the HVAC system Visibly Clean and capable of passing cleaning verification methods (See applicable NADCA Standards) and other specified tests, in accordance with all general requirements. No cleaning methods, or combination of methods, shall be used which could potentially damage components of the HVAC system or negatively alter the integrity of the system.
 - .1 All methods used shall incorporate the use of vacuum collection devices that are operated continuously during cleaning. A vacuum device shall be connected to the downstream end of the section being cleaned through a predetermined opening. The vacuum collection device must be of sufficient power to render all areas being cleaned under negative pressure, such that containment of debris and the protection of the indoor environment are assured.
 - .2 All vacuum devices exhausting air inside the building shall be equipped with HEPA filters (minimum efficiency), including hand-held vacuums and wet-vacuums.
 - .3 All vacuum devices exhausting air outside the facility shall be equipped with Particulate Collection including adequate filtration to contain Debris removed from the HVAC system. Such devices shall exhaust in a manner that will not allow contaminants to re-enter the facility. Release of debris outdoors must not violate any outdoor environmental standards, codes or regulations.
 - .4 All methods require mechanical agitation devices to dislodge debris adhered to interior HVAC system surfaces, such that debris may be safely conveyed to vacuum collection devices. Acceptable methods will include those, which will not potentially damage the integrity of the ductwork, nor damage porous surface materials such as liners inside the ductwork or system components.
- .2 Methods of Cleaning Fibrous Glass Insulated Components
 - .1 Fibrous glass thermal or acoustical insulation elements present in any equipment or ductwork shall be thoroughly cleaned with HEPA vacuuming equipment, while the HVAC system is under constant negative pressure, and not permitted to get wet in accordance with applicable NADCA and NAIMA standards and recommendations.
 - .2 Cleaning methods used shall not cause damage to fibrous glass components and will render the system capable of passing Cleaning Verification Tests (see NADCA Standards).
- .3 Damaged Fibrous Glass Material
 - .1 Evidence of damage: If there is any evidence of damage, deterioration, delaminating, friable material, mold or fungus growth, or moisture such that fibrous glass materials cannot be restored by cleaning or resurfacing with an acceptable insulation repair coating, they shall be identified for replacement.
 - .2 Replacement: When requested or specified, Contractor must be capable of remediating exposed damaged insulation in air handlers and/or ductwork requiring replacement.
 - .3 Replacement material: In the event fiber glass material must be replaced, all materials shall conform to applicable industry codes and standards, including those of UL and SMACNA.
- .4 Cleaning of coils
 - .1 Any cleaning methods may be used which will render the Coil Visibly Clean and

capable of passing Coil Cleaning Verification (see applicable NADCA Standards). Coil drain pans shall be subject to Non-Porous Surfaces Cleaning Verification. The drain for the condensate drain pan shall be operational. Cleaning methods shall not cause any appreciable damage to, displacement of, inhibit heat transfer, or erosion of the coil surface or fins, and shall conform to coil manufacturer recommendations when available. Coils shall be thoroughly rinsed with clean water to remove any latent residues.

- .5 Biocidal Agents and Coatings
 - .1 Biocidal agents shall only be applied if active fungal growth is reasonably suspected, or where unacceptable levels of fungal contamination have been verified through testing.
 - .2 Application of any biocidal agents used to control the growth of fungal or bacteriological contaminants shall be performed after the removal of surface deposits and debris.
 - .3 When used, chemical biocides and coatings shall be applied in strict accordance with manufacturer recommendations and EPA registration listing.
 - .4 Biocidal coatings shall be applied according to manufacturer's instructions. Coatings shall be sprayed directly onto interior ductwork surfaces, rather than "fogged" downstream onto surfaces. A continuous film must be achieved on the surface to be treated by the coating application. Application of any biocidal coatings shall be strict accordance with manufacturer's minimum mileage surface application rate standards for effectiveness.

3.4 CLEANLINESS VERIFICATION

- .1 Verification of HVAC System cleanliness will be determined after mechanical cleaning and before the application of any treatment or introduction of any treatment-related substance to the HVAC system, including biocidal agents and coatings.
- .2 The HVAC system shall be inspected visually to ensure that no visible contaminants are present.
 - .1 If no contaminants are evident through visual inspection, the HVAC system shall be considered clean; however, the owner reserves the right to further verify system cleanliness through Surface Comparison Testing or the NADCA vacuum test specified in the NADCA standard.
 - .2 If visible contaminants are evident through visual inspection, those portions of the system where contaminants are visible shall be re-cleaned and subjected to re-inspection for cleanliness.
 - .3 NADCA vacuum test analysis should be performed by a qualified third party experienced in testing of this nature.
 - .4 Cleanliness verification shall be performed immediately after mechanical cleaning and before the HVAC system is restored to normal operation.
- .3 Verification of Coil Cleaning
 - .1 Cleaning must restore the coil pressure drop to within 10 percent of the pressure drop measured when the coil was first installed. If the original pressure drop is not known, the coil will be considered clean only if the coil is free of foreign matter and chemical residue, based on a thorough visual inspection (see NADCA Standards).

3.5 POST-PROJECT REPORT

- .1 At the conclusion of the project, provide a report to the owner indicating the following:

- .1 Success of the cleaning project, as verified through visual inspection and/or gravimetric analysis.
- .2 Areas of the system found to be damaged and/or in need of repair.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all products specified in this Section except piping and unions.

2 PRODUCTS

2.01 PIPE, FITTINGS AND JOINTS

- .1 Black Steel - Screwed Joint
 - .1 Mild black carbon steel, Grade B, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.
- .2 Black Steel - Welded Joint
 - .1 Mild black carbon steel, Grade B, ASTM A53, mill or site bevelled, complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, with long sweep pattern elbows unless otherwise specified, and welded joints.
- .3 Black Steel - Grooved End Mechanical Joint
 - .1 Mild black carbon steel, Grade B, ASTM A53, factory or site roll grooved, complete with cast ductile iron grooved end fittings, including full flow elbows, and conforming to ASTM A536.
 - .2 Acceptable products are:
 - .1 Victaulic Style 107 "QuickVic" rigid couplings for sizes 50 mm (2") to 200 mm (8"), Style 07 "Zero-Flex" rigid couplings for sizes 250 mm (10") to 300 mm (12"), Style W07 AGS rigid couplings for sizes 350 mm (14") to 1525 mm (60");
 - .2 Gruvlok Fig. 7402 "SlideLOK" for sizes 50 mm (2") to 200 mm (8"), Fig. 7401 "Rigidlok" for sizes 250 mm (10") to 610 mm (24").
- .4 Gaskets for Grooved End Mechanical Joints
 - .1 Unless otherwise noted, type Ethylene Propylene Diene Monomer (EPDM), suiting temperature and chemical compatibility for fluid used in intended applications.
 - .2 Confirm type with respective system manufacturers and review with Consultant.
- .5 Soft Copper Pipe
 - .1 Type "L" seamless soft copper to ASTM B77.
- .6 Hard Copper - Solder Joint
 - .1 Type "L" hard drawn seamless copper to ASTM B88, complete with wrought copper fittings to ANSI B16.22, and 95% tin / 5% Antimony solder joints.

2.02 PIPING UNIONS

.1 Screwed Piping

- .1 Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).

.2 Flanged Piping

- .1 Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

2.03 SHUT-OFF VALVES

.1 Ball Type

- .1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, threaded ends, and removable lever handle.

.2 Acceptable products are:

- .1 Toyo Valve Co. Fig. 5044A;
.2 Watts Industries (Canada) Inc. #FBV-3;
.3 Kitz Corp. Code 58;
.4 Victaulic Co. of Canada Ltd. Series 722;
.5 Apollo Valve #77-100.

.2 Butterfly Type

- .1 Cast ductile iron, lug body style, 1200 kPa (175 psi) rated butterfly valve, each complete with a neck to permit 50 mm (2") of insulation above the flange, a field replaceable EPDM seat, ductile iron disc, stainless steel shaft with EPDM seal, a lever handle for valves to and including 150 mm (6") diameter, a handwheel and gear type operator for valves larger than 150 mm (6") diameter, and each suitable for bubble-tight dead end service with valve closed and either side of connecting piping removed.

.2 Acceptable products are:

- .1 DeZurik of Canada Ltd., Figure No. 632;
.2 Victaulic Co. of Canada Ltd. Vic-300 MasterSeal or AGS Vic-300;
.3 Apollo Valve 143 Series;
.4 Watts Industries (Canada) Inc. #BF-03;
.5 Kitz Corp. 6112 Series;
.6 Toyo Valve Co. 918DESL/G2.

2.04 SWING CHECK VALVES

- .1 Bronze - Screwed
 - .1 Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends.
 - .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 236;
 - .2 Nibco #T-433;
 - .3 Kitz Corp. Code No. 22.
 - .2 Steel - Grooved Ends
 - .1 Victaulic Co. of Canada Ltd. Series 716, 779 or W715 grooved end carbon steel check valves suitable for mounting horizontally or vertically.
 - .3 Cast Iron - Screwed and Flanged
 - .1 Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover, and screwed or flanged ends as required.
 - .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 435A;
 - .2 Watts Industries (Canada) Inc. #F-511;
 - .3 Kitz Corp. Code No. 78.

2.05 DRAIN VALVES

- .1 Minimum 2070 kPa (300 psi) WOG rated, 20 mm (¾") diameter straight pattern bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") diameter hose, and a cap and chain.
- .2 Acceptable products are:
 - .1 Toyo Valve Co. Ltd. Fig. 5046;
 - .2 Watts Industries (Canada) Inc. #B-6000-CC;
 - .3 Kitz Corp. Code No. 68AC;
 - .4 Apollo Valves #78-104-01.

2.06 CIRCUIT BALANCING VALVES

- .1 Screwed or flanged as required, globe style, non-ferrous circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter.
- .2 Acceptable products are:
 - .1 S.A. Armstrong Ltd. Series "CBVI" screwed or "CBVII" flanged;
 - .2 Victaulic Co. of Canada Ltd. (Tour & Anderson) Series 787 screwed, Series 788 flanged, and 789 grooved end, and Series 78K "Koil Kit" valves.

2.07 AIR VENTS

- .1 Manual Air Vents
 - .1 Equal to Conbraco 27 Series, 3.2 mm (1/8") diameter with a key handle.
- .2 Automatic Air Vents
 - .1 Float actuated air vents, each complete with a semi-steel body and cap, a stainless steel float assembly and seat, and a neoprene head.
 - .2 Acceptable products are:
 - .1 Spirax Sarco Ltd., Type 13 W for system working pressures to 1035 kPa (150 psi), 13 WH for system working pressures greater than 1035 kPa (150 psi);
 - .2 Armstrong International Inc. No. 1-AV.

2.08 STRAINERS

- .1 Cast iron wye shaped strainers, minimum 890 kPa (125 psi) rated and complete with a removable type 304 stainless steel screen with perforations sized to suit the application, and, for strainers 50 mm (2") diameter and larger, a blowdown pipe connection tapping.
- .2 Acceptable products are:
 - .1 Spirax Sarco Ltd. Type IF-125 screwed or Type AF-250 flanged;
 - .2 Toyo Valve Co. Ltd. Fig. 380A screwed or Fig. 381 flanged;
 - .3 Victaulic Co. of Canada Style 732 or W732 "Vic-Strainer";
 - .4 Armstrong International Inc. A1 Series;
 - .5 Watts Industries (Canada) Inc. #77SCI;
 - .6 Mueller Steam Specialty Products Model 11M screwed or Model 758 flanged.

3 EXECUTION

3.01 DEMOLITION

- .1 Perform required hydronic piping system demolition/revision work. Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 PIPING INSTALLATION REQUIREMENTS

- .1 Provide required hydronic piping. Pipe, unless otherwise specified, is to be:
 - .1 for pipe to and including 65 mm (2-½") diameter, Schedule 40 black steel, screwed, or type "L" hard copper with solder joints or pressure coupled joints;
 - .2 for pipe 65 mm (2-½") to 300 mm (12") dia. and larger, Standard weight grooved end black steel (10 mm [0.375"] thickness) pipe with grooved end fittings and couplings, or, Standard weight black steel (10 mm [0.375"] thickness) pipe with welding fittings and welded joints;
 - .3 for short branch connections to heating equipment where structural obstructions occur and site bending of pipe is advantageous, a single length of type "L" soft copper.
- .2 Slope horizontal piping mains to provide a minimum continuous up-grade of 25 mm (1") in 6 m (20') to high points. Slope branch supply and return piping connections to equipment a minimum of 25 mm (1") in 1.2 m (4'). Leave sufficient room at high points for installation and maintenance of air vents.
- .3 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the control work. Refer to drawing control diagrams and details.
- .4 Connect equipment provided as part of the work of other Sections with piping as indicated and/or required. Refer to pipe connection details on drawings.
- .5 Provide screwed unions, removable mechanical joint couplings, or weld-on or solder-on flanges in piping at all connections to valves, strainers and similar piping system components which may need maintenance or repair, at equipment connections, in runs of piping exceeding 9 m (30') at 4.5 m (15') regular intervals to permit removal of sections of piping, and wherever else indicated on drawings.
- .6 Provide shut-off valves in piping connections to equipment, to isolate piping risers, to isolate other sections of systems as shown, and wherever else indicated on drawings. Valves in piping to and including 50 mm (2") dia. are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified. Locate valves so they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.
- .7 Provide a check valve in discharge piping of every pump, and elsewhere in piping where shown on drawings. Where check valves are required in vertical piping, ensure they are suitable in all respects for the application. Check valves for vertical in-line and/or base mounted circulating pumps are integral with the discharge accessory.
- .8 Provide a drain valve at base of each piping riser, in drain connections to equipment, in low points of horizontal piping, and wherever else shown and/or specified.
- .9 Provide circuit balancing valves in piping generally where shown on drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations prior to installation.

3.03 INSTALLATION OF AIR VENTS

- .1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Equip each air vent with a ball type shut-off valve. Install vents in 100 mm (4") dia. and larger piping and all vents in mechanical rooms in accordance with drawing detail.
- .2 Provide 9 mm (3/8") dia. copper drain piping from each automatic air vent to nearest suitable drain and terminate so discharge is visible. Identify drain piping.

3.04 INSTALLATION OF STRAINERS

- .1 Provide strainers in piping. Locate strainers so baskets are easily accessible and removable. Clean strainer baskets during and after piping system flushing and cleaning is complete, and before water quantity balancing commences.

3.05 FLUSHING AND CLEANING PIPING

- .1 Flush and clean new piping in accordance with requirements specified in Section entitled HVAC Water Treatment.

3.06 TESTING, ADJUSTING AND BALANCING

- .1 When work is complete and equipment is operating as intended, test, adjust and balance water flows in accordance with requirements specified in Section entitled Testing, Adjusting, and Balancing.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all products specified in this Section except shop fabricated ductwork and fittings.
- .2 Include capacity, throw and terminal velocity, noise criteria, and pressure drops with grille and diffuser shop drawing/product data sheet submission.

1.02 QUALITY ASSURANCE

- .1 Grilles and diffusers are to be tested and performance certified to ANSI/ASHRAE 70, Method of Testing the Performance of Air Outlets and Air Inlets.

2 PRODUCTS

2.01 GALVANIZED STEEL DUCTWORK

- .1 Galvanized steel sheet is to be hot dipped in accordance with requirements of ASTM A653. Provide G60 galvanizing for bare uncovered duct and with finish paint. Provide G90 galvanizing for other galvanizing.
- .2 Rectangular
 - .1 Lock forming grade hot dip galvanized steel, ASTM A653, shop fabricated, minimum #26 gauge.
- .3 Round
 - .1 Factory machine fabricated, spiral, mechanically locked flat seam, single wall duct, fittings and couplings.
- .4 Flat Oval
 - .1 Factory machine fabricated, single wall, 4-ply spiral lock seam duct, fittings and couplings.

2.02 METAL DUCT SYSTEM JOINT SEALANT

- .1 ULC listed and labelled, premium grade, grey colour, water base, non-flammable duct sealer, brush, or gun applied, with a CAN/ULC S102 tested maximum flame spread rating of 5 and smoke developed rating of 0.
- .2 Acceptable manufacturers are:
 - .1 Duro Dyne Canada Inc.
 - .2 Ductmate Industries.
 - .3 H.B. Fuller Company (Foster).

2.03 ROUND TO RECTANGULAR DUCT CONNECTIONS

- .1 Equal to Flexmaster Canada Ltd. galvanized steel, flared, flanged or notched "Spin-On" round duct take-off collars with locking dampers in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.04 AIR TURNING VANES

- .1 For square elbows, multiple-radius turning vanes interconnected with bars, adequately reinforced to suit pressure and velocity of system, constructed of same material as duct they are associated with, and in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 For short branch ducts at grille and diffuser connections, air extractor type each equipped with a matching bottom operated 90° opposed blade volume control damper, constructed of same material as duct it is associated with and in accordance with requirements and details in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.05 MANUAL BALANCING (VOLUME) DAMPERS

- .1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of same material as connecting ductwork unless otherwise specified, each designed to maintain internal free area of connecting duct, and each complete with:
 - .1 hexagonal or square shaft extension through frame;
 - .2 non-stick, non-corrosive synthetic bearings for rectangular dampers, flange stainless steel bearings for round dampers;
 - .3 blade stops for single blade dampers, designed to prevent blade from moving more than 90°;
 - .4 linkage for multiple blade dampers;
 - .5 locking hand quadrant damper operator with 50 mm (2") standoff mounting for insulated ducts.
- .2 Rectangular Dampers: Nailor Industries Inc. 1800 Series, maximum size 1.2 m x 1.2 m (4' x 4') for a single damper.
- .3 Round Dampers: Nailor Industries Inc. Model 1890, maximum 600 mm (24") diameter, equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.
- .4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of same material as damper and designed for tight and secure mounting of individual dampers.
- .5 Acceptable manufacturers are:
 - .1 Nailor Industries Inc.;
 - .2 T.A. Morrison & Co. Inc. "TAMCO";
 - .3 NCA Manufacturing Ltd.;
 - .4 Greenheck Fan Corp.;

- .5 Ruskin Co.

2.06 DUCT ACCESS DOORS

- .1 In accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, with sizes suitable in all respects for purpose for which they are provided, and, unless otherwise specified, constructed of same material as duct they are associated with.

2.07 GRILLES AND DIFFUSERS

- .1 Grilles and diffusers of type, size, capacity, finish, and arrangement as shown on drawings and in accordance with drawing schedule, each equipped with all required mounting and connection accessories to suit mounting location and application.
- .2 Acceptable manufacturers are:
 - .1 Price Industries Inc.;
 - .2 Anemostat;
 - .3 Krueger Division of Air System Components Inc.;
 - .4 Titus;
 - .5 Nailor Industries Inc.;
 - .6 Tuttle & Bailey.

3 EXECUTION

3.01 CLEANLINESS REQUIREMENTS FOR HANDLING AND INSTALLATION OF DUCTWORK

- .1 Handle and install ductwork in accordance with CSA Z317.2, Special Requirements for Heating, Ventilation, and Air-Conditioning (HVAC) Systems in Healthcare Facilities and SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.

3.02 FABRICATION AND INSTALLATION OF GALVANIZED STEEL DUCTWORK

- .1 Provide required ductwork, rectangular, round and/or flat oval. Where rectangular ductwork is shown, round or flat oval ductwork of equivalent cross-sectional area is acceptable.
- .2 It is to be understood that all duct dimensions shown on drawings are clear internal dimensions.
- .3 Unless otherwise specified, construct and install ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct pressure class designation of minimum 500 Pa (2" w.c.) positive or negative as applicable, a minimum velocity of 10 m/s (2000 fpm), and so ductwork does not "drum". Flat surfaces of rectangular ductwork are to be cross-broken. Duct system sealing is to meet ANSI/SMACNA Seal Class A requirements.

- .4 Variable air volume ductwork from supply fans to boxes is as above but rectangular duct take-offs are double side straight taper type with a take-off length equal to 0.5 times the branch duct width but minimum 150 mm (6") length, and double taper side is to have an included angle of minimum 60°.
- .5 Confirm routing of all ductwork at site and site measure ductwork prior to fabrication. Duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by Consultant. Duct routing and/or dimension revisions to suit conditions at site are not grounds for a claim for an extra cost.
- .6 Refer to structural drawings. Where ductwork is to be run within or through open web steel joists, ductwork shown on mechanical drawings is schematic only and is to be altered as required to suit steel joist configuration, spacing, panel points, and cross-bridging at no additional cost.
- .7 Wherever ductwork is required at locations where sprayed fireproofing is applied to building construction, install ductwork only after fireproofing work is complete and do not compromise fire rating of sprayed fireproofing.
- .8 Install (but do not connect) duct system mounted automatic control components supplied as part of the automatic control work.
- .9 Where indicated, provide duct connections to fan powered heat transfer equipment with integral coils.
- .10 Flange connect ductwork to hot water reheat coils in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Coils will be suspended independent of connecting ductwork as part of the heat transfer work.
- .11 Support horizontal rectangular ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with, unless otherwise specified, galvanized steel channels, and galvanized steel hanger rods for exposed ducts and concealed ducts wider than 500 mm (20"). Support hardware constructed of same material as duct for metal duct, and, unless otherwise specified, type 316 stainless steel for non-metal duct. Supports for "heavy" duct such as cementitious core duct is to be suitable in all respects for the application and approved by Consultant.
- .12 Support round and flat oval ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at top of duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If duct is insulated, size strap to suit diameter of insulated duct. Unless otherwise specified, duct support hardware for metal duct is constructed of same material as duct, and for non-metal duct, type 316 stainless steel.
- .13 Where flanged duct joints are used, do not locate joints in wall or slab openings, or immediately at wall or slab openings. Do not use flanged joints for exposed uninsulated ducts in finished areas.
- .14 Leakage Testing:
 - .1 Ductwork leakage is not to exceed following:
 - .1 ductwork to 2" W.C. Class, 1% of total air quantity handled by respective fans;

- .2 ductwork exceeding 2" W.C. Class, 2% of total air quantity handled by respective fans.
- .2 Leakage testing is to be performed by the Testing, Adjusting and Balancing (TAB) agency in accordance with SMACNA HVAC Air Duct Leakage Test Manual and is to be witnessed by Consultant.
- .3 Be responsible for following:
 - .1 preparing duct systems for leakage testing prior to installation of external insulation including capping duct runouts and provision of final tap-in for test equipment;
 - .2 schedule testing with TAB agency in advance, be present for all testing and ensure notice is given to Consultant so they may witness testing;
 - .3 resealing and/or replacement of defective ductwork;
 - .4 bearing all costs associated with retesting ductwork which has failed to pass leakage testing.
- .15 Seal all ductwork in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings which does not require site applied sealant. Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.
- .16 Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.
- .17 Clean exterior exposed (uninsulated) ducts and coat with a heavy full coverage of Bakor #410-02 black metal paint.
- .18 Where dissimilar metal ducts are to be connected, isolate ducts by means of flexible duct connection material.
- .19 Equip ducts with a dimension of 600 mm (24") and larger and located in mechanical equipment rooms of any kind with hanger rods equipped with double deflection neoprene rod isolation hangers properly sized for associated load. Also refer to Section entitled Seismic Control and Restraint.

3.03 INSTALLATION OF ROUND TO RECTANGULAR DUCT CONNECTIONS

- .1 Cut round holes in rectangular ducts and provide round to rectangular lock-in fittings with dampers for connection of flexible round ductwork.

3.04 INSTALLATION OF TURNING VANES

- .1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

- .2 Provide volume extractor type turning vanes in short branch supply duct connections off mains to grilles and diffusers where shown and/or specified.

3.05 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS

- .1 Provide manual balancing dampers as required to provide a fully balanced system, including but not limited to in all open end ductwork, in all duct mains, and wherever else shown and/or specified.
- .2 Install dampers so operating mechanism is accessible and positioned for easy operation, and so dampers cannot move or rattle. Ensure operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.
- .3 Where a duct for which a balancing damper is required has dimensions larger than dimensions of maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.
- .4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit. Include for providing 5 additional dampers at no additional cost.

3.06 INSTALLATION OF DUCT ACCESS DOORS

- .1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils. Install in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure doors are properly located for damper maintenance.
- .3 When requested, submit a sample of proposed duct access doors for review.
- .4 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce ductwork to suit access door installed.

3.07 INSTALLATION OF GRILLES AND DIFFUSERS

- .1 Provide grilles and diffusers. Wherever possible, grilles and diffusers are to be product of same manufacturer.
- .2 Unless otherwise specified connect grilles and diffusers in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .3 Exactly locate grilles and diffusers to conform to final architectural reflected ceiling plans and detailed wall elevations, and to conform to final lighting arrangement, ceiling layout, ornamental and other wall treatment.
- .4 Equip supply diffusers having a basic 4-way or all round air pattern for operation in 1-, 2-, or 3-way pattern where indicated on drawings.

- .5 Provide sheet metal plenums, constructed of same material as connecting duct, for linear grilles and/or diffusers where shown. Construct and install plenums in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible. Where individual sections of linear grilles or diffusers are not equipped with a volume control device, equip duct connection collar(s) with volume control device(s).
- .6 Where linear type diffusers/grilles are installed in suspended T-bar ceilings, clip diffusers/grilles in place using clip supplied by diffuser/grille manufacturer.
- .7 Confirm grille and diffuser finishes prior to ordering.

3.08 DUCT SYSTEM PROTECTION, CLEANING AND START-UP

- .1 Temporarily cover all open ends of ducts during construction.
- .2 Remove all dirt and foreign matter from entire duct systems and clean duct system terminals and interior of air handling units prior to operating fans.
- .3 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.
- .4 Provide cheesecloth over duct system inlets and outlets and run system for 24 hours, after which remove cheesecloth and construction filters, and install new permanent filters.
- .5 Include all labour for a complete site walk-through with testing and balancing personnel following route of all duct systems to be tested, adjusted and balanced for the purpose of confirming proper position and attitude of dampers, location of pitot tube openings, and any other work affecting testing and balancing procedures. Perform corrective work required as a result of this walk-through.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings/product data sheets for air terminals. Include following:
 - .1 capacity and pressure drop;
 - .2 sound power data to verify conformance with specified sound power levels;
 - .3 leakage and dimensions;
 - .4 mounting details to suit locations shown, indicating methods and hardware to be used;
 - .5 control components and a control wiring schematic.
- .2 Submit with shop drawings/product data, a test report in accordance with ANSI/AMCA 210 requirements and ISO 3741, published test data on DIN (Direct Internal Noise) made by an independent testing agency for 2.5 and 6 m/s (8.2 and 19.7 ft/min) branch velocity or inlet velocity, sound power levels with a minimum inlet pressure of 0.25 kPa (0.036 psi) in accordance with ISO 3741 for the 2nd through 7th octave bands, and confirmation pressure loss through a silencer will not exceed 60% of inlet velocity pressure maximum.
- .3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.

1.02 QUALITY ASSURANCE

- .1 Air terminals manufacturers are to be current members of Air-Conditioning, Heating and Refrigeration Institute (AHRI), and terminals are to be in accordance with requirements of following standards:
 - .1 ANSI/AHRI Standard 880, Performance Rating of Air Terminals;
 - .2 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating;
 - .3 International Organization of Standardization (ISO) Standard 3741, Acoustics-Determination of Sound Power Levels of Noise Sources Using Sound Pressure-Precision Methods for Reverberation Rooms.
- .2 Equip boxes with factory secured seismic restraint connection hardware.
- .3 Acceptable manufacturers are:
 - .1 Price Industries Inc.;
 - .2 Titus;
 - .3 Nailor Industries Inc.;
 - .4 Krueger Division of Air System Components Inc.

2 PRODUCTS

2.01 VARIABLE AIR VOLUME (VAV) TERMINAL BOXES

- .1 Single duct, controller type, pressure independent variable air volume boxes in accordance with drawing schedule, each individually field adjustable to minimum and maximum air volumes, and complete with:
 - .1 #22 gauge galvanized steel housing, sealed and gasketed, and complete with:
 - .1 internally lined with 25 mm (1") thick glass fibre duct lining material with a neoprene coating meeting NFPA 90A and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102;
 - .2 internally lined with 25 mm (1") thick fibre-free foam lining material meeting NFPA 90A and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102;
 - .3 exposed cut edges of the liner material factory coated with NFPA 90A and CAN/ULC S102 approved sealant;
 - .4 50 mm (2") long, round inlet duct connection;
 - .5 rectangular discharge opening with slip and drive cleat duct connection facilities;
 - .6 protective galvanized steel shroud for controller and damper actuator.
 - .2 air valve damper, normally open, galvanized steel blade with peripheral gasket, pivoting in self-lubricating bearings and with air leakage past a closed damper of 2% or less of rated capacity at 750 Pa (3" wc) inlet static pressure;
 - .3 air flow sensor located at box inlet, complete with gauge taps, multiple pressure sensing ports, and an averaging chamber designed to accurately average the flow across the inlet of box with an accuracy of within 5% with a 90° sheet metal elbow located directly at inlet, and amplify the sensed air flow signal;
 - .4 digital controller/actuator factory installed, connected and tested control package including a microprocessor based stand-alone digital controller capable of networking with a building automation system, personal computer, or a portable operator interface device, an electronic flow transducer, and an electronic actuator for damper, all calibrated and factory set for maximum and minimum air flow, field adjustable and equipped with gauge taps for balancing with a standard pressure gauge;
 - .5 factory tested hot water reheat coils in accordance with drawing schedule, each complete with copper tubes mechanically expanded into plate type aluminum fins, factory mounted in an enclosure insulated with foil faced insulation meeting NFPA 90A and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, and complete with a quick-opening insulated access panel sized and located for coil inspection and maintenance;
 - .6 galvanized steel attenuators, lined as per box housings, each factory supplied loose and with a length in accordance with drawing schedule;
 - .7 wall mounting thermostat with thermometer and guard, supplied with boxes by box manufacturer, suitable in all respects for box it controls and control sequence, and complete with all required installation and connection accessories.

- .2 Terminal box to be complete with attenuator or lined discharge duct in place. Maximum sound power levels in decibels and specific static pressure are scheduled on drawings for each size of box.

3 EXECUTION

3.01 INSTALLATION OF TERMINAL BOXES

- .1 Provide ceiling mounted terminal boxes.
- .2 Secure each box in place from structure by means of galvanized steel angles and hanger rods, independent of connecting ductwork.
- .3 Brace and secure each unit in accordance with requirements specified in Section entitled Seismic Control and Restraint.
- .4 Coordinate provision of transformers, actuators and controllers with Controls Contractor.
- .5 Connect each box with ductwork as indicated. Provide straight inlet duct same size as box inlet and of a length equal to a minimum of 4 duct diameters. Refer to drawing detail. Coordinate final box adjustments and settings with personnel doing system testing and balancing work.
- .6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.
- .7 Include for a 1/2 day on-site operation demonstration and training session. Training is to be a full review of all components including, but not limited to, a full operation and maintenance demonstration, and setting and adjusting controls.

END OF SECTION

1 GENERAL

1.01 GENERAL

- .1 This General Requirements Section applies to all work performed under this section.
- .2 The "provide" in this Division shall be interpreted as "supply, install, connect, program and debug".
- .3 All work shall conform to Canadian Metric Practice Guide CSA CAN3-Z234.1-89, CAN/CSA-Z234.1-89(R1995).
- .4 Provide all required adapters between "metric" and "Imperial" components.
- .5 Metric descriptions in this Division are nominal equivalents of Imperial values.
- .6 All equipment and material to be new, CSA certified, manufactured to minimum standard quoted including additional specified requirements.
- .7 Standards Compliance: Where materials or equipment are specified to conform to requirements of the standards of organizations, such as the Canadian Standard's Association (CSA) that use a label or listing as method of indicating compliance, proof of such conformance shall be submitted and approved, indexed and cross-referenced with the Government specification. The label or listing of the specified organization will be acceptable evidence. In lieu of the label or listing, the Contractor shall submit a certificate from a testing organization adequately equipped and competent to perform such services, and approved by the manufacturers/Engineer, stating that the item has been tested in accordance with the specified organization's test methods and that the item conforms to the specified organization's standard or code. For materials whose compliance with organizational standards or specifications is not regulated by an organization using its own listing or label as proof of compliance, a certificate from the manufacturer shall be furnished to the Engineer stating that the material complies with the applicable referenced standard or specified.
- .8 Where there is no alternative to supply equipment which is not CSA certified, submit such equipment to Inspection Authorities for special inspection and obtain approval before delivery of equipment to site.

1.02 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2, Canadian Electrical Code, Part II, General Requirements.
 - .2 CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- .2 American National Standards Institute (ANSI)
 - .1 ANSI/ISAS 5.5, Graphic Symbols for Process Displays.
 - .2 ANSI/IEEE 260, Letter Symbols for SI and Certain Other Units of Measurements.
 - .3 CEMA2Y.1.

1.03 PERMITS AND FEES

- .1 Submit certificate of acceptance from authority having jurisdiction to Consultant & Owner. Obtain all permits required to perform the work listed in these specifications. Cost shall be the contractors responsibility.

1.04 SCOPE OF WORK

- .1 The work covered by this specification and related sections consists of providing submittals, shop drawings, equipment, labour, materials, engineering, programming, technical supervision, commissioning, site reviews, as-builts, and transportation as required to furnish and install a fully operational Energy Monitoring and Control System (EMCS) as required to provide the operation specified in strict accordance with these specifications and the contract drawings, and subject to the terms and conditions of the contract. The work in general consists of but is not limited to, the following:
 - .1 The preparation of submittals and provision of all related services.
 - .2 Provide and install data communication equipment necessary to affect an EMCS data transmission system including necessary interfaces, gateway routers.
 - .3 Provide and install Programmable Control Units, sensors, control devices, conduit and wiring, as required to provide the operation specified.
 - .4 Provide, load and program all software required to implement a complete and operational EMCS.
 - .5 Provide all field equipment including control valves, control dampers, etc. as specified.
 - .6 Finetune all control loops and calibrate sensors & transmitters and adjust all control devices to perform to tolerances specified as required until approved final inspection.
 - .7 Provide complete operating and maintenance manuals as well as field training of operators, programmers, and maintenance personnel as outlined in these specifications.
 - .8 Perform acceptance tests and technical support during commissioning as indicated.
 - .9 Provide full documentation for all software and equipment in hard and soft copy.
- .2 (Programmable Control Units) to meet the intent of the specification and spare capacity requirements. The quantity and point content of the Programmable Controllers must be approved by the Consultant prior to installation.
- .3 Final location for all controllers to be approved by Consultant before mounting.
- .4 Electrical contractor shall be responsible for providing power to all Controllers. Use emergency power supply. Division 25 00 00 controls contractor shall be responsible for extending the power from dedicated 120V control system circuits to control devices and shall provide require stepdown transformers.
- .5 The programmable controllers provided shall ensure a minimum of 15% spare capacity for inputs and outputs as well as 15% spare capacity for program memory and control logic blocks. Without addition of modules and I/O control boards.
- .6 Controls contactor shall be responsible for coordinating controls wiring termination points with equipment manufacturers prior to shop drawing submittal.

1.05 METRIC REFERENCES

- .1 Conform to CAN/CSA-Z234.1.
- .2 Provide all required adapters between Metric and Imperial components.

1.06 WORK BY OTHERS

- .1 Mechanical contractor installs all wells, valves, taps, dampers, flow stations furnished by EMCS manufacturer.
- .2 Electrical Contractor provides power to all controllers and designated control circuit location indicated on the drawings.

1.07 ELECTRICAL WORK AND SAFETY REQUIREMENT

- .1 Electrical work shall meet or exceed Canadian Electrical Code, Ontario Electrical Safety Code, Ontario Hydro Requirements, and Canada Labour Code Part IV. Electrical wiring, terminal blocks and other high voltage contacts shall be fully enclosed or properly guarded and marked to prevent accidental injury to personnel.

1.08 MANUFACTURER'S RECOMMENDATIONS

- .1 Where installation procedures, or any part thereof, are required to be in accordance with the recommendations of the manufacturer of the material being installed, printed copies of these recommendations shall be furnished to the Consultant with shop drawing submission. Installation of the item will not be allowed to proceed until the recommendations are received. Failure to furnish these recommendations shall be cause for rejection of the material.

1.09 WIRING

- .1 All wiring associated with and required by the EMCS shall be the responsibility of this contractor. The term "wiring" shall be construed to include furnishing of wire, transformers, conduit, miscellaneous material and labour as required to install a total working system. If departures from the contract drawings are deemed necessary by the contractor, details of such departures, including changes in related portions of the project and the reasons therefore, shall be submitted with the drawings to the Consultant for approval. Wiring to conform with Electrical specifications.
- .2 Cable tray supplied by the Electrical Contractor available to be used for low voltage communication and control device wiring. See Electrical drawings for cable tray locations.
- .3 120V control power supplied by Electrical Contractor to central distribution locations as shown on drawings, Section 25 00 00 shall supply control transformer, wiring in conduit to required field devices and controllers.

1.10 PRODUCT AND SERVICE

- .1 Materials and equipment shall be essentially the catalogued products of manufacturers regularly engaged in production of such materials or equipment and shall be manufacturer's latest standard design that complies with the specification requirements. Where two units of the same class of equipment are required, these units shall be products of a single manufacturer; however, the component parts of the system need not be the products of a single manufacturer. Each major component of equipment shall have the manufacturer's name and address and the model and serial number on a nameplate securely attached in a conspicuous place.

- .2 Control equipment and installation shall be the product and service of one manufacturer unless otherwise specified.

1.11 QUALITY ASSURANCE

- .1 The controls contractor shall provide experienced project manager for this work, responsible for direct supervision of the design, installation, start up and commissioning of the EMCS.
- .2 Materials and equipment shall be the catalogued products of manufacturers regularly engaged in production and installation of automatic temperature control systems and shall be manufacturer's latest standard design that complies with the specification requirements.
- .3 This system shall have a documented history of compatibility by design for a minimum of 10 years. Future compatibility shall be supported for no less than 20 years. Compatibility shall be defined as the ability to upgrade existing field panels to current level of technology, and extend new field panels on a previously installed network.
 - .1 Compatibility shall be defined as the ability for any existing field panel microprocessor to be connected and directly communicate with new field panels without bridges, routers or protocol converters.

1.12 VERIFICATION OF DIMENSIONS

- .1 The Contractor shall visit the premises to thoroughly familiarize himself with all details of the work and working conditions and verify all information in the field, and shall advise the Consultant of any discrepancy before performing any work. The Contractor shall be specifically responsible for the coordination and proper relation of his work to the building structure and to the work of all trades.

1.13 PRELIMINARY DESIGN REVIEW MEETING

- .1 The contractor shall convene before programming is to start, a review of sequence of operations to insure a meeting of the minds between the Consultant and the contractor's programmer. Note that contractor's programmer must be at the meeting and that the Consultant has the right to revise any sequence or subsequent CDL to his satisfaction at any time prior to software finalization without cost to the Owner or Consultant.

1.14 SHOP DRAWINGS

- .1 Before start of construction and as stated in Section 20 05 00 provide shop drawings consisting of:
 - .1 Wiring and piping diagrams. Show conduit size and spare capacity. Provide interface wiring diagrams complete with termination connections for existing equipment and equipment supplied by others. Indicate signal levels.
 - .2 Shop drawing for each input/output point showing all information associated with each particular point including:
 - .1 Sensing element type and location.
 - .2 Transmitter type and range.
 - .3 Details of associated field wiring schematics, schedules and terminations.
 - .4 Pneumatic schematics and schedules.

- .5 Point address.
- .6 Setpoints, curves, graphs, alarm limits (H + L, 4 types) and signal range.
- .7 Manufacturer's recommended installation instructions and procedures for each type of sensor and/or transmitter.
- .3 Control schematics with Narrative Description and Control Description Logic fully showing and describing operation and/or manual procedures available to achieve proper operation of the building.
- .4 Complete system CDL's including companion English language explanations on the same sheet (use different fonts and italics). CDL's must contain the energy optimization programs specified elsewhere.
- .5 A listing and example of all reports.
- .6 A listing of all time schedules.

1.15 SYSTEM DESIGN RESPONSIBILITY

- .1 Design and provide all conduit and wiring linking all elements of system.
- .2 Supply sufficient programmable controllers of all types to meet project requirements. Quantity and points contents to be approved by Consultant/Owner prior to installation.
- .3 Location of controllers to be approved by Consultant/Owner prior to installation. Refer to drawings for designated control panel locations.

1.16 TESTING

- .1 This work shall include the testing and verification of all major subsystems of the complete EMCS including all field components and an onsite field operational test.
- .2 The Contractor shall provide all test equipment including 2 way radios.
- .3 All test equipment such as digital thermometers, humidistats, velometers and milliamp and volt meters shall be certified as accurate by an independent testing laboratory no later than 2 months prior to the tests. Test equipment used shall be of equal or better accuracies then these specified for the devices.
- .4 Notify the Consultant in writing at least 14 working days before testing is to take place.
- .5 Provide all necessary personnel and coordinate with other trades.
- .6 Perform tests in presence of Consultant.
- .7 Demonstrate the proper operation of each component.
- .8 Correct any deficiencies and re-test until designated part of the system performs satisfactorily.
- .9 Acceptance of tests by the Consultant shall not relieve the Contractor of responsibility for the complete system meeting the requirements of these specifications after installation.

1.17 COMMISSIONING

- .1 General

- .1 Commissioning to be carried out under general direction of the Commissioning Agent.

1.18 AS-BUILT RECORDS

- .1 Final Control Diagrams
 - .1 Provide before acceptance in both hard and soft copy.
 - .2 Show:
 - .1 All changes to contract documents as well as all addenda and contract extras.
 - .2 All changes to interface wiring.
 - .3 Major routing of conduit and control air lines.
 - .4 All signal levels, setpoints, reset curves, schedules.
 - .3 Where possible, bind with Operating and Maintenance Manuals specified herein.
 - .4 Provide listing of alarm messages.
 - .5 Provide soft copy of all updated drawings on system and soft copy back-up AutoCAD 2010 format.
- .2 Language
 - .1 To be in English.
- .3 O & M Manuals
 - .1 O & M Manuals (both hard and soft copy) to be custom designed and contain material pertinent to this project only, and to provide full and complete coverage of all subjects referred to in this section.
 - .2 Provide two (2) soft copies and six (6) hard copies in hard-back, 2", 3 ring, D-ring binders.
 - .1 Binders to be 2/3 maximum full.
 - .2 Provide index to full volume in each binder.
 - .3 Identify contents of each manual on cover and spine.
 - .4 Include names, addresses, telephone numbers of each sub-contractor having installed equipment, local representative for each item of equipment, each system.
 - .5 Provide Table of Contents in each manual. Assemble each manual to conform thereto, with tab sheets placed before instructions covering subject.
 - .3 Furnish one (1) complete set of hard and soft copy to system or equipment tests. Furnish remainder upon acceptance.

- .4 Include complete coverage in concise language readily understood by operating personnel using common terminology of all functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.
- .5 Functional description to include:
 - .1 Functional description of theory of operation.
 - .2 Design philosophy.
 - .3 Specific functions of design philosophy and system.
 - .4 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.
 - .5 Explicit description of hardware and software functions, interfaces, requirements for all components in all functions and operating modes.
 - .6 Description of person-machine interactions required to supplement system description, all known or established constraints on system operation, operating procedures currently implemented for implementation in automatic mode.
- .6 System operation to include:
 - .1 Complete step-by-step procedures for operation of system including required actions at each OWS.
 - .2 Operation of computer peripherals, input and output formats.
 - .3 Emergency, alarm and failure recovery.
 - .4 Step-by-step instructions for start-up, back-up equipment operation, execution of all systems functions and operating modes.
- .7 Software to include:
 - .1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.
 - .2 Detailed descriptions of program requirements and capabilities.
 - .3 All data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.
 - .4 All software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device.
 - .5 Complete program cross reference plus any linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.
 - .6 All software for each PCU and single section referencing all PCU common parameters and functions.

- .8 Maintenance: document all maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, FID's plus diagnostics and repair/replacement of system hardware.
- .1 Test procedures and reports: record implementation, description of test procedures. Provide for measurement or observation of results.
- .2 System configuration document:
 - .1 Basic system design and configuration.
 - .2 Provisions and procedures for planning, implementing, recording hardware and software modifications required during installation, test and operating lifetime of system.
 - .3 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.
 - .4 Full documentation of new system configurations.
- .9 PROM programmer and test equipment manual: include full documentation on all PROM's including as minimum PROM locations in system, stock number, Programmer/PROM unique considerations.
- .10 Programmer control panel documentation: provide where panels are independently interfaced with EMCS, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

1.19 TRAINING

- .1 Training Proposal
 - .1 At least 30 days prior to anticipated date of commencement of training, provide complete hour-by-hour schedule complete with brief overview of content of each segment.
 - .2 Submittal to list name of person conducting each session, visual and audio aids to be used.
 - .3 Indicate how training schedule to be co-ordinated with other training programs in mechanical and electrical systems connected to EMCS.
- .2 Instructors
 - .1 To be bilingual competent, thoroughly familiar with all aspects of EMCS installed in this facility.
 - .2 Consultant reserves right to approve instructors, based on qualifications.
- .3 Instruction
 - .1 Provide instruction to designated personnel in adjustment, operation, maintenance, pertinent safety requirements of EMCS installed.
 - .2 Training to be project-specific.

- .4 Number of 8 h person-days of instruction to be as specified in this section (one person-day = 8 h including two 15 min breaks and excluding lunch time).
- .5 Training Materials
 - .1 Provide all equipment, visual and audio aids, and materials for classroom training.
 - .2 Provide manual for each trainee, describing in detail data included in each training program.
- .6 Training Program
 - .1 Provide eight (8) hours of training to operating and maintenance personnel for operating, controlling, adjusting, trouble-shooting and servicing of control systems provided under this contract.
- .7 Additional Training
 - .1 To be available from Contractor and/or manufacturer for personnel requiring greater in-depth understanding of hardware or software than provided by training specified herein.
- .8 Monitoring of Training
 - .1 Consultant will monitor training program and retains right to modify schedule and content.

1.20 WARRANTY

- .1 Provide all services, materials and equipment necessary for the successful operation of the entire EMCS system for a period of one year after acceptance from Consultant.
- .2 The adjustment, required testing, and repair of the system includes all computer equipment, transmission equipment and all sensors and control devices.
- .3 The on-line support services shall allow the local EMCS subcontractor to dial out over telephone lines to monitor and control the facility's building automation system. This remote connection to the facility shall be within 2 hours of the time that the problem is reported. This coverage shall be extended to include normal business hours, after business hours, weekends and holidays.
- .4 If the problem cannot be resolved on-line by the local office, with on-line support services, the EMCS manufacturer shall dispatch the appropriate personnel to the job site to resolve the problem within 3 hours of the time that the problem is reported.

1.21 ACCEPTABLE EMCS CONTRACTOR.

- .1 Ainsworth

2 PRODUCTS (NOT USED)

3 EXECUTION (NOT USED)

END OF SECTION

1 GENERAL

1.01 ACCEPTABLE CONTROLS CONTRACTOR

- .1 Ainsworth

1.02 SUBMITTALS

- .1 Submit shop drawings/product data sheets for following:
 - .1 all control system components;
 - .2 identified schematic control diagrams with component identification, catalogue numbers, and sequence of operation for all systems;
 - .3 certified wiring diagrams for all systems.
- .2 Submit following samples for review:
 - .1 control damper section with linkage, operator, and certified flow and leakage data;
 - .2 wall mounting control system flow diagram as specified in Part 2 of this Section;
 - .3 each type of thermostat to be used, each identified as to intended use.
- .3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.
- .4 Submit written confirmation from control component manufacturer that site installation personnel are qualified and experienced in installation of components, and have parts and service availability on a 24/7 basis.

1.03 QUALITY ASSURANCE

- .1 Control systems are to be installed by control component manufacturer or by licensed personnel authorized by control component manufacturer. Submit written confirmation from control component manufacturer.
- .2 Control system installation company is to have local parts and service availability on 24/7 basis.
- .3 Control wiring work is to be performed by licensed journeyman electricians, or under direct daily supervision of journeyman electricians.

2 PRODUCTS

2.01 AUTOMATIC CONTROL VALVES AND OPERATORS

- .1 Each control valve must be suitable in all respects for application, including system pressure, and pressure drop.
- .2 Unless otherwise indicated, control valves for proportional operation are to have equal percentage characteristics, and control valves for open/shut 2-position operation are to have straight line flow characteristics. Valves are to have position indicators. Valves for outdoor applications to be suitable in all respects for application.

- .3 Heating valves are to be normally open, unless otherwise specified.
- .4 Cooling valves are to be normally closed, unless otherwise specified.
- .5 Unless otherwise specified, control valves in hydronic piping systems are to conform to requirements specified in Section entitled HVAC Piping and Pumps.
- .6 Control valve operators are to be spring return type for fail safe operation, sized to tightly shut the control valves against differentials imposed by system, equipped with position indicators, and suitable in all respects for environment in which they are located.
- .7 Electric valve operators are to be Belimo "EF Series" or approved equal, enclosed reversible gear type operators that can accept modulating control signals as required. Each is to be 1-phase AC, 120 or 24 volt as required or indicated, overload protected, and complete with enclosure to suit the mounting location.

2.02 CONTROL SYSTEM COMPONENTS

- .1 Components specified below are required for control of equipment and systems in accordance with drawing control diagrams and sequences of operation. Not all required components may be specified.
- .2 Sensor/transmitter input devices to be suitable in all respects for application and mounting location. Devices are as follows:
 - .1 unless otherwise specified, temperature sensors are to be resistance type, either 2-wire 1000 ohm nickel RTD or 2-wire 1000 ohm platinum RTD with accuracy (includes errors associated with sensor, lead wire, and A to D conversion), equipped with type 316 stainless steel thermowells for pipe mounting applications, as follows:
 - .1 chilled water, room temperature, and duct temperature points, $\pm 1^{\circ}\text{C}$ ($\pm 0.5^{\circ}\text{F}$);
 - .2 all other points, $\pm 0.75^{\circ}\text{C}$ ($\pm 1.3^{\circ}\text{F}$).
 - .2 room temperature sensors constructed for surface or recessed wall box mounting, complete with an adjustable set-point reset slide switch with a $\pm 1.66^{\circ}\text{C}$ ($\pm 3^{\circ}\text{F}$) range, individual heating/cooling set-point slide switches as required, momentary override request pushbutton for activation of after-hours operation, an analogue thermometer;
 - .3 insertion duct mounting sensors type with lock nut and mounting plate, designed to mount in an electrical box (weather-proof with gasket and cover where outside) through a hole in duct;
- .3 Electronic signal isolation transducers, Advanced Control Technologies or approved equal, for installation whenever analog output signal from building automation system is to be connected to an external control system as an input (i.e. equipment control panel) or is to receive as an input signal from a remote system, and to provide ground plane isolation between systems.
- .4 Thermostats:
 - .1 Wall mounting adjustable set-point thermostats, each suitable in all respects for equipment (and operating sequence) they are provided for, equipped with a thermometer, cover and any required mounting and connection accessories.

- .2 Line voltage thermostats are to be 115 volt.
 - .3 Low voltage thermostats are to be 24 volt electronic type.
 - .4 Set-point adjustment for thermostats in public spaces is to be concealed behind cover. Set-point adjustment for other thermostats is to be accessible through cover.
 - .5 Covers are to be removable, tamper-proof covers with temperature set-point and thermometer displays.
 - .6 Guards for thermostats are to be clear, ventilated polycarbonate covers with allen key locking hardware.
- .5 Hardware to permit building automation system control and monitoring of input/output points in accordance with Section entitled Building Automation System, points schedule, and drawing control diagrams and operation sequences. Such hardware is to be suitable in all respects for interface with BAS.

2.03 WATER DETECTOR

- .1 CUL listed conductivity cable water detector to detect the presence of conductive liquids. Plenum rated. 4X, IP65 enclosure. 12-24V power. Relays for alarm integration to BAS for water detection and loss of power. Complete with all required cables, mounts and accessories for wall-mounted installation above ceiling. Complete with conductivity cable – length as identified on drawings.
- .2 Greystone WLDC series or equivalent.

2.04 SYSTEM WIRING MATERIALS

- .1 System wiring, conduit, boxes, and similar materials are to be in accordance with requirements specified in appropriate Section(s) of Electrical Work specification.

3 EXECUTION

3.01 DEMOLITION

- .1 Perform required control system demolition work.
- .2 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.02 GENERAL RE: INSTALLATION OF CONTROLS

- .1 Provide complete systems of control and instrumentation to control and supervise building equipment and systems in accordance with this Section and drawings.
- .2 Control systems are to generally be as indicated on drawing control diagrams and are to have elements therein indicated or implied.
- .3 Control diagrams show only principal components controlling equipment and systems. Supplement each control system with relays, transformers, sensors, etc., as required to enable each system to perform as specified and to permit proper operation and supervision.

- .4 Brace and secure control system equipment in accordance with requirements specified in Section entitled Seismic Control and Restraint.

3.03 SUPPLY OF AUTOMATIC CONTROL VALVES AND OPERATORS

- .1 Unless otherwise specified, supply required automatic control valves. Hand valves to appropriate piping trades at site in locations they are required for installation as part of piping work. Ensure each valve is properly located and installed.
- .2 Provide operator for each valve.

3.04 INSTALLATION OF THERMOSTATS

- .1 Unless otherwise noted, provide required thermostats.
- .2 Provide a ventilated clear polycarbonate cover for each thermostat located in finished areas, and a wire type guard for each thermostat located in unfinished areas and in areas such as mechanical rooms where thermostat is subject to damage.
- .3 Unless otherwise indicated, mount room thermostats in accordance with requirements of local governing authority and, where applicable, barrier-free requirements. Review exact location of thermostats with Consultant prior to roughing-in.
- .4 Provide stand-off mounting and an insulated sub-base for thermostats on outside walls.
- .5 Perform control wiring associated with installation of electric or electric-electronic thermostats.

3.05 INSTALLATION OF CONTROL SYSTEM COMPONENTS

- .1 Provide required control system components and related hardware. Refer to drawing control diagrams and sequences.
- .2 Where components are pipe, duct, or equipment mounted supply components at proper time, coordinate installation with appropriate trade, and ensure components are properly located and mounted.

3.06 CONTROL WIRING

- .1 Perform required control wiring work for control systems except:
 - .1 power wiring connections to equipment and panels, except as noted below;
 - .2 control wiring associated with mechanical plant equipment and systems whose control is not part of work specified in this Section;
 - .3 starter interlock wiring.
- .2 Except as specified below, install wiring in conduit. Unless otherwise specified, final 600 mm (2') connections to sensors and transmitters, and wherever conduit extends across flexible duct connections is to be liquid-tight flexible conduit.
- .3 Control wiring in ceiling spaces and wall cavities may be plenum rated cable installed without conduit but neatly harnessed, secured, and identified.

- .4 Wiring work is to be in accordance with certified wiring schematics and instructions, and wiring standards specified in appropriate Sections of Electrical Work Specification.

3.07 IDENTIFICATION AND LABELLING OF EQUIPMENT AND CIRCUITS

- .1 Refer to identification requirements specified in Section entitled Basic Mechanical Materials and Methods.
- .2 Identify equipment as follows:
 - .1 enclosures and components: engraved laminated nameplates with wording listed and approved prior to manufacture of nameplates;
 - .2 wiring: numbered sleeves or plastic rings at both ends of conductor, with numbering corresponding to conductor identification on shop drawings and "as-built" record drawings.

3.08 TESTING, ADJUSTING, CERTIFICATION, START-UP, AND TRAINING

- .1 When control work is complete, check installation of components and wiring connections, make any required adjustments, and coordinate adjustments with personnel doing HVAC testing, adjusting and balancing work.
- .2 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.
- .3 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.
- .4 Include for 2 full, 8 hour days on-site operation demonstration and training sessions. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.
- .5 Include for 2 follow-up site training and troubleshooting visits, one 6 months after Substantial Completion and other at end of warranty period, both when arranged by Owner and for a full, 8 hour day to provide additional system training as required, and to demonstrate troubleshooting procedures.

END OF SECTION



Kingston Health Sciences Centre Hotel Dieu Hospital

KINGSTON, ONTARIO

HDH Jeanne Mance Level 0 UCC X-Ray Room Equip Replacement

Client Project Number: 10460977

WSP Project No. CA0011456.9528

Construction Documents

ELECTRICAL

Issued for Bid/ Permit

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DIVISION 26/27/28 - ELECTRICAL

26 00 10	ELECTRICAL WORK GENERAL INSTRUCTIONS
26 05 00	BASIC ELECTRICAL MATERIALS AND METHODS
26 05 19	LOW VOLTAGE CABLES
26 05 26	GROUNDING AND BONDING
26 05 48	VIBRATION ISOLATION AND SEISMIC RESTRAINTS
26 05 70	ELECTRICAL WORK ANALYSIS AND TESTING
26 05 90	HAZARDOUS MATERIALS
26 20 00	ELECTRICAL SERVICE AND DISTRIBUTION
26 27 26	WIRING DEVICES
26 50 00	LIGHTING
26 52 00	EMERGENCY LIGHTING
27 10 00	STRUCTURED CABLING
28 31 00	FIRE ALARM SYSTEM

END OF SECTION

PART 1 - GENERAL

1.01 REFERENCES

- .1 Division 00 and Division 01 apply to and are a part of this Section.

1.02 APPLICATION

- .1 This Section specifies requirements that are common to Electrical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. Where requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Division 00 or 01 to take precedence.
- .2 Advise product vendors of requirements of this Section.

1.03 DEFINITIONS

- .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
- .2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
- .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
- .4 "provision" or "provide" (and tenses of "provide") – means supply and install complete.
- .5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.
- .6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer's supply of any special cables, standard on site testing, initial start-up, programming, basic commissioning, warranties and manufacturers' assistance to Contractor.
- .7 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, and remove obsolete materials including back boxes and exposed piping and raceways; and patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Owner and reviewed with Consultant.
- .8 "barrier-free" - means when applied to a building and its facilities, that building and its facilities can be approached, entered and used by persons with physical or sensory disabilities in accordance with requirements of local governing building code.
- .9 "BAS" – means building automation system; "BMS" – means building management system, "FMS" – means facility management system; and "DDC"

means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same.

- .10 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.
- .11 "OSHA" and "OHSA" – stands for Occupational Safety and Health Administration and Occupational Health and Safety Act, and wherever either one is used, they are to be read to mean local governing occupational health and safety regulations that apply to and govern work and to which work must adhere, regardless if Project falls within either authority's jurisdiction.
- .12 "Mechanical Divisions" - refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.
- .13 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.
- .14 "Consultant" – means person, firm or corporation identified as such in Agreement or Documents, and is licensed to practice in Place of the Work, and has been appointed by Owner to act for Owner in a professional capacity in relation to the Work.
- .15 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.
- .16 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.04 DOCUMENTS

- .1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.
- .2 Specification is arranged in accordance with CSI/CSC 50 Division Sections MasterFormat.
- .3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.
- .4 Review Drawings and Specification in conjunction with documents of other Divisions and, where applicable, Code Consultant's report.
- .5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Electrical Divisions are not intended to delegate functions nor to delegate work

and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.

- .6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and materials. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.
- .7 Drawings are intended to convey scope of work and do not show architectural and structural details. Provide fittings, offsets, transformations and similar items required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.
- .8 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.
- .9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa.
- .10 Starter/motor control centre (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements of Mechanical Divisions specifications and drawings, prior to Bid submission. Confirm and coordinate exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.
- .11 Drawings and Specifications are prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by Consultant to any other party.
- .12 In case of discrepancies or conflicts between Drawings and Specifications, Documents will govern in order specified in "General Conditions", however, when scale and date of Drawings are same, or when discrepancy exists within Documents, include most costly arrangement.

1.05 METRIC AND IMPERIAL MEASUREMENTS

- .1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Exact measurements to be confirmed based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

1.06 EXAMINATION OF BID DOCUMENTS AND SITE

- .1 Carefully examine Documents and visit site to determine and review existing site conditions that will or may affect work, and include for such conditions in Bid Price.

- .2 Report to Consultant, prior to Bid Submittal, any existing site condition that will or may affect performance of work as per Documents. Failure to do so will not be grounds for additional costs.
- .3 Upon finding discrepancies in, or omissions from Documents, or having doubt as to their meaning or intent, immediately notify Consultant, in writing.

1.07 WORK STANDARDS

- .1 Where any code, regulation, bylaw, standard, contract form, manual, printed instruction, and installation and application instruction is quoted it means, unless otherwise specifically noted, latest published edition at time of submission of Bids adopted by and enforced by local governing authorities having jurisdiction. Include for compliance with revisions, bulletins, supplementary standards or amendments issued by local governing authorities.
- .2 Where regulatory codes, standards and regulations are at variance with Drawings and Specification, more stringent requirement will apply unless otherwise directed by Owner and reviewed with Consultant.
- .3 Supplementary mandatory Specifications and requirements to be used in conjunction with project include but are not limited to following:
 - .1 American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc., (ASHRAE);
 - .2 American National Standards Institute (ANSI);
 - .3 ANSI/ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings;
 - .4 Building Industry Consulting Services, International (BICSI);
 - .5 Canadian Standards Association (CSA);
 - .6 CSA C282, "Emergency Electrical Power Supply For Buildings";
 - .7 CSA Z32;
 - .8 CSA Z432, "Safeguarding of Machinery";
 - .9 CSA Z462, "Workplace Electrical Safety";
 - .10 Electrical and Electronic Manufacturers Association of Canada (EEMAC);
 - .11 Electrical Safety Authority (ESA);
 - .12 Electronic Industries Association (EIA);
 - .13 Illuminating Engineering Society (IES);
 - .14 Institute of Electrical and Electronic Engineers (IEEE);
 - .15 National Building Code of Canada (NBC);
 - .16 National Electrical Manufacturers Association (NEMA);

- .17 National Fire Protection Association (NFPA);
- .18 Occupational Health and Safety Act (OHSA);
- .19 Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces";
- .20 Ontario Building Code (OBC);
- .21 Ontario Electrical Safety Code (OESC);
- .22 Technical Standards and Safety Authority (TSSA);
- .23 Telecommunications Industry Association (TIA);
- .24 Underwriters' Laboratories of Canada (ULC);
- .25 Material Safety Data Sheets by product manufacturers;
- .26 local utility inspection permits;
- .27 codes, standards, and regulations of local governing authorities having jurisdiction;
- .28 additional codes and standards listed in Trade Sections;
- .29 Owner's standards.
- .4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.
- .5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted to appropriate authorities. Be responsible for costs associated with these submittals.
- .6 Unless otherwise specified install, equipment in accordance with equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions. Notify Consultant in writing of conflicts between Contract Documents and manufacturer's instructions.
- .7 Work is to be performed by journeyperson tradesmen who perform only work that their certificates permit, or by apprentice tradesmen under direct on site supervision of experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined by the Board as stated in Ontario College of Trades and Apprenticeship Act or local equivalent governing body in Place of the Work.
- .8 Journeyperson tradesmen are to have copy of valid trade certificates available at site for review by Consultant at any time.
- .9 Maintain experienced and qualified superintendent on-site at times when work is being performed.

- .10 Protect existing areas above, below and adjacent areas of Work from any debris, noise, or interruptions to existing services to satisfaction of Owner and reviewed with Consultant. Maintain in operation existing services to these areas to allow Owner to continue use of these areas. If services that are required to be maintained run through areas of renovations, provide necessary protection to services or reroute, in coordination with Owner and review with Consultant. Include for required premium time work to meet these requirements.
- .11 Work being performed within occupied spaces and work affecting surfaces adjacent to occupied spaces may need to be performed after regular business hours. For areas where spaces are used by Owner on a 24 hours basis or over various hours, coordinate hours of work with Owner on a regular basis to suit Owner's schedule. Execute work at times confirmed with and agreed to by Owner and reviewed with Consultant, so as not to inconvenience Owner's occupation or in any way hinder Owner's use of building. Include for required premium timework to meet these requirements.
- .12 Coordinate work inspection reviews and approvals with governing inspection department to ensure construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.
- .13 Properly protect equipment and materials on site from damage and defacement due to elements and work of trades, to satisfaction of Owner and reviewed with Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

1.08 HEALTHCARE FACILITY STANDARDS

- .1 Comply with following CAN/CSA Standards:
 - .1 CAN/CSA Z317.13, Infection Control During Construction, Renovation, and Maintenance of Health Care Facilities;
 - .2 CAN/CSA Z317.10, Handling of Waste Materials in Health Care Facilities and Veterinary Health Care Facilities;
 - .3 CSA Z317.5, Illumination Systems in Health Care Facilities;
 - .4 CAN/CSA Z32, Electrical Safety and Essential Systems in Health Care Facilities;
 - .5 CSA Z8001, Commissioning of Health Care Facilities.
- .2 Prepare list of areas of work where infection control procedures are to be in force and review list and procedures with healthcare facility's Infection Control Officer or a designated healthcare facility representative prior to commencing work in aforementioned areas. As work proceeds, ensure infection control procedures are being maintained.
- .3 Comply with healthcare facility's latest policies and procedures regarding infection prevention and decontamination measures during work of project. Refer to additional requirements of Division 01.

1.09 PERMITS, CERTIFICATES, APPROVALS AND FEES

- .1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities.
- .2 Submit required applications, shop drawings, electrical distribution system protection device coordination studies, and short circuit calculations, and any other information requested by local authority.
- .3 Provide ample notification to authorities having jurisdiction to perform required on-site inspection of work, allowing sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work. If any defect, deficiency or non-compliance is found in work by inspection, be responsible for costs of such inspection, including any related expenses, making good and return to site, until work is passed by governing authorities.
- .4 Obtain and submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities and are acceptable by such authorities.
- .5 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities.
- .6 Where electromagnetic locks are provided whether by this Division or by others, be responsible for obtaining and paying for required certificates of work with regards to such electromagnetic lock work.

1.10 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

- .1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer or, structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.
- .2 Retained engineer's professional liability insurance is to protect Contractor's consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned consultants and their respective servants, agents, and employees in regards to the Work of this Contract.
- .3 Unless otherwise specified in Division 00 and 01, liability insurance requirements are as follows:
 - .1 coverage is to be a minimum of \$1,000,000.00 CDN inclusive of any one occurrence;
 - .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;
 - .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;

- .4 retained consultants are to ascertain that sub-consultants employed by them carry insurance in form and limits specified above;
- .5 evidence of required liability insurance in such form as may be required is to be issued to Owner, Owner's Consultant, and Municipal Authorities as required prior to commencement of aforementioned consultant's services.

1.11 WORKPLACE SAFETY

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.
- .2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/ insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces" and any other applicable Ministry of Labour requirements.
- .3 If at any time during course of existing building work, hazardous materials other than those identified in Documents and pertaining to Project Scope of Work, are encountered or suspected that were not identified as being present and which specific instructions in handling of such materials were not given, cease work in area in question and immediately notify Consultant. Comply with local governing regulations with regards to working in areas suspected of containing hazardous materials. Do not resume work in affected area without approval from Owner and review with Consultant.

1.12 PLANNING AND LAYOUT OF WORK

- .1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.
- .2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:
 - .1 piping requiring uniform pitch;
 - .2 piping 100 mm (4") dia. and larger;
 - .3 large ducts (main runs);
 - .4 cable tray and bus duct;
 - .5 conduit 100 mm (4") dia. and larger;
 - .6 piping less than 100 mm (4") dia.;
 - .7 smaller branch ductwork;
 - .8 conduit less than 100 mm (4") dia..

- .3 As reviewed with Consultant, Mechanical Contractor is to generally determine final locations of major work within ceiling spaces.
- .4 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of work.
- .5 Do not use Contract Drawing measurements for prefabrication and layout of raceways, conduits, ducts, bus ducts, luminaires, and other such work. Locations and routing are to be generally in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.
- .6 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or $\frac{1}{4}"=1' 0"$) of work for coordination with each trade Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, engineering drawings for this use. Contractors' interference drawings are to be distributed among other Trade Contractors. Submit drawings to Consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.
- .7 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.
- .8 Control products, products requiring maintenance, junction boxes, and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.
- .9 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination.
- .10 Where drawings indicate that acoustic tile ceiling is being suspended below plaster ceiling, coordinate design of framework used to support suspended ceiling, lighting, diffusers, and other Divisions components that are mounted within or through ceiling. Do not mount devices to suspended ceiling. Secure and mount to ceiling slab above. Seal ceiling openings to maintain required fire rating.

1.13 COORDINATION OF WORK

- .1 Review Contract Documents and coordinate work with work of each trade. Coordination requirements are to include, but not be limited to following:
 - .1 requirements for openings, sleeves, inserts and other hardware necessary for installation of work;
 - .2 concrete work such as housekeeping pads, sumps, bases, etc., required for work, and including required dimensions, operating weight of equipment, location, etc.;
 - .3 depth and routing of excavation required for work, and requirements for bedding and backfill;
 - .4 wiring work required for equipment and systems but not specified to be done as part of mechanical work, including termination points, wiring type and size, and any other requirements.
- .2 Ensure materials and equipment are delivered to site at proper time and in such assemblies and sizes so as to enter into building and be moved into spaces where they are to be located without difficulty.
- .3 Wherever possible, coordinate equipment deliveries with manufacturers and/or suppliers so equipment is delivered to site when it is required, or so it can be stored within building subject to available space as confirmed with Owner and reviewed with Consultant and protected from elements.
- .4 Ensure proper access and service clearances are maintained around equipment, and, where applicable, access space for future equipment removal or replacement is not impeded. Comply with code requirements with regards to access space provision around equipment. Remove and replace any equipment which does not meet this requirement.
- .5 Where work is to be integrated, or is to be installed in close proximity with work of other trades, coordinate work prior to and during installation.

1.14 COMPONENT FINAL LOCATIONS

- .1 Owner and Consultant reserve right to relocate electrical components such as receptacles, switches, communication system, outlets, hard wired outlet boxes and luminaries at a later date, but prior to installation, without additional cost to Owner, if relocation per components do not exceed 3 m (10') from original location. No credits will be anticipated where relocation per components of up to and including 3 m (10') reduces materials, products and labour. Should relocations exceed 3 m (10') from original location, adjust contract price for that portion beyond 3 m (10') in accordance with provisions for changes in Contract Documents.

1.15 SYSTEMS COORDINATION

- .1 Be responsible for and perform specific coordination of various low voltage systems supplied by Electrical Divisions and also with systems supplied by other Divisions of Work. Include for but not be limited to provision of following, as applicable:

- .1 coordinate with General Contractor and other Subcontractors, various systems of trades which in any way are interfaced with or monitored by or integrated to, or need to be coordinated with;
- .2 prepare systems coordination drawings detailing related system coordination and integration points being monitored and/or controlled; submit coordination drawings as part of shop drawing submission;
- .3 coordinate security system requirements with successful door hardware supplier and prepare detailed coordination drawings of component installations, wiring and conduit layouts, division of responsibility between various trades, etc.; review security system requirements with associated door hardware (electromagnetic locks, electric strikes, etc.), to ensure proper sequence of operation and door functionality is provided to suit each door configuration; prepare detailed door functionality of each door configuration and submit to and review with Consultant;
- .4 review systems requirements for component back boxes and conduits; ensure that system of conduits and boxes meet respective system wiring bending radii requirements;
- .5 review specifications of each trade/Division (i.e. for BAS points, elevator requirements, electrical devices in millwork or prefabricated service consoles, outlet box and back box requirements), to ensure proper power supplies, interconnecting wiring requirements and back box/ outlet box requirements;
- .6 review with manufacturers coordination and integration requirements of their systems;
- .7 review each systems communication protocols to ensure they are compatible and can communicate with each other as required;
- .8 review system shop drawings prior to submission to Consultant, to verify that each system has been coordinated with other systems and that required options and features are selected to meet coordination requirements;
- .9 be present at testing and commissioning functions of each system and provide technical assistance with regards to system operations;
- .10 be "on-site" coordinator of respective system trades with regards to respective system coordination of installation and testing;
- .11 coordinate with various trades and equipment vendors and review with Consultant with regards to ensuring that systems coordinate and integrate properly to meet intent of design and Owner requirements;
- .12 document coordination and integration requirements and maintain records for submission as part of shop drawings;
- .13 respond to coordination and integration requirements and be responsible for such work;
- .14 where a system integrator has been included for, coordinate integration requirements with system integrator.

1.16 PRODUCTS

- .1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.
- .2 Provide Canadian manufactured products wherever possible or required and when quality and performance is obtainable at a competitive price. Products are to be supplied from manufacturer's authorized Canadian representative, unless otherwise noted. Unless otherwise specified, products are to be new and are to comply with applicable respective Canadian standards. References to UL listings of products to include requirements that products are to be also Underwriters Laboratories of Canada (ULC) listed for use in Canada. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.
- .3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.
- .4 Products scheduled and/or specified have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for any product specified by manufacturer's name and model number. Where acceptable manufacturers are listed, first name listed is base specified company. Bid Price may be based on products supplied by any of manufacturers' base specified or named as acceptable for particular product. If acceptable manufacturers are not stated for a particular product, base Bid Price on product supplied by base specified manufacturer.
- .5 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Above conditions supplement and are not to supersede any specification conditions in Division 01 with regards to substitutions or failure to supply product
- .6 Listing of a product as "acceptable" does not imply automatic acceptance by Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.

- .7 If products supplied by a manufacturer named as acceptable are used in lieu of base specified manufacturer, be responsible for ensuring that they are equivalent in performance and operating characteristics (including energy consumption if applicable) to base specified products. It is understood that any additional costs (i.e. for larger starters, larger feeders, additional spaces, etc.), and changes to associated or adjacent work resulting from provision of product supplied by a manufacturer other than base specified manufacturer, is included in Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of base specified equipment and dimensions of such equipment differs from base specified equipment, prepare and submit for review accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.
- .8 In addition to manufacturer's products base specified or named as acceptable, other manufacturers of products may be proposed as substitutions to Consultant for review and consideration for acceptance, listing in each case a corresponding credit for each substitution proposed. However, base Bid Price on products base specified or named as acceptable. Certify in writing to Consultant that proposed substitution meets space, power, design, energy consumption, and other requirements of base specified or acceptable product. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of proposed substitution. Consultant has sole discretion in accepting any such proposed substitution of product. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by Consultant.
- .9 When requested by Consultant, identify names of manufacturers for proposed products to be supplied, and which were base specified or scheduled with a manufacturer's name. Names of proposed manufacturers on list must be one of names stated as acceptable for particular products, unless prior approval from Owner has been given for use of products by other manufacturers. Submit to Consultant for review as directed.
- .10 Where products are listed as "or approved equal", certify in writing that product to be used in lieu of base specified product, at least meets space, power, design, energy consumption, and other requirements of base specified product and is equivalent or better than base specified product. When requested by Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or approved equal" products is at sole discretion of Consultant. It is understood that there will be no increase in Contract Price by reason of any changes to associated equipment, mechanically, electrically, structurally or architecturally, required by acceptance of approved equal product. There must be no increase in Contract price due to Consultant's rejection of proposed equivalent product.
- .11 Whenever use of product other than base specified product is being supplied, ensure corresponding certifications and product information (detailed catalogue and engineering data, fabrication information and performance characteristics) are submitted to Consultant for review. Failure of submission of these documents to Consultant in a timely manner to allow for review will result in base specified product to be supplied at Consultant's discretion, at no additional cost to Contract.

- .12 Products supplied by a manufacturer/supplier other than a manufacturer listed as acceptable may be considered for acceptance by Consultant if requested in writing with full product documentation submitted, a minimum of 10 working days prior to Bid closing date.
- .13 Any proposed changes initiated by Contractor after award of Contract may be considered by Consultant at Consultant's discretion, with any additional costs for such changes if accepted by Owner and reviewed with Consultant, and costs for review, to be borne by Contractor.
- .14 Whenever use of product other than based specified products or named as acceptable is being supplied, allow sufficient time for processing of product submissions and time for Consultant's review, such that there will not be significant impact on contract time or work schedule.
- .15 Requirements for low voltage systems of this project that are of technology that changes rapidly and are forever evolving and changing, resulting in systems that may be out dated by time of installation, are to include provisions to allow Owner option to select most updated technology. Shop drawings for such systems and equipment are to include provisions for a minimum 6-week review time for Owner to review degree of technology of each system and determine acceptance. Owner will have right to substitute a more advanced technology subject to negotiated pricing.

1.17 NON-FERROUS MATERIALS

- .1 Materials within designated imaging rooms to be of non-ferrous construction as reviewed with Consultant. Devices, luminaires, various communications system components, etc., utilized to be approved for use in designated imaging room type applications. Methods of construction to take into consideration use of non-ferrous materials. Ultimate approval of any materials, devices or components, or methods of construction to be at imaging system manufacturer's discretion. Coordinate and confirm final requirements with successful imaging system supplier.

1.18 SHOP DRAWINGS

- .1 At start-up meeting review with Consultant, products to be included in shop drawing submission. Prepare and submit list of products to Consultant for review.
- .2 Submit electronic copies of shop drawings unless otherwise directed by Owner or reviewed with Consultant. Review exact requirements with Consultant.
- .3 Submit for review, drawings showing in detail design, construction, and performance of equipment and materials as requested in Specification. Submit shop drawings to Consultant for review prior to ordering and delivery of product to site. Include minimally for preparation and submission of following, as applicable:
 - .1 product literature cuts;
 - .2 equipment data sheets;
 - .3 equipment dimension drawings;
 - .4 system block diagrams;
 - .5 sequence of operation;

- .6 connection wiring schematic diagrams;
- .7 functionality with integrated systems.
- .4 Each shop drawing or product data sheet is to be properly identified with project name and product drawing or specification reference. Shop drawing or product data sheet dimensions are to match dimension type on drawings.
- .5 Where any item of equipment is required by Code or Standard or By-Law to meet a specific energy efficiency level, or any other specific requirement, ensure this requirement is clearly indicated on submission.
- .6 Ensure proposed products meet each requirement of Project. Endorse each shop drawing copy "CERTIFIED TO BE IN ACCORDANCE WITH ALL REQUIREMENTS". Include company name, submittal date, and sign each copy. Shop drawings that are received and are not endorsed, dated and signed will be returned to be resubmitted.
- .7 Consultant to review shop drawings and indicate review status by stamping shop drawing copies as follows:
 - .1 "REVIEWED" or "REVIEWED AS NOTED" (appropriately marked) – If Consultant's review of shop drawing is final, Consultant to stamp shop drawing;
 - .2 "RETURNED FOR CORRECTION" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.
- .8 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each and every shop drawing submitted:

"THIS REVIEW BY CONSULTANT IS FOR SOLE PURPOSE OF ASCERTAINING CONFORMANCE WITH GENERAL DESIGN CONCEPT. THIS REVIEW DOES NOT MEAN THAT CONSULTANT APPROVES DETAILED DESIGN INHERENT IN SHOP DRAWINGS, RESPONSIBILITY FOR WHICH REMAINS WITH CONTRACTOR. CONSULTANT'S REVIEW DOES NOT RELIEVE CONTRACTOR OF RESPONSIBILITY FOR ERRORS OR OMISSIONS IN SHOP DRAWINGS OR OF CONTRACTOR'S RESPONSIBILITY FOR MEETING REQUIREMENTS OF CONTRACT DOCUMENTS. BE RESPONSIBLE FOR DIMENSIONS TO BE CONFIRMED AND CORRELATED AT JOB SITE, FOR INFORMATION THAT PERTAINS SOLELY TO FABRICATION PROCESSES OR TO TECHNIQUES OF CONSTRUCTION AND INSTALLATION, AND FOR CO-ORDINATION OF WORK OF SUB-TRADES."
- .9 Submit each system and each major component as separate shop drawing submissions. Submit together, shop drawings for common devices such as devices of each system.
- .10 Obtain shop drawings for submission from product manufacturer's authorized representatives and supplemented with additional items specified herein.
- .11 Do not order product until respective shop drawing review process has been properly reviewed with Consultant.

- .12 Where extended warranties are specified for equipment items, submit specified extended warranty with shop drawing submittal.
- .13 Refer to specific requirements in other Sections.

1.19 ENGINEERED SUBMITTALS

- .1 Submittals for items required to be sealed by a professional engineer (engineered) are to be duly prepared, sealed, and signed under direct control and supervision of a qualified professional engineer licensed in jurisdiction of the work. Professional engineer is to conform to requirements specified in this Section in article entitled Requirements for Contractor Retained Engineers.
- .2 Engineered submittals are to include, but not be limited to, following:
 - .1 complete CAD layout drawings indicating equipment, wiring schematic, conduit routing and sizing, zones, devices, and any other pertinent data;
 - .2 listing of design data used to determine system layout and sizing;
 - .3 complete copies of design calculations and listing of design data used in preparing calculations;
 - .4 list detailing standards, codes, regulations, etc. adhered to when designing system;
 - .5 items as noted in other Sections of the Specification.
- .3 Professional engineer responsible for engineered submittals is to perform periodic field reviews, including review of associated mock-ups where applicable, at locations wherever work as described by engineered submittal is in progress, during fabrication and installation of such work, and submit a field review report after each visit. Submit field review reports to Consultant and authorities having jurisdiction as required.
- .4 Field reviews are to be at intervals as necessary and appropriate to progress of work described by engineered submittal to allow engineer to be familiar with progress and quality of such work and to determine if work is proceeding in general conformity with Contract Documents including reviewed shop drawings and design calculations.
- .5 Upon completion of work as described by engineered submittal, professional engineer responsible for preparation of engineered submittal and for performing periodic field reviews is to prepare and submit to Consultant and, if applicable, authorities having jurisdiction, a letter certifying that work has been supplied and installed in accordance with requirements of Contract Documents, authorities having jurisdiction and engineered submittal.

1.20 EQUIPMENT LOADS

- .1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to Consultant, via shop drawing submissions, prior to construction.
- .2 Where given choice of specific equipment, actual weight, location and method of support of equipment may differ from those assumed by Consultant for base

design. Back-check equipment loads, location, and supports, and include necessary accommodations.

- .3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Review locations of equipment with Consultant prior to construction.

1.21 OPENINGS

- .1 Supply opening sizes and locations to Consultant to allow verification of their effect on design, and for inclusion on structural drawings where appropriate.
- .2 No openings are permitted through completed structure without written approval from Owner and review with Consultant. Show required openings on a copy of structural drawings. Identify exact locations, elevations, and size of proposed openings and submit to Consultant for review, well in advance of doing work.
- .3 Prior to leaving site at end of each day, walk through areas of work and check for any openings, penetrations, holes, and/or voids created under scope of work of project, and ensure that any openings created under scope of work have been closed off, fire-stopped and smoke-sealed. Unless otherwise directed by Owner and reviewed with Consultant, do not leave any openings unprotected and unfinished overnight.

1.22 SCAFFOLDING, HOISTING, AND RIGGING,

- .1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to approval from Owner and review with Consultant.
- .2 Use scaffolds in such a manner as to interfere as little as possible with work of other trades.
- .3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Owner and review with Consultant. No supports, clips, brackets or similar devices are to be welded, bolted or otherwise affixed to any finished member or surface without approval from Owner and review with Consultant.
- .4 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.

1.23 CHANGES IN THE WORK

- .1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity, or type of any work from that required by Contract Documents, prepare and submit to Consultant for review, a quotation detailing proposed cost for executing change or revision.
- .2 Quotation to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.
- .3 If overhead and profit percentages are not specified in Division 00 or 01, but allowable under Contract as reviewed with Consultant prior to contract signing,

then allowable maximum percentages for overhead and profit are to be 7% and 5% respectively.

- .4 Unless otherwise specified in Divisions 00 or 01, following additional requirements apply to quotations submitted:
 - .1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;
 - .2 material costs are not to exceed those published in local estimating price guides;
 - .3 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at difficult level, less 25%;
 - .4 mechanical material labour unit costs are to be in accordance with Mechanical Contractors Association of America Labor Estimating Manual, less 25%;
 - .5 costs for journeyman and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;
 - .6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary;
 - .7 costs for rental tools and/or equipment are not to exceed local rental costs;
 - .8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;
 - .9 quotations, including those for deleted work, to include a figure for any required change to Contract time.
- .5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.
- .6 Make requests for changes or revisions to work in writing to Consultant and, if accepted by Owner, Notice of Change to be issued.
- .7 Do not execute any change or revision until written authorization for change or revision has been obtained from Owner and reviewed with Consultant.

1.24 PROGRESS PAYMENT BREAKDOWN

- .1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.

- .2 Payment breakdown is subject to Owner's approval and Consultant's review. Progress payments will not be processed until an approved breakdown is in place. Breakdown is to include one-time claim items such as mobilization and demobilization, insurance, bonds (if applicable), shop drawings and product data sheets, commissioning including system testing and verification, and project closeout submittals.
- .3 Indicate equipment, material and labour costs for site services (if applicable) and indicate work of each trade in same manner as they will be indicated on progress draw.

1.25 NOTICE FOR REQUIRED FIELD REVIEWS

- .1 Whenever there is a requirement for Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to Consultant.
- .2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.
- .3 Do not conceal work until Consultant advises that it may be concealed.
- .4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.26 PRELIMINARY TESTING

- .1 When directed by Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.
- .2 When, in Consultant's opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.
- .3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.
- .4 When, in Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.27 CAN/ULC S1001 INTEGRATED SYSTEMS TESTING AND VERIFICATION

- .1 Include for hiring an Integrated Testing Coordinator (ITC) to provide the following.

- .1 Produce draft integrated systems testing plans to be submitted to the AHJ for review at project commencement.
- .2 Provide updated final integrated systems plans based on latest contract documents.
- .3 Once all integrated systems have been installed, tested individually, and preliminary integrated systems testing completed with all intended functions operating correctly with no errors, ITC is to attend final integrated systems testing with all other required contractors, and complete final integrated systems testing plans. Plans to be signed off by ITC, and all contractors required for integrated systems testing for this project.
- .4 The integrated testing coordinator shall be knowledgeable and experienced in the design, installation, and operation of fire protection and life safety system(s), and the fire protection and life safety functions of building systems.
- .5 The integrated testing coordinator shall have knowledge and understanding of:
 - .1 The Codes and Standards that regulate the design and installation of fire protection and life safety system(s);
 - .2 How individual and integrated fire protection and life safety system(s) are designed to operate during normal operating conditions and emergency conditions; and
 - .3 Methods for validating the intended functionality of integrated fire protection and life safety system(s).
- .6 The integrated testing coordinator shall have all licenses and certifications if required by:
 - .1 Federal, provincial, territorial or other applicable regulations; and/or
 - .2 Contractual obligations.
- .2 Be responsible for allowing for all costs associated with CAN/ULC S1001 integrated systems testing, including but not limited to, pre-testing to ensure systems function correctly prior to final testing, coordination of other trades, generator fuel, etc.
- .3 Be responsible for arranging and chairing meetings with all other trades which have life safety systems tied into the fire protection and life safety systems to ensure systems are integrated and tested in accordance with CAN/ULC S1001.

1.28 PROVISIONS FOR SYSTEMS/EQUIPMENT USED DURING CONSTRUCTION

- .1 Any system or piece of equipment that is specified to be provided under requirements of Documents and is required to be used during construction stages of work prior to issuing of Certificate of Substantial Performance of the Work, are to be provided with special interim maintenance and service to cover systems/equipment during time of use during construction period of project until project has been certified as substantially performed and such systems/equipment are turned over to Owner.

- .2 During this period of construction, such systems/equipment to not become property of Owner or be Owner's responsibility for maintenance or service. Systems/equipment are to remain property of respective manufacturers/suppliers or Contractor, who are responsible for full maintenance and servicing of systems/equipment in order to maintain validity of warranties after turn over to Owner.
- .3 Prior to application for a Certificate of Substantial Performance of the Work and turn over to Owner, such systems/equipment to be cleaned, restored to "new" condition, paint finishes "touched-up", filters cleaned or replaced, etc.

1.29 TEMPORARY SERVICES

- .1 Coordinate with Prime Contractor, requirements for temporary services including but not limited to temporary electrical power, lighting, heating, fire alarm and exit pathways. Locations of exit pathways to be as decided at discretion of Prime Contractor and to be illuminated complete with emergency lighting, and provided with exit signage and fire alarm devices. Unless otherwise noted, provide required services in accordance with requirements of local governing building code and local governing inspection authorities.
- .2 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.
- .3 Protect existing fire alarm devices within the room and provide temporary fire detection as required during construction. Include for all devices, wiring, conduit, testing and verification.

1.30 CLEANING

- .1 During construction, keep site reasonably clear of rubbish and waste material resulting from work on a daily basis to the satisfaction of Owner and Consultant. Before applying for a Certificate of Substantial Performance of the Work, remove rubbish and debris, and be responsible for repair of any damage caused as a result of work.
- .2 At time of final cleaning, clean luminaire reflectors, lenses, and other luminary surfaces that have been exposed to construction dust and dirt, including top surface, whether it is exposed or in ceiling space.
- .3 Clean switches, receptacles, communications outlets, coverplates, and exposed surfaces.
- .4 Clean other electrical equipment and devices installed as part of this project.
- .5 For work performed in electrical equipment rooms, electrical closets and communication closets, perform following:
 - .1 HEPA vacuum and clean interiors and buswork of switchboards, panels, cabinets and other electrical equipment of construction debris and dust prior to energization;
 - .2 HEPA vacuum top of switchboards, panels, cabinets, bus ducts, cable trays and conduits in room, followed by a thorough HEPA vacuuming of floors;

- .3 do not lay permanent switchboard matting in electrical rooms until rooms are re-cleaned, and floors wet mopped and dried just prior to final turn over to Owner.

1.31 RECORD AS-BUILT DRAWINGS

- .1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version reviewed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant, at expense of \$25.00 CDN plus HST, per drawing, up to first 10 drawings, and \$5.00 CDN plus HST, per any additional drawings thereafter. Drawings may also to be used for preparation of layouts and interference drawings.
- .2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date, and ensure set is available for periodic review. As-built set is also to include following:
 - .1 dimensioned location of inaccessible concealed work;
 - .2 locations of control devices with identification for each;
 - .3 location and identification of devices in concealed locations such as accessible ceiling spaces and raised floors;
 - .4 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;
 - .5 location of concealed services terminated for future extension and work concealed within building in inaccessible locations.
 - .6 location of fire alarm devices and include addresses of devices; identify fire alarm zones;
 - .7 identify routing and location of concealed conduits/ducts of diameter 50 mm (2") and greater;
- .3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Consultant for review. Make necessary revisions to drawings as per Consultant's comments, to satisfaction of Consultant.
- .4 Use final reviewed "as-built" drawing set to provide CAD files of drawings thus forming true "as-built" set of Contract Drawings. Identify set as "Project Record Copy". Load digital copies of final reviewed by Consultant as-built drawings onto USB type flash drive. Provide 2 complete sets of "as-built" drawings on separate USBs. Submit "as-built" sets of white prints and USBs to Consultant.

- .5 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Consultant.
- .6 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with Consultant.
- .7 Prepare and submit for review with record drawings, a neat, clear, properly identified, "as-built" electrical distribution riser diagram record drawing (in AutoCAD format release version confirmed with Consultant) of entire electrical distribution system up to and including line side connections to panelboards. Building and room outlines are to reflect "as-built" outlines. Include in diagrams for feeder types and sizes, conduit sizes, breaker, switchboard and distribution panel sizes, etc. Submit sample version to Consultant for review and comments prior to final manufacturer. Size diagrams same size as issued full Size Drawings. Mount riser diagrams on 10 mm (3/8") thick foam core complete with mylar finish cover, and hardware suitable for wall mounting in main electrical room.
- .8 Include on single lines, panelboard locations identified by room numbers below panel. When specific identified location is not available, nearest available room number to be used followed by a (Δ) triangle to flag approximate location. Encircle various loads by Building Wings (where applicable) for ease of identification. Group lighting loads on panelboards on top of panel. Identify motor control centres and splitters similar to panelboards. Identify fuse sizing including existing equipment where there is no difficulty in obtaining information. Use these requirements for pricing, and review exact requirements with Consultant prior to commencing work.
- .9 Replace existing posted single line electrical distribution drawings with revised to reflect renovations and revisions to electrical distribution equipment. Drawings to be of type to match existing as confirmed with Owner. Supply electronic files of format confirmed with Owner and reviewed with Consultant for following:
 - .1 fire alarm system test report devices and addresses;
 - .2 network cabling system test report devices and labelling of each device and cable.

1.32 OPERATING AND MAINTENANCE MANUALS

- .1 For each item of equipment for which a shop drawing is required (except for simple equipment), supply minimum 3, project specific, indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Review exact quantity of manuals with Consultant. Consolidate each copy of data in an identified hard cover three "D" ring binder. Each binder to include:
 - .1 front cover: project name label; wording – "Electrical Systems Operating and Maintenance Manual"; and date;
 - .2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;
 - .3 equipment manufacturer's authorized contact person name, telephone number and company website;

- .4 Table of Contents sheet, and corresponding index tab sheets;
- .5 copy of each "REVIEWED" or clean, updated "REVIEWED AS NOTED" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "REVIEWED AS NOTED" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;
- .6 maintenance data as follows:
 - .1 operation and trouble-shooting instructions for each item of equipment and each system;
 - .2 schedules of tasks, frequency, tools required, and estimated task time;
 - .3 recommended maintenance practices and precautions including warnings of any maintenance practice that will damage or disfigure equipment/systems;
 - .4 complete parts lists with numbers.
- .7 performance data as follows:
 - .1 equipment and system start-up data sheets;
 - .2 equipment test reports;
 - .3 final verification and commissioning reports.
- .8 explanation of operating principles and sequences;
- .9 inspection certificates issued by regulatory authorities;
- .10 wiring and connection diagrams;
- .11 copies of additional and revised panelboard directories;
- .12 warranties;
- .13 items requested specifically in Section Articles.
- .2 Generally, binders are not to exceed 75 mm (3") thick and not to be more than 2/3 full.
- .3 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner's building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.
- .4 Before applying for a Certificate of Substantial Performance of the Work, assemble one draft copy of O & M Manual and submit to Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.

- .5 Provide 2 digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to Consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as reviewed with Consultant and enhanced with bookmarks and internal document links.

1.33 COMMISSIONING

- .1 Commissioning Agent is appointed by Owner to oversee commissioning activities of contract.
- .2 Interface, cooperate and coordinate with Commissioning Agent and attend commissioning meetings. Perform commissioning activities for aspects of work provided in Electrical Divisions and perform corrective work identified by Commissioning Agent.
- .3 Submit copies of submittals such as O&M manuals, shop drawings, schedules and test reports of systems and equipment to Commissioning Agent, prior to start of commissioning activity or as directed by Commissioning Agent.
- .4 Commissioning Agent may also be present for any testing/commissioning activities. Notify Commissioning Agent in advance of these activities.

1.34 WARRANTY

- .1 Unless otherwise specified in Divisions 00 and 01, warrant work to be in accordance with Contract Documents and free from defects for a period of 1 year from date of issue of a Certificate of Substantial Performance of the Work.
- .2 Where equipment includes extended warranty period, e.g., 5 years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner. Submit signed and dated copies of extended warranties to Consultant.
- .3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.
- .4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner's staff or agents is exempted.
- .5 Do not include Owner deductible amounts in warranties.
- .6 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner representatives. These site visits to occur:
 - .1 once during first month of building operation;
 - .2 once during third month of building operation;

- .3 once between fourth and tenth month in a season opposite to first and third month visits.

1.35 PROJECT CLOSE OUT SUBMITTALS

- .1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:
 - .1 Operating and Maintenance Manuals;
 - .2 as-built record drawings and associated data;
 - .3 extended warranties for equipment as specified;
 - .4 operating test certificates;
 - .5 final commissioning report;
 - .6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;
 - .7 other data or products specified.

1.36 INSTRUCTIONS TO OWNER

- .1 Refer to equipment and system operational and maintenance training requirements specified in Division 01.
- .2 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.
- .3 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner's choice), of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.
- .4 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
 - .1 Operational Requirements and Criteria: equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;
 - .2 Troubleshooting: diagnostic instructions, test and inspection procedures;
 - .3 Documentation: equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;
 - .4 Maintenance: inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;

- .5 Repairs: diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
- .5 Before instructing Owner's designated personnel, submit to Consultant for review preliminary copy of training manual and proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.
- .6 Obtain in writing from Consultant, list of Owner's representatives to receive instructions. Submit to Consultant prior to application for Certificate of Substantial Performance of the Work, complete list of systems for which instructions were given, stating for each system:
 - .1 date instructions were given to Owner's staff;
 - .2 duration of instruction;
 - .3 names of persons instructed;
 - .4 other parties present (manufacturer's representative, consultants, etc.).
- .7 Obtain signatures of Owner's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.
- .8 Submit to Consultant copy of electronic version of training materials loaded on USB flash drive. Include in operating and maintenance manuals submission.

1.37 FINAL INSPECTION

- .1 Submit to Consultant, written request for final inspection of systems. Include written certification that:
 - .1 deficiencies noted during job inspections have been completed;
 - .2 field quality control procedures have been completed;
 - .3 maintenance and operating data have been completed and submitted to, reviewed with Consultant and accepted by Owner;
 - .4 tags and nameplates are in place and equipment identifications have been completed;
 - .5 clean-up is complete;
 - .6 spare parts and replacement parts specified have been provided and acknowledged by Consultant;
 - .7 as-built and record drawings have been completed and submitted to and reviewed with Consultant and accepted by Owner;
 - .8 Owner's staff has been instructed in operation and maintenance of systems;
 - .9 commissioning procedures have been completed;

- .10 fire alarm verification has been 100% completed and Verification Certificate has been submitted to and accepted by Consultant.

.2

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

NOT USED

END OF SECTION

PART 1 - GENERAL

1.01 REFERENCE

- .1 Division 00 and Division 01 apply to and are a part of each Electrical Division Section.

1.02 APPLICATION

- .1 This Section specifies products, criteria and characteristics, and methods and execution that are common to one or more Sections of Electrical Divisions. It is intended as a supplement to each Section of Electrical Divisions and is to be read accordingly.

1.03 SUBMITTALS

- .1 Submit shop drawings for products of this Section.
- .2 Additionally as part of shop drawing submission process, submit following to Consultant for review:
 - .1 sample of each proposed type of access door if supplied under work of this Division, as well as electronic copies of reflected ceiling plan drawings and wall elevation drawings showing proposed access door locations;
 - .2 dimensioned location drawings indicating required sleeves and formed openings in structural poured concrete or precast concrete construction or in roofing, and locations of cutting or drilling required for Electrical Divisions work;
 - .3 samples of materials and any other items as specified in succeeding Sections of Electrical Divisions;
 - .4 weight loads of selected equipment (upon request);
 - .5 equipment nameplate and warning sign proposed nomenclature, print type, symbols, sizing and colours;
 - .6 fire stopping installation drawings with ULC certifications;
 - .7 copies of prior to start of construction approvals from local governing authorities having jurisdiction.
- .3 Prior to application for Substantial Performance of the Work, submit following to Consultant for review (note: funds will be withheld until each of following items have been completed and documented to satisfaction of Consultant):
 - .1 fire alarm system testing and verification report of each component of work; devices to be certified working and in proper order;
 - .2 final distribution system testing and arc flash study performed and documented to satisfaction of Consultant;
 - .3 structured network cabling system tested and verified to be operating and performing in accordance with specified standards.

1.04 PATIENT CARE AREAS

- .1 Comply with requirements for patient care areas (PCA) included in Work as required by Section 24 of OESC. Patient care areas are identified on drawings or in schedule appended to end of this Section. Confirm final PCA nomenclature with Consultant prior to start of Work.
- .2 Note that room and area names/numbers are based on information available at time of preparation of documents and such names/numbers may be revised in later documents or during construction of Work. In no way are patient care area classifications to be reduced due to name/number revisions. Be responsible for confirming exact classifications as per local governing electrical code requirements to suit final construction and any design changes made by Consultant.
- .3 Provide testing and verification of circuits and devices to confirm compliance with OESC.

1.05 HAZARDOUS MATERIALS

- .1 Hazardous materials and infectious materials are known to be present on site in existing buildings, including but not limited to following:
 - .1 aspergillus;
 - .2 mould;
 - .3 asbestos;
 - .4 PCBS;
 - .5 lead;
 - .6 mercury.
- .2 Division 01 identifies specific requirements and if such materials are present, include for costs to be educated and trained on special working conditions, to work in areas with hazardous materials including protective clothing, gear, tenting, enclosures, etc., and perform necessary partitioning/tenting/ventilation work to isolate areas and maintain disturbances of such materials to a minimum. Comply with infection control requirements and those of governing local Health and Welfare authority. An asbestos abatement report is available for review from Consultant. Unless otherwise noted, any abatement removal is responsibility of another Division of Work.
- .3 If proper abatement procedures are not followed, be responsible for bearing full cost of a full time qualified abatement inspector chosen by Owner. In areas where work is being done above or below an area being occupied, any slab penetrations into vertically adjacent occupied space are to utilize a proper enclosure in area of that work on that occupied floor. Be responsible for failure to comply with special requirements in working in areas of hazardous materials.
- .4 Include for company specializing in removal and disposal of materials containing PCB's to remove and dispose off-site luminaire ballasts containing PCB's. Check luminaires being deleted for ballasts containing PCB's. Disconnect and dispose off-site such ballasts. Only companies that are certified and comply with Ministry of Environment and Ministry of Transport regulations with regards to hazardous waste materials are to be used to perform this Work. Prior to start of Work, submit to Consultant a copy of PCB disposal certificate and identification of Ministry authorized and designated disposal site.

- .5 Fluorescent lamps being replaced and containing mercury are to be properly transported offsite and disposed of as per local governing Ministry guidelines.

1.06 PRODUCT REQUIREMENTS IN SPECIAL AREAS

- .1 Provide certain areas such as Mental Health Areas and children care areas with special provisions such that intended users of area are not exposed to or subject to hazards from supplied products. In non-climate controlled areas, supplied products are to be manufactured for use in such environments.
- .2 Provide tamper-proof and vandal/impact resistant receptacles, switches or any communication devices in Mental Health Areas. Such provisions include but are not limited to providing tamperproof screws, polycarbonate covers, or locating such controls out of these areas, as approved by Consultant.
- .3 Products in non-climate controlled areas are to include weatherproof provisions such as gasketed covers, corrosion resistant hardware, weatherproof finishes, etc. Devices to be manufactured to operate in extreme temperatures.
- .4 Products in public areas such as exterior areas and in parking areas are to also be vandal-proof and impact resistant.

PART 2 - PRODUCTS

2.01 CONDUITS

- .1 EMT (Thinwall), galvanized electrical metallic tubing to CSA C22.2 No. 83, complete with factory made bends where site bending is not possible and joints and terminations made with steel couplers and steel set screw type connectors with insulated throats, and concrete tight where required.
- .2 Galvanized steel flexible liquid tight metallic conduit to CSA C22.2 No. 56, complete with Ideal "Steel Tough" liquid-tight flexible conduit connectors at terminations.
- .3 Galvanized steel flexible metallic conduit to CSA C22.2 No. 56, complete with proper and suitable squeeze type connectors at terminations.
- .4 CSA approved and labelled, FT-4 rated, rigid plastic (PVC) conduit complete with site made heat gun bends on conduit to 50 mm (2") diameter, factory made elbows in conduit larger than 50 mm (2") diameter, solvent weld joints, factory made expansion joints where required, and terminations made with proper and suitable connectors and adaptors.

2.02 OUTLET BOXES

- .1 CSA approved stamped galvanized steel outlet boxes.
- .2 CSA certified rigid plastic (PVC) outlet boxes.
- .3 Standard general purpose service floor boxes: CSA approved, UL scrub water compliant, fully adjustable angular and vertically, formed steel/cast iron, round single gang / rectangular or square multi-gang as required, flush in concrete floor installation, boxes complete with conduit knockout openings, adjustable collars, hinged flip open brass covers with provisions for mounting of duplex power receptacles, telephone jacks and data jacks. Provide barriered boxes when boxes

contain both power and communication outlets and different voltage levels. Size boxes to suit thickness of floor slab as confirmed with Consultant and also to suit required bending radii of conductors. Refer to drawings for number of gang requirements. Acceptable manufacturers are Hubbell, Legrand and Thomas & Betts. Special floor boxes are specified elsewhere in another Section.

- .4 Each outlet box and back box to be suitable in respects for application and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers, carpet flanges and any other required accessory.
- .5 Electrical boxes exposed exterior of building or in non-climate controlled locations to be weatherproof boxes complete with gasketed covers/faceplates.

2.03 PULLBOXES AND JUNCTION BOXES

- .1 Galvanized or prime coat plated steel, suitable in respects for application and complete with screw-on or hinged covers as required, and connectors suitable for connected conduit.
- .2 Physical size of pullboxes to be as required by local governing electrical code to suit number and size of conduits and conductors.
- .3 Each box to be suitable in respects for application and complete with suitable securing lugs, connectors suitable for connected conduit, knockouts and, where necessary, suitable plaster rings, concrete rings, covers and any other required accessory.
- .4 Boxes exposed exterior of building or in non-climate controlled locations to be weatherproof boxes complete with gasketed covers.

2.04 SLEEVES

- .1 Galvanized steel sleeves as follows:
 - .1 No. 24 gauge with an integral flange at one (1) end to secure sleeve to formwork construction;
 - .2 Schedule 40 pipe;
- .2 Schedule 40 PVC sleeves.

2.05 FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Asbestos-free, elastomeric materials and intumescent materials, tested, listed and labelled by ULC in accordance with CAN/ULC S115, and CAN/ULC S101 for installation in ULC designated firestopping, and smoke seal systems to provide a positive fire, water and smoke seal and a fire resistance rating (flame, hose stream and temperature) no less than fire rating for surrounding construction.
- .2 Firestopping and smoke seal material system to be specifically ULC certified with designated reference number for its specific installation. As part of shop drawing submission, submit copies of firestopping drawings with ULC certificate and system number for each specific installation.

- .3 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with firestopping manufacturer's recommendations and ULC tested assembly. Coordinate material requirements with trades supplying abutting areas of materials.
- .4 Submit schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
- .5 Typically, for openings of up to 250 mm (10") in diameter, provide putty pad type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds.
- .6 Typically, for openings of greater than 250 mm (10") in diameter, and for rectangular openings, provide pillow type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" re-enterable, non-curing, mineral fibre core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.
- .7 For applications where fire rated firestopping cable pathway system is to be special structurally reinforced, reusable and require no or minimal alterations to firestop component when cables are either added or removed, provide Specified Technologies Inc. "EZ-PATH" device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill. Structure to be sturdy enough to stand up to constant modification and use, but maintain its ULC firestopping rating.
- .8 Supply products of a single manufacturer for use on work of this Division.
- .9 Installer to be manufacturer trained and certified on specific product. Submit copy of certificate with shop drawings.
- .10 Include for manufacturer's authorized representative to inspect and verify each installation and application. Submit test report signed and verified by system installer's authorized representative and manufacturer's representative.
- .11 Acceptable certification to also include certification by Underwriters Laboratories of Northbrook IL, using tests conforming to ULC-S115 and given cUL listing published by UL in their "Products Certified for Canada (cUL) Directory".
- .12 Acceptable manufacturers are:
 - .1 Specified Technologies Inc.;
 - .2 3M Canada Inc.;
 - .3 Tremco;
 - .4 A/D Fire Protection Systems;
 - .5 Nelson;
 - .6 Hilti Canada.

2.06 FASTENING AND SECURING HARDWARE

- .1 Concrete inserts - Crane Canada Ltd., No. 4-M for concrete work for single or double conduit, cable tray, etc., runs and equipment. Unistrut Ltd. multiple type inserts for runs of three (3) or more conduits etc., or where a grid support system is required.

- .2 Concrete fasteners – "WEJ-IT" anchors, lead cinch anchors and/or "STAR" or "PHILLIPS" self-drilling anchors.
- .3 Masonry inserts – "WEJ-IT" expansion shields and machine bolts or, for light loads, fibre or lead plugs and screws.
- .4 Drywall or plaster wall and/or ceiling fasteners – 2-wing spring toggles.
- .5 Structural steel - Crane Canada Ltd., beam clamps.
- .6 Metal framing channels – typical 40 mm (1-5/8") width but increased where required to suit application, galvanized steel channels complete with required fittings and ancillary hardware. Acceptable manufacturers of framing channels are:
 - .1 Unistrut;
 - .2 Thomas & Betts;
 - .3 Hilti;
 - .4 Eaton B-Line.
- .7 Acceptable manufacturers of fastening and securing hardware:
 - .1 Crane;
 - .2 Hilti;
 - .3 Thomas & Betts.
- .8 Metal "J" hooks or Panduit "J-Pro" cable support systems for communications system cabling in accessible ceiling spaces where conduit or cable tray is not being provided. Use of J-hooks is subject to approval from Owner and review with Consultant.
- .9 Velcro tie wraps for bundling and securing cables.

2.07 ACCESS DOORS

- .1 Coordinate consistency of look and finish of access doors on project with each Division of Work. Coordinate exact requirements with General Trades Contractor.
- .2 Access doors to be rust resistant steel door panels, with concealed hinges and positive locking and self-opening screwdriver operated lock. Wall type frame to be suitable for wall installation and have integral keys for plaster walls. Doors in tile wall to be stainless steel and in ceilings to be suitable for plaster covering with only frame joint showing. All other doors to be prime painted steel.
- .3 Size access door to suit the concealed work for which they are supplied, and wherever possible they are to be of standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.
- .4 Lay-in type tiles, properly marked, may serve as access panels. Coordinate marking of ceiling tiles with Consultant. Panels in glazed tile walls to be 12 gauge, 304 alloy stainless steel, No. 4 finish, with recessed frame secured with stainless steel counter-sunk flush head screws.
- .5 Panels in plaster surfaces to have dish-shaped door and welded metal lath, ready to take plaster. Provide a plastic grommet for door key access.

- .6 Other access doors to be welded 12 gauge steel, flush type with concealed hinges, lock and anchor straps, complete with factory prime coat. Submit to Consultant for review, details of non-standard door construction details.
- .7 Access doors in fire rated ceilings, walls, partitions, structures, etc., to be ULC listed and labelled and of a rating to maintain fire separation integrity.
- .8 Where access doors are located in surfaces where special finishes are required, they are to be of a recessed door type capable of accepting finish in which they are to be installed so as to maintain final building surface appearance throughout.
- .9 Acceptable manufacturers include Le Hage, SMS, Pedlar and Acudor.

2.08 IDENTIFICATION NAMEPLATES

- .1 Laminated plastic (Lamacoid) black-white-black with bevelled edges, stainless steel screws, and proper identification engraving. Each nameplate to be sized to suit equipment for which it is provided, and required wording. Confirm nomenclature with Consultant. Various colour configurations to be used to differentiate systems. Confirm exact colour scheme with Consultant and/or Owner.
- .2 Brother "P-Touch", portable electronic labelling system complete with self-adhesive, permanent printed labels with required nomenclature.

2.09 SYSTEM BACKBOARDS

- .1 FSC (Forest Stewardship Council), G1S (good one side) construction grade fir plywood, containing no added urea formaldehyde, flame retardant prime coat painted on exposed surfaces, minimum 20 mm (3/4") thick, as sized on drawings and with flame spread rating in accordance with local governing building code requirements.

2.10 MOTOR STARTER PANELS

- .1 Minimum No. 14 gauge sheet steel panels complete with steel angle reinforcing, framing and suitable splitter trough, fully primed and enamel painted, sized to accommodate starters required with spare space and capacity for at least two additional units.

2.11 SPRINKLER PROTECTION

- .1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:
 - .1 factory constructed by respective equipment manufacturers;
 - .2 constructed from non-combustible materials (sheet steel);
 - .3 enamel painted to match equipment;
 - .4 surfaces and edges filled/sanded smooth prior to painting;
 - .5 supported from equipment with structural steel rods/metal framing or other method reviewed with Consultant;

- .6 structural support finish painted to match shield.
- .2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.
- .3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketting and/or waterproof sealant to prevent water from entering enclosure.
- .4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.
- .5 Above requirements are additional minimum "sprinkler protection" standards for equipment specified as NEMA (EEMAC) 1, 2 or 12.
- .6 Obtain CSA approval where required by local governing authorities.

PART 3 - EXECUTION

3.01 GENERAL CONDUIT INSTALLATION REQUIREMENTS

- .1 Install conduit concealed in finished areas, and concealed to degree made possible by finishes in partially finished and unfinished areas. Conduit may be exposed in unfinished areas such as Electrical and Mechanical Rooms, unless otherwise noted on drawings or specified herein. Refer to and examine architectural drawings and room finish schedules to determine finished, partially finished or unfinished areas of building. Documents do not identify exact routing. Where shown, routing is diagrammatic, identifying general requirements of routing and locations. Include for necessary offsets, fittings, transformations and similar items required as a result of obstructions and other architectural or structural details not shown.
- .2 Where conduits are exposed, arrange them to avoid interference with other work, parallel to building lines and install as high as possible. Do not install conduits within 150 mm (6") of "hot" pipes or equipment unless conduits are associated with equipment. Independently run conduit to be supported from wall/ceiling structure, not from ceiling hangers, ductwork, piping, cable trays, formed steel decking, etc. Do not run conduits within 900 mm (3') of equipment access opening covers.
- .3 Where conduit is proposed to be embedded within structural concrete, obtain Owner's approval and review with Consultant (Structural Engineer). Install such conduit in compliance with requirements of latest edition of CSA Standard CAN3-A23.1, "Concrete Materials, and Methods of Concrete Construction". Confirm and review with Structural Consultant, proper installation practices and methods. In areas where Consultant has directed conduit not to be embedded in concrete, run conduits through beams via sleeved openings pre-coordinated and reviewed with General Contractor and by Consultant (Structural Engineer). Do not embed conduit runs in concrete slab of parking garage areas, unless approved by Owner and reviewed with Consultant.
- .4 So as not to impair required strength of structure, following criteria to be generally followed but which is to be reviewed and coordinated with Consultant prior to start of Work:

- .1 where conduits pass by a column, stay at least two times thickness of slab and drop away from column;
 - .2 where conduits terminate adjacent to a column or wall, bring conduit in toward column/wall as close to 90° to face of column as possible within two times thickness of slab and drop away from column;
 - .3 maximum size of conduit in structural slabs is 1/5 of solid portion of slab thickness;
 - .4 where more than two conduits are adjacent to each other, they are to be spaced greater of 3 diameters or 100 mm (4") apart;
 - .5 total of depth of conduits crossing over each other is to be less than one-third thickness of slab;
 - .6 place conduit in middle third of thickness of slab; do not lay conduit directly on reinforcing steel;
 - .7 do not run conduit adjacent to parallel reinforcing bars;
 - .8 do not run conduit longitudinally in beam without approval of Owner and review with Consultant; pass through beams at right angles to span of beam;
 - .9 where conduits pass through beams, maintain at least twice depth of beam separation away from supports;
 - .10 do not run conduits in slab beside a drop or beam within twice depth of slab from edge of drop or beam;
 - .11 do not run conduits through shear walls or columns without approval of Owner and review with Consultant;
 - .12 do not place conduit in structural elements in parking garage structures, water retaining structures or structures subjected to de-icing chemicals, without approval of Owner and review with Consultant.
- .5 For proposed use of conduit runs underground below slab include following provisions:
- .1 concrete encased ductbank with conduits of non-ferrous materials and sloped to drain properly into pit;
 - .2 proper drain pit;
 - .3 system to be a pull-in system;
 - .4 20% spare conduits (with minimum of at least 1);
 - .5 system proposal to consider and address any effects of magnetic fields.
- .6 For isolation rooms, seal conduits that penetrate through walls, floor, or ceilings with suitable elastomeric and intumescent materials around penetrating item and within any openings of item to ensure complete isolation of rooms. Such sealing materials are to be suitable for specific applications and maintain fire rating of

penetrated surface and not be of a hazardous material. Submit shop drawings of proposed materials.

- .7 Conduits are sized on drawings, but in absence of type and sizing, type and size to suit intended application in accordance with applicable local governing electrical code requirements. Sizes identified on drawings are minimum sizes and are not to be decreased unless approved by Owner and reviewed with Consultant.
- .8 Where receptacle type devices are located in existing floors and/or where feeds are required to furniture systems in open spaces, and where chasing of floor slab to run conduit is not acceptable to Owner after review with Consultant provide fire rated "poke-thru" assembly installed through floor and feed from conduit runs provided in ceiling space of floor below.

3.02 INSTALLATION OF CONDUIT

- .1 Provide conduit for conductors except armoured cable and copper sheathed mineral insulated conductors, and except where duct or similar raceway materials are provided.
- .2 Provide conduit as follows:
 - .1 for interior building surface mounted conductors greater than 600 V – rigid galvanized steel;
 - .2 for branch circuit conductors underground inside building, and underground outside building beneath concrete, asphalt, and similar paving material-rigid PVC;
 - .3 for short branch circuit connectors to motorized equipment and distribution transformers (minimum length 450 mm (18"), maximum length 600 mm (24") with 180° loop where possible) – galvanized steel flexible liquid-tight conduit;
 - .4 at points, where conductors cross building expansion joints – galvanized steel flexible conduit with no less than 600 mm (24") of extra curve;
 - .5 for branch circuit conductors in poured concrete slab – rigid PVC;
 - .6 for interior conduit above 50 mm (2") diameter containing distribution conductors or communication systems conductors (fire alarm, telephone etc.) (except as noted above) – EMT with separate insulated ground conductor;
 - .7 for conductors except as noted above or elsewhere in this Specification – EMT.
- .3 Run rigid conductors in rigid type conduits suitable for application. Do not use flexible conduit.
- .4 Secure conduit located in poured concrete work in place in a manner such that conduit will not float or move when concrete is poured. Adequately protect such conduit from damage prior to and during concrete pour, and from concrete and water penetration.
- .5 Review with Consultant prior to Start of Work, maximum allowable size of conduit for installation in poured concrete. Placement of reinforcing steel in structural concrete work will take precedence over placement of conduit. Spaced

- adequately multiple runs of conduit in poured concrete work, as reviewed with Consultant.
- .6 Install flexible polyethylene conduit in continuous lengths wherever possible and "snake" conduit in trench. Where joints are necessary, make same with nylon inserts and stainless steel gear type clamps. Terminate with rigid conduit threadless connectors. Grade bed to provide proper drainage of conduits.
 - .7 Support underground conduit on a well-tamped flat bed of earth, free from rocks or protrusions of any kind. Grade and slope bed to provide conduits and ducts with proper drainage. Coordinate with General Trades Contractor for provision of means to carry away drainage water. Obtain required approvals of work from local governing electrical utility and review with Consultant prior to back filling and covering. Provide pull cord in each duct run.
 - .8 Provide manufactured expansion joints in rigid PVC plastic conduit at spacing as recommended by conduit manufacturer.
 - .9 Provide a separate ground conductor in plastic conduits.
 - .10 Support and secure surface mounted and suspended single or double runs of metal conduit at support spacing in accordance with local governing electrical code requirements by means of galvanized pipe straps, conduit clips, ringbolt type hangers, or by other proper manufactured devices.
 - .11 Support multiple mixed size metal conduit runs with Unistrut Ltd., Electrovert Ltd. "CANTRUSS" or Burndy Ltd. "FLEXIBLE" conduit racks spaced to suit spacing requirements of smallest conduit in group.
 - .12 Unless otherwise noted, provide conduit fittings constructed of same materials as conduit and which are suitable in respects for application.
 - .13 Provide proper adaptors for joining conduits of different materials.
 - .14 Cut square and properly ream site cut conduit ends.
 - .15 Provide conduit as sized on drawings. Size conduit not sized on drawings in accordance with latest edition of local governing electrical code with consideration that sizes of branch circuit conductors indicated are minimum sizes and must be increased as required to suit length of run and voltage drop in accordance with voltage drop schedule found on drawings or at end of this section. Where conductor sizes are increased to suit voltage drop requirements, increase scheduled or specified conduit size to suit. Unless otherwise noted on drawings or required by local governing electrical code or specified elsewhere, conduit to be of minimum size 19 mm (3/4") diameter. Structured network cabling system conduit to be of minimum 26 mm (1") diameter, unless otherwise noted.
 - .16 Site made bends for conduit to maintain full conduit diameter with no kinking, and conduit finishes are not flake or crack when conduit is bent.
 - .17 Plug ends of roughed-in conduits which are exposed during construction with approved plugs.
 - .18 Ensure that conduit systems which are left empty for future wiring are clean, clear, capped and properly identified at each termination point. Provide end bushing and suitable fish wires in such conduits.

- .19 Provide empty conduits to ceiling spaces from flush mounted panelboards located below and/or near hung ceiling. Refer to drawing detail.

3.03 EXPANSION FACILITIES FOR CONDUIT CROSSING BUILDING EXPANSION JOINTS

- .1 Wherever concealed or surface mounted conduits cross building expansion joints, provide expansion facilities to permit free movement without imposing additional stress or loading upon support system, and to prevent excessive movement at joints and connections, in accordance with drawing details and local governing inspection approvals.

3.04 INSTALLATION OF OUTLET BOXES AND BACK BOXES

- .1 Provide an outlet box or back box for each luminaire, wiring device, telephone outlet, fire alarm system component, communications systems components, and each other such outlet.
- .2 Size boxes to accommodate exact supplied components and for bending radii of installed cables. Confirm requirements with respective system vendors.
- .3 Outlet boxes flush mounted in interior construction, surface mounted in concealed interior locations, and surface mounted in exposed interior locations where connecting conduit is EMT, to be stamped and galvanized steel outlet boxes unless otherwise noted.
- .4 Provide sealing around boxes in walls where insulation and vapour barrier is present or for walls of rooms that are sealed. Maintain sealing system of wall.
- .5 Outlet boxes in underground plastic conduit systems to be rigid PVC plastic outlet boxes, unless otherwise noted.
- .6 Outlet boxes for flush floor mounted devices to be concrete tight formed galvanized steel fully adjustable flush floor boxes. Locate in to position and install in accordance with manufacturer's instructions. Coordinate installation with trades pouring concrete floor slab or trade responsible for floor construction.
- .7 Provide barriered outlet box for switches connected to normal and emergency power and share a common faceplate.
- .8 Provide outlet boxes for special wiring devices, for special equipment and special applications. Refer to requirements specified in other Sections and/or on drawings.
- .9 Size and arrangement of outlet boxes to suit device which they serve.
- .10 Mounting heights and locations for outlet boxes are typically indicated on drawings, however confirm exact location and arrangement of outlets prior to roughing-in. Architectural drawings and Consultant's instructions have precedence over electrical drawing diagrammatic layouts and specified mounting heights and locations.
- .11 Do not install outlet or back boxes "back-to-back" in walls and partitions. Stagger such outlets and seal against noise transmission in accordance with drawing details. "Thru-wall" type boxes will not be permitted for any application.

- .12 Provide blank coverplates on existing obsolete boxes which are to remain in position.
- .13 Provide blank coverplates over boxes left empty for future installation of devices. Clearly identify each box as to its intended use, to Owner's approval and reviewed with Consultant. Generally, provide stainless steel type blank coverplates.

3.05 INSTALLATION OF PULLBOXES AND JUNCTION BOXES

- .1 Provide pullboxes in conduit systems wherever shown on drawings, and/or wherever necessary to facilitate conductor installations. Generally, conduit runs exceeding 30 m (100") in length, or with more than two - 90° bends, are to be equipped with a pullbox installed at a convenient and suitable intermediate accessible location.
- .2 Size boxes to accommodate exact supplied system and for bending radii of installed cables. Confirm requirements with respective system vendors.
- .3 Provide junction boxes wherever required and/or indicated on drawings and as required by local governing electrical code.
- .4 Provide sealing around boxes in walls where insulation and vapour barrier is present or for walls of rooms that are sealed. Maintain sealing system of wall.
- .5 Boxes in rigid conduit and EMT inside building to be stamped galvanized or prime coated steel.
- .6 Boxes in exterior rigid conduit and boxes in perimeter wall where insulation and vapour barrier is present, to be "Condulet" cast gasketed boxes, unless otherwise noted.
- .7 Boxes in plastic conduit to be rigid PVC plastic boxes complete with required couplings.
- .8 Pullboxes and junction boxes to be accessible after work is completed.
- .9 Accurately locate and identify concealed pullboxes and junction boxes on "As-built" record drawings.
- .10 Clearly identify main pull or junction boxes (excluding obvious outlet boxes) by painting outside of covers. Spray painting is not permitted unless approved by Owner and reviewed with Consultant. Paint colours to be in accordance with following schedule:
 - .1 lighting-yellow;
 - .2 normal power-blue;
 - .3 essential power-orange;
 - .4 fire alarm-red;
 - .5 telephone-green;
 - .6 miscellaneous signals-brown.

- .11 In addition to painting miscellaneous signal boxes, clearly identify specific system in which box is installed.
- .12 Cover boxes in fire walls with aluminium tape and seal with caulking.

3.06 INSTALLATION OF SLEEVES

- .1 Where conduits, round ducts and conductors pass through structural poured concrete, provide sleeves of type suitable for application, and approved by local governing codes.
- .2 Sleeves in concrete slabs, except as noted below, are to be No. 24 gauge or equivalent, with an integral flange to secure sleeves for formwork construction.
- .3 Sleeves in waterproof concrete slabs and in other slabs where waterproof sleeves are required are to be lengths of Schedule 40 pipe sized to extend 100 mm (4") above floor.
- .4 Sleeves in poured concrete walls and foundation are to be Schedule 40 pipe.
- .5 Size sleeves, unless otherwise noted, to leave 13 mm (1/2") clearance around conduit, duct, conductor, etc. Void between sleeves and conduit, duct, conductors, etc., to be packed and sealed for length of sleeves as in accordance with article entitled "Firestopping and Smoke Seal Materials" specified here in this Section. Ensure that sleeves set in exterior walls are packed and sealed with governing authority approved materials suitable for application and that both ends of sleeves are packed watertight with approved permanently flexible and water tight materials. Exact responsibility of work to be coordinated with General Trades Contractor.
- .6 Submit to concrete reinforcement detailer at proper time, drawings indicating required sleeves, recesses and formed openings in poured concrete work. Completely and accurately dimension such drawings and relate sleeves, recesses and formed openings to suitable grid lines and elevation datum.
- .7 Supply sleeves of a water protecting type in accordance with detail found on drawings for installation in following locations:
 - .1 in Mechanical and Fan Room floor slabs, except where on grade;
 - .2 in slabs over Mechanical, Fan, Electrical and Telephone Equipment Rooms or closets;
 - .3 in floors equipped with waterproof membranes.
- .8 "Gang" type sleeving to be permitted only with approval of Owner and reviewed with Consultant.
- .9 Terminate sleeves for work which is exposed, so that sleeve is flush at both ends with wall, partition, or slab surface such that sleeve may be covered completely by escutcheon plates.

3.07 INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Where work penetrates or punctures fire rated construction, provide ULC certified, listed and labelled firestopping and smoke sealing packing material systems to

seal openings and voids around and within raceway and to ensure that continuity and integrity of fire separation is maintained. Openings not in immediate vicinity of working areas are to be firestopped and sealed same day as being opened.

- .2 Install firestopping and smoke seal materials for each installation in strict accordance with specific ULC certification number and manufacturer's instructions. Comply with local governing building code requirements and obtain approvals from local building inspection department. Ensure that openings through fire separations do not exceed maximum size wall opening, and maximum and minimum dimensions indicated in ULC Guide No. 40 U19 for Service Penetration Assemblies and firestopping materials.
- .3 Ensure that continuity and integrity of fire separation is maintained and conform to requirements of latest edition of ULC publication "List of Equipment and Materials, Volume II, Building Construction".
- .4 Comply with following requirements:
 - .1 Examine substrates, openings, voids, adjoining construction and conditions under which firestop and smoke seal system is to be installed. Confirm compatibility of surfaces.
 - .2 Verify penetrating items are securely fixed and properly located with proper space allowance between penetrations and surfaces of openings.
 - .3 Report any unsuitable or unsatisfactory conditions to Consultant in writing, prior to commencement of work. Commencement of work will mean acceptance of conditions and surfaces.
 - .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces. Remove stains on adjacent surfaces.
 - .5 Prime substrates in accordance with product manufacturer's written instructions.
 - .6 Provide temporary forming as required and remove only after materials have gained sufficient strength and after initial curing.
 - .7 Tool or trowel exposed surfaces to a neat, smooth, and consistent finish.
 - .8 Remove excess compound promptly as work progresses and upon completion.
- .5 Notify Consultant when work is complete and ready for inspection, and prior to concealing or enclosing firestopping and smoke seal materials and service penetration assemblies. Arrange for final inspection of work by local governing authority inspector prior to concealing or enclosing work. Make any corrections required.
- .6 On completion of firestopping and smoke sealing installation, submit a Letter of Assurance to Consultant certifying the firestopping and smoke sealing installation has been carried out throughout the building to service penetrations and that installation has been performed in strict accordance with requirements of local governing building code, any applicable local municipal codes, ULC requirements, and manufacturer's instructions.

- .7 Manufacturer's authorized representative to inspect and verify each installation and provide a test report signed by installing trade and manufacturer's representative. Test report to list each installation and respective ULC certification and number.
- .8 Where work requires removal of existing firestopping materials and replacement of firestopping materials after cabling changes have been made, ensure that replacement material is same material and manufacturer of existing if any remains in place, or ensure that all existing material is removed before installation of replacement material.

3.08 INSTALLATION OF FASTENING AND SECURING HARDWARE

- .1 Provide fasteners and similar hardware required for conduit, duct, raceway, conductors, etc. and for equipment hanger and/or support material unless otherwise noted.
- .2 Accurately and properly set concrete inserts in concrete framework. Where multiple type inserts are used, space same to suit requirements of smallest conduit, etc., in group.
- .3 Fasten hanger and support provisions to masonry with expansion shields and machine bolts, or, for light loads, use plugs, and screws.
- .4 In drywall or plaster walls and/or ceilings use two wing toggles and for heavy loads, provide steel anchor plates with two or more toggles to spread load.
- .5 Provide beam clamps for attaching hanging and/or support provisions to structural steel, or where approved by Owner and reviewed with Consultant, weld hanging and support provisions to structural steel.
- .6 Explosive powder actuated fasteners are not permitted unless specific approval for their use and type has been obtained from Owner and reviewed with Consultant.
- .7 Under no circumstances use ceiling suspension hangers or grids for suspension of conduit and conductors. Install supports to permanent structure of building, limited to areas that will not damage structural stability.
- .8 Provide "J" hooks in accessible ceiling spaces where conduit is not provided for structured cabling runs or other telecommunication cabling, as approved by Owner and reviewed with Consultant.
- .9 Comply with J-hook manufacturer's loading limitations and spacing criteria. Do not exceed 1.2 m (4') spacing interval. Add additional J-hooks if cabling sags, at discretion of Consultant. Drill anchors for J-hooks into slab not into post tensioned beams. Do not install more than one system on each J-hook.
- .10 Install Velcro tie wraps on bundled telecommunication cables and do not over tighten. Provide FT6/CMP rated wraps in plenum type spaces as per local building code requirements.
- .11 Comply with Consultant's (Structural Engineer's) limitations for maximum penetrations of securing hardware into concrete slabs.

3.09 SUPPLY OF ACCESS DOORS

- .1 Supply access doors to give access to junction boxes, pull boxes, conductor joints and other similar electrical work which may need maintenance or repair but which is concealed in inaccessible construction.
- .2 Before commencing installation of work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange electrical work to suit.
- .3 Access doors to be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.
- .4 Wherever possible, access doors to be of a standard size for each application. Confirm exact dimensions and minimum size restrictions with Consultant prior to ordering.
- .5 Coordinate with Mechanical Contractor and General Trades Contractor to ensure that access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and that work involving both mechanical and electrical services should where possible be accessible from common access door. Coordinate work to ensure that common location access doors are not supplied by both Mechanical Divisions and Electrical Divisions.

3.10 INSTALLATION OF IDENTIFICATION NAMEPLATES

- .1 For each piece of electrical distribution equipment from electrical source of supply up to and including panelboards, for special control panels and cabinets, and for each other piece of electrical equipment, provide engraved Lamacoid identification nameplates secured to apparatus with stainless steel screws. Nameplates to indicate source of electrical supply and include Consultant's equipment identification number. Identify whether equipment is on "NORMAL POWER SYSTEM" or "ESSENTIAL POWER SYSTEM". Comply with CSA Z32 requirements.
- .2 Equip large multiple cell or component apparatus such as switchboards and distribution panels with main nameplates identifying equipment, voltage characteristics, capacity and source of supply, and with sub-nameplates clearly identifying each cell or component and its service.
- .3 Panelboard nameplates to identify panelboard number as designated on drawings, unless otherwise instructed. Nameplates for disconnect switches, control panels, and cabinets to outline their service and source of supply.
- .4 In areas where equipment having removable doors that can be commonly installed on different equipment, ensure that each door is identified to which piece of equipment it is associated with, such that nameplates are with correct equipment.
- .5 Provide nameplates engraved "Dedicated Circuit" on faceplates for receptacles on dedicated circuits in Critical and Intermediate Patient Care Areas. Provide nameplates engraved "Housekeeping" for Housekeeping receptacles generally located in Corridors with exact extent to be determined on site. In these areas

- where lamacoid nameplates are employed, engrave source of supply (circuit designation) on these nameplates as well.
- .6 Faceplates for devices not in patient care areas or not in corridors in vicinity of patient care areas are to be labelled with plastic self-adhesive printed labels with similar information as specified for nameplates. Provide labels on inside and outside face of faceplates. Apply a layer of a clear coat finish over each label.
- .7 Panelboard identification is to be arranged as follows: "WING-C-LP-A-1" where:
- .1 "WING" denotes building wing;
 - .2 "C" denotes floor of wing;
 - .3 "LP" denotes panelboard type;
 - .4 "A" denotes panelboard number;
 - .5 "1" denotes a sub-fed panelboard of same number.
- .8 Building wings for panelboard identifications to be confirmed with Consultant prior to start of work.
- .9 Building floors for panelboard identifications to be indicated as follows:
- .1 "B" or "C" denotes Basement or Concourse where applicable to match installation;
 - .2 "G" denotes Ground Floor;
 - .3 1 to 10 denotes Floors 1 through 10.
- .10 Panelboard types are to indicate service as follows:
- .1 "DP" denotes "Distribution Panel" that feeds various branch circuit panels and larger loads;
 - .2 "LP" denotes "Lighting Panel" for lighting and general receptacle loads;
 - .3 "PP" denotes "Power Panel" for multiple loads within a specific area such as a shop;
 - .4 "VP" denotes "Vital Panel" for designated Critical Patient Care Area loads;
 - .5 "KP" denotes "Kitchen Panel" for equipment loads within kitchen.
- .11 Where panelboards are supplied from Emergency Power, panelboard type to be preceded by letter "E", i.e. "EDP", "ELP", "EPP", "EKP", etc.
- .12 Nameplates to be mechanically secured lamacoid and be colour coded as follows:
- .1 Normal Power Black with white letters;
 - .2 Emergency Power Red with white letters;
 - .3 Isolated Power Red with white letters;
 - .4 Vital Power Yellow with white letters;
 - .5 UPS Power Orange with white letters.
- .13 Above identification nameplate and nomenclature requirements are for typical requirements for pricing only.
- .14 In pull boxes, junction boxes and at terminations, identify feeders by use of plastic plates indicating system voltage and circuit designations. Plates to be 25 mm (1") in diameter and have letter stamped 9 mm (5/8") high. Colour coding to be:
- .1 Phase A – red;

- .2 Phase B – black;
- .3 Phase C – blue;
- .4 Neutral – white;
- .5 Ground - green.

- .15 Confirm print size type and size, colours, sizing and nomenclature of nameplates with Consultant prior to ordering. Submit sample board.

3.11 INSTALLATION OF TERMINAL BACKBOARDS

- .1 Provide specified terminal backboards for communication systems and electrical distribution equipment.
- .2 Securely wall mount each backboard with proper fasteners to suit wall construction.
- .3 Unless otherwise noted, size backboards to sufficiently provide adequate terminal space for each system, plus 20% space for future additions.

3.12 INSTALLATION OF WARNING SIGNS

- .1 Provide warning signs as applicable for following:
 - .1 on doors into transformer vaults;
 - .2 on doors into high voltage switchgear rooms;
 - .3 on doors to genset room;
 - .4 on doors into main electrical rooms;
 - .5 for other applications as noted.
- .2 Secure signs to equipment with stainless steel screws. Number of signs required and sign wording, symbols, and colours to be approved by Owner and reviewed with Consultant, and local electrical utility, where applicable.

3.13 BRANCH CIRCUIT BALANCING

- .1 Connect branch lighting and power circuits to panelboards so as to balance actual loads (wattage) within 5%. If required, transpose branch circuits when work is complete to meet this requirement.
- .2 At request of Consultant, perform necessary tests to show compliance with above requirement. Make such tests after building is occupied.

3.14 DISCONNECTION, REMOVAL AND RELOCATION WORK

- .1 Where indicated on drawings or where required to perform Work of this Project, disconnect and remove items of existing obsolete electrical work. Relocate required devices as required to accommodate work of other Divisions. Where luminaires, switches, receptacles, and other devices and/or equipment is removed, disconnect at point of electrical supply, remove obsolete wiring and conduit up to source, unless otherwise noted, and make system safe to Owner's satisfaction and as reviewed with Consultant. Remove obsolete conduit/raceways in accessible ceiling spaces, exposed locations, etc. Where existing obsolete conduit and similar raceway material cannot be removed, such as embedded in concrete, cut back and cap obsolete conduit and raceways. Refer to specific notes on drawings.

- .2 When respective work is deleted, such deletions are to in no way affect operation of any existing interconnected mechanical or electrical components that remain. When existing circuits are being disconnected, maintain supervision of area to ensure that such circuits do not affect essential existing circuits being retained.
- .3 Refer to architectural drawings which define extent of areas being demolished in existing building. Review drawings and site and include for demolition and/or renovation of services as required to accommodate alterations detailed.
- .4 Unless otherwise noted, obsolete materials which are removed and are not to be relocated or reused are to become your property. Remove from site and properly dispose. Obtain from Owner and review with Consultant, a list of existing electrical items which are to be removed and turned over to Owner. Said items are to remain property of Owner.
- .5 Where existing services pass through or are in an area to serve items which are to remain, or pass through areas that are to be deleted, maintain services, but re-route as required. Include for rerouting existing services concealed behind existing finishes and which become exposed during renovation work, so as to be concealed behind new or existing finishes. Confirm with Owner services which are to be kept in service and operational.
- .6 Revise panelboard directories accordingly, if affected by any renovation, disconnection, or removal of work. Use Owner's actual room names/numbers.
- .7 Protect existing devices being relocated or deleted to ensure that they are not damaged. Test such devices prior to disconnection and de-energization, to ensure that each device is in proper working condition. Ensure that motors are in proper rotation direction. Examine each device for damage. Report devices not working or with damage to Consultant prior to initiating any work. It will be assumed that devices are in proper working order and good condition if not reported.
- .8 Provide junction boxes, outlet boxes, wiring, plates, etc., as necessary for complete relocation of devices. Clean relocated or temporary removed devices and equipment, and ensure that they are in good operating condition before being reinstalled. Where existing luminaires are relocated, clean luminaires and inspect for damage. Relamp relocated luminaires. Report defects or damages to Consultant. Do not splice conductors unless approved by Owner and reviewed with Consultant. Utilize junction boxes and terminal devices for proper extension of circuits where approved. Otherwise replace circuits with home run continuous run of suitable lengths.
- .9 Provide blank coverplates on existing obsolete boxes which are to remain in position.
- .10 After installation is complete, test parts of re-used or relocated electrical equipment and correct faults and grounds. Include for fire alarm verification company to verify any relocated devices and downstream affected devices, and verify system as required by local fire authority to suit actual relocation work. For other existing systems, engage manufacturers authorized representative or Owner's system maintenance contractor, to inspect and verify relocated devices. Review exact requirements with Owner and Consultant. Document testing in test reports, signed by testing technician. Submit copies to Consultant.
- .11 Interior, exterior or underground electrical services (including auxiliary services, telephone, fire alarm, P.A. System, etc.) to operating parts of building are not to

be hampered under any conditions and to that effect, necessary work may have to be carried out on an overtime basis, at no additional cost to this project. Existing risers are to be maintained in service as required to feed other areas of building(s). Do not interrupt any services without prior written approval by Owner and review with Consultant. Submit formal requests to Consultant outlining in detail requirements of proposal and wait for instructions from Consultant.

- .12 Be present when new doors or openings are being cut into existing walls and ceilings. Should any damage occur to electrical system, restore system to a safe and sound condition.
- .13 Where references are made on drawings that existing receptacles, etc., be extended and/or relocated to suit new construction, receptacles, etc., are to be tested and if found defective, be replaced with new devices. Cracked or broken cover plates are to be replaced and match Architectural finishes. Contractor may optionally replace existing basic receptacles, switches, and faceplates with devices matching existing devices.
- .14 Be responsible for disconnecting power supply to branch circuits controlling lighting, receptacles, panels, mechanical equipment, etc., for safe removal of equipment, conduit, wiring, boxes, etc., affected by demolition.
- .15 Close openings in boxes, panels, etc., that result from removal of equipment, conduit, wiring, fixtures, etc. Close openings in a proper manner and properly terminate and insulate cables to restore system to a safe operating condition, to Consultant's satisfaction.
- .16 Be present and supervise removal of electrical equipment, P.A. speakers, etc., during demolition of ceilings, walls, floors, etc. Existing equipment which is not to be relocated but interferes with demolition, are to be temporarily relocated until demolition work is completed. Services to temporarily relocated equipment are to be maintained at all times.
- .17 Remove and re-install existing ceiling tiles as required to perform work. Prior to removal, inspect tiles for damage and report any to Owner and Consultant. Any loose cabling is to be secured, and luminaires additionally supported with cables secured to ceiling slab. After work has been completed and successfully inspected, re-install ceiling tiles to existing standards and re-install devices. Be responsible for replacement of tiles and grid members damaged during work of Electrical Division. Comply with applicable governing authority requirements with regards to ceiling work in special areas.
- .18 Where existing surfaces are damaged by Electrical Divisions work and/or where existing devices are removed from wall, ceilings, floors and other surfaces, and such deleted devices are not being replaced in same locations, patch locations of these removed devices and re-finish. Patching and finishing is to be provided by tradesmen skilled in particular trade or application worked on, to Owner's approval and review with Consultant. Where openings are left in existing ceiling tiles, replace ceiling tiles with new matching tiles approved by Owner and reviewed with Consultant. Unless otherwise included for in other Divisions, include for:
 - .1 preparing existing surfaces to be filled and repainted to be cleaned as required to remove dirt, dust, oil, grease, loose paint, rust and any other foreign matter which would prevent proper bonding of new finish; sand glossy surfaces to uniform dull texture;

- .2 filling in and patching surfaces with same material as existing surfaces; finished surfaces to match and line with existing adjoining surfaces;
 - .3 providing fire stopping materials to maintain fire rating of the existing surfaces; refer to specification article entitled - Firestopping and Smoke Seal Materials.
 - .4 using paint rollers and/or brushes to apply and extend paint finish over full height and/or width of area affected, to a straight line in location reviewed with Consultant;
 - .5 applying sufficient number of coats such that patched area is indistinguishable to surrounding area;
 - .6 materials used to be of equivalent quality to existing finishes standards and be compatible with finishes to which they are applied;
 - .7 finishes to be approved by Owner and reviewed with Consultant.
- .19 Check luminaires to be deleted for PCB ballasts. Disconnect and remove such ballasts. As specified previously, include for company specialized in such hazardous materials to remove and dispose such materials off-site in compliance with Ministry of Environment, Ministry of Transport and any other governing authority regulations.
- .20 If at any time during course of building work, asbestos containing materials are encountered or suspected, cease work in area in question and immediately notify Consultant. Comply with local governing authority regulations. Do not resume work in affected area without approval from Owner and review with Consultant.

3.15 INTERRUPTIONS TO AND SHUT-DOWNS OF SERVICES AND SYSTEMS

- .1 Shutdowns and interruptions to existing systems and services are to be coordinated fully with and performed at times acceptable to Owner and reviewed with Consultant. Generally, shutdown may be performed only between hours of 12:00 midnight Sunday until 6:00 a.m. Monday morning. Include for costs of premium time to perform work during nights, weekends or other times outside of normal working hours, which may be necessary to comply with stipulations specified herein this Article. Services for operation of existing non-renovated areas of building are to be maintained.
- .2 Upon award of contract, submit to Consultant for review and approval, a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform Consultant and Owner in writing minimum 5 working days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut down or interrupt any system or service without written consent. Note that shutdowns of some essential services may require additional advance notification time.
- .4 Work associated with shut-downs and interruptions are to be carried out as continuous operations to minimize shut-down time and to reinstate systems as soon as possible. Prior to any shut-down, ensure that materials and labour required to complete work for which shut-down is required are available at site.

- .5 Review with Consultant if any conductor/feeder is designated for special considerations and if designated as such and is to be interrupted, ensure that at least following preparations are met:
 - .1 provide a schedule of proposed feeders to be interrupted; propose one feeder at a time to be worked on per scheduled shutdown;
 - .2 provide a method of procedure for work;
 - .3 prepare above documentation and submit for review by Consultant at least fifteen working days prior to date of each proposed work;
 - .4 on day/night of proposed feeder work, advise Consultant of which feeder is to be worked on; review with Consultant requirements for witnessing work;
 - .5 de-energize feeders and perform work as per Consultant and Owner reviewed schedule;
 - .6 after feeders are re-routed, megger test each feeder.
- .6 Where working in close proximity to "live parts" or inside energized panels or energized cubicles of switchboards/substations, provide protection "boots" over bussing and insulating mats to cover areas of exposed live parts.

3.16 EQUIPMENT BASES AND SUPPORTS

- .1 Provide equipment bases and supports. Coordinate concrete pour for housekeeping pads and luminaire poles bases with Division 03. Ensure that applicable seismic restraint provisions are provided as per local governing building code.
- .2 Secure floor mounted equipment in place on minimum 100 mm (4") high concrete housekeeping pads, minimum 100 mm (4") wider and longer than equipment base dimensions.
- .3 Supply dimensioned drawings, templates, and anchor bolts for proper setting of equipment on bases and pads. Be responsible for required levelling, alignment, and grouting of equipment.
- .4 Submit to Consultant for review, dimensioned shop drawings of structurally designed bases for support of large, heavy equipment. Indicate on shop drawings total weight of base, reinforcement, and equipment for which it is required.
- .5 Perform work within formwork contractor's schedule. Failure to meet formwork schedule will result in Electrical Division Contractor being responsible for providing concrete work including formwork and reinforcing steel, to standards of Division 03.
- .6 Unless otherwise noted, support equipment suspended above floor level with suitable welded or bolted prime coat painted structural steel angles or channels bracketed to wall or secured by hanger rods.

3.17 CONCRETE WORK

- .1 Unless otherwise noted, concrete required for electrical work is to be provided as part of Work of Division 03. Coordinated exact requirements (sizes, locations) with General Trades Contractor.
- .2 Layout, mark, coordinate and work with Division 03 contractor as required for installation of concrete necessary for duct banks, housekeeping pads, cubed openings, etc.

3.18 EXCAVATION AND BACKFILL

- .1 Unless otherwise noted, excavation and backfill work required for electrical work is to be done as part of work of Division 02 or 31, except for final hand grading work and backfill to 450 mm (18") above service which is to be done as part of electrical work. Mark out location and routing of excavation required for work as well as required depth. Ensure that bedding is graded to provide proper drainage for ducts as reviewed with Consultant.
- .2 Inverts and locations of existing site services may have been site surveyed and approximate location may be shown on drawings. Confirm that local utilities have performed locates and marking out. Ensure inverts and locations are correct, prior to commencement of work. Where discrepancies are found, immediately inform Consultant, and await direction.
- .3 Ensure that work is inspected by Consultant before covering and backfilling. Failure to do so prior to backfilling will require re-excavating work and re-backfill at no additional cost to Owner.

3.19 CUTTING, PATCHING AND CORE DRILLING

- .1 Unless otherwise noted, General Trades Contractors are responsible for cutting, patching, and core drilling of existing building required for installation of Work.
- .2 Where added conduits and/or conductors penetrate existing construction, identify, and mark out locations for openings. Size openings to leave 13 mm (1/2") clearance around conduit and/or conductors. Coordinate work with General Trades Contractor.
- .3 Ensure that openings in fire rated construction are sealed as per requirements of article entitled "Firestopping And Smoke Seal Materials" specified herein this Section and as per Division 07, as applicable.
- .4 Fire stop and seal openings as specified, and patch as required before end of workday. No openings are to be left open overnight unless approved by Owner and reviewed with Consultant.

3.20 FINISH PAINTING OF ELECTRICAL WORK

- .1 Unless otherwise noted, finish painting of exposed Electrical Divisions work is to be performed as part of work of Division 09.
- .2 Provide identification painting for electrical distribution equipment in accordance with application requirements of Division 09. Review exact finish colours with Consultant. Equipment requiring special colour identification painting to include but not be limited to following:

- .1 pull boxes and junction boxes;
 - .2 communication system conduit;
 - .3 genset exhaust piping.
- .3 Spray painting is not permitted unless approved in writing by Owner and reviewed with Consultant.

3.21 PROVISIONS FOR FURNITURE SYSTEMS

- .1 Ensure that rough-in for electrical devices including but not limited to outlets, switches, thermostats, control devices, fire alarm devices and clocks and communications devices are located to avoid wall mounted systems furniture wall strips. Relocate conduit and devices which do not coordinate with systems furniture requirements identified on systems furniture drawings.
- .2 Coordinate location of electrical conduits/ducts within floor slabs and mounted to underside of floor slabs, with location of free standing work stations and furniture systems.
- .3 Coordinate connection of electrical and communication devices with systems furniture supplier. Generally, supply and installation of power, data and communication wiring and devices are by Electrical Division. Furniture system connection "whips" to be supplied by furniture system vendor and turned over to Electrical Division for installation. Confirm responsibility of supply of whip with General Trades Contractor. Power conductors are to be installed to a wall/ceiling mounted junction box and extended out to furniture system, through empty conduit, raceways, and back boxes provided within furniture system. Branch circuit conductors in furniture system raceways may be AC-90 flexible armoured conductors. Telecommunication (data/voice) conductors are to be complete home runs from LAN closet to work station outlet. Testing and verification of furniture system devices is responsibility Electrical Division. Confirm exact requirements with furniture system trades. Where furniture systems are not supplied with pre-wired devices, be responsible for supply, installation and wiring of required devices.

3.22 CONDUIT PROVISIONS FOR MISCELLANEOUS SYSTEMS

- .1 Provide following components to accommodate future installation of various miscellaneous systems by system installers who are to provide equipment and wiring:
 - .1 conduit - diameters as sized on drawings with non-metallic fish wires or pull cords and suitable bushings for conduit terminations, and as specified in Part 2; provide labelling at each end to clearly identify each conduit run with respect to system and path;
 - .2 outlet boxes - standard galvanized steel, each complete with a blank type faceplate, and as specified in Part 2;
 - .3 pull boxes, junction boxes, back boxes and sleeves - and as specified in Part 2.
- .2 Miscellaneous systems are typically as shown on drawings. Unless otherwise noted on drawings, provide dedicated conduit runs for each system. Coordinate sizes of boxes with respective system vendors to ensure proper sizing to

accommodate components and that allows for wiring bending radii. Confirm conduit and box requirements also with system vendors.

- .3 Provide pullboxes in conduit runs longer than 30 m (100') or having more than two -90 bends. Size pullboxes to be at least 8 times entering conduit in length. Pullbox sizes to comply with respective system standards.
- .4 Leave conduits free and clear of all obstructions and terminate as required. Equip terminations with bushing, and clearly identify each run. Provide fish wires in all empty conduits. Run telecommunications conduits to comply with separation from sources of electromagnetic radiation as per standard ANSI/TIA/EIA-569. Site bend telecommunications conduit elbows to comply with system conduit bending radii requirements.
- .5 Review exact requirements and locations of equipment with Consultant and respective system installers prior to roughing-in.
- .6 Refer to system riser diagrams on drawings.
- .7 Quantities for outlets to be as per floor plan drawings and not riser diagrams.

3.23 DOOR HARDWARE

- .1 Generally, Division 08 or another Division not under scope of Electrical Contractor, is responsible for supply and installation of door alarm contacts, door holders, electric strikes, electromagnetic locks, door operator controls, power supplies, door controllers, central electromagnetic lock release controller and other door hardware. Coordinate and confirm with General Trades Contractor and respective equipment vendors (door hardware / security) exact responsibility of each Division of the Work.
- .2 Confirm product and wiring requirements, back box requirements and wiring installation requirements with door hardware trades and with equipment vendors. Provide required wiring in conduit from each device to respective controllers, between each device, and to central control panel and for power connection to such controls and devices. Provide line level voltage power feeds to equipment as required.
- .3 For controls and interconnections between devices, when such device terminations are responsibility of others, supply and run interconnecting wiring in conduit to devices and allow spare length of 1.8 m (6') coiled wiring at each end for final termination to devices by others.
- .4 For applications of electro- magnetically held closed doors, engage fire alarm system vendor to provide fire alarm type pull station with auxiliary contacts as required for interconnection of electro- magnetic door hardware and fire alarm system for release of doors. Provide required wiring in conduit and connections. Coordinate pull station requirements with fire alarm system vendor.
- .5 Exact type of door alarm contacts to be coordinated with door construction and finishes. Contacts to generally be recessed mounted and wiring be installed in concealed conduits. Confirm exact requirements with door hardware/security vendor and General Trades Contractor.
- .6 Where controls are located remotely from door locations, such as in closets, provide wiring in conduit and extend from local above door junction boxes and

devices as required with homeruns back to closet location of equipment and leave slack wiring for terminations by others. Confirm exact requirements with door hardware / security vendor and General Trades Contractor.

- .7 Drawing details issued with electrical drawings are for pricing reference only and are based on assumptions. Obtain detailed design drawings from successful door hardware / security vendors and provide wiring in conduit to coordinate with and accommodate final systems designs. Coordinate with General Contractor.
- .8 Submit as part of shop drawing submission, detailed responsibility matrix identifying work and responsibilities of each trade and required interconnections.
- .9 After installation is complete, test and verify operation of components in coordination with General Contractor and door hardware vendor.

3.24 PROVISIONS FOR LEAD SHIELDING

- .1 As part of scope of General Trades work, walls to be provided with lead shielding. Coordinate exact scope of work with General Trades Contractor and Consultant and be responsible for following:
 - .1 disconnection of electrical and communications system devices to accommodate lead shielding installation work;
 - .2 relocation/extension of back boxes and outlet boxes to accommodate work;
 - .3 provision of pull/junction boxes located in accessible ceiling space for existing conductors which are of insufficient length to suit device relocations; do not splice telecommunications cabling (structured data/voice cabling) if run is not sufficient length; replace with home run data/voice cabling; splicing of power conductors must be made by means recommended by cable manufacturers and reviewed with Consultant and approved by Owner; clearly identify each box to its purpose;
 - .4 maintain integrity of lead shielding; do not penetrate lead shielding unless method of procedure is approved in writing by Owner and reviewed with Consultant;
 - .5 existing wall mounted raceway to be relocated out from wall to accommodate installation of lead shielding; if necessary, provide additional raceways to match existing raceway;
 - .6 where existing devices are disconnected and that such devices are part of a telecommunication system or other such building system, engage respective system vendor's authorized technician to provide required system programming, control work, testing and verification to ensure devices are left in proper operating order.

END OF SECTION

APPENDIX A - SCHEDULE OF PATIENT CARE CLASSIFICATIONS

AREA	LEVEL	ROOM NO.	ROOM NAME	BASIC CARE	INTERMEDIATE CARE	CRITICAL CARE
Jeanne Mance	0	084	UCC X-Ray Room	X		

END OF APPENDIX

PART 1 - GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings for products and accessories.

PART 2 - PRODUCTS

2.01 GENERAL POWER CABLES

- .1 CSA approved, ULC labelled and certified. Unless otherwise noted, conductors to be copper and be suitable for applications as noted in governing local electrical code.
- .2 "RW90" CSA certified, single copper conductor to CSA C22.2 No. 38, 600/1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, X-link polyethylene (XLPE) insulation, colour coded.
- .3 "RWU90" CSA certified, single copper conductor to CSA C22.2 No. 38, 1000 volts, maximum 90°C (194°F) conductor temperature, -40°C (-40°F) minimum installation temperature, extra thickness X-link polyethylene (XLPE) insulation suitable for wet and buried installations, colour coded.
- .4 "AC90 ISO-BX" flexible armoured cable with "RW90" conductors with low temperature Exelene insulation and two additional solid copper bonding conductors (one bare, one insulated) and overall interlocked aluminium tape armour, to CSA C22.2 No. 51(R2004).
- .5 Solid conductors to and including No. 10 AWG; stranded conductors in sizes larger than No. 10 AWG; branch circuit conductors constructed of 98% conductive copper; with minimum 1000 volt rating.

2.02 CONNECTORS

- .1 Armoured cable connectors must be proper squeeze type connectors and plastic anti-short bushings at terminations.
- .2 Connectors for conductors connecting to devices as per local governing electrical requirements to be equal to IDI Electric (Canada) Ltd., "Ideal" No. 451, No. 452 and No. 453, "Wing-Nut", CSA certified, 600 volts, rated pressure type connectors.
- .3 For conductors sized 3/0 and greater, provide long barrel double crimp, 2 hole compression type lug connectors, unless otherwise noted.

2.03 STANDARD CONTROL AND COMMUNICATIONS CABLES

- .1 ULC listed and labelled, CSA certified to C22.2 No. 127, No. 18 AWG "TEW" thermoplastic insulated, solid copper wire rated for 600 volts service, and 105°C (220°F) conductor temperature, complete with required number of copper conductors and colour coding.

- .2 Nexans, "Securex II", FAS 105, 300 volts, 105°C (220°F) conductor temperature rated fire alarm system flexible armoured cable with solid copper conductor, shielding, flame retardant PVC insulation and red colour outer overall jacket, ULC listed and labelled and CSA certified to C22.2 No. 208.

2.04 CONDUCTOR PULLING LUBRICANT

- .1 IDI Electric (Canada) Ltd., "Ideal Yellow 77" or "Wire Lube" as required.

2.05 TECK CABLES

- .1 Nexans, "Firex II Teck" cables as follows:
 - .1 certified to CAN/CSA C22.2 No.131, Type TECK 90 Cable;
 - .2 rated for outdoor, weather resistant and wet locations including direct burial applications;
 - .3 1000 V rated;
 - .4 Conductor: Bare, Soft drawn, Class B Compact or Compressed Stranded Copper conductors per ASTM;
 - .5 insulation: chemically cross linked thermosetting polyethylene (XLPE);
 - .6 bonding conductor (1/C Cable): Soft drawn bare copper;
 - .7 inner jacket: sunlight resistant PVC jacket tightly applied over assembly, to prevent slipping of core in a vertical position;
 - .8 armour: flexible interlocked aluminum armour, over inner jacket for mechanical protection;
 - .9 cable shall be shielded type teck cable;
 - .10 overall PVC jacket rated -40°C (-40°F);
 - .11 barrier tape over shield;
 - .12 terminations to suit specific applications.
- .2 Acceptable manufacturers are:
 - .1 Nexans;
 - .2 Prysmian Cables (Pirelli);
 - .3 General Cable;
 - .4 Aetna Cables;
 - .5 Kerite Company.

PART 3 - EXECUTION

3.01 PROJECT CONDITIONS

- .1 If identified in documents, verify that field measurements and conditions are as identified.
- .2 Cable routing on drawings is schematic and approximate. Route cable as required to meet project conditions. Determine exact routing and lengths on site.
- .3 Confirm fire protection ratings of construction to ensure that rooms and paths of conductors are fire rated in accordance with local governing codes requirements. Include fire rated conductors as required to meet local governing codes requirements.

3.02 CO-ORDINATION

- .1 Co-ordinate work with work provided under other electrical work and work of other trades.
- .2 Determine required separation between cable and other work.
- .3 Determine cable routing to avoid interference with other work.
- .4 Submit any alternative cable routing to Consultant for review prior to proceeding with work.

3.03 INSTALLATION OF CONDUCTORS

- .1 Provide required conductors. Ensure fire rated conductors are provided for applications as required by local governing codes, standards and local governing authorities.
- .2 In applications where multiple conductors in conduit are being run, provide a trapeze configuration of metal C-channels and threaded rod hangers to support cable/conduit from ceiling slab. Wall mounted cable/conduit brackets and ring type conduit hangers may also be permitted in applications approved by Owner and reviewed with Consultant. Provide required cable support system accessories which are not specified herein or shown on drawings but are required for proper installation.
- .3 Conductors, unless otherwise noted, to be as follows:
 - .1 underground inside or outside building and for non-climate controlled areas - "RWU90";
 - .2 for connections to electric heating coils in supply air ductwork systems, and for connections to other electric heating equipment where use of 90 degrees C. rated conductors are recommended by heating equipment manufacturer - "RW90";
 - .3 branch circuit wiring for patient care areas accessible suspended ceiling spaces consisting of drops down to luminaires - "AC90" flexible armoured cable ("BX"); (maximum 3 m (10') run permitted); flexible armoured cable (i.e. "AC90") is not permitted within walls of patient care areas";
 - .4 branch circuit wiring for non-patient care areas in accessible ceiling spaces and within stud wall construction consisting of drops down to luminaires and drops down stud walls to devices and in furniture systems - "AC90" flexible armoured cable ("BX") (maximum 6m (20') run permitted);
 - .5 for installation interior of pre-fabricated service consoles –"RW90" in flexible metallic conduit; or "AC90 ISO-BX" to code requirements; refer also to drawing notes;
 - .6 for climate controlled areas wiring except as noted above or specified elsewhere in Specification or as noted on drawings - "RW90".
- .4 Support flexible armoured cable in ceiling spaces and in stud wall construction with steel 2 hole cable straps to "Code" requirements. Flexible armoured cables must run in a neat manner parallel to building lines. Utilize centralized conduit

runs to maintain maximum permitted runs of flexible armoured cables as specified. Provide insulating grommet at cut ends of flexible armoured cable to protect conductor insulation.

- .5 Low voltage conductors to typically be No. 18 AWG "TEW" except for use in fire alarm system applications, unless otherwise noted. Provide specified fire alarm cables for fire alarm system applications or security system applications as approved by Code and local governing authorities. Conductors not installed in conduit or raceways to be fire insulated rated in accordance with latest governing Code Flame Spread requirements.
- .6 Generally, conductor sizes are indicated on drawings. Such sizes are minimum requirements and must be increased, where required, to suit length of run and voltage drop in accordance with applicable conductor voltage drop schedule appended to end of this Section. Conductors not sized or specified of type, to be sized and of type in accordance with requirements of local electrical code.
- .7 Do not use conductors smaller than No. 12 AWG in systems over 30 volts, unless otherwise noted. Do not use conductors smaller than No. 6 AWG for exterior luminaire wiring unless otherwise noted.
- .8 Colour code conductors throughout to identify phases, neutrals and ground by means of self-laminating coloured tape, coloured conductor insulation, or properly secured coloured plastic discs. Colours, unless otherwise noted, to be as follows:
 - .1 Phase A - red;
 - .2 Phase B - black;
 - .3 Phase C - blue;
 - .4 Ground - green;
 - .5 Neutral - white;
 - .6 Control - orange.
- .9 When pulling wires into conduit use lubricant and ensure that wires are kept straight and are not twisted or abraided.
- .10 Control conductors, in addition, to be numbered with Brady Ltd. or Electrovert Ltd. Z type markers.
- .11 Colour code conductors for communications systems in accordance with system component manufacturer's recommendations.
- .12 Neatly secure exposed wire in apparatus enclosures with approved supports or ties.
- .13 Install low voltage conductors in conduits, unless otherwise noted within Documents.

3.04 INSTALLATION OF TECK CABLES

- .1 Provide cables as required for specific applications. Handle, install, and terminate in accordance with manufacturer's recommendations and instructions and as herein specified.
- .2 When pulling cable, apply pulling tension to conductor not in sheath of cable. Limit cable pulling tension to as recommended by cable manufacturer.
- .3 Terminate cable in equipment with lugs and termination kits as per cable manufacturer's instructions.
- .4 Installation of cable splices and terminations to be made by personnel skilled in this type of work.
- .5 Ground shielding as per cable manufacturer's instructions.
- .6 Take necessary precautions when handling cable on reel to ensure that no damage will result in uncoiling process.
- .7 No splices are allowed unless justified by cable pulling tension calculations and approved in writing by Owner and reviewed with Consultant. Review locations of splices with Consultant.

END OF SECTION

SECTION 26 05 19
 LOW VOLTAGE CABLES – APPENDIX

VOLTAGE DROP SCHEDULES

MAXIMUM BRANCH WIRING DISTANCE FOR 120 VOLT SYSTEM AT 2% VOLTAGE DROP

WIRE SIZE	BREAKER SIZE (AMPERES)	15	20	30	40	50	60	70	80	100
	MAX LOAD AT 80% (AMPERES)	12	16	24	32	40	48	56	68	80
No. 12	-	16.8	12.2	-	-	-	-	-	-	-
No. 10	-	25.9	19.0	12.9	-	-	-	-	-	-
No. 8	-	39.6	30.4	20.5	15.2	-	-	-	-	-
No. 6	-	62.4	47.2	32.0	23.6	19.0	16.0	-	-	-
No. 4	-	99.0	73.1	50.2	38.1	30.4	24.3	21.3	19.0	-
NO. 2	-		114.3	77.2	57.9	47.2	38.8	33.5	28.9	22.8
No.1	-	-	-	96.0	73.1	57.9	47.2	42.6	36.5	27.4
No. 1/0	-	-	-	-	85.3	68.5	56.3	48.7	41.9	33.5
No. 2/0	-	-	-	-	102.8	80.7	67.0	57.9	50.2	40.3
No. 3/0	-	-	-	-	-	95.2	79.2	68.5	59.4	47.2
No. 4/0	-	-	-	-	-	-	92.9	79.2	70.1	56.3
250 MCM	-	-	-	-	-	-	102.8	86.8	76.2	60.9
300 MCM	-	-	-	-	-	-	-	100.5	88.3	70.1

Note: Distances indicated in metres from panel to load for single phase.

END OF APPENDIX

PART 1 - GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings for products and accessories.

PART 2 - PRODUCTS

2.01 BASIC MATERIALS

- .1 Ground Conductors: Solid copper, insulated and bare to suit application and code requirements; and bond conductors.
- .2 Ground Busbar: Solid copper busbar, predrilled for two-hole lug connections, of size of 50 mm x 9 mm x 900 mm (2" x 3/8" x 36"), for wall and backboard mounting using standoff insulators.
- .3 Ground Connections:
 - .1 Above Grade or in Manholes: Compression type connectors; Exothermic connections permitted above grade if approved by Consultant.
 - .2 When making ground and bonding connections, apply a corrosion inhibitor to contact surfaces. Use corrosion inhibitor appropriate for protecting a connection between metals used.
- .4 Miscellaneous ancillary components to complete grounding and bonding work to requirements of local governing electrical authority and codes.

PART 3 - EXECUTION

3.01 GENERAL GROUNDING AND BONDING REQUIREMENTS

- .1 Provide required grounding and bonding work in accordance with drawings, local governing electrical authority, governing authorities having jurisdiction and local governing electrical inspection authority. Provide local governing electrical utility's grounding requirements for stations, vaults and electrical rooms, as applicable. Confirm requirements with local governing electrical utility.
- .2 Provide 50 mm x 9 mm x 900 mm (2" x 3/8" x 36") electrical grade copper ground bus on perimeter wall of electrical rooms, 300 mm (12") above finished floor level. Secure ground bus on 20 mm (3/4") standoff insulators. Connect electrical rooms ground grid with ground bus with minimum 3/0 copper ground conductor in conduit. Connect each electrical room perimeter ground electrode system back to main electrical room ground electrode with minimum No. 3/0 copper conductors.
- .3 Ground and bond other equipment such as transformers, switchboards, panelboards, and similar metal work to perimeter ground bus. Provide minimum No. 3/0 insulated ground wire from ground bus in electrical rooms to switchboards, transformers, structure, floor, etc.
- .4 Extend conductors to metal piping of main water service and connect ground conductor to street side of water meter. If piping is not metallic, make necessary connections as required by local governing electrical utility.

- .5 Effectively bond metallic pipe services such as, gas mains, water mains, and dry risers, to main grounding terminal at their point of entry. Make connections to services with purpose-made grounding clamps.
- .6 When buses are in place, bolts have been tightened, and lugs have been installed, coat entire installation with two (2) 100% covering coats of suitable shellac to prevent bus from oxidizing.
- .7 Throughout complex, solidly ground systems and make required grounding connections to electrical devices and apparatus. Ground conductors to be insulated copper wire connected with approved fittings in accordance with local governing electrical code.
- .8 Effectively bond building structures to main grounding system (grid).
- .9 Provide separate insulated ground wire for each isolated ground receptacle.
- .10 Extend isolated grounding conductors of computer receptacles to isolated ground bus of computer panel board serving area. From ground bus extend ground conductors to building grounding station.
- .11 In areas of raised floor systems, provide copper ground system as sized and detailed on drawings and as per local governing electrical code requirements. Bond ground system to every third raised floor support using Burndy Inc., ground clamps, and connects system to building ground system in conduit. Bond every metallic conduit which penetrates raised floor to raised floor stringer system
- .12 Connect grounding conductors to motors 10 hp and above or circuits 20A or above, with a solderless terminal and a bolt tapped to motor frame or equipment housing. Connect to smaller motors or equipment by fastening terminal to a connection box. Connect junction boxes to equipment grounding system with grounding clips mounted directly on box or with machine screws. Completely remove paint, dirt, or other surface coverings at grounding conductor connection points so good metal-to-metal contact is made.
- .13 Ground metal sheathing and any exposed metal vertical structural elements of buildings. Ground metal fences enclosing electrical equipment. Bond any metal equipment platforms which support electrical equipment to equipment ground. Bond rooftop equipment.
- .14 Bond metal work associated with pools such as reinforcing steel, piping, ladders, etc., above ground loops by copper conductors in accordance with local governing electrical code. Clean water pump prior to bond being using approved clamps. At your discretion, make several bonds at various locations or collect wires and make one (1) bond. Ensure that electrical equipment associated with these piping systems are grounded adequately by installing flexible conduit and ground jumper wire to motors. Ground telephone boxes, speakers, pull stations and other such equipment within pool area with jumper wires within connecting conduit to ensure proper grounding. Include for ground connections to pool reinforcing steel.
- .15 Provide separate ground connection for bathtubs.
- .16 Provide service conductors exceeding 400 amperes with minimum No. 3/0 AWG grounding conductors, unless otherwise noted.

- .17 Ground and bond various telecommunications, audio visual systems, security, life safety and control systems in accordance with respective system manufacturers recommendations and in accordance with local governing electrical code requirements.
- .18 Do not use conduit systems as ground conductors in patient care areas or in areas as per local governing electrical code requirements.
- .19 Extend grounding from ground bus in isolated power units to ground busses within panelboard serving area. From ground bus extend ground conductors in PVC conduit which is located in a concealed space in a wall or in a concrete floor slab and connect to building grounding station as close as practical to station.
- .20 Confirm exact method of executing grounding for isolated ground system with governing authorities. Generally, method to comply with CSA Standard Z32 and NFPA No. 56. Testing of grounding of isolated ground system to be performed by independent test company specified for "Distribution System Testing And Coordination Study" work.
- .21 Make ground connections in slab or buried underground using local governing electrical authority approved welded copper connections.
- .22 Provide minimum no. 3/0 AWG insulated copper ground conductors and LAN Room copper ground bus mounted on walls with standoff insulators in each LAN room. Connect ground bus to computer equipment racks and to building ground system.
- .23 Ground conductors not sized on drawings are to be sized in accordance with local governing electrical authority requirements. Ground conductor size is to be no smaller than requirements specified herein this article or on drawings.
- .24 Bond all mechanical ductwork, medical gas lines, and water lines within patient care areas with #6 AWG RW90 to electrical panel feeding outlets within the area or equipotential ground point if available. Locate ground clamps in ceiling above headwall. Label each and every connection for ease of testing. Provide all required grounding clamps and fittings.
- .25 Provide #6 AWG RW90 bonding conductor between electrical panels in 3/4" (21mm) serving outlets/wiring devices within the same patient care area/environment.

END OF SECTION

PART 1 - GENERAL

1.01 SUBMITTALS

- .1 Submit copies of documents requested herein, testing reports, certificate of approvals, and commissioning sheets.

PART 2 - PRODUCTS

2.01 VIBRATION CONTROL AND SEISMIC RESTRAINT

- .1 Electrical equipment installation is to meet local governing authority having jurisdiction and code seismic requirements and additional requirements for vibration isolation.
- .2 Provide labour, materials, and equipment required and necessary to seismically restrain electrical equipment and equipment bases including concrete pads, and guarantee function of materials and equipment supplied.
- .3 Make electrical connections to vibration-isolated equipment with flexible conduit or other flexible means acceptable to Consultant and local governing authority having jurisdiction so as not to restrict maximum anticipated movement of equipment under seismic excitation movement.
- .4 In event that inadequate isolation is provided by isolation product manufacturer's isolation package, be responsible for improving isolation to an acceptable standard at no additional cost to contract. Isolation product manufacturer's seismic restraint engineer to verify that seismic restraints and combination isolator/restraints intended for use on project are fit for intended purpose. Be responsible for ensuring that manufacturer's seismic restraints are in compliance with applicable local building code requirements for Place of Work.
- .5 Provide additional seismic requirements for suspended electrical raceways, luminaires, and other equipment as per governing local authority requirements and requirements of current codes and by-laws.
- .6 Acceptable manufacturers of seismic restraints include:
 - .1 Vibro-Acoustics;
 - .2 Mason Industries;
 - .3 Kinetic Noise Control;
 - .4 Eaton B-Line.

PART 3 - EXECUTION

3.01 INSTALLATION

- .1 Comply with seismic restraint Engineer's and manufacturer's installation recommendations.
- .2 Obtain required training from manufacturer's representative on any special installation procedures. Install components in accordance with manufacturer's instructions to suit specific installation requirements.

- .3 Contractor to retain Professional Engineer (Registered in Ontario) who is in good standing to review Seismic Restraints and provide stamped report(s) certifying installation. Test, adjust, and certify installation. Submit copies of test report to Consultant.
- .4 Refer to Part 2 for specific installation requirements.

3.02 INSPECTION

- .1 Inspect for removal of break away hardware to ensure proper torques of installed systems.
- .2 For non-visually verifiable product, manufacturers to verify proper torque for a minimum 10% of application. Document torques for applications per manufacturer's instructions.

END OF SECTION

PART 1 - GENERAL

1.01 SUBMITTALS

- .1 Submit as part of shop drawing submission, copies of:
 - .1 system and equipment testing reports;
 - .2 arc flash analysis report;
 - .3 copies of certificate of approvals from local governing inspection authorities.
- .2 Submit electrical distribution system coordination study and short circuit calculations reports prior to or with proposed shop drawings of major electrical distribution equipment. Allow in shop drawing process, sufficient time for Consultant to review and make comments and for Contractor and equipment vendors to incorporate Consultant comments, necessary revisions and results of reports into equipment shop drawings. Do not order equipment until shop drawings have been reviewed with Consultant and Consultant's comments have been addressed. Time for this shop drawing review process will be at Consultant's discretion, but typically allow for 10 working days for initial review submission with additional 10 working days added to accommodate each resubmission.
- .3 If formal completion of studies and reports may cause delay in equipment manufacture, direction from Consultant may be obtained for preliminary submittal of sufficient data to ensure that selection of device ratings and characteristics will be satisfactory. Subsequently, provide formal studies and reports to verify preliminary findings.
- .4 Submit after completion of factory testing, copies of completed product testing reports.
- .5 Submit after installation and testing, copies of:
 - .1 completed testing reports with completed test results sheets;
 - .2 certificate of approvals from local governing authorities, manufacturers' of systems and equipment and testing companies.
- .6 Review form of submittals (submission procedures, number of hard copies and requirements for electronic copies) with Consultant at project start-up. For pricing assume minimum 3 hard coloured copies bound and electronic pdf copy.

PART 2 - PRODUCTS

2.01 GENERAL SCOPE OF WORK

- .1 Include for but not be limited to following:
 - .1 determining short-circuit current ratings to check that electrical distribution equipment can safely withstand level of fault current;
 - .2 preparing and submitting arc flash study with calculations for use in determining required electric shock and arc flash protection;
 - .3 product manufacturers providing equipment inspection, testing, start-up, adjustments and verification;

- .4 electricians/trades people on site to handle equipment, make temporary connections, operate equipment and make repairs and adjustments and assist manufacturer's / testing organization's personnel during on-site inspection, testing, calibration, start-up, verification work and where supplementary commissioning;
- .5 coordination of work with testing company and equipment/system manufacturer's authorized technician in performing adjustments and start-up procedures to equipment/systems;
- .6 preparing testing reports and documentation for submission to Consultant.

PART 3 - EXECUTION

3.01 GENERAL ELECTRICAL WORK TESTING

- .1 In addition to tests required by local governing authorities having jurisdiction, local codes and regulations, perform following:
 - .1 after luminaires, switches, receptacles, motors, signals, etc., are installed, whether same are installed as part of this Division or by other Divisions (telephone systems excepted), test work to ensure that there are no leaks, grounds or crosses;
 - .2 establish and ensure proper motor rotation - measure full load running currents and check overload elements - report to Consultant any discrepancies which are found; existing motors which have been worked on (disconnected and reconnected) must be checked with rotation meter to ensure proper rotation; be responsible for any damage caused by reverse rotation;
 - .3 demonstrate to Consultant that branch circuit voltage drop is within specified units;
 - .4 ensure that devices are commissioned and operable.
- .2 Document results into distribution system testing report. Report must state that testing was successful and Work complies with project documents, applicable CSA standards, and other applicable governing codes and requirements.

3.02 SYSTEMS INSPECTION, TESTING, START-UP AND VERIFICATION

- .1 When each system and each major piece of equipment installation is complete and ready for acceptance, include for system and equipment manufacturer or manufacturer's authorized representative to visit site to provide system inspection, testing, start-up, and verification. Perform following:
 - .1 check component connections and overall installation;
 - .2 adjust sound systems for high quality, distortion free performance, free from noise, cross-talk, hum or other interference;
 - .3 test and adjust system and ascertain that components are as specified and ensure that products operate as designed;
 - .4 provide start-up procedures for systems and equipment;

- .5 verify and certify system component operations;
- .6 prepare, document and evaluate test results;
- .7 authenticate test results with signature of authorized testing Engineer/Technician;
- .8 check and verify nameplates;
- .9 provide maintenance and operating instructions to Owner's personnel.
- .2 Perform work properly documented, and in accordance with manufacturer's instructions and recommendations.
- .3 Perform work under presence of Owner/Consultant/Commissioning Agent at times approved by Owner and reviewed with Consultant.
- .4 Provide these requirements after each phase (as applicable) to allow Owner option to use area of phase of work. These requirements are also to be provided prior to applying for Certificate of Substantial Performance of the Work of project.
- .5 Megger tests all new feeder cables after they have been installed in conduits. Megger testing shall be performed to NETA standards if manufacturer data is not provided and shall be tested from phase to phase and phase to ground. Provide test report to consultant as soon as testing is completed and repair any failed cables and re-test to satisfaction of the consultant.
- .6 Include for manufacturers authorized technicians of equipment/systems integrated to equipment/systems being tested to be onsite during full integration testing. Coordinate with each manufacturer.
- .7 When system inspection, testing, start-up and verification specified above is complete, obtain from supplier/manufacturer (or where specified, independent inspection company) a test report with test sheets, and covering verification letter signed by authorized testing technician, stating that system or equipment has been inspected and tested, performs as specified and is ready for acceptance. Include date and time of testing, testing technician's name and specification section number test fulfilled.
- .8 Bind documents under cover and submit copies to Consultant.

3.03 ELECTRICAL DISTRIBUTION SYSTEM TESTING AND VERIFICATION

- .1 Provide services consisting of on-site engineering inspection, testing and verification of electrical distribution equipment and other systems and equipment. Perform work to standards of applicable local governing authorities, local electrical inspection authority and CSA Standards.
- .2 Services to be performed by an approved independent testing company and be initially conducted prior to system/equipment being energized and further testing when energized, and include following items, where applicable:
 - .1 testing, cleaning when necessary, and calibrating relays and circuit breaker trip devices (calibration of protective devices to conform to requirements of approved coordination curves);

- .2 function test of associated control devices;
- .3 replacement of fuses destroyed during testing;
- .4 acceptance test in presence of Consultant;
- .5 presence, for length of time required, of qualified and competent equipment manufacturer's service representative during start-up;
- .6 carry out insulation resistance testing of outgoing feeders with respect to ground;
- .7 inspection and testing of cables, bus duct, power panels, lighting panels, transformers, power receptacles and switches;
- .8 inspection and testing of electrical system auxiliary systems and devices such as metering, power factor capacitors, UPS, isolated power centres, transfer switches, inverters, central battery systems, generators sets and load banks;
- .9 inspection and testing of electrical devices and communication system components installed in service consoles, headwalls, furniture systems, etc., whether or not devices are supplied by Electrical Divisions;
- .10 inspection and testing of motor control centres, starters and variable frequency drives;
- .11 inspection and testing of lighting control systems including central control systems, low voltage relays, sensors and dimming controls; ensure that devices perform in conformance with ASHRAE 90.1 requirements;
- .12 verification and certification work of equipment and systems;
- .13 witness testing of EMI testing and verification (signing of report) of test results.
- .3 Perform services procedures properly documented, and in accordance with manufacturer's instructions and recommendations.
- .4 Submit copies of engineering and testing report to Consultant.
- .5 Where relays, breakers, etc., do not perform to Consultant reviewed coordination curves, revise as part of work.
- .6 Adjust and calibrate existing trip units, relays, breakers, etc., which do not perform to approved coordination curves. Where defective or incorrectly applied relays or breakers are found in existing distribution system, identify problem areas clearly on curves of test report and provide recommended course of remedial action. Where replacement of existing devices not identified in Documents to be replaced is necessary to provide coordination, submit estimate of costs to Consultant. Where directed by Owner, perform work at additional cost to Contract amount. Clearly show on coordination curves in report and clearly identify recommended remedial course of action.
- .7 Test high voltage cable installation before placing in regular service. Work includes phase verification, grounding verification, hi-pot test of insulation strength

to IPCEA Specifications (Leakage Curves to be obtained), and time domain reflectometer tests to give records of cable impedance profiles to draw attention to cable damage. Reference cable manufacturers testing procedures and do not exceed maximum test voltage levels and durations.

- .8 Testing organization to report high voltage cable defects directly to Consultant as soon as such defects are discovered. Re-test affected cables after proper repair. Also, re-test cables in cases where cable damage after installation is suspected. On completion of satisfactory testing of installation, submit a report by testing organization stating that cables concerned have satisfactorily passed required tests and are suitable for service. Submit copies of report to Consultant. Submit recorded test data (properly bound) with report, in each case.
- .9 Test main power transformers before placing in regular service. Work to include voltage ratio test, phase angle test, insulation resistance, oil sampling (liquid type transformer), start-up and other manufacturer's recommended tests.
- .10 Provide testing and coordination of emergency power distribution system to ensure that system performs in accordance to latest requirements of CSA Standard C282 and CAN/CSA Z32. Ensure that engine-generator set manufacturer and testing and coordination companies co-operate to ensure compliance with CSA requirements. Provide necessary adjustments and coordination to ensure that emergency power distribution system transfers essential loads to emergency power within required response time of loss of normal power.
- .11 Test new receptacles within imaging suite and panel boards serving these spaces to the latest edition of CSA Z32. Provide test reports Consultants for review as soon as testing is complete.
- .12 Provide visual and mechanical inspection of ground system and verify that it is in compliance with issued documents and local governing electrical code requirements.
- .13 Additionally, perform testing of lighting control systems and devices to ensure conformance with ASHRAE 90.1 requirements.
- .14 Document testing, coordination study and arc flash analysis in a report signed by a Professional Engineer licensed in the Place of Work and authorized by testing company. Submit copies of report to Consultant. Report to include test results with properly plotted curves, identified trouble areas of coordination, extensive comments regarding test results and recommendations on best course of remedial action.
- .15 Acceptable companies to provide this work are to be independent of successful manufacturers providing distribution system equipment and include:
 - .1 G.T. Woods;
 - .2 Eaton Electric Services Division;
 - .3 Schneider Electric Services Division;
 - .4 Brosz Technical Services.

3.04 BRANCH CIRCUIT WIRING TESTING FOR PATIENT CARE AREAS

- .1 Provide on-site engineering inspection and testing of branch circuit wiring and branch circuit devices in patient care areas in accordance with CSA Standard Z32.
- .2 Patient Care Areas include applicable critical patient care, intermediate patient care and general patient care areas of renovated and additional areas.
- .3 Branch circuit wiring testing to be performed by an approved independent testing company and be executed immediately upon energizing system prior to occupancy of an area by Owner.
- .4 Thoroughly review requirements of CSA Standard and ensure that entire scope of branch circuit wiring to be tested is understood by testing company.
- .5 Testing to be witnessed by Owner and Consultant. Notify Owner and Consultant in writing minimum of 7 working days in advance of proposed testing date.
- .6 Document testing in distribution system testing report and submit copies to Consultant.
- .7 Acceptable testing companies are as those listed for distribution system testing work.

3.05 SHOCK AND ARC FLASH PROTECTION

- .1 Provide for electric shock and arc flash protection as required by local governing electrical code and local governing authorities. Scope of work to be for additional and revised equipment and first level of upstream devices.
- .2 Prepare study to determine severity of potential exposure, planning safe work practices and selecting personal protective equipment under general guidelines of governing edition of CSA Z462.
- .3 Design safety signs and labels for applications to equipment under general guidelines of ANSI Z535.4.
- .4 Determine arc flash hazard distance and incident energy that workers may be exposed to from electrical equipment under general guidelines of IEEE 1584.
- .5 Incorporate documentation with distribution system and coordination study report.
- .6 Provide labels as required on equipment, meeting applicable standards and codes, to standards of local governing authorities and as reviewed with Consultant.
- .7 Acceptable companies to provide this work are to be successful manufacturer of electrical distribution system equipment and include:
 - .1 Eaton Electric Services Division;
 - .2 Schneider Electric Services Division;
 - .3 G.T. Woods;
 - .4 Brosz Technical Services.

3.06 INFRARED SCANNING

- .1 Provide infrared scanning of Work and connections to electrical distribution equipment as noted.
- .2 Infrared scanning process to include but not be limited to following:
 - .1 use of latest technology infrared fast scanning thermal imaging camera with colour digital conversion thermographic imaging capabilities; camera to be capable of determining temperature differences using generated isotherms;
 - .2 scanning distribution system with ability to detect 1°C between subject area and reference at 30°C;
 - .3 equipment to detect emitted radiation and convert detected radiation to visual image;
 - .4 infrared surveys to be performed during periods when equipment is under intended full operating load;
 - .5 perform scanning of essential power equipment when gensets are in operation and essential power is on line.
- .3 Some guidelines for interpretation of temperature gradients are:
 - .1 temperature gradients of 3°C to 7°C indicate possible deficiency and warrant investigation;
 - .2 temperature gradients of 7°C to 15°C indicate deficiency; required repair as time permits as directed by Consultant;
 - .3 temperature gradients of 16°C and above indicate major deficiency; requires repair immediately.
- .4 Document testing in a report signed by a Professional Engineer licensed in the Place of Work and authorized by testing company. Submit copies of report to Consultant. Report to include but not be limited to include:
 - .1 indication of problem area (location of "hot spot");
 - .2 indication of temperature rise between "hot spot" and normal or reference area;
 - .3 indication of cause of heat rise;
 - .4 indication of phase unbalance, if present;
 - .5 indication of areas scanned;
 - .6 colour photographs and thermograms of deficient area as seen on imaging system;
 - .7 summary of work;
 - .8 list of test equipment;
 - .9 faults, corrections required, recommendations;
 - .10 retesting of corrected faults.
- .5 Acceptable infrared scanning companies:
 - .1 Eaton Canada;
 - .2 Siemens Canada;
 - .3 GT Wood;

- .4 Pelikan Inc;
- .5 Brosz Technical Services.

END OF SECTION

PART 1 - GENERAL

1.01 SUBMITTALS

- .1 Submit copies of following as applicable to work:
 - .1 waste tracking procedure;
 - .2 testing reports;
 - .3 completed test results sheets;
 - .4 certificate of approvals;
 - .5 identification of waste treatment facility proposed and description of type of waste that facility is licensed to handle;
 - .6 description of closure plan of facility;
 - .7 copies of insurance and bonding;
 - .8 certificates of destruction.

PART 2 - PRODUCTS

2.01 HAZARDOUS MATERIALS

- .1 Hazardous materials and infectious materials are known to be present on site in existing buildings, including but not limited to following:
 - .1 aspergillus;
 - .2 mould;
 - .3 asbestos;
 - .4 Polychlorinated biphenyls (PCBs);
 - .5 lead;
 - .6 mercury.
- .2 Division 00 and/or Division 01 identify additional specific requirements and if such materials are present, include for costs to be educated and trained on special working conditions, to work in areas with hazardous materials, requiring protective clothing, gear, tenting, enclosures, etc., and performing necessary partitioning/tenting/ventilation work to isolate areas and maintain disturbances of such material to a minimum. Comply with infection control requirements and requirements of Health and Welfare governing authority requirements. An asbestos abatement report is available for review from Consultant. Unless otherwise noted, any abatement removal will be responsibility of another Division of Work or is not included under scope of work of this project.
- .3 If proper abatement procedures are not followed, be responsible for bearing full cost of a full time qualified abatement inspector chosen by Owner. In areas where work is being done above or below an area occupied by Owner's staff and/or building occupants, any slab penetrations into vertically adjacent occupied space to utilize a proper enclosure in area of that work on that occupied floor. Be responsible for failure to comply with special requirements in working in areas of hazardous materials.
- .4 Include for company specializing in removal and disposal of materials containing polychlorinated biphenyls (PCBs) to disassemble equipment as required to access material containing PCBs, and remove and properly dispose of such material off site. Any luminaire being deleted to be checked for ballast containing PCBs and such ballasts to be disconnected and disposed off-site. Only companies that are certified and comply with Ministry of Environment and Ministry

of Transport regulations with regards to hazardous waste materials to be used to perform this Work. Prior to start of Work, submit to Consultant a copy of PCB disposal certificate and identification of Ministry authorized and designated disposal site. Lamps containing mercury (fluorescent lamps) to be removed and transported to a government approved disposal site.

2.02 PCB REMOVAL, TRANSPORTATION AND DISPOSAL

.1 General:

- .1 Provide a specialty contractor experienced and certified in province of Work (Ontario), to perform polychlorinated biphenyls PCBs abatement removal work and approved by Ministry of Environment (MOE), to provide removal work of existing transformers and associated cables containing PCBs. Work to include but not be limited to following:
 - .1 disconnection and decommissioning of transformers;
 - .2 properly draining of PCB containing liquid;
 - .3 dismantling and cutting-up of transformers to allow for removal from site;
 - .4 proper packaging of PCB containing and contaminated materials to allow for removal from site;
 - .5 removal from site of materials and transportation of PCB containing materials to a Ministry approved designated site (identify site in shop drawing submissions);
 - .6 work performed to Ministry Of Environment and Transport Canada requirements, including proper permits, approvals and fees;
 - .7 submission to Consultant of detailed report of work, including copies of permits, certificate of approvals and identification of site where materials are to be delivered; submit these details as shop drawings prior to start of Work;
 - .8 remove materials from site and properly dispose of in manner approved by local authority having jurisdiction; identify in shop drawings proposed route and means for moving materials from building.
- .2 Include additionally for administering, supervising, arranging, and coordinating of work and for disconnection and making safe of connections (primary and secondary power cabling, controls and protection circuits, monitoring circuits) to existing transformers. Replace any connectors and wiring that have come into contact with PCBs.
- .3 Prior to start of Work, obtain approval from Consultant of path of egress for existing transformers and components. Ensure that such egress is protected from spills and other damage that may occur in movement of material.
- .4 Perform Work at scheduled times approved in writing by Consultant and Owner.

- .5 Be responsible for removing existing PCB liquid filled power transformers off site. Perform work required for inspecting, characterizing packaging, labelling, loading, transportation and destruction of PCB material.
 - .6 Remove waste in an expedient manner in accordance with agreed project schedule.
 - .7 Supply final Certificates of Destruction For All Waste (solid/liquid) to Consultant no later than 30 days after PCB waste is removed from site.
 - .8 Ensure that people involved in handling, loading, transportation and destruction of PCB Material are appropriately trained and licensed in accordance with Workplace Hazardous Materials Information System (WHMIS) and Transportation of Dangerous Goods Act, Transport Canada (TDG).
 - .9 Act in a manner that is consistent with safe handling, loading, testing, and transporting PCB material.
- .2 Codes and Standards:
- .1 Be responsible for ensuring that recommended solutions are in compliance with applicable current Federal and Provincial Regulations, Codes, Standards and Policies. In Particular, without limiting Contractor's responsibilities, following regulations/guidelines, latest editions as amended, are to apply as required:
 - .1 The Canada Labour Code;
 - .2 National Fire Code;
 - .3 Occupational Health and Safety Act, Revised Statutes of Ontario, as amended (including latest edition);
 - .4 Transportation of Dangerous Goods Act;
 - .5 Canadian Environmental Protection Act, Environment Canada;
 - .6 PCB Transformer Decontamination, Standards and Protocols, Canadian Council of Ministries of the Environment;
 - .7 Any Workplace hazardous materials as outlined in Hazardous Materials Information System (WHMIS) as established in Hazardous Product Amendment Act.
- .3 Obtain Certificate of Approvals as follows:
- .1 Waste Management Systems;
 - .2 Transportation;
 - .3 Transfer;
 - .4 Treatment.
- .4 Inspections and Characterization:
- .1 Provide materials and labour required for inspection of PCB Material in storage or use at site prior to each shipment of PCB Material.

- .2 Characterize and profile PCB material as required in accordance with requirements of TDG and WHMIS and any other applicable federal, provincial, or municipal regulations.
- .3 Sample, characterize, and profile PCB material as required by any Subcontractors involved in this Contract, including preparation of waste profile sheets (WPS) with WPS Numbers assigned specifically to each existing PCB filled power transformer. A comprehensive bar-coded waste tracking system to be used by treatment facility to ensure accurate tracking of PCB Material. This bar-coding system is to be computerized as to minimize risk of human error when moving waste. Consultant reserves right to inspect waste tracking procedures throughout duration of contract.
- .5 Treatment Facility:
 - .1 PCB samples taken from materials following treatment to be analysed in a Canadian Association of Environmental Laboratories (CAEL) approved laboratory. Prior to commencement of Work, forward to Consultant Certificate of laboratory.
 - .2 Treatment facility to be capable of receiving various types of PCB Materials. A copy of waste tracking procedure to be submitted as part of shop drawings. This procedure to include tracking of PCB material, which is sent to a third party for incineration. This procedure to explain how specific WPS used for this project is tracked throughout work.
 - .3 Ensure that PCB Materials carries this car coding from point of pick-up of PCB Materials from site.
 - .4 Shop drawings to include a copy of Certificate of Approval. Description of types of waste that treatment facility can receive to accompany shop drawings.
 - .5 A description of closure plan of facility to be included with shop drawings. This closure plan to include a closure bond, which can be used in event of insolvency or bankruptcy of Contractor. Amount of this bond is to be included with proposal and is to be sufficient to cover cost of destruction for materials which appear in Certificate of Approval for storage at Contractor's facility at any given time.
 - .6 Include Certificates of Insurance with this proposal. Treatment facility to carry a minimum \$5,000,000.00 Pollution Legal Liability Insurance and a minimum of \$5,000,000.00 Aggregate Consultant's Environmental Liability Insurance. Commercial General Liability Policy to carry a minimum of \$5,000,000.00 Umbrella.
 - .7 Test metals continuously after treatment to ensure no contaminated metal leaves site. Sample cleaned metals using hexane ensuring that any PCB residual is transferred to swab.
 - .8 Consultant and Owner will not entertain any proposals which include storage of PCB material outdoors. Materials, before and after treatment to be stored inside Contractor's own building.
- .6 Acceptable PCB removal specialist companies are as follows:

- .1 Aevitis Inc.;
- .2 Sanexen.

2.03 ELECTROMAGNETIC INTERFERENCE PROVISIONS

- .1 Electromagnetic interference (EMI) provisions to include shielding of applicable structures, systems, and components as outlined herein this article. Include for requirements and costs.
- .2 Cover wall behind vertical bus duct risers with electromagnetic shielding, consisting of solid hot-rolled pickled steel or μ -metal (mu-metal) as required, designed to reduce magnetic field radiated from bus duct to a maximum of 5 milligauss at a distance of 500 mm (20") from wall in adjacent offices and occupied spaces.
- .3 Enclose horizontal bus duct runs in ventilated shielding enclosures to reduce magnetic field radiation from bus duct to floors above and below and maintain full bus duct ampacity. Shielding to have sufficient attenuation ratio to reduce magnetic field to 5 milligauss or less at desk top level 900 mm (3') above floor).
- .4 Cover floor under main power transformers with continuous shielding slab of sufficient grade to reduce magnetic field radiation from transformers to 5mG at desktop level on occupied floors below. Mount transformers on Trelleborg rubber isolators or approved equal.
- .5 Install wall and floor mounted magnetic shields after civil work is finished but prior to installation of electrical equipment. Install shielding enclosure on horizontal bus duct runs after bus duct installation. Test and verify shielding performance in accordance to IEEE 644-94 as specified in Part 3 of this Section. Test results to be presented in a comprehensive engineering report to Consultant.
- .6 Specialist Subcontractor retained for this project to have minimum 10 years experience in engineering design and installation on power frequency electromagnetic shielding, on major projects.
- .7 Acceptable firms include:
 - .1 C-INTECH, 905-472 3949;
 - .2 Power Line Systems Engineering, 905-294-5468.

PART 3 - EXECUTION

3.01 TRANSFORMER DRAINING AND DISMANTLING

- .1 Establish work area for draining transformer oil, to set up spill containment, empty drums, hose and pumping equipment, and to dismantle transformer, as required. Provide enclosures, floor pads, warning signage and any other requirements for properly sealing off area. Ensure that warning signage and area barriers provisions clearly outline area is restricted to authorized personnel only. Notify Owner and obtain Owner's approval prior to start of work.
- .2 Ensure that floor drains located in close proximity to transformers are plugged to eliminate potential for contaminant migration in instance of an accidental release of transformer oil.

- .3 When transferring liquids such as transformer oil, ensure proper use of Personal Protective Equipment (PPE) and spill containment on-site staff.
 - .1 Dismantle and/or cut-up transformer to allow for proper removal out of building through existing openings and routing as approved and directed by Owner and Consultant. Review onsite restrictions prior to Bid Submission.
 - .2 Perform documented procedures with Ministry of Environment, such as a Certificate of Approval and listing materials required and methods to be followed when pumping liquids from transformers into drums. Provide this documentation with MOE submission.
 - .3 Should PCBs be identified within any materials which have been used or have come in contact with PCBs during draining, dismantling, and removal operations, such as hoses or PPE, these are to be considered as PCB waste or PCB-related waste and are to be packaged, transported and treated in accordance with regulatory requirements, at Contractor's expense.

3.02 PCB MATERIAL PACKAGING, LABELLING AND LOADING

- .1 Package, label, and load dismantled sections of transformer and PCB material.
- .2 Provide labour and material required to repackage PCB material if, for any reason, repackaging is required to conform to TDG, WHMIS or Contractor requirements.
- .3 Provide labour and material to label and placard PCB material and vehicles in accordance with TDG.
- .4 Provide labour, equipment, material, and vehicles required to move and load PCB Material from work area to loading area and from site to designated final destinations for storage/handling. Secure PCB Material into/onto specialty contractor's transportation vehicles, in accordance with TDG requirements.

3.03 PCB MATERIAL TRANSPORTATION

- .1 Provide labour, material and vehicles required for transport of PCB materials to treatment facility.
- .2 Be responsible for obtaining applicable Provincial, Federal and Municipal approvals and or permits required for transportation of PCB materials to treatment facility at Contractor's expense. This includes but is not limited to approvals for transporting material into or through jurisdictions outside province of Work.
- .3 Prior to any shipment leaving site, confirm with Consultant in writing, that required approvals have been received, and that required notifications of other jurisdictions have been made.
- .4 Prior to any shipments leaving site, indicate to Consultant in writing, final destination of shipments, and route that will be used to reach that destination.
- .5 Prior to any shipment leaving site, perform an inspection of vehicle(s). Any loading or repackaging required to satisfy regulations or to ensure safe shipment of PCB Materials to be at Contractor's expense,

- .6 Prior to any shipment leaving site, prepare required waste manifests in accordance with TDG. Be responsible to ensure that waste manifests are completed by vehicle driver and that copies are distributed in accordance with TDG requirements within required time.
- .7 In Section 8.7(b) of TDG, requirements are specified for inspection of loads before and during transport of PCB material. If, Contractor proposes to use road vehicles for transporting PCB Material, then at each inspection stop that is required by TDG, telephone Consultant to provide an update on vehicle location and anticipated progress.
- .8 Proposals that involve interim storage of PCB materials are unacceptable. PCB Materials to be handled by Contractor.
- .9 Provide details on treatment technology to be used. This description to include, but not limited to, any limitations on nature or type of PCB materials that can be treated or stored, and a description of residual waste streams and location for destruction of same. Proposals which include land filling of any residual material are unacceptable. Nor is recycling of metals through scrap dealers acceptable.
- .10 Destroy PCB material, including porous residuals at an approved Canadian destruction facility. Submit to Consultant, documentation confirming that facility is approved to treat or store types of PCB material.
- .11 Upon destruction of PCB material, issue to Consultant a Certificate of Destruction for materials taken from site. Certificate of Destruction to reference waste manifests and specific waste profile sheets used for this project. These Certificates to also be specific to location from which PCB material is removed.

END OF SECTION

PART 1 - GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.

1.02 SERIES RATED COMBINATIONS

- .1 Comply with local governing electrical code rule with regards to series rated combinations of over-current protective devices and ensure that equipment in which lower rated devices are installed are marked with a series combination interrupting rating at least equal to available fault current.

1.03 PROTECTIVE COORDINATION AND EQUIPMENT WITHSTAND RATINGS

- .1 Obtain results of coordination study and short circuit calculations reports and Consultant comments and incorporate into shop drawings of electrical distribution equipment (high voltage and low voltage equipment as applicable). Do not order equipment until shop drawings submission process has been completed to satisfaction of Consultant.
- .2 Provide ratings for electrical equipment, circuit protective devices, bussing, and switches to interrupt and withstand short circuit faults greater than available fault current at its source of supply.

1.04 BREAKERS

- .1 Breakers to be NEMA rated types, and for switchboards and distribution panelboards, breakers when frame sized 225 amperes and greater, to be provided with solid state adjustable trip units with long time, short time and instantaneous time (LSI) functions and time delays. Set trip units at ratings as per coordination study as required for proper selective coordination. Provide ground fault alarm and trip functions at breaker trip rating above 600A, as coordinated with results of coordination study and as confirmed with Consultant.
- .2 Size breakers as per drawings and/or schedules, but in absence of direction, size breakers to suit intended application, to suit coordination study requirements and in accordance with local governing electrical code.

PART 2 - PRODUCTS

2.01 ADDITIONAL DEVICES FOR EXISTING EQUIPMENT

- .1 Additional breakers and switch and fuses assemblies for existing panelboards or switchboards are to match existing device standards and be completely compatible to board in which they are installed. During Bidding period, check and verify exact requirements of existing equipment to ensure that additional devices are accommodated. Make necessary modifications to equipment to accommodate device and feeder installation. Provide suitable engraved lamacoid identification nameplate on additional components. Revise typed circuit directory cards on branch circuit panelboards. Mount additional devices to standards of existing equipment manufacturer. Refer to notes on drawings.

- .2 Switchboard(s):
 - .1 Submit shop drawing of proposed additional breaker to existing switchboard. Identify work proposed for existing switchboard to accommodate breaker.
 - .2 Provide additional breakers as shown and sized on drawings and with interrupting capacity to accommodate intended application and match existing devices. Install into existing switchboard(s), as required.
 - .3 Provide additional features not identified in issued documents to match existing features of existing devices in each respective switchboard. Confirm requirements of existing boards on site.
 - .4 Provide air circuit power breaker(s) with solid-state trip units, and other required features to match existing devices. Adjust trip settings in accordance with electrical distribution system co-ordination study.
 - .5 Make necessary modifications to switchboards to accommodate device and feeder installation.
 - .6 Provide suitable engraved lamaroid identification nameplate and revise mimic bus (where applicable).
 - .7 Mount additional devices to standards of existing switchboard.
 - .8 Work to be performed by companies approved by respective switchboard manufacturer and approved by Owner and reviewed with Consultant.
- .3 For additional breakers and components as noted specifically on drawings, provide following:
- .4 required contacts;
 - .1 current transformers;
 - .2 potential transformers;
 - .3 wiring in conduits;
 - .4 test blocks and terminals;
 - .5 necessary components for remote connection of alarms and monitoring points to BAS; co-ordinate work with BAS Contractor.
- .5 Provide additional retrofit work to existing equipment as noted on drawings.
- .6 Products to be of types from existing equipment manufacturers.

2.02 SPLITTER TROUGH

- .1 CSA approved, splitter trough each complete with:
 - .1 formed, factory primed and painted steel box with knockouts;
 - .2 hinged front coverplate;
 - .3 suitable mounting provisions;
 - .4 a nameplate giving its rating.
- .2 Terminal blocks consist of pressure type main lugs and branch lugs approved for copper wiring and mounted on porcelain bases.

- .3 Enclosures for splitters mounted in climate controlled areas to be NEMA 1. For standard non-climate controlled applications, enclosures to be minimum NEMA 3R. Use NEMA 4X for corrosive environment applications.
- .4 Splitter trough ratings are scheduled on drawings.
- .5 Acceptable manufacturers are:
 - .1 Bel Inc.;
 - .2 Hydrel;
 - .3 Hammond.

2.03 CONTACTORS

- .1 Eaton, CSA approved, NEMA rated, factory assembled, magnetic, full voltage contactors as follows:
 - .1 To CSA C22.2 No.14;
 - .2 "Freedom" CN15 series, non-reversing type for heating and motor loads; features long life twin break, silver cadmium oxide contacts and steel mounting plate; magnetically actuated switch to include remote operation capability;
 - .3 Series A202 electrically held, magnetically latched contactor for lighting loads; contactors designed to withstand large initial inrush currents.
- .2 Each contactor to be suitable in respects for application and complete with following, as applicable:
 - .1 "Hand-Off-Auto" switch and pilot lamp;
 - .2 "START/STOP" pushbutton;
 - .3 an enclosure of NEMA size to suit application with necessary accessories;
 - .4 factory primed and painted enclosures;
 - .5 minimum NEMA 1 type enclosures for climate controlled areas;
 - .6 minimum NEMA 3R type enclosures for non-climate controlled areas;
 - .7 ampere rating, number of poles, etc., as noted on drawings.
- .3 Acceptable manufacturers are:
 - .1 Eaton;
 - .2 Schneider Electric (Square D);
 - .3 Rockwell Automation (Allen-Bradley);
 - .4 GE.

2.04 DISCONNECT SWITCHES

- .1 Eaton, heavy duty, CSA approved, disconnect (safety) switches. Features include:
 - .1 front operated with a handle suitable for padlocking in "OFF" position and arranged so that enclosure cover cannot be opened while handle is in "ON" position
 - .2 operating mechanisms: quick-break, positive acting with visible blades and a line terminal shield;

- .3 fusible units with fuse clips suitable for HRC fuses, unless otherwise noted;
- .4 ampere rating, number of poles and fuse requirements as indicated on drawings;
- .5 factory primed and painted switch enclosures.
- .2 Disconnects for variable speed drives to be suitable for use with such drives and include auxiliary switch/contact to de-energize control power circuit, as required and as applicable.
- .3 Enclosures for disconnects mounted in interior climate controlled areas and standard non-climate controlled areas to be NEMA 3R . For corrosive environmental applications, enclosures to be minimum NEMA 4X.
- .4 Acceptable manufacturers are:
 - .1 Eaton;
 - .2 Siemens Electric Ltd.;
 - .3 Schneider Electric (Square D).

PART 3 - EXECUTION

3.01 INSTALLATION OF SPLITTER TROUGH

- .1 Provide splitter trough and install into locations and connect complete. Ensure adequate clearance is provided as per code requirements and as required for access for operation and maintenance.
- .2 Ensure enclosure ratings are suitable for intended applications.
- .3 Secure splitter trough in place independent of connecting conduit, secure into position and connect complete.
- .4 Provide engraved Lamacoid nameplate with nomenclature reviewed with Consultant.

3.02 INSTALLATION OF CONTACTORS

- .1 Provide contactors in enclosures for electric heating, outside lighting control and other equipment. Connect complete to equipment and auxiliary control devices as required.
- .2 Wall mount each enclosure independent to panelboard to which loads are connected.
- .3 Ensure enclosure ratings are suitable for intended applications.
- .4 Provide engraved Lamacoid nameplate with nomenclature reviewed with Consultant.

3.03 INSTALLATION OF DISCONNECT SWITCHES

- .1 Provide disconnects switches and install into locations and connect complete. Ensure adequate clearance is provided as per local code requirements and as required for access for operation and maintenance. Install as follows:

- .1 wherever shown on drawings and/or specified herein;
 - .2 wherever required by MCC/VFD/starter schedule drawings;
 - .3 for motorized equipment which cannot be seen from motor starter location or is more than 9 m (30') from starter location (in accordance with local governing electrical code requirements);
 - .4 for "packaged" equipment fed from a motor starter panel.
- .2 Ensure enclosure ratings are suitable for intended applications.
 - .3 Provide engraved Lamacoid nameplate with nomenclature reviewed with Consultant.

3.04 ELECTRICAL CONNECTIONS FOR MECHANICAL, OWNER'S, ETC., EQUIPMENT

- .1 Provide required electrical connections to apparatus provided and/or supplied by Electrical Divisions. Review shop drawings and coordinate with each equipment vendor, requirements for power feeds and control/communication interconnections and provide these requirements to complete installations work.
- .2 In addition to providing electrical feeders and connections to equipment provided by Electrical Divisions, provide required electrical connections to apparatus provided and/or supplied by Mechanical Divisions, Owner and as part of other Divisions.
- .3 Unless otherwise noted, provide electrical connections including power and control wiring for equipment supplied by Owner or by other Divisions, and except where specified for control wiring of Mechanical Divisions automatic control systems specification Section. Provide complete wired and empty conduit systems with fish cord, junction boxes, pull boxes, outlet boxes, faceplates, sleeves, etc. Provide disconnect switches, receptacles and other required wiring and connection accessories. Coordinate work with respective Consultants and suppliers of equipment to be provided with electrical connections.
- .4 Refer to Division 11, and include for coordination and interconnections of Division 11 requirements and equipment schedule.
- .5 Coordinate with trades of other Divisions to ensure provision of proper electrical requirements. Unless otherwise noted or reviewed with Consultant, be responsible for provision of interconnect wiring between remote operator devices, controllers, and equipment being controlled by operator devices, whether or not such devices/controllers are supplied by Electrical Divisions. Where equipment is of split unit design and line voltage is required to both units, be responsible for feeders to each unit as coordinated with equipment manufacturer and Division responsible for equipment. Provide disconnect switches, receptacles and other required wiring and connection accessories. Provide system/equipment power feeds with hard wired or receptacle type connections, as required. Coordinate exact requirements prior to start of work, at time of shop drawing submissions and prior to roughing-in of work. Coordinate work with suppliers of equipment to be provided with electrical connections which may include but not be limited to following:
 - .1 imaging/diagnostic equipment;
 - .2 other medical equipment;
 - .3 audio visual systems;
 - .4 telecommunication systems;
 - .5 mechanical systems and equipment.

- .6 Provide coordination of alarm connections of equipment with Mechanical Divisions BAS Contractor. Refer to drawings of both Electrical Divisions and Mechanical Divisions for BAS points to be connected. Include for wiring in conduit, contacts, termination/junction boxes, etc., as required for inter connection.

3.05 PROVISIONS FOR MEDICAL IMAGING/SCANNING EQUIPMENT

- .1 Imaging/scanning equipment to be provided and/or relocated into areas of Work. Refer to issued equipment vendor drawings and review requirements necessary for their equipment installation. Comply with equipment vendor limitations to material composition of devices being installed in vicinity of equipment.
- .2 Provide required power feeders, raceways, conduits, feeders, boxes, wiring as per drawing notes and schedules.
- .3 Confirm with equipment vendors, special power requirements such as transformer impedances and power/voltage regulation and include required provisions.
- .4 Provide required grounding and bonding of equipment.
- .5 Coordinate with respective electrical product vendor, communications system vendors, security system vendors and telecommunication system vendors to ensure compliance with medical equipment vendor requirements.
- .6 Refer also to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.
- .2 Submit samples of each typical wiring device, faceplates, finishes and colours. Mount to sample board, clearly labelling devices and finishes. Submit for review by Owner and Consultant. Do not order any device unless finishes have been reviewed and approved by Consultant.

2 PRODUCTS

2.01 SWITCHES

- .1 Switches to be CSA approved, ULC listed and labelled devices.
- .2 Hubbell Canada Inc., HBL 1221 Series, CSA approved, heavy duty, industrial grade, back, and side wired, AC quiet action toggle type, 20 ampere, 120-277 V switches. Switches to include steel-nickel plated bridge, nylon toggle, one piece rivetless copper alloy spring contact arm and terminal plate, silver cadmium oxide contacts, brass binding head screws, one piece integral grounding terminal and stainless steel automatic grounding clips. Provide single way, 2-way, 3-way, and key type to suit specific application requirements.
- .3 Hubbell Canada Inc. No. 1221-IL, CSA approved, heavy duty, specification grade, AC quiet action, illuminated polycarbonate handle toggle type, 20 ampere, 120-277 V switches.
- .4 Legrand - Pass & Seymour, No. 1200 series, pressure sensitive door switches complete with metal box, plates, and wire leads, and suitable for flush installation. Light is "ON" when door is open.
- .5 Rockwell Automation (Allen Bradley), 800T series, CSA approved and labelled, operator devices including pushbuttons and pilot lamps mounted in recessed mounting stations or surface mounting NEMA 4/13 enclosures. Enclosures in non-climate controlled areas to be NEMA type 4 weatherproof and water tight.
- .6 Acceptable manufacturers are:
 - .1 Hubbell Canada Inc.;
 - .2 Cooper Wiring Devices (Arrow Hart);
 - .3 Legrand - Pass & Seymour;
 - .4 Leviton.

2.02 RECEPTACLES

- .1 Receptacles to be CSA approved, ULC listed, certified and labelled devices.
- .2 Hubbell Canada Inc., No. HBL 8200, extra heavy duty hospital grade with green dot symbol, back and side wired, flush, thermoplastic polyester face/body construction, duplex U-ground, 15 ampere, 125 V, 2-pole, 3-wire grounding receptacles complete with one piece nickel-plated brass mounting strip with integral grounding clips, ground retention clips, nickel-plated brass wiring clamps

with nickel-plated brass screws, front circuit identification area and reinforced thermoplastic base.

- .3 Hubbell Canada Inc., No. HBL 8300 extra heavy duty hospital grade, U-ground, 20 ampere, 125 V, 3-wire duplex receptacle.
- .4 Hubbell Canada Inc., No. HBL 8200SG series, extra heavy duty hospital grade, 15 ampere, 125 V, 2-pole, 3-wire grounding, tamper-resistant (safety shutter) duplex receptacles.
- .5 Hubbell Canada Inc., No. IG 8200 series, extra heavy duty hospital grade, 15 ampere, 125 V, nylon construction, back and side wired, one piece mounting strap, isolated ground duplex receptacles.
- .6 Hubbell Canada, No. HBL8262SA / HBL8362SA "CIRCUITGUARD" Series, hospital grade, 15/20 ampere, 125 V, duplex, surge suppression receptacles in blue finish, complete with light and alarm, 240 joules/15000A per mode.
- .7 Hubbell Canada, No. IG8262SA / IG8362SA "CIRCUITGUARD" Series, hospital grade, 15/20 ampere, 125 V, duplex, isolated ground, surge suppression receptacles in blue finish, complete with light and alarm, 240 joules/15000A per mode.
- .8 Hubbell Canada, No. GFR8200SG / GFR8300SG "AUTOGUARD" Series, extra heavy duty hospital grade, 15/20 ampere, 125 V, duplex, ULC Class "A", Group One, tamper resistant, weather resistant ground fault circuit interrupting receptacles complete with automatic self-test diagnostics, green power ON LED, red ground fault LED and 10ka short circuit current rating.
- .9 Legrand - Pass & Seymour, No. 2122, 15 ampere, 125 V, recessed, ivory clock hanger receptacles and wall plates.
- .10 Hubbell Canada, No. BR15TR series, specification grade, 15 ampere, 125 V, 2-pole, 3-wire, tamper resistant, safety shutter receptacles.
- .11 Hubbell Canada, No. 4710, specification grade, 15 ampere, 125 V, single, 2-pole, 3-wire grounding twist lock receptacle.
- .12 Hubbell Canada, No. 15 ampere and 50 ampere receptacles complete with neutral and ground conductors required for indicated number of phases as shown.
- .13 Where noted that 20 A receptacles are required, include for "T" slot type of respective series of receptacles.
- .14 Colour of special switches and receptacles (unless specified above), to be as specified in PART 3 of this Section of Specification.
- .15 Special switches and receptacles not specified above are to be specified on drawings. Low voltage lighting controls are specified in Section entitled Lighting Control.
- .16 Acceptable manufacturers are:
 - .1 Hubbell Canada Inc.;
 - .2 Cooper Wiring Devices (Arrow Hart);
 - .3 Legrand - Pass & Seymour;

.4 Leviton.

2.03 FACEPLATES

- .1 Grade 18 8, type 430, 1 mm (0.032") thick stainless steel, satin, brushed or natural finish, complete with a peel off protective plastic film, and stainless steel screws.
- .2 Legrand - Pass & Seymour, "Jumbo" 302 stainless steel wallplates.
- .3 Colours and finishes of faceplates are specified in Part 3 of this Section.
- .4 Acceptable manufacturers are as per switches and receptacles.

2.04 PUSHBUTTONS OPERATORS

- .1 Rockwell Automation (Allen-Bradley) Ltd., 800T Series operators as follows:
 - .1 emergency off pushbuttons: oversized 60 mm (2-1/2") diameter red plastic mushroom head pushbutton with shroud, thrust washer, and an aluminum faceplate with "EMERGENCY POWER OFF" identification lettering or other nomenclature as required to suit application. Push buttons to be Pull/Twist to release type. EPO push button to be 2-pole type to achieve functionality as illustrated on system wiring diagrams shown on the drawings. Equivalent to Allen-Bradley 800T-FX6AV series;
 - .2 pushbuttons: standard 30 mm (1-1/4") diameter plastic pushbuttons in Red/Green colours as required for application, momentary/maintained/2 position push-pull operations as required, flush/extended/mushroom heads; non-illuminated/illuminated, with aluminum faceplate with identification lettering nomenclature as required to suit application;
 - .3 pilot lamps: 30 mm (1-1/4") diameter illuminated LED pilot lights, red/green/amber/white/clear colours as required to suit application; of voltage ratings as required to suit application; with contact block; with aluminum faceplate with identification lettering nomenclature as required to suit application; push to test feature where required;
 - .4 with enamel painted steel or stainless steel faceplate for flush mounting onto recessed wall boxes or in millwork, suitable for mounting of devices;
 - .5 with NEMA 1 box for surface mounting applications in climate controlled areas, CSA approved for application and of size suitable for mounting of devices;
 - .6 with minimum NEMA 3R box for surface mounting applications in non-climate controlled areas, CSA approved for application and of size suitable for mounting of devices;
 - .7 with STI type flip open polycarbonate tamper-proof cover and audible alarm device activated when cover is open, and custom labelling.
- .2 Exact type and ratings of devices are to suit specific applications.
- .3 All devices provided shall be CSA/ULC listed.

- .4 Acceptable manufacturers are:
 - .1 Rockwell Automation (Allen-Bradley);
 - .2 Eaton (Cutler-Hammer);
 - .3 Square D;
 - .4 GE.

3 EXECUTION

3.01 INSTALLATION OF SWITCHES

- .1 Provide switches and install in electrical outlet boxes. Refer to drawings to determine flush or surface mounting requirements. Generally, flush mount devices in finished areas. Size electrical boxes to suit device requirements as per device manufacturer's recommendations. Properly ground device to box and ground system as per code requirements and manufacturer's instructions.
- .2 For pricing only, switches to be ivory for devices connected to normal power circuits, red for devices connected to essential power circuits including isolated power centres.
- .3 Every switch connected to essential (emergency) power circuits, to be illuminated toggle type.
- .4 Illuminated operation of lighted switches to suit specific applications as confirmed with Consultant.
- .5 Ensure that switches located adjacent to doors are located at strike side of door. Confirm door swing requirements on architectural drawings, not on electrical drawings.
- .6 Coordinate installation of door switches with trades responsible for provision of doors and frames. Confirm exact locations of switches with Consultant to ensure optimum operation of switch to door position.
- .7 Within special imaging/scanning unit type rooms, devices including mounting screws and hardware must be of non-ferrous construction as per unit manufacturer's instructions.
- .8 Confirm final switch finishes with Consultant as per sample board submission specified in Part 1. Do not order any devices unless final finishes have been approved by Consultant.
- .9 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.02 INSTALLATION OF RECEPTACLES

- .1 Provide hospital grade receptacles and install in electrical outlet boxes. Refer to drawings to determine flush or surface mounting requirements. Generally, flush mount devices in finished areas. Size electrical boxes to suit device requirements as per device manufacturer's recommendations. Properly ground device to box and ground system as per code requirements and manufacturer's instructions.
- .2 For pricing only, receptacles to be ivory for devices connected to normal power circuits, red for devices connected to essential power circuits. Isolated ground

receptacles connected to circuits fed from uninterruptible power supply units to be orange colour. Generally, install receptacles in Patient Care Areas vertically with ground pins up.

- .3 Safety shutter type receptacles to be located where shown and required by code and CSA Z32.
- .4 Confirm receptacle finishes via submission of sample board to Consultant. Do not order any devices unless final finishes have been approved by Consultant.
- .5 In patient care areas, 15A/20A straight blade receptacles to be hospital grade.
- .6 Comply with requirements of CSA Standard Z32, with regards to identifying circuit number and supplying panelboard, permanently identified at outlets. Identify this information in areas on front of each receptacle. In addition, provide typed label on wall below each device faceplate, identifying circuit number and panelboard from where each device is fed. Confirm nomenclature with Consultant prior to printing of labels and nameplates. Turn over label maker to Consultant/Owner prior to application for Certificate of Substantial Performance of the Work.
- .7 Within special imaging/scanning unit type rooms, devices including mounting screws and hardware must be of non-ferrous construction as per unit manufacturer's instructions.
- .8 Where receptacles are indicated in counters and benches, box cut-out to be provided in counter and bench. Provide a box, receptacle, plate and branch circuit wiring. Branch circuit wiring within counters and benches to be flexible armoured cable, under requirements of local governing electrical code and standards. Install and connect complete.
- .9 Confirm final receptacle finishes with Consultant as per sample board submission specified in Part 1. Do not order any devices unless final finishes have been approved by Consultant.
- .10 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.03 INSTALLATION OF FACEPLATES

- .1 Provide each switch and receptacle with a faceplate with an opening or openings suitable for device it conceals and covers openings around boxes. Secure faceplates to device frames with screws to match faceplates. Provide larger than standard type faceplates for devices that require engraved nomenclature to define special purpose for that device.
- .2 Provide stainless steel faceplates in operating rooms, laboratories, treatment rooms, test rooms, etc.
- .3 Provide nylon type faceplates for switches and receptacles circuited to emergency power sources and/or isolated power centres. For flush mounted devices, provide oversized faceplates as required to properly cover wall openings around recessed boxes. Provide faceplates with suitable identification label. Colour finish to be red, but to be confirmed with Consultant.
- .4 Provide nylon type standard size faceplates for flush mounted switches and receptacles circuited to normal power.

- .5 Provide galvanized stamped steel faceplates in service areas and equipment rooms where devices are surface mounted.
- .6 Provide faceplates for computer equipment isolated ground receptacles with label printed with "Computer Equipment Only" lettering.
- .7 Provide faceplates for housekeeping receptacles with label printed with "Housekeeping Only" lettering.
- .8 Provide weatherproof insulated faceplates with hinged and gasketed receptacle access flaps for weatherproof receptacles denoted "WP" on drawings.
- .9 Generally, oversized faceplates to be provided where engraved lettering is required.
- .10 Faceplates for flush floor mounted receptacles to be forged brass rectangular faceplates.
- .11 Confirm exact material, finish, and colour of faceplates for devices in any particular area with Consultant prior to ordering. Submit sample board as per requirements of Part 1.
- .12 Provide faceplates with printed self-adhesive label on inside face identifying circuit number and panel feeding device. Turn over label maker to Consultant prior to application for Certificate of Substantial Performance of the Work.

3.04 INSTALLATION OF PUSHBUTTON OPERATORS

- .1 Provide specified and suitable pushbutton operators and pilot lamps to suit various applications.
- .2 Where flush mounted, provide faceplate for mounting onto recessed boxes.
- .3 Where surface mounted climate controlled areas, provide suitable NEMA 1 box. In non-climate controlled areas, surface mounted devices to be mounted within minimum NEMA 3R rated boxes.
- .4 Install devices in accordance with manufacturer's instructions to suit application requirements of Owner. Connect complete to respective equipment being controlled. Provide required wiring in conduit.
- .5 Test and verify operation of each device. Provide engraved lamaroid nameplate to identify system being operated and any special instructions. Confirm exact nomenclature with Consultant prior to ordering.

END OF SECTION

PART 1 - GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings for products of this Section, and on Schedule of Luminaires on drawings.
- .2 Include photometric data, lamp, and ballast information for each luminaire. Include ballast data identifying maximum circuit loading limitations.
- .3 Photometric data to include: total input watts, candlepower summary, candela distribution zonal lumen summary, luminaire efficiency, CIE type, coefficient of utilization, lamp type and lumen rating in accordance with IESNA testing procedures.
- .4 Include copy of certification that lenses and louvers comply with local governing building code requirements for flame spread ratings.
- .5 For poles, submit documentation that poles supplied are suitable for steady wind velocity and gust velocity of area of installation, and suitable for total effective projected area of mounted lighting equipment.
- .6 For exterior site areas or parking areas, where luminaires are proposed that are not from based specified manufacturer, provide luminaire manufacturer's computer prepared detailed photometric layout drawings with complete photometry showing performance levels of proposed luminaires. Clearly identify lighting levels, quantity, locations, mounting heights, etc. Identify variances from base design.

1.02 WARRANTY

- .1 Warranty requirements are as follows:
- .2 unless otherwise noted, LED and LED drivers for a period of five (5) years from date of acceptance of Work by Owner for its intended use;
 - .1 include costs for personnel, equipment and labour for replacing lamps and ballasts covered under warranty;
 - .2 re-lamp luminaires (except LED types) used during construction period before such date of acceptance of Work by Owner.

1.03 SUBSTITUTIONS

- .1 Provide luminaires as specified in Schedule of Luminaires and as per documented List of Manufacturers, where applicable. During construction period, no substitutions are permitted unless compelling reasons are given and accepted by Owner and reviewed with Consultant. A delay caused by Contractor's failure to order luminaires to meet construction schedule is not a valid reason.
- .2 Make requests for proposed substitutions as per requirements of Section entitled Electrical Work General Instructions and Division 01.
- .3 Consideration of any proposed substitutions after Bid Period to be at Consultant's sole discretion.

PART 2 - PRODUCTS

2.01 LUMINAIRES

- .1 Provide luminaires in accordance with Schedule of Luminaires found on drawings. Luminaires are to be CSA approved or have special local electrical authority approval.
- .2 Provide thickness of metal as indicated in Schedule of Luminaires and details, or as required so that luminaires are rigid, stable and resists deflection, twisting, warping or bending under normal installation procedures, re-lamping etc., or no less than requirements specified herein the specifications.
- .3 Unless otherwise noted, construct fluorescent luminaire bodies from minimum 20 gauge cold rolled prime steel and of rigid construction to permit any suspension method without sag. Unless otherwise noted, provide body finishes of corrosion resistant, chemically treated and electrostatically spray painted baked white enamel. Reflecting surfaces to be white with an average reflectance of not less than 85%. Provide adjustable mounting brackets for troffers mounted in ceilings.
- .4 Unless otherwise noted, linear and continuous linear architectural LED luminaires bodies to be constructed of extruded aluminum and of rigid construction. Unless otherwise noted, provide body finishes of corrosion resistant, chemically treated and electrostatically applied post powder coat finish. Efficiency not to be less than 69%.
- .5 Unless otherwise noted, vandal resistant luminaires to be constructed of heavy duty extruded aluminum rails and die cast end caps, complete with stainless steel torx with centre reject pin and Allen head set screws. Screw heads to be mounted and concealed under lens. Lens to be extruded UV stabilized polycarbonate lens with internal linear ribbed design.
- .6 Provide neoprene or silicone gasketting, barriers and stops where required to prevent light leaks or water/water vapour penetration.
- .7 Fabricate housings to allow for easy accessibility and replacement of parts.
- .8 Fabricate fixtures with a minimum number of joints. Make unexposed joints by acceptable method such as welding, brazing, screwing or bolting. Soldered joints are unacceptable. Do not use blind metal tapping methods or rivets for fastening parts which must be removed during service, or for fastening electrical components and supports. Cast parts, including die-cast members, to be of uniform quality, close grained, rigid, true to pattern, free from blow holes, pores, discoloration, hard spots, shrinkage defects, and cracks or other imperfections that affect strength and appearance or are indicative of inferior metals or alloys.
- .9 Reflectors and reflecting cones or baffles to be free of any tooling marks, spinning lines or marks by other assembly techniques. For fluorescent sources, iridescence to be low. Finishes to be equal to first quality polished, baffled, and anodized "Alzak".
- .10 Lamp sockets to be suitable for indicated lamps and be set so that lamps are positioned in optically correct relation to all luminaire components. Preset adjustable sockets at factory for lamp specified.

- .11 Lenses and louvers to comply with local governing building code and other local governing code flame spread rating requirements.
- .12 Unless otherwise noted, construct acrylic lens from 100% virgin acrylic and not less than 3.22 mm (0.125") thick. Fluorescent K12 acrylic lenses to have recessed prismatic pattern with no fade-outs or streaks and be of strain-free and uniform production. Glass lenses to be minimum 9.5 mm (0.375") thick.
- .13 Recessed luminaires with replaceable/serviceable parts such as ballasts, lamps, sockets, etc., must be accessible from lens side (ie. room side) of fixtures to allow for proper accessibility.
- .14 Luminaires to be factory assembled and tested prior to delivery on site.
- .15 Exposed parts and hardware of luminaires located in non-climate controlled areas to be corrosion resistant and weather resistant. Hardware to be tamper-proof. Manufacturer exterior luminaire poles with corrosion resistant finish and construction. Pole suppliers to ensure that poles supplied are suitable for steady wind velocity and gust velocity of area of installation, and suitable for total effective projected area of lighting equipment. Submit verification of this with shop drawings.
- .16 When requested, submit luminaire samples.
- .17 Dimensions for coves, valances, and strips as shown on drawings are for bidding purposes only. Job measure for exact dimensions of louvers, lenses and strips.
- .18 Dimensions for linear and continuous linear LED as shown on drawings are for bidding purposes only. Job measure for exact dimensions requirements to suit installation location.
- .19 Review exact colours and finishes of luminaires with Consultant after award of contract but prior to ordering. Obtain information in time to meet installation schedule.
- .20 For high intensity discharge types of luminaires, arrange for manufacturer of ballasts to supply with shop drawings a detailed data sheet identifying maximum circuit loading limits. Review drawings and confirm that circuits are not overloaded.
- .21 Coordinate with ballast manufacturers and dimmer/occupancy control manufacturers to ensure that components are compatible with each other and that interconnections do not affect performance, life or any warranties.
- .22 Products of same specified type to be of same manufacturer.

2.02 MEDICAL SYSTEMS SIGNAGE

- .1 Illuminated signage is specified on Schedule of Luminaires. Signage is of type that wording is visible when sign is illuminated. Review exact nomenclature and colour of display (lamps and/or illuminated panels) with Consultant and local governing authority prior to ordering.
- .2 Coordinate exact connection and integration requirements with respective medical equipment to which with signage are associated. Refer to issued drawings.

2.03 LEDS AND DRIVERS

- .1 General features include:
 - .1 CSA approved, ULC listed and labelled;
 - .2 Operating temperature:
 - .1 Luminaires for applications in climate controlled area: operating temperature range through -20°C (-4°F) to 50°C (122°F);
 - .3 With rapid and changing development of LED technology, provide most technically proven and most advanced and successfully tested LED technology at time of installation;
 - .4 Specification standards to meet requirements of IES LM 79 and LM-80.
 - .5 Be 100% compatible with connected dimmer controls to provide dimming down to 5%.
- .2 Light emitting diodes (LEDs) features to include:
 - .1 LEDs to be selected from same colour bin size for consistency in chromaticity and meet ANSI C78 377A as a minimum;
 - .2 generally, colour temperature range to be from 2700 K to 6500 K; specific temperature requirements to be identified on Schedule of Luminaires;
 - .3 minimum CRI of 85, but shall be as specified on the fixture schedule;
 - .4 rated life (based on 70% lumen depreciation level) from 50,000 to 70,000 hours.
- .3 Driver (ballast) features to include:
 - .1 Operate from 60 Hz input source of 120 VAC with sustained variations of $\pm 10\%$ (voltage and frequency) with no damage to driver;
 - .2 Output regulated to $\pm 5\%$ across load range;
 - .3 Power factor greater than 0.90;
 - .4 Total harmonic distortion less than 20%;
 - .5 Class A sound rating;
 - .6 Comply with ANSI C62.41 Category A for transient protection.
- .4 Acceptable manufacturers to be as recommended by luminaire manufacturers.

2.04 DIMMERS

- .1 EATON WBSD-010SLC-V Greengate 0-10V Slide Dimmer Wallstation
- .2 Lutron Diva Series, DVSTV-WH

- .3 Acceptable manufacturer is EATON, Lutron or Wattstopper. Other Dimmers low voltage dimmers will be considered if recommended by supplier and meeting the criteria noted above.

PART 3 - EXECUTION

3.01 INSTALLATION

- .1 Provide luminaires as required. Obtain required training from manufacturer's representative on any special installation procedures. Install products in accordance with manufacturer's instructions to suit specific installation requirements.
- .2 Before placing luminaire orders:
 - .1 verify quantity requirements;
 - .2 thoroughly review ceiling types, finishes and construction details; verify ceiling types with latest Architectural Drawings; order luminaires to suit correct ceiling type;
 - .3 ensure that required mounting assemblies, frames, rings and similar features are included;
 - .4 review colours and finishes with Consultant.
- .3 Include for assembly and mounting of luminaires and lamps, complete with:
 - .1 wiring and connections;
 - .2 fittings and hangers;
 - .3 aligners;
 - .4 box covers;
 - .5 other accessories required for a complete, safe and fully operational assembly.
- .4 Where outlet boxes locations are shown on drawings, they are diagrammatic only. Position outlet boxes to coincide with suspension hangers and knockouts.
- .5 Install ceiling fixtures in centre of tiles unless dimensioned otherwise on Reflected Ceiling Plans. Locate hangers on tile centres or intersections. Mount recessed downlights, troffers, and surface mounted luminaires in or on full tiles. Install fixtures in and on acoustical tile ceilings in alignment with tile joints.
- .6 Cut holes for recessed luminaires to exact size so that gaps are not visible or luminaire trims cover gaps.
- .7 Mount surface ceiling luminaires perfectly level or plumb, tightly to ceiling without showing a space or light leak between frame and ceiling.
- .8 Carefully align linear luminaires shown in continuous lines or rows, so that rows appear as straight lines. Variation in alignment not to exceed 6 mm (1/4") for any 5 m (16') run.

- .9 Provide spacers for fixtures mounted on low density ceiling material.
- .10 Provide plaster frames for recessed fixtures in plaster or gypsum board ceilings.
- .11 Prepare fixtures, trim and poles and standards required to be painted.
- .12 Wiring between fluorescent lamp holders and associated operating and starting equipment to be of similar or heavier gauge than leads furnished with approved types of ballasts with equal or better insulating and heat-resistant characteristics.
- .13 Protect wiring with tape or tubing at all points where abrasion may occur. Conceal wiring within fixture construction except where design or mounting dictates otherwise.
- .14 Splices:
 - .1 Minimize number of splices.
 - .2 Make with approved mechanical insulated steel spring type connectors, suitable for temperature and voltage conditions to which splices are to be subjected.
 - .3 Splices are not to be made unless properly terminated in accessible identified junction boxes.
- .15 Support luminaires directly by ceiling slab structure and not to formed steel decking, ceiling hangers, ductwork, piping, cable trays, etc.
- .16 Do not tighten wing nuts, bolts, or screws that allow fixture adjustment for recessed adjustable fixtures.
- .17 Install spread lenses only where called out on Schedule of Luminaires and Specifications.
- .18 Use cloth gloves when handling reflector cones, louvers, halogen lamps, glass, sconces and all exposed surfaces of fixtures.
- .19 Co-ordinate luminaire installation with work of other trades to ensure that necessary recessing depths and mounting spaces are provided.
- .20 Install luminaires in accordance with applicable architectural drawing reflected ceiling plans and/or wall elevations and/or field instructions issued by Consultant. Review final luminaire locations with Consultant prior to roughing-in. In equipment rooms, shafts and similar secondary areas, install luminaires after mechanical and other major work is roughed in and adjust luminaire locations as required.
- .21 Align and position all adjustable luminaires, and ensure that luminaires with adjustable lamp holders are properly positioned to correspond to lamps specified.
- .22 Comply with requirements of local governing electrical code regarding support of luminaires in suspended ceilings.
- .23 Independently suspend luminaires in suspended ceilings from ceiling slab. For each luminaire, provide minimum two (2) cable supports secured to ceiling slab and to luminaire. Confirm with local governing authorities and review with

Consultant if a variance to this requirement can be made for specific luminaires of low weight.

- .24 Connect luminaires to power circuits and controls as required. Refer to drawings notes and schedules. Include for both normal and emergency power circuits as required.
- .25 Locate exit signs in final locations reviewed with Consultant and approved by local building code authority. Connect to power circuits as required. Where applicable for emergency power requirements, connect to emergency battery units. Relocate exit sign and re-direct direction arrows to suit local building code authority requirements and directions, and as reviewed with Consultant.
- .26 Notify Consultant immediately and relocate if necessary as reviewed with Consultant, if:
 - .1 fixture placement is in conflict with a structural beam, mechanical duct, plumbing pipe, etc.;
 - .2 space above ceiling is not sufficient;
 - .3 any reason that a fixture cannot be located where it is dimensioned or shown on construction documents.
- .27 Existing luminaires designated to be relocated and reused, to be:
 - .1 disconnected, removed and stored in a safe area as designated by Owner and reviewed with Consultant until ready for re-installation;
 - .2 inspected, cleaned, repaired and re-lamped;
 - .3 identified to Consultant of requirement for replacement parts for broken lenses, faulty ballasts, broken mounting hardware, etc., as necessary to return luminaires to good working condition; identify cost to Consultant for repair/replacement parts.
- .28 Extend ground conductors from metal parts of poles to building grounding provisions. Generally locate devices in locations on drawings, but base exact locations on coordination and review with Consultant and governing authorities. Review luminaires and pole finishes with Consultant prior to ordering. Run wiring in conduit.
- .29 Provide seismic restraints to suspended luminaires, in accordance with latest local governing building code requirements to suit zone of Place of Work.
- .30 Provide dimming ballasts or drivers luminaries to be dimmed. Coordinate between dimming system vendor and luminaire vendors to ensure 100% compatibility.
- .31 Generally, provide fluorescent luminaires with electronic type ballasts, unless within areas or rooms with electronically sensitive equipment, for which ballasts are to be electromagnetic types. Refer to luminaire schedules on drawings.
- .32 Ground and bond luminaires as per local governing electrical code requirements.
- .33 New fluorescent lamps to be operated for minimum 100 hours at full output prior to application for a Certificate of Substantial Performance of the Work.

- .34 If requested, demonstrate operation of luminaires intended for special applications such as building floodlights and other decorative purposes. Adjust their locations within a reasonable distance to obtain effects desired.
- .35 Test and adjust exterior luminaires at times after sunset, in presence of Consultant and at times acceptable to Owner and reviewed with Consultant.
- .36 Prior to turn over of Work to Owner, clean luminaires in manner recommended by manufacturer and to satisfaction of Consultant.
- .37 Lamps to be new and intact when project is complete and ready for acceptance.
- .38 Include a full lamp listing in Operating and Maintenance Instruction Manuals.
- .39 Additionally, refer to testing and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.02 INSTALLATION OF DIMMERS

- .1 Provide flush wall box dimmers in locations and connect to control lighting as indicated. Confirm exact locations prior to roughing-in. Equip each dimmer with a faceplate. Review faceplate colour with Consultant prior to ordering.
- .2 Install components in accordance with manufacturer's instructions to suit specific installation requirements.
- .3 Where identified, provide central enclosure cabinet for mounting dimmers within and connect complete. Clearly identify each dimmer and enclosure with engrave Lamacoid nameplates with circuit labels. Review exact nomenclature with Consultant prior to ordering.
- .4 When installation is complete, check and test operation of each dimmer and adjust as required.
- .5 Ensure that each dimmer is properly sized to suit connected load.

END OF SECTION

PART 1 - GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.

PART 2 - PRODUCTS

2.01 EMERGENCY LIGHTING UNITS

- .1 Emergi-lite "ESL" Series, CSA approved, 120 VAC/6 VDC emergency lighting battery units. Units are complete with batteries, charger, dual LED lamp heads per unit (where shown); cabinet and 1.2 m (4') AC cord and plug set. Units to also be complete with automatic testing and self-diagnostic circuitry, and remote monitoring provisions. System to be designed to provide emergency lighting levels in accordance with local governing building requirements.
- .2 Cabinets are constructed of No. 18 gauge steel, finished in white enamel. Front cover is removable to provide easy and full access to battery and charger connections. Knockouts are provided on top for lamp heads. Cabinet includes protective wire-guard, where required and/or where identified with "WG" designation on drawings.
- .3 Units include "PUSH-TO-TEST" switch, AC and high charge pilot lights and AC cordset.
- .4 Integral lampheads are 6V, 4W MR16 LED lamps, decorative design, high impact plastic, adjustable heads.
- .5 Unless otherwise scheduled in Schedule of Luminaires, provide remote lamp heads as follows:
 - .1 remote recessed mounted heads in climate controlled areas to be type EF15 series gimbal ring adjustable "eyeball"; overall ring diameter of 200 mm (8") and in-ceiling depth of 86 mm (3-3/8"), with 6V, 4 W MR16 LED lamps;
 - .2 remote in suspended ceiling type battery units to be provided as per Schedule of Luminaires; remote heads connected to these battery units to be provided as per drawing Schedule of Luminaires;
 - .3 remote heads to be of tamper proof construction;
 - .4 wire-guards where identified with "WG" designation on drawings.
- .6 Include for manufacturer's authorized representative to perform on-site after installation inspection, testing, adjusting, and verification of equipment. Such work to be performed during premium after hours' time. Refer to Part 3 for additional requirements.
- .7 Acceptable manufacturers are:
 - .1 Emergi-lite;
 - .2 Lumacell;
 - .3 Beghelli (supplied by Omnilumen);
 - .4 Read-lite
 - .5 Aimlite.

PART 3 - EXECUTION

3.01 INSTALLATION OF EMERGENCY LIGHTING UNITS

- .1 Provide emergency lighting battery units and lighting heads as specified herein and on Schedule of Luminaires, and mount where required. Connect battery units complete to dedicated emergency circuit of local power panels designated for this purpose or where identified on drawings, plug into designated adjacent receptacle. Provide wiring in conduit and connections to remote lamp heads and extend to central battery unit serving area.
- .2 Install units such that units to be automatically actuated upon failure of power supply to normal lighting in area covered by that unit equipment.
- .3 Connect exit signs to battery units circuits in applications where exit signs require backup DC supply.
- .4 Install combination units in locations and connect complete.
- .5 Obtain required training from manufacturer's representative on any special installation procedures. Install units in accordance with manufacturer's instructions to suit specific installation requirements.
- .6 Note that drawings identify location for battery units and generally identify circuiting of remote heads. In absence of direction of circuiting, provide wiring in conduit to feed remote heads and exit lights from nearest battery unit with sufficient capacity in area, in accordance with application requirements, manufacturer's requirements, and applicable codes. Multiple battery units may be required to accommodate connection of remote heads in some areas. Provide sufficient battery units to accommodate connected lamp loads and system design time of operation. Where more than one battery unit is installed in same immediate location, only one unit is required to be provided with integral lampheads.
- .7 Where battery model number is noted, it is for general reference and exact capacity may be required to be increased to suit connected loads and required battery output time duration to suit local governing codes. Ensure that emergency lighting operates at lighting levels and for duration to meet local governing codes.
- .8 For units serving genset room, provide SPD unit to line side of power supply to battery unit and install and connect in accordance with manufacturer's instructions.
- .9 Provide remote mounting lamp heads as specified and refer to Schedule of Luminaires where additional requirements may be identified. Provide remote mounting lampheads in locations to provide system performance in compliance with requirements of Documents and where applicable, local governing building code. Connect complete to battery units. Be responsible for revisions to system, including relocations, aiming and additional remote heads as determined by testing results. Generally, provide wiring in accordance with manufacturer's requirements but be minimum No. 10 AWG, and increased to suit voltage drop requirements recommended by system manufacturer to comply with local electrical code requirements. Confirm finish requirements with Consultant prior to ordering.

- .10 Provide hazardous location type heads in areas to suit local governing authority hazardous classification requirements.
- .11 Provide wiring in conduit and install devices in accordance to manufacturer's instructions. Comply with local governing codes and authority requirements with regards to providing fire rated conductors (MI) for life safety applications.
- .12 When installation of emergency lighting equipment is complete, and in conjunction with manufacturer's authorized representative, inspect and test entire system, adjust as required, and certify in writing to Consultant that system is complete, have been tested, adjusted, and are in proper operating condition. Also, be responsible for engaging emergency lighting manufacturer to perform an illumination level test in presence of Consultant, throughout all areas of building. Manufacturer's technician to be responsible for properly aiming remote light heads, recording light level readings on a record set of floor plans and calculating light level readings. Co-ordinate and arrange for local authority building inspector approvals. Prepare and submit to Consultant a letter on manufacturer's letterhead and signed by manufacturer's authorized technician, stating that emergency lighting levels meet requirements of local building code requirements and applicable CSA Standards. Notify Owner and Consultant at least 10 days prior to propose testing date. Testing dates and times to be reviewed with Consultant.
- .13 Provide minimum one hard bound copy and electronic copy of signed test report.

END OF SECTION

PART 1 - GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section.
- .2 Include data sheets for cabling, faceplates, terminal cabinets, racks, etc., and proposed cabling testing sheets.
- .3 Submit following:
 - .1 proof that final installation drawings have been reviewed by a Registered Communications Distribution Designer (RCDD);
 - .2 sample of proposed labelling of components and wiring;
 - .3 sample of proposed test sheet;
 - .4 copy of tester calibration certificate;
 - .5 written confirmation that telecommunication system vendor is manufacturer's valid certified system vendor for at least duration of contract work and is in good standing at time of Bid submission;
 - .6 copy of system manufacturer's warranty.

1.02 REFERENCE STANDARDS

- .1 Comply with latest editions of following, as applicable for project:
 - .1 ANSI/TIA-568-C., family of Telecommunications Standards, including:
 - .1 ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises;
 - .2 ANSI/TIA-568-C.1 - Commercial Building Telecommunications Cabling Standard;
 - .3 ANSI/TIA-568-C.2 - Balanced Twisted-Pair Telecommunication Cabling and Components Standard;
 - .4 ANSI/TIA-568-C.3 - Optical Fiber Cabling Components Standard;
 - .5 Issued addenda.
 - .2 ANSI/EIA/TIA 606-B (CSA T528) - Administration Standard for Telecommunications Infrastructure of Commercial Buildings;
 - .3 ANSI/EIA/ TIA-607-B (CSA T527) - Grounding and Bonding Requirements for Telecommunications in Commercial Buildings;
 - .4 ANSI/EIA/TIA-569-C (CSA T530) - Commercial Building Standards for Telecommunications Pathway and Spaces;
 - .5 ANSI/TIA-526-14-B - Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant;
 - .6 ANSI/TIA/EIA-526-7 - Optical Power Loss Measurements of Installed Singlemode Fiber Cable Plant;

- .7 Latest Building Industry Consulting Service International (BICSI) standards;
- .8 Applicable local Building Codes.
- .2 Work to be installed by system manufacturers certified system installers/vendors who are certified and experienced in implementing selected data cabling system and to perform related testing programs.
- .3 System final installation layout to be designed and/or reviewed by a RCDD. Submit shop drawings verifying this requirement.

1.03 WARRANTY

- .1 System manufacturers to provide a minimum twenty (20) year full parts, labour, and performance warranty on all passive components including structural cabling system. These warranties to be provided in written certificate form and that guarantee following:
 - .1 passive system components, e.g. patch panels, UTP cable and outlet jacks, are free from manufacturing defects in material or workmanship;
 - .2 approved cabling systems exceed specifications of TIA-EIA 568B.2.1 standards for specified category, in particular for attenuation and near-end cross-talk, loss and bandwidth requirements;
 - .3 installation supports applications for which it was originally designed as well as future versions of system performance specifications and any future applications using TIA/EIA 586B.2.1 component and cabling standards;
 - .4 replacement or repair of any originally installed registered system component to be completed at no cost for parts and labour to Owner during warranty period. Any components repaired or replaced to be warranted for remainder of warranty.
- .2 System manufacturers to provide in writing to Owner that in event of demise or failure or change in approved status of installing certified system installer/vendor, manufacturer to be responsible for providing another certified system installer/vendor to fulfil remainder of warranty conditions.
- .3 Claim for repair procedure to comprise of contractor being notified of a problem and who will conduct necessary tests and repairs to correct problem. Should contractor be unable to resolve problem, contractor to contact system supplier who will take necessary action and provide any technical support to correct problem.
- .4 Initial response time to a repair claim for a registered system to be within four (4) hours from time Contractor was notified of system fault.
- .5 Ensure that selected network cabling component manufacturer includes a system warranty that is a true "end-to-end" structured cabling system warranty from a single manufacturer, which includes data/voice communications outlet and patch cord at workstation, horizontal copper cabling, and patchpanel and patch cords at LAN room. In addition, this warranty is to be valid with selected fibre optic cabling solution.

1.04 SCOPE OF WORK

- .1 This Section provides minimum standards for provision of a structured cabling system to network computer systems for complex. Requirements for network electronics are responsibility of Owner's Network Integrator. Work includes but is not to be limited to following:
 - .1 provision of Category grade End-to-End certified structured cabling system;
 - .2 provision of data and voice cabling, communications outlets, patchpanels and associated equipment;
 - .3 system testing and verification;
 - .4 coordination of system requirements and integration requirements with integrated systems.
- .2 The local area network system must be "protocol neutral" and provide users access into a variety of resources from any location within the Complex. An Ethernet backbone shall be utilized for the system with intelligent network switches coordinating and managing data flow. The wiring configuration is based on a "physical star" topology in which cabling runs emanate in a radial pattern from the main data communications room in which the intelligent switches are located.
- .3 The network cabling system vendor shall coordinate with Electrical Contractor to ensure that properly sized conduits, back boxes outlet boxes, junction boxes and floor boxes are provided of sufficient size as per EIA/TIA Standards to accommodate CAT 6 system wiring and devices, with particular emphasis on bending radii of cabling. Conduit and boxes not meeting Cat 6 standard requirements must be replaced.
- .4 System to be designed to support minimum 1000Base-T standards.
- .5 System to be designed to support minimum 802.11a/b/g/n/ac standards.

1.05 SYSTEM SUPPLIER QUALIFICATIONS

- .1 System supplier qualifications include:
 - .1 being an established communications and electronics contractor that has and currently maintains a locally run and operated business for at least five years and holds applicable provincial and local licenses;
 - .2 be an Authorized Distributor or established franchisee for manufacturer of product/system proposed with full manufacturer's warranty privileges and be capable of providing post warranty service;
 - .3 employ technicians who have attended and successfully completed manufacturer's technical certification classes for proposed system;
 - .4 show satisfactory evidence, upon request, that they maintain a fully equipped service organization capable of furnishing adequate inspection and service to system on a 24-hour/7-day basis;

- .5 maintain at their facility necessary spare parts in proper proportion as recommended by manufacturer to maintain and service equipment being supplied.
- .2 Submit written evidence of qualifications to Consultant for approval.

PART 2 - PRODUCTS

2.01 BACKBONE CABLING

- .1 Copper Backbone:
 - .1 Backbone cabling to be ULC listed, and labelled, UTP cable to comply with TIA/EIA-568-C requirements for Category 5e transmission, tested and verified to exceed Category 5e component performance. Minimum cable specifications are:
 - .1 24 AWG copper conductor, twisted with 25-pairs contained in a PVC jacket;
 - .2 Riser rated CMR (if run in conduit); grey outer jacket;
 - .3 Conductor insulation shall be colored as per the TIA/EIA-568-C standards.

2.02 HORIZONTAL CABLING

- .1 Cable shall be Hubbell Nextspeed.
- .2 Horizontal cabling to be ULC listed, and labelled, UTP cable to comply with TIA/EIA-568-C requirements for Category 6 transmission, tested and verified to exceed Category 6 component performance. Horizontal cabling shall have a FT4 CMR rating, unless run in a plenum space and not contained within a conduit in which case shall have a FT6 CMP rating. Minimum cable specifications are:
 - .1 Conductors: 23 AWG. solid copper insulated conductor twisted with four pairs around a star filler contained in a PVC jacket;
 - .2 Plenum rated CMP; blue outer jacket;
 - .3 Conductor insulation shall be colored as per the TIA/EIA-568-C standards.

2.03 JACKS

- .1 Copper jacks:
 - .1 Jacks shall be Hubbell Nextspeed.
 - .2 Data/voice jacks to exceed category 6 performance and meets following specifications:

- .1 RJ45, eight pin modular jack;
- .2 Housing constructed of high impact, flame retardant, thermoplastic, white in color;
- .3 Pins constructed of beryllium copper tinned with 50-micro inch gold plating;
- .4 IDC 110 punch down contacts.

2.04 OUTLETS

- .1 Designed to accommodate Hubbell jacks;
- .2 Stainless steel, with top and bottom labelling fields
- .3 4-port for general use outlets;
- .4 1-port telephone mountable for outlets identified as 1-voice.

2.05 BIX WIRING FIELD

- .1 GigaBIX 2-connector housing;
- .2 GigaBIX 6-port and 25-pair connectors;
- .3 Category 6 cross connect jumper wire;
- .4 Designation strips, labels and wiring distribution rings;

2.06 ACCEPTABLE NETWORK CABLING SYSTEM MANUFACTURERS

- .1 Horizontal network copper cabling infrastructure is to be end-to-end solution from a single manufacturer, which includes data communication outlets and patch cords at workstations, and patch panels and patch cords at LAN/Telecommunication rooms. To this horizontal network is integrated fibre optic cabling infrastructure from same manufacturer or approved listed herein, maintaining full warranty requirements for systems comprising this Section.
- .2 Acceptable network cabling system manufactures for provision of horizontal network copper cabling infrastructure are:
 - .1 Hubbell;
- .3 Acceptable network cabling system manufactures for provision of backbone network fibre cabling infrastructure are:
 - .1 Corning;

2.07 ACCEPTABLE CONTRACTORS

- .1 ComNet
- .2 State Group
- .3 Marcomm

PART 3 - EXECUTION

3.01 INSTALLATION OF NETWORK CABLING – GENERAL

- .1 Properly handle and install structured network cabling in accordance with manufacturer's specifications. Avoid undue pulling tension, abrasion, or rough handling to ensure that cables will permit transmission up to required category rating design speed for cables. Install cables without splices or cuts to ensure elimination of reflections, discontinuities, impedance mismatches, etc. maximum horizontal length of copper cabling from workstation to network switch is not to exceed 90 m (295') or less if recommended by system manufacturer to meet required category grade rating performance standards. Maximum length of patch cables (either cross connects or interconnecting with electronic equipment to connect devices at work area outlet), to be a total of 10 m (30'). Maintain system manufacturer's minimum channel lengths as confirmed with system manufacturer. Provide cable loops in accordance with manufacturer's instructions.
- .2 Unless otherwise noted or where cable tray is shown for such use, run cabling in conduit. Install pull cords for future use, in conduits extending between floors.
- .3 Generally, no more than two (2) 90-degree changes in direction are recommended for cable installed in conduit without pullboxes and not more than 40% fill ratio. Confirm exact conduit bending radii restrictions and fill ratios with system manufacturer and comply with those standards.
- .4 With consideration in minimizing alien crosstalk to levels as per BICSI standards and manufacturer's standards, dress cables in a neat and orderly fashion from entrance of communications closet to relay racks using vertical and horizontal cable management trays and paths. Do not exceed manufacturer's distance limitations to maintain required category rating performance standards.
- .5 Care to be taken to ensure that during installation, nicks, abrasions, burning and scuffing of cable is prevented. Replace cables found to be damaged regardless of whether cable passes category grade rating or fibre performance testing standards.
- .6 Secure bundled cables transitioning between floors via ladder cable tray, to vertical ladder sections with Velcro wraps. Use waterfall (rounded transition) fittings for cable changing from a horizontal path to a vertical one. This is to maintain minimum bend radius for cabling system. Support cables running through risers between floors such that they are properly supported for their weight, especially in situations with high pair count cables and large bundles.
- .7 Electrical Contractor and telecommunication system vendor to provide coordination of structured cabling system with other systems as required.
- .8 Required necessary drilling and anchoring components to be installed before any horizontal cable is installed.
- .9 Route horizontal cable into equipment racks/enclosures and neatly bundle with Velcro cable ties. Maximum number of cables per bundle to be 25.
- .10 Securely mount fire retardant plywood on wall in each telecommunications room or closet.
- .11 Cables wraps are to be Velcro type and are not to be over tightened.

- .12 Provide grounding and bonding requirements as specified in Section entitled Grounding and Bonding.

3.02 COPPER CABLE INSTALLATION

- .1 Establish good communications between pull and monitor locations prior to starting a cable pull.
- .2 Allow no rough handling, kinking, denting or abrasion of the cable, and that cable is never left on the ground where it may be stepped on or otherwise damaged. Should the cable be damaged in any way, the comm. contractor shall replace the cable at the cost of the comm. contractor.
- .3 If cable is unreeled during installation, maintain an extended figure 8 configuration to prevent kinking or bending. When layering long lengths of cable in 'figure 8s', use cardboard between layers for strain relief.
- .4 Do not exceed maximum pulling force as per manufacturer's specifications.
- .5 Maintain a bend radius during installation of 20 times the cable diameter.
- .6 Cable coiled in an outlet box should be installed with a 10 x cable diameter bending diameter (i.e. 50 mm) to the extent possible.
- .7 Cable permanent link shall not exceed 90 m
- .8 Cable slack shall be included in the 90 m cable limit. Provide 200 mm of slack in the outlet and 3m within the comm. room when installing copper cable

3.03 SEPARATION OF DATA COMMUNICATION CABLES FROM SOURCES OF ELECTROMAGNETIC INTERFERENCE

- .1 Separate data communication cables from sources of electromagnetic radiation in accordance with TIA Standard Proposal SP-2072 and following:
 - .1 FT-6 rated data cabling raceway and power conductors (2 KVA power circuits) raceway require 125 mm (5") clearance;
 - .2 for fluorescent and LED luminaires, required clearance is 300 mm (12");
 - .3 clearance increases up to 600 mm (24") for power circuits over 5 KVA.
 - .4 for large motor, transformers, power panels, etc., required clearance is 1m (39");
 - .5 route cables to avoid direct contact with steam piping, hot water piping or other heat sources to avoid thermal degradation.
 - .6 CCTV coax, controls and security cables shall not but run in the communications raceway.

3.04 INSTALLATION OF RACKS

- .1 Provide racks and secure to floor with bolts and concrete anchors.

- .2 In locations where more than one rack is required, butt multiple racks together. Provide wiring channel interconnection such that wiring from rack to another is not exposed.
- .3 For open racks, provide metal raceway chimney channel for conductors extending down from ceiling, such that wiring is not exposed. Secure channel to rack and ceiling.
- .4 Run wiring neatly bundled within wiring management channels. Do not over tighten Velcro tie wraps such that they deform cable jacket. Velcro straps to easily slide along length of cable. Velcro tie wraps used in plenum spaces to be CMP/FT-6 rated.
- .5 Protect cable from any obstructions using appropriate grommeting in roof of rack.
- .6 Properly ground and bond rack and equipment to room ground bus as per specifications and to standards of TIA/EIA 607.

3.05 SYSTEM IDENTIFICATION

- .1 Provide a complete identification system that clearly designates following:
 - .1 horizontal cable;
 - .2 workstation (or faceplate);
 - .3 horizontal/passive patchpanel port;
 - .4 switch/active patchpanel port;
 - .5 patch cords;
 - .6 switch rack.
- .2 Obtain Owner's approval of identification format, prior to start of work. Format to comply with Owner's standards. Submit proposed identification system and nomenclature with shop drawing submission.
- .3 Labels:
 - .1 Labels for outlet and patch panel identification to be typewritten/computer printed self-adhesive type with white printing area at outlet location and on face of patch panel; legible permanent marker on inside of outlet box cover; use minimum font size Arial 10 point.
 - .2 Number and identify each computer hub rack with a 20 mm x 50mm ($\frac{3}{4}$ " x 2") engraved lamaroid plate, with white letters on black background. For letters and numbers use Arial 24 font size. Fasten nameplates with minimum two metal screws.
 - .3 Cable, faceplate Identification:

- .1 Confirm identification scheme with KGH IT before proceeding with labelling, including the Telco room designation.
- .2 Permanently identify horizontal UTP cables at both ends of cable, placed within 13mm (½") at outlet location and 50 mm (2") at rack location and inside of outlet cover in following manner:

" RACK - FLOOR - PORT ", Example: "HDF1-4-E01"
- .4 Patchpanel And Patch Cord Identification:
 - .1 Identify patchpanel ports in simple numeric form approved by Consultant/Owner.
 - .2 Identify patch cords at both ends in simple numeric form, not necessarily corresponding to port numbers and be approved by Consultant/ Owner.
- .4 Identification Log:
 - .1 Record cable and workstation identification in a hard copy "CABLE IDENTIFICATION LOG" which is to be handed over to Owner after cable testing and certification is complete. Forward duplicate copy to Consultant.

3.06 CABLE TESTING AND SYSTEM CERTIFICATION

- .1 Trained technicians who have successfully attended an appropriate training program and have obtained a certificate as proof thereof shall execute the tests.
- .2 Test procedures and test equipment shall comply with the following standards (in their latest draft including all addendums):
 - TIA/EIA-568-C
 - TIA/EIA TSB-140
 - TIA/EIA-526-14-A
- .1 The copper test equipment shall comply with the accuracy requirements for level III field testers and Category 6 cabling as defined in the above standards. All software shall be the latest versions, and licensed.
- .2 The optical fibre test equipment shall comply with the accuracy requirements for field testers and fibre optic cabling as defined in the above standards. The OTDR shall operate within the range of 1310 nm +/- 10 nm and 1550 nm +/- 20 nm for singlemode fibre testing
- .3 All installed cable runs shall be tested and must pass the requirements of the standards defined above. Any failing link shall be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The passing result of the tests for all links shall be provided in the test results documentation.
- .4 All Category 6 cable links shall be tested for channel link performance and the following parameters:
 - T568A wire map for continuity on all pairs

- Length – using an accurate NVP value, the pair with the longest electrical delay shall be used for the maximum length.
 - Insertion Loss
 - NEXT Loss must be tested from both ends of the cabling
 - ELFEXT must be tested from both ends of the cabling
 - Propagation delay and delay skew
 - Return Loss must be tested from both ends of the cabling
 - PSNEXT must be tested from both ends of the cabling
 - Power Sum ELFEXT must be tested from both ends of the cabling
- .5 All fibre cable shall be tested before installation while still on the reel for attenuation at both 1310 nm and 1550 nm for single mode to ensure that it meets or exceeds the manufacturer's stated performance. The contractor shall provide a soft copy of the test results to the Communications Consultant. The Communications Consultant must approve this report prior to any installation activity.
- .6 All fibre cable links shall be tested for channel link performance for the following parameters:
- End-to-end attenuation tested at both 1310 nm and 1550 nm for single mode to ensure predicted system performance.
 - A-B Polarity where duplex connectors are used
 - Optical Time Domain Reflectometer (OTDR) signature trace documentation for as-built records.
- .6 An independent testing agency shall be used to perform random testing of 10% of all copper runs at the discretion of the consultant. Testing agencies must be requested by the contractor for review and written acceptance by the Consultant.
- .7 The testing agency will provide a written report and all test results to the Consultant for his review and acceptance. If the testing agency identifies in a written report that the test results agree with the test result achieved by the Contractor, no further testing will be required. If the results are not in sufficient agreement, the Contractor will correct the problem and retest all of the installed cables and arrange to have a new 100% testing performed by the testing agency and a new report prepared. This will continue until the testing agency agrees that the test results are acceptable. This is all at the Contractor's sole expense.
- .8 Testing will be considered completed once records show that all installations meet the 100% pass rate.
- .9 Test Result Documentation:
- .1 The test results information for each link shall be recorded in the memory of the field tester upon completion of the test.
 - .2 The test results records saved by the tester shall be transferred into a Windows™-based database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that these results are transferred to the PC unaltered, i.e., "as saved in the tester" at the end of each test.
 - .3 The database for the completed job shall be stored and delivered on CD-ROM including the software tools required to view, inspect, and print any selection of test reports.

.4 General Information to be provided in the electronic data base with the test results information for each link:

- The identification of the customer site as specified by the end-user
- The identification of the link in accordance with the naming convention defined in the overall system documentation
- The name of the technician performing the test.
- The work station room/area number of the cable being tested.
- The overall Pass/Fail evaluation of the link-under-test
- The name of the standard selected to execute the stored test results
- The cable type and the value of NVP used for length calculations
- The cables available headroom.
- The date and time the test results were saved in the memory of the tester
- The brand name, model and serial number of the tester
- The identification of the tester interface
- The revision of the tester software and the revision of the test standards database in the tester
- The results for each of the tests in text form and graphical form.

All of the above entries shall appear on a single 8.5" x 11" page per cable.

END OF SECTION

PART 1 - GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings for products specified in this Section. Include annunciator schedules, revised system programming and sample of revised graphic annunciator layout and nomenclature.
- .2 Submit copies of final system testing and verification reports and certificates of approvals from local governing inspection authority.

PART 2 - PRODUCTS

2.01 EXISTING FIRE ALARM SYSTEM

- .1 Existing fire alarm system serving complex is SIEMENS. Provide additional devices and work to retrofit and extend system to serve additional and renovated areas. Additional devices to be 100% compatible with and of same manufacture as per existing system. Include provision of necessary control panel and annunciator work of existing system to accommodate integration of additional devices.
- .2 Include for and engage Owner's existing system manufacturer's authorized technicians to provide and perform required system products and work. Contact for existing system is Shaun Mcalister (E-mail: shaun.mcalister@siemens.com, Tel: 613-316-3732).
- .3 Verify with existing fire alarm system manufacturer during Bid period, exact requirements needed to provide renovation work. If necessary, visit site with manufacturer to review existing conditions. Confirm and coordinate exact work responsibilities with system vendor. Review items of clarification or proposed revisions to Bid Documents with Consultant during Bid Period.

2.02 ADDITIONAL FIRE ALARM SYSTEM WORK

- .1 System retrofit work to include but not be limited to provision of following:
 - .1 modifications to existing head end equipment including provision of additional device connection modules, zone modules, amplifiers and system re-programming;
 - .2 additional transponders/data gathering panels (DGP);
 - .3 additional initiating devices (pull stations, heat/smoke/flame detectors);
 - .4 additional alarm indicating devices (speakers, horns, strobes);
 - .5 additional interfaces and interconnections to auxiliary building systems;
 - .6 review of existing battery backup capacity and amplifiers (as applicable) and increasing capacities to accommodate additional device loading and to meet applicable governing local code requirements;
 - .7 additional wiring in conduit and/or fire rated cables.
- .2 Additional system components to be listed as products of a single manufacturer under appropriate category, by Underwriter's Laboratories of Canada and bear ULC label. System components and work in conjunction with system installation to meet specific application requirements of local governing authorities, codes, standards, regulations and requirements of following:

- .1 CAN/ULC-S524, Standard For Installation Of Fire Alarm Systems;
- .2 CAN/ULC-S527, Control Units For Fire Alarm Systems;
- .3 CAN/ULC-S537, Standard For Verification Of Fire Alarm Systems ;
- .4 local governing building code;
- .5 local governing electrical code;
- .6 local governing building permit applications for approvals;
- .7 other requirements of local governing authorities.

2.03 RETROFIT WORK AND DEVICES

- .1 Retrofit control panels and annunciators to supervise and annunciate additional and relocated devices. Additional initiating devices shall be devices that are 100% compatible with existing controls and be ULC listed and labelled for connecting to respective control units. Include costs for manufacturer's authorized representative to perform control panel/transponder work and to reprogram system software to accommodate renovation work. Provide additional zone modules as required and additional batteries as required to supply back-up battery capacity to the additional components.
- .2 Additional devices to be ULC listed and labelled devices suitable for fire alarm applications. Power supplies and other components to be CSA approved where required by local governing authorities and codes.
- .3 Exact type of device to be used in each area of installation to be as recommended by system manufacturer to suit specific applications and to be approved for such use as per ULC standards. Devices in non-climatic controlled areas to be weatherproof, corrosion resistant and ULC listed for use in below freezing temperatures. System manufacturer to be responsible for ensuring compliance with these requirements.
- .4 Transponders:
 - .1 Transponders or data gathering panels to match type of existing manufacturer's system serving facility and of series of intelligent, microprocessor based control panel that connects back to existing system panel to handle network communications. Transponders to have full system operations data available on display on LCD. System connected data communications, control points and monitoring points to be monitored and controlled by transponders. Information on transponder is to be made available to network and to be displayed at each transponder as required. Such points include:

- .1 initiating circuit devices such as addressable analogue detectors, including detector type and detector values;
- .2 conventional addressable or zone connected smoke, heat and flame detectors;
- .3 addressable devices such as pull stations; sprinkler devices;
- .4 control circuits such as speaker/strobe circuits, fan/elevator/smoke exhaust controls, electromagnetic lock controls and other similar operations and integrated equipment.
- .2 Transponders to include features and accessories to at least match existing units but supplemented with additional components to suit project renovation requirements as per system manufacturer's recommendations.
- .3 Connections back to existing system panels to include required cabling, wired in Class A (as required by local fire authorities and confirmed with system manufacturer) identifiable loops in addition to other fire rated conductors. Final wiring requirements to be determined by system manufacturer to suit specific applications and local governing authority code requirements.
- .4 Transponder enclosures to be minimum NEMA 1 with additional sprinkler-protection provisions including gasketing of openings/doors and ventilation louvers designed to protect live components from water spray of activated sprinklers. Surface mounted panels to include drip shield. Panels to be wall mounted, enamel finished, steel cabinets. Where flush mounted, include suitable trim. Panels mounted in finished areas to be of finishes reviewed with Consultant.
- .5 Devices:
 - .1 Additional smoke detectors and heat detectors: to be of type and rating to suit specific application as per existing system manufacturer's recommendations.
 - .2 Strobes and combinations strobes/audible devices: of type to match existing system standards; include additional strobes to meet latest governing building code requirements.
 - .3 Addressable modules as required for connection of additional devices.
 - .4 Ancillary devices as required to complete system.
 - .5 Refer to drawings for additional device requirements.
- .6 End-Of-Line Resistors and Isolators:
 - .1 End-of-line resistors for standard alarm and signalling circuits to be sized to ensure correct supervisory current flows in each circuit.
 - .2 End-of-line resistors to be mounted on a stainless steel plate for mounting on a standard single gang box and bear ULC label.

- .3 Isolators to be provided in accordance with code requirements and installed as per system manufacturer's requirements to isolate/monitor zones, loops, group of devices within building and between buildings.
- .7 Wiring:
 - .1 CSA approved and ULC listed wire and cable, approved for fire alarm circuits; with colour coded, insulated solid copper conductors; of type as per local governing electrical code and local governing fire authority requirements.
 - .2 Sized and installed in accordance with system manufacturer's instructions and local governing electrical code.
 - .3 To be mechanically protected to satisfaction of local fire authority.

2.04 TESTING AND VERIFICATION WORK

- .1 Refer to Part 3 for system testing, verification and certification Work.

PART 3 - EXECUTION

3.01 INSTALLATION – GENERAL

- .1 Prior to start of Work as part of shop drawing submission process, review with system manufacturer following:
 - .1 device types to ensure that selected type is suitable for intended application on project;
 - .2 locations of devices to ensure proper operation and coverage are in compliance with requirements of local fire authorities;
 - .3 device mounting heights to ensure proper operation and coverage are in compliance with requirements of local fire authorities;
 - .4 device back box requirements to ensure size and depth suit system manufacturer's recommendations for specific devices;
 - .5 proposed revisions required to existing system sequence of operation.
- .2 Immediately advise Consultant of any requirements of above that may necessitate revisions to design documents.
- .3 Install fire alarm system components and connect complete.
- .4 Perform Work in conjunction with this installation to meet requirements of latest editions of local governing building code, local governing electrical code, ULC Standards including Installation Standard CAN/ULC-S524, and any applicable local governing codes. If any requirements of these specifications are different, omitted or contrary to ULC-S524 Standard, then ULC Standard governs and overrides these specifications, but in no instance will standards established by drawings and specifications be reduced by any of Codes referred to previously. Control units and annunciators to be in accordance to latest requirements of ULC Standard CAN/ULC-S527 "Control Units for Fire Alarm Systems.
- .5 In addition, work to meet Owner's standards, and recommendations and instructions from system manufacturer.

- .6 During work to existing fire alarm system, proposed time and duration of interruption to be approved by Owner and reviewed with Consultant. At any time due to emergency situations, Owner may request by-passed zone(s) to be re-instated immediately. In all areas where renovation work requires shutdown of any part of fire alarm protection system, provide manual fire alarm protection (Fire Warden) by means of supervising area as approved by local governing authorities. At no time allow fire alarm system or any one zone to be left inoperative overnight. Provide required bypass wiring and temporary wiring to maintain all parts of fire alarm system operative during construction and alterations.
- .7 Fire alarm system manufacturer's authorized technician to supervise control panel, transponder, and annunciator work.
- .8 Provide sequence of operation for fire alarm system as approved by local fire authority and reviewed with Consultant. Refer to additional requirements on drawings.
- .9 Demonstrate system to local Fire Department and obtain their approval for complete system.

3.02 INSTALLATION OF DEVICES

- .1 Install required devices. Do not install devices in locations that may hamper proper operation of devices including adjacent devices.
- .2 Obtain required training from manufacturer's representative on any special installation procedures. Install devices and perform work in accordance with manufacturer's instructions and requirements and in accordance to applicable codes of local governing authorities having jurisdiction.
- .3 Review device finishes with Consultant prior to ordering.
- .4 Install manual pull stations in boxes as required, recessed outlet boxes with plaster rings, except in unfinished areas where pull stations are surface mounted, in which case, install stations in surface mounted boxes. Comply with mounting height requirements for local governing building code barrier free access.
- .5 Install mounting plate of thermal detectors to ceiling mounted boxes as required. Secure detectors to plates. Refer to floor plans and drawing symbol list to determine rating of detectors in any given area. Generally, do not install rate-of-rise type detectors in areas subject to sudden changes in temperatures, such as entrance vestibules. Confirm application requirements with system manufacturer and ensure that devices are ULC listed for such applications and are approved by local fire authority for such use.
- .6 Secure base of each ceiling mounted products of combustion detectors to boxes as required, either flush or surface mounted as required. Secure detector heads to bases.
- .7 Install cross zoned connection of detectors and remote indicating devices for areas of raised floors or within accessible ceiling spaces or for applications detailed on drawings.
- .8 Mount each duct mounted products of combustion detector on duct in question and connect with smoke sampling tubes which extend into duct air stream. Install

a remote alarm lamp assembly for each duct mounted detector. Wall mount each lamp assembly on a standard 100 mm (4") outlet box as close as possible or practicable to detector. Do not locate duct detectors within 1 m (3') of duct size increaser or decreaser fittings or any duct elbow. Provide wiring in conduit and extend to connect back to system control unit.

- .9 In application with hold open devices on doors, ensure compliance with NFPA regarding smoke detectors tied to hold open devices such that a signal received directly from smoke detector to cause release of door. Where electromagnetic locks are used on doors of egress, provide required automatic release of locks upon activation of fire alarm (i.e. via connection to auxiliary contact of adjacent pullstation). Provide required conductors and connections to fire alarm system and to electromagnetic locks.
- .10 Provide required speakers. Speakers are flush and surface wall mounted cone type and surface mounted horn type as indicated to suit architectural wall/ceiling types, each complete with a proper backbox. Exterior speakers to be weatherproof and mounted with a weather sealed gland nut connection at proper dispersion angle. Install speakers in accordance with manufacturer's instructions for specific applications.
- .11 Mount speakers in stairwells and wire vertically connected to specific zone as approved by local fire authority and reviewed with Consultant. Refer to drawing riser and annunciator schedule.
- .12 Generally, audible device locations are indicated on drawings, however, exact audible device quantities and locations to be in accordance with results of audibility device coverage site tests. Provide suitable sound detection metering and personnel to make necessary tests. Relocate audible devices and/or provide additional audible devices as required.
- .13 Support flush ceiling mounted speaker backboxes from structure and not suspended ceiling grid or tiles. Connect speakers to specified taps and ensure that sound levels are in accordance with local authority and sound level requirements. Adjust as required and certify that levels are in compliance with Code level requirements. Audible devices to be synchronized.
- .14 Install amplifiers sized as required to power additional speakers and include spare capacity as specified.
- .15 Install specified telephone handsets and mount in recessed wall mounting boxes. Connect complete with wiring in conduit to local transponder.
- .16 Provide double voltage relays, with multiple contacts as required, to shut down fans as noted on drawings. Arrange relays to be energized at all times from fire alarm system to ensure that they are fail safe.
- .17 Install visual notification appliances 2400 mm (8') above floor or 300 mm (12") below finished ceiling line. Provide visual notification devices in areas subject to high ambient noise levels, such as mechanical equipment rooms, computer equipment rooms, parking garage, etc., and areas designated for hearing impaired as per local building code requirements. Provide minimum 2 circuits per floor and connect devices in alternating scheme.
- .18 Relocate devices to accommodate ceiling and wall demolitions and installation of ceilings and walls. Maintain fire alarm protection in areas of Work to satisfaction of

Owner and local fire authority. Provide required temporary supporting structures to support temporary located devices in order to maintain proper operation and fire protection. Obtain required inspections and approvals from local fire authority and Owner. Relocate devices to suit local fire authority directions.

- .19 When ceiling and/or wall work has been completed, disconnect temporary devices and existing devices in temporary locations. Locate devices in permanent locations to suit renovations work as per issued drawings and Consultant's directions. Connect, adjust, test and verify.
- .20 Provide required additional devices and install existing devices as required. Circuit device's to existing standards and in compliance with local governing codes and authorities. Determine exact quantities of circuits based on requirements of governing codes and standards, and recommendations of system manufacturer.
- .21 Unless otherwise noted in Contract Documents, do not load device circuits more than 80% capacity.
- .22 Devices in non-climate controlled areas to be weatherproof, corrosion resistant, ULC listed for operation in below freezing temperatures, and as recommended by system manufacturer for use for each specific application. Where electronics are not recommended for cold temperature applications, include for manufacturer's recommendations and directions in remotely locating addressable modules in closest heated areas and connecting to respective device in non-climate controlled areas.

3.03 REQUIREMENTS FOR INTEGRATED SYSTEMS AND EQUIPMENT

- .1 Perform required fire alarm system wiring connections to mechanical equipment and other building systems to perform required interrelated functions. Provide required wiring, relays and/or contactors between fire alarm system and various equipment to achieve automatic or manual control and monitoring of equipment and to perform required integrated to fire alarm system functions. Provide shunt trip breakers as required. Provide fire rated conductors where required by local codes and local authorities.
- .2 Provision of fire alarm supervisory wiring connections to include but not be limited to following (where applicable):
 - .1 door holders/releases and electromagnetic locks;
 - .2 devices as shown on drawings.

3.04 ADDITIONAL REQUIREMENTS

- .1 Install wiring in conduit unless otherwise approved by Owner and reviewed with Consultant. Perform wiring connections associated with fire alarm system on terminal strips in junction boxes and colour coded. Provide wiring colour coding consistent for entire length of each run. When pulling wires into conduit, use lubricant and run wires straight and not twisted or abraded. Neatly secure exposed wires in apparatus enclosures with approved supports or ties. Clearly identify wiring at each termination point. In addition, number wiring with Brady Ltd. or Electrovert Ltd. Z-type markers. Colour conductors for each part of system in accordance with system equipment manufacturer's recommendations. Paint conduit couplings red of paint type suitable for application to standards of Division 09.

- .2 Install wiring in accordance to requirements of applicable governing electrical code and to requirements of local governing authorities.
- .3 Run alarm indicating circuits (speakers) and alarm receiving circuits (pull stations, detectors) in separate conduits from each other.
- .4 Arrange sprinkler system alarm valve alarm zones to be separate from manual station, thermal detector and products-of-combustion detector device zones, which may be connected together into zones.
- .5 Provide engraved Lamacoid identification nameplates for each equipment or wiring housing and secure to front of housing. Review exact wording designations and sizes to with Consultant prior to manufacture.
- .6 Review nomenclature of annunciator identification with Consultant prior to ordering.
- .7 Install end-of-line resistors to electrically supervise wiring. Generally, locate end-of-line resistors at ceiling lines above a pull station location. Provide isolators and install in accordance with ULC standards. Properly label and identify. Do not locate end-of-line resistors and isolators in concealed locations. Generally install in equipment rooms.
- .8 Refer to drawing riser diagram and connection schedules. Riser drawings are diagrammatic and are not to be used for determining quantities or lengths. Quantities of components to be as per floor plans.
- .9 Review exact location of components with Consultant prior to roughing-in.
- .10 Ground and bond system as required by local governing electrical code and authority and system manufacturer.

3.05 SYSTEM TESTING, VERIFICATION AND CERTIFICATION

- .1 Submit to Owner and Consultant, proposed schedule for testing and verification of system. Obtain such reviews prior to start of testing. Consultant and/or other Owner's representatives to have option to witness all or part of testing and verification work. Notify Consultant and Owner minimum 7 working days in advance of testing.
- .2 Include for fire alarm system manufacturer to inspect, test, verify and certify system components and wiring, individually and as a complete system, in accordance with requirements of CAN/ULC S537. Work to include but not be limited to provision of following:
 - .1 to ensure that type of equipment installed is that designated by Contract Documents;
 - .2 to ensure that wiring connections to equipment components show that installer observed ULC and CSA requirements;
 - .3 to ensure that equipment was installed in accordance manufacturer's recommendations, and that signalling devices of whatever manufacture were operated or tested to verify their operation;

- .4 to ensure that supervisory wiring of those items of equipment connected to a supervised circuit is operating and that governmental regulations, if any, concerning such supervisory wiring, have been met to satisfaction of inspecting officials;
 - .5 to ensure that sequence of operation is in accordance with existing sequence of operation and any modifications identified on documents and are approved by local fire authority;
 - .6 to ensure that devices are commissioned and operable.
- .3 System manufacturer to also be responsible for but not be limited to provision of following additional work to existing systems:
- .1 coordinate with local fire authority inspector and Electrical Division Contractor, required testing and verification work in order to obtain certification and meet local fire code and local fire authority requirements;
 - .2 test system battery power supplies and demonstrate compliance with local governing building code and local fire authority requirements that battery supplies are capable of providing required 24 hours of supervisory power followed by local governing building code required time (or time directed by local fire authority) of full load power; exact method of testing to be approved by local fire authority, Consultant and Owner; confirm and review exact procedures with previously named parties prior to testing; include for sufficient sound measurement devices and personnel in order to successfully comply with this requirement;
 - .3 full review, testing, and verification of operation of building ventilation and smoke exhaust system and its integrated operation with fire alarm system and various pieces of air handling equipment;
 - .4 full review, testing and verification of operation of integrated systems such as elevators and their emergency sequence of operation, supervisory annunciation of sprinkler/standpipe monitor switches, pressure switches and flow switches, diesel genset alarms, security alarms, BAS alarms, release of door holders and electromagnetic locks, and any other integrated components; coordinate requirements with trades responsible for integrated components and systems who will be present at time of testing and verification work;
 - .5 test that system audible devices provide alarm sound levels in areas as per local governing building code and local fire authority requirements; site adjust tap settings of audible devices as required to achieve required audibility levels; also test that emergency voice communication system meets or exceed intelligibility requirements of local governing building code and is approved by local fire authority;
 - .6 assist in testing and verification of electromagnetic door locks to meet requirements of authorities having jurisdiction and to obtain overall approval of installation;
 - .7 coordination with Electrical Divisions and local fire authority to provide requirements to obtain certificates of approvals from local fire authority;

- .8 provide full detailed test sheets of tested components and provide certification that system work has been fully tested, that devices have passed testing and that system is in proper work order in compliance to local governing code requirements and project documents; testing report documents to be additionally provided in electronic format as confirmed with Owner and reviewed with Consultant.
- .4 Where project work is phased and Owner requires occupancy at various stages, include for providing system testing, verification and certification after completion of each phase of work, to approval of local governing authorities. Upon Substantial Performance of the Work, include for providing system testing, verification and certification of entire system work.
- .5 Contact local fire authority inspector and coordinate and arrange for Fire Inspector to perform required inspections. Integrate local fire authority inspection requirements with testing and verification work to extent as per Fire Inspector's directions. Obtain full approval and certification by local fire authority.
- .6 Local fire authority inspector, Consultant and Commissioning Agent to at their discretion test system or parts of system in their review of test reports. Correct/repair any failures or deficiencies found in system, whether or not identified in test reports of manufacturer. Re-test and re-verify until successfully passed, at no extra cost to Owner.
- .7 Obtain from local fire authority required certificate of approval of system and forward to Consultant.
- .8 Arrange for manufacturers to supply reasonable amounts of technical assistance with respect to any changes required to conform to paragraphs above. During period of inspection, testing and verification, make Electricians available to do any required correction work and to assist during this Work. Include for trades responsible for integrated components (i.e. exhaust fans, sprinklers, elevators, gensets, etc.) and systems to be present at time of testing and verification work.
- .9 On completion of verification, inspection and testing of system, obtain from manufacturer and forward to Consultant, a verification certificate together with detailed inspection reports listing each and every system component, its location in building and its acceptability. Verification certificate and inspection reports to be prepared and signed by certified testing technicians of manufacturer. Signed test reports to confirm that systems are installed and perform in accordance with requirements specified above.
- .10 Obtain from system manufacturer and testing agency and forward to Consultant a certificate of liability insurance of minimum amount of Two Million Dollars (\$2,000,000.00) that is to be registered for this project to show satisfactory proof of manufacturer's liability coverage for both their product and personnel.
- .11 Unless approved in writing by Owner and reviewed with Consultant, do not use open flame and/or smoke for testing.
- .12 Testing technicians to be registered technicians in good standing with Canadian Fire Alarm Association (CFAA) or be a Certified Fire Alarm Electrician (CFAE) with Electrical Contractors Association of Ontario (ECAO) as deemed acceptable to Ontario Fire Marshall.

- .13 Additionally, refer to testing, coordination and verification requirements in Section entitled Electrical Work Analysis and Testing and include applicable requirements.

3.06 MONITORING OF SYSTEMS

- .1 In areas that remain occupied and used by Owner during Work, daily monitor and supervise existing fire alarm system and other fire protection systems serving renovation/working areas. Ensure that system is left in proper operating condition at end of each working day. Include for but not be limited to performing following:
 - .1 under presence of Owner's representative, check each morning and evening (start and end of work) of each day, system to ensure that it is in proper working condition;
 - .2 if portions of system are not in proper working order, provide temporary bypass wiring (if fire alarm system, must be subject to approval of local fire authority), and/or provide supervisory personnel to monitor systems for area affected;
 - .3 document and sign off with Owner's representative signing off also, each respective daily check condition;
 - .4 retrofitting work to system in manner that does not affect portion of system serving areas outside of renovation/working areas.
- .2 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.

END OF SECTION