



Facilities Management

PROJECT MANUAL

**WESTERN UNIVERSITY
PROJECT NO. 9E7401**

LHSB Renovations

Labatt Health Sciences Building

Prepared by
Facilities Development & Engineering

Cornerstone Architecture Inc.

ISSUED FOR TENDER
May 26, 2026

**PROJECT NO. 9E7401
LHSB Renovations
Labatt Health Sciences Building**

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1.00 FORM OF CONTRACT

- 1.01 The successful Contractor shall enter into a Stipulated Price Contract with the Owner in the form of Canadian Standard Construction Document CCDC 2 - 2020.
- 1.02 Do not commence any of the work until written authorization is issued by the Owner.
- 1.03 The Contract Documents consist of following:
 - .1 CCDC 2 - 2020
 - .2 Instructions to Bidders
 - .3 List of Drawings
 - .4 Completed Stipulated Price Bid Forms (Document 00 41 00).
 - .5 Amendments to CCDC2 - 2020 (Document 00 73 00).
 - .6 Specifications
 - .7 Schedules
 - .8 Addenda
 - .9 Bid Bond
 - .10 Performance Bond
 - .11 Labour and Material Payment Bond
 - .12 Pre-Bid Site Visit minutes (or associated addenda).
 - .13 Post-Bid Review meeting minutes
 - .14 Letter of Intent (if appropriate)
 - .15 Insurance Certificates
 - .16 WSIB Clearance Certificate
 - .17 WISR

2.00 GENERAL CONDITIONS

- 2.01 Articles A-1 to A-8, Definitions and General Conditions GC 1 to GC 13 inclusive of Document CCDC 2, 2020, shall govern this Contract except as modified hereinafter and in Document 00 72 00 Amendments to CCDC 2 -2020.

3.00 INSURANCE

- 3.01 The Contractor shall provide and maintain for all insurance described in Clause GC 11 of the General Conditions and in the Supplementary Conditions.

4.00 BID BOND

- 4.01 Submit Bid Bond in accordance with CCDC Form 220, with Bid for 10% of the Bid Price.

5.00 BONDS (in reference to GC 11.2 of the General Conditions, the following shall apply to this Contract.)

- 5.01 Each bid shall be accompanied by an Agreement to Bond from the Bonding Company for the Performance Bond and Labour and Materials Payment Bonds.
- 5.02 The successful bidder will execute Bonds within seven (7) days of request.
- 5.03 The successful bidder will be required to furnish and maintain a 50% Performance Bond and a 50% Labour and Materials Payment Bond covering the faithful performance of the contract including the requirements of the Warranty provided for in GC 12 - Warranty, and the payment of all obligations arising under the Contract.
- 5.04 All bonds shall be in the Canadian construction Association approved format and shall remain in effect for one year from date of substantial completion certificate.

- 5.05 All costs for bonds shall be included in the Bid Price.
- 5.06 Bids may not be considered unless the required bid security and consent to surety is enclosed with the Bid Submission.

6.00 OWNER

- 6.01 The "Owner" is: The Board of Governors,
 The University of Western Ontario
 1151 Richmond St.
 London, ON N6A 3K7

7.00 CONSULTANT (AND QUESTIONS)

- 7.01 The "Consultant" is: Cornerstone Architecture Inc.
 102-320 Thames St.
 London, ON N6A 0E1
- 7.02 Submit questions regarding bid documents to the Consultant in writing, sent by e-mail. Replies will be issued to pre-qualified general contractor bidders as addenda to the bid documents and will become part and parcel of the contract document. The Consultant and Owner will not be responsible for oral clarification. Questions received less than 48 hours before the bid closing cannot be answered. Upon receipt of the documents, the bidders shall verify that they are complete. Notify the Consultant of any omissions or discrepancies.

8.00 DISCREPANCIES

- 8.01 Should a bidder find discrepancies or omissions from the drawings, specifications, other documents or having any doubt as to the meaning or intent of any part thereof, the bidder shall at once notify the Consultant who will send out written instructions or explanations to all bidders.

9.00 ADDENDA

- 9.01 If discrepancies in, or omission from the drawings, specifications or documents are observed, or if the bidder shall be in doubt as to their meaning, the bidder shall immediately notify:

Trent Williams, Project Manager (Western)
Cell Number: 519-282-8365 or email: twill53@uwo.ca

AND

Ryan Olsson, Partner (Cornerstone)
Cell Number: 519-432-6644 x224 or email: rollson@cornerstonearchitecture.ca

- 9.02 Certification thereof will be made in addendum form and distributed prior to bid due date. The Owner will not be responsible for any oral instructions or interpretations.
- 9.03 All addenda issued during the bidding period are to be included and acknowledged in the bid form and are to be considered part of the contract documents.

10.00 BIDS

- 10.01 Use the bid form appended to this Specification.
- 10.02 Bids, under seal, signed, executed, and dated, shall be submitted on the bid form stipulated.

Incorporated companies shall affix their corporate seal under the hand of their proper officers. Bids not completed in full may, at the Owner's sole discretion, be rejected. Bidders insertion of hand written or typed additions to the bid text, except to fill blank spaces, may make the bid informal and subject to disqualification at the Owner's sole discretion.

10.03 Bids shall be received on or before **2:00 PM on Thursday, June 18, 2025** on the form provided. Complete all blank spaces in the form. In addition to the signature, the name and position of the individual signing the bid shall be printed. Bid proposals not submitted in this manner may be rejected.

10.04 Bids shall be submitted electronically in PDF format and e-mailed to fdetenders@uwo.ca
Email subject line will include:
"Tender Submission", 9E7401, LHSB Renovations.

It is the responsibility of the Bidders to submit their completed PDF submissions on or before the prescribed time and date indicated in 10.04 (A) above. It is recommended that you allow at least fifteen (15) minutes prior to the closing time to begin the emailing of your PDF submission. You will receive an email confirmation receipt once you finalize your submission, and it has been received by Western.

10.05 Bid Submission Times: the time clock upon which the time will be determined is defined in Clause 10.04. All times mentioned in this clause are based on UTC-4 (Coordinated Universal Time minus 4 hours) for email submissions. When the digital clock displays the prescribed hour, the bids will be deemed closed.

10.06 Bid submissions shall constitute acknowledgement by the bidder of existing site conditions including conditions within existing buildings as applicable, the requirements of the bid documents, and moreover shall constitute a waiver of claims for extra compensation on account of additional work resulting from existing conditions reasonably inferable from examination of the site at the time of bidding and the requirements of the bid documents.

10.07 Prepare and submit the bid at the bidder's expense and without expectation for reimbursement of costs by the Owner or Consultant.

10.08 Submissions by fax will not be accepted.

10.09 Labour and materials required to achieve Ready-For-Takeover at the date identified herein are included in the Base Bid.

11.00 OWNER CONTACT

11.01 If discrepancies or omissions are observed, notify:
Trent Williams, Project Manager
Cell: 519-282-8365 or email: twill53@uwo.ca

12.00 SITE VISIT

12.01 Bidders, whether general contract bidders or subtrade bidders shall visit the site and/or building and become familiar with existing conditions which may affect the Work. Take into consideration and provide for existing conditions. Bidders shall review the requirements of the Occupational Health and Safety Act, Ontario Regulation 213/91 and other authorities having jurisdiction over the Work. No claim for additional costs will be considered or paid where arising from the contractors or subtrades failure to take into consideration existing conditions, which are reasonably apparent.

- 12.02 **A pre-bid site visit will be held on June 4, 2026 at 10:00 AM.** Attendees will meet at the south entrance of the Labatt Health Sciences Building. Parking is available in the South Valley and Huron Flats Parking Lots.
- 12.03 Before bidding, carefully examine the site and ascertain the extent and nature of all conditions affecting the performance of the work including the location of all services and equipment which may need to be protected, removed, or relocated.
- 12.04 All contractors wishing to submit bids on this project are to attend the pre-bid site meeting. Any bid received by contractor who was not represented at this meeting may be declared invalid and the bid may not be opened.
- 12.05 Attendance will be recorded. Minutes will be written by the Consultant and distributed to all attendees as an addendum. The minutes will form part of the bid documents.

13.00 FEES AND PERMITS

- 13.01 The contractor shall pay for all permits, fees and inspections by authorities having jurisdiction. The Owner will apply and pay for the building permit. The Consultant will be responsible for following up the process of issue with the City to facilitate the expeditious issue of the building permit. The contractor shall provide the owner with an emailed PDF copy of all permits.

14.00 SUPERVISOR

- 14.01 The Contractor's supervisor must be in attendance at the place of work when the work is being performed.
- 14.02 The designated Site Superintendent (i.e. not a replacement) is to remain full time on the project until all deficiencies are complete and deemed completion has been achieved, and the approval of the Owner and Consultant has been obtained. Space will be provided by the Owner in the completed building for the Site Superintendent during this period. The Contractor shall supply furnishings, telecommunication devices, and other necessary equipment in the space designated by the Owner. Associated costs will be paid by the Contractor.

For the purpose of this contract, the "superintendent" shall mean and shall be interchangeable with the term "supervisor".

15.00 ACCEPTANCE OF OFFER

- 15.01 In submitting this bid, the Contractor recognizes and accepts the right of the Owner to accept any bid which may be deemed to be most advantageous to the Owner (or any part thereof) at the price submitted, or to reject any or all bids. The Owner further reserves the right to waive informalities in the bids, and any awards shall be made on bids that will give the greatest value to the Owner based on quality, service, and price. When applicable, Alternate Prices, Unit Prices, Labour Rates, and Itemized Prices, if requested on the bid form, may be considered in making final decisions. These conditions will be at the Owner's sole discretion.

16.00 SCHEDULING AND COMPLETION DATE

- 16.01 Time is a critical element of this project. By entering a bid, the Contractor agrees to adhere to the specified schedule and completion time.

- 16.02 The place of work will be available to start the work immediately upon award of the project.
- 16.03 Substantial performance of the work for this Project is to be achieved prior to 12/11/2026.
- 16.04 Ready-For-Takeover is to be achieved prior to 12/11/2026.
- 16.05 Labour and materials required to achieve Ready-For-Takeover are included in the base bid.

17.00 DESIGNATED SUBSTANCE REPORT

- 17.01 The Owner may commission a Designated Substance Report for inclusion in the bid and contract documents where appropriate.
- 17.02 Before bidding and/or starting any work on site, examine the work site and associated Western University Asbestos Database. The database is attached herein. The database is a guide to most areas of campus buildings documenting known asbestos data. Be aware of work site condition.
- 17.03 Assume that all fluorescent light fixtures made prior to 1979 (check date stamp on ballasts) have ballasts containing PCB's, unless otherwise advised.

PCB LIGHT BALLAST IDENTIFICATION GUIDE

Canadian General Electric:

A code number ending with an **AE@** means **no** PCB's present.

A code number ending with a **AT@** means PCB's present.

Ignore a **AW@** if it appears at the end of the number; therefore, go to the previous letter and follow the rules above.

Philips Electronics:

These will have a **>non-PCB** stamp on the label.

If not stamp appears, the ballast should be classified as PCB-containing.

In general, PCB's are present in ballasts manufactured prior to 1978 unless otherwise indicated.

Sola Canada:

Code **AAACA@** indicates the presence of PCB's.

Any ballast made before 1980 would also contain PCB's. This can be determined by looking at the date code. The letter represents the month of the manufacture, and the next two numbers represent the year. For example, D67 would be April 1967.

Sola USA:

This type has the year in the first two digits, e.g. 61F311EG would mean that the ballast was made in 1961. Any ballast made before 1980 should be considered PCB-containing.

Westinghouse Canada:

A code number ending with the letter **AT@** would indicate the presence of PCB's.

Aerovox Capacitors:

Examine the 5th character on the code. The letter **AF@** would confirm PCB content.

Allanson Division of Jannock Ltd.:

A code number with a prefix letter AN@ would mean no PCB's present.

Universal Manufacturing: Code AN@ indicates no PCB's present.

- 17.04 Laboratory sink traps, old thermostats, and areas behind and under laboratory benches may contain mercury.
- 17.05 Paint in buildings more than ten years old may contain lead.
- 17.06 Ceiling tiles and floor tiles may contain asbestos.
- 17.07 Pipe and duct insulation may contain asbestos.

18.00 RESERVED

19.00 CONTRACT PRICE BREAKDOWN

- 19.01 The Contractor will be required to provide a complete contract price breakdown by construction division within seven working days from receipt of the letter of intent. The breakdown must be representative of the full contract price as identified in the letter of intent.

20.00 SCHEDULE

- 20.01 The Contractor will be required to submit a provisional schedule of construction with their bid. The schedule must be updated within 10 working days of the issue of a contract or letter of intent to include all options identified and carried in the Bid and confirmed in the letter of intent.
- 20.02 In determining the Ready-For-Takeover date as requested in the bid form, (see Clause 16.00), the bidder is to provide for a completion date relating to the base bid and completion date to include all options bid upon.

21.00 Workplace Injury Summary Report and WSIB Registration

- 21.01 Submit completed WISR information within 48 hours of Owner's request. This submission will be assessed as part of any consideration to award a contract. The acceptance of any bid based on this element rests with the Owner.
- 21.02 The bidders are referred to a News Release from the Ontario Ministry of Labour dated June 14, 2001 "*Government Acts to Level Playing Field for Ontario Contractors*". The Contractor will be required to show proof of registration with the WSIB before the final award of a contract.

22.00 POST BID REVIEW MEETING

- 22.01 A post-bid review meeting may be convened and chaired by the Owner who will invite the consultant and contractor under consideration along with associated major subcontractors to review the contract documents and bid submitted. This meeting will be prior to the Owner issuing a letter of intent or contract and is subject to requisite Owner approvals. The award of any contract is at the Owner's sole discretion based on the bids received and subject to the results of this meeting. The bid bond will remain valid for the bid acceptance period until the Owner's decision is made. This meeting does not constitute or infer any contract award to the proposed contractor or any other contractor, nor that the project will proceed.

23.00 LETTER OF INTENT

- 23.01 The Owner may issue a letter of intent as discussed during the post-bid review meeting, subject to requisite Owner approvals. The letter of intent will be the authority for the successful bidder to commence work under the limiting conditions of the letter of intent. This letter will be as binding as the Contract upon which the Bid was submitted.

24.00 ONTARIO MOL AGREEMENT ON LABOUR MOBILITY@ (Issued June 2006)

- A. Be aware of this Document from the Ontario Ministry of Labour.
- B. Compliance is mandatory.

25.00 OTHER INSTRUCTIONS TO BIDDERS

- 25.01 Bid documents are available on Link2Build.
- 25.02 Use of bid documents
- .1 Bid documents are made available only for the purpose of obtaining offers for this project. Their use does not confer a license or grant use for other purposes.
- 25.03 The Bid results will be made available to the General Contractors who submitted a bid.
- 25.04 Bid Security will be retained by the Owner from the three preferred bidders as determined solely by the Owner, until award of the Contract.
- 25.05 Sales Tax
- .1 Applicable Harmonized Sales Tax (HST): shall not be included on the Bid Form.
- .2 The successful bidder shall provide (at the Post Bid Review Meeting) their HST Registration Number, which will be included on each Certificate of Payment along with the added applicable HST amount.

26.00 MAINTENANCE RETENTION FUND (DEFICIENCIES SECURITY)

- 27.01 This contract is entered into with an understanding that 1% of the contract amount will be retained as security to ensure expeditious completion of warranty items. The funds will be released upon satisfactory completed warranty items, one year from the date of (or date certified by the Consultant) (or date of publication in DCN) issue of the Certificate of Substantial Completion. The deduction shall be made from each Certificate of Payment and shall be retained by the Owner. Any warranty work not properly completed will be undertaken by the Owner and charged against the maintenance retention fund. It is noted that associated costs incurred by the Owner will be recovered from the total retention fund and not on a prorated basis related to the value of subcontractors work being remedied. This retention fund is independent of the 10% lien holdback and any other deficient items.

28.00 PRE-QUALIFIED GENERAL CONTRACTORS, SUBTRADES AND SUPPLIERS

- 29.01 Refer to Appendix A for a list of pre-qualified General Contractors, subtrades and suppliers. Only the companies listed may be utilized in the preparation of the bid. Failure to name a subtrade or supplier from the pre-qualified list may result in the disqualification of the bid at the Owner's sole discretion.

----END OF INSTRUCTIONS TO BIDDERS----

BID FORM

1.00 SUBMITTED BY: _____

2.00 TO: The Board of Governors
The University of Western Ontario
Stevenson Hall, Room 4101
London, ON N6A 5B8

3.00 PROJECT

3.01 PROJECT NO: **9E7401** (WESTERN)

PROJECT NO. **1176** (CONSULTANT)

3.02 PROJECT TITLE: **LHSB Renovations**

3.03 BUILDING: **Labatt Health Sciences Building**

4.00 BASE BID

4.01 The drawings, specifications, and other contract documents for this project, have been examined, as well as the premises and job site conditions affecting the work. The undersigned hereby offers to complete the work in accordance with the contract documents for the following base bid sum, including all taxes, but excluding HST:

Dollars \$ _____)

in Canadian funds, excluding HST only. HST only will be added to the base bid.

In the event that a discrepancy arises between the written bid price and the associated numerical price, the written bid price will be deemed to be correct. Sales tax will be based on the written bid price irrespective of any discrepancy.

In submitting this bid, the bidder recognizes that changes to this bid form or unsolicited attachments or enclosures from the Bidder may be rejected by the Owner.

In submitting this Bid, the undersigned recognizes and accepts the right of the Owner to accept any Bid, which is deemed the most advantageous to the Owner, (or any part thereof), at the price submitted, or to reject any or all Bids. The Owner further reserves the right to waive informalities in the bids, and any awards shall be made on bids that will give the greatest value to the Owner based on quality, service, and price. To meet its budgetary and operational requirements, the university may use alternate prices to make final decisions in determining the award of contract. These conditions will be at the sole discretion of the owner.

5.00 TIME OF COMPLETION

5.01 The undersigned hereby affirms and states that, if awarded the Contract for said work, **the entire contract will be completed within the time frame as stated in the Instructions to Bidders.**

5.02 Work related to the Project shall be scheduled to achieve Ready-For-Takeover on or prior to 12/11/2026.

5.03 Labour and materials required to achieve Ready-For-Takeover are included in the Base Bid.

6.00 SUMMARY

- 6.01 The undersigned agrees that the bid shall remain in effect for acceptance for a period of 60 (sixty) calendar days from the date of receipt of bids. The undersigned agrees to assume all increases in labour rates and material prices, cost indexes, or any other rates that may develop during the life of this Contract. For taxes and duties, reference CCDC2-2020 GC 10.1 Taxes and Duties as well as Specification Section 00 73 00 Amendments to CCDC2-2020 SC-12 item 12.1.

7.00 CONTRACT DOCUMENTS IDENTIFICATION

- 7.01 The contract documents listed in "Table of Contents", "List of Drawings" and CCDC 2, 2020 are identified as Project 9E7401 and were prepared by Facilities Development & Engineering, Facilities Management, Western University and/or Cornerstone Architecture.

8.00 HARMONIZED SALES TAX (HST)

- 8.01 The bidder shall not include the applicable HST in the bid price, nor in any separate, alternate, or itemized prices. The successful contractor will indicate on each application for payment as a separate amount the appropriate HST the Owner is obliged to pay.

9.00 ADDENDA

- 9.01 The undersigned acknowledges receipt of addenda numbers ___ through ___ inclusive, and that the price, or adjustment thereof, for all work required therein is included in this proposal.

10.00 SUBCONTRACTORS AND SUPPLIERS

- 10.01 If the bid is accepted, it is our intention to employ the following owner pre-qualified subcontractors and/or suppliers from Appendix A, attached:

- 10.02 Refer to GC 3.8.2.

<u>Description of Work</u>	<u>Name</u>
Doors and Frames	_____
Drywall, Plastering & Acoustics	_____
Millwork	_____
Electrical	_____
Mechanical	_____
Flooring	_____
Glass & Glazing	_____
Painting	_____

- 10.03 If the bid is accepted, it is our intention to employ the following subcontractors and manufacturers for the Mechanical and Electrical items listed below.

<u>Mechanical Subcontractors</u>	<u>Name</u>
Insulation	_____
Sheet Metal	_____
Sprinkler System	_____
Testing and Balancing	_____

<u>Mechanical Manufacturers</u>	<u>Name</u>
Fans – Exhaust Air	_____
Grilles, Registers and Diffusers	_____
Plumbing Fixtures	_____
Sprinkler Heads	_____
Variable Air Volume Boxes	_____
 <u>Electrical Subcontractors</u>	 <u>Name</u>
Fire Alarm System	_____
 <u>Electrical Manufacturers</u>	 <u>Name</u>
Cable Tray	_____
Disconnect Switches	_____
Exit Signs	_____
Fire Alarm Devices	_____
Lighting Control Systems	_____
Luminaires (by Type)	_____
Panelboards	_____
Structured Wiring	_____
Wiring Devices	_____

11.00 SEPARATE PRICE

11.01 Separate Prices are not included in the base bid. The intent of Separate Prices is to allow the Owner to accept or reject any Separate Price items listed for the prices quoted at the Owner's discretion. They are inclusive of all labour, material, tools, equipment, overhead and profit, and taxes, but exclude HST.

1. Cost to replace ceiling, including mechanical and electrical devices, in Corridor TA.3.
\$ _____

12.00 IDENTIFIED PRICE

12.01 Identified Prices are included in the Base Bid. The intent of Identified Prices is to provide the Owner with information regarding the cost of certain portions of the work. They are inclusive of all labour, material, tools, equipment, overhead and profit, and taxes, but exclude HST. **Only the low bidder will be required to provide this information. Pricing must be submitted within 24 hours of the time specified for the submission of Bids in paragraph 10.03 of Division 00 – Procurement and Contracting Requirements, Section 00 21 13 – Instructions to Bidders.**

- .1 Cost of scope of work on Ground and Second Floor.
- .2 Cost of scope of work on Third Floor.

13.00 PRELIMINARY CONSTRUCTION SCHEDULE

13.01 A preliminary construction schedule indicating major activities, substantial performance, and deemed completion to meet the project deadlines.

14.00 ACCEPTANCE AND/OR REJECTION OF BIDS

- 14.01 In submitting the bid, the bidder recognizes that changes to this bid form, or unsolicited attachments or enclosures from the bidder, may be rejected by the owner.
- 14.02 In submitting this bid, the bidder recognizes and accepts the right of the owner to accept any bid which is deemed to be the most advantageous to the owner, (or any part thereof), at the price submitted, or to reject any or all bids. The owner further reserves the right to waive informalities in the bids, and any awards shall be made on bids that will give the greatest value to the Owner, based on quality, service and price. When applicable, Alternate Prices, Unit Prices, Labour Rates, and Itemized Prices, if requested on the bid form, may be considered in making final decisions. These conditions will be at the Owner's sole discretion.

14.03 SIGNATURE: _____ COMPANY SEAL: _____

NAME PRINTED: _____ TITLE: _____

COMPANY: _____

ADDRESS: _____

PHONE: _____

DATE: _____

15.00 BIDDERS CHECK LIST

The following items are required in accordance with the bid documents:

- | | |
|--|--|
| <input type="checkbox"/> 10% Bid Bond | <input type="checkbox"/> Separate Prices |
| <input type="checkbox"/> Agreements to Bond | <input type="checkbox"/> Construction Schedule |
| <input type="checkbox"/> Sub-Contractors & Suppliers | |

Bidders to check off (✓) items to verify that documents and/or information have been attached and/or included.

----END OF BID FORM----

00 73 00
AMENDMENTS TO CCDC2 - 2020

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These Supplementary Conditions to the CCDC 2 – 2020 Standard Construction Document for Stipulated Price Contract, English version, consisting of the Agreement Between Owner and Contractor, Definitions, General Conditions of the Stipulated Price Contract, the Schedules and Appendices, are part of the Contract Documents and modify, delete and/or add to the CCDC 2 – 2020 Stipulated Price Contract between Owner and Contractor. These Supplementary Conditions shall be read in conjunction with, and in the case of conflict, take precedence over the Agreement between Owner and Contractor, the Definitions, the General Conditions, the Schedules and Appendices of the CCDC 2 – 2020 Stipulated Price Contract between Owner and Contractor.

Where any article, section, subsection or clause in the CCDC 2 – 2020 document is supplemented by one of the following, the provisions of such article, section, subsection or clause shall remain in effect and the supplemental provisions shall be considered as added thereto.

Where any article, section, subsection or clause in the CCDC 2 – 2020 document is amended, deleted, voided, or suspended by any of the following, the provisions of such article, section, subsection or clause not so amended, voided, deleted or suspended, shall remain in effect.

The CCDC 2 – 2020 Stipulated Price Contract between Owner and Contractor is amended as follows:

AMENDMENTS TO AGREEMENT BETWEEN OWNER AND CONTRACTOR

AGREEMENT BETWEEN OWNER AND CONTRACTOR

SC-1 AGREEMENT BETWEEN OWNER AND CONTRACTOR

1.1 ARTICLE A-1 THE WORK

1.1.1 At the end of section 1.2, after “*Contract Documents*”, delete “, and”, and add the following:
“using reasonable skill, methods and expertise”

1.1.1 Add “, and” to the end of section 1.3.

1.1.2 Add a new section 1.4 as follows:

“1.4 diligently proceed with and complete the *Work* in a good and workmanlike manner in all respects and in accordance with the *Contract*, including the *Work* set out in the *Contract Documents*, the construction schedule provided for in GC 3.4 - CONSTRUCTION SCHEDULE, and the *Contract Price* and the date fixed for *Ready-for-Takeover*.”

1.2 ARTICLE A-2 AGREEMENTS AND AMENDMENTS

1.2.1 Add new sections 2.3 and 2.4 as follows:

“2.3 The *Contractor* represents and covenants that it has the experience, expertise and resources to carry out and complete the Project in a professional and expeditious manner and in accordance with the *Contract* and all applicable laws, regulations, codes, authorities, government directions and standards.”

“2.4 The *Owner* and *Contractor* acknowledge that:

- (i) it has not entered into this *Contract* on the basis of and does not rely, and has not relied, upon any statement or representation, whether negligent or innocent, or warranty or other provision, whether oral, written, express or implied, made or agreed to by any person, whether a Party to this *Contract* or not, except those expressly made, given or repeated in this *Contract* and the only remedy or remedies available in respect of any misrepresentation or untrue statement made to it shall be those expressly provided for in this *Contract*; and

- (ii) this article shall not apply to any statement, representation or warranty made fraudulently, or to any provision of this *Contract* which was induced by fraud, for which the remedies available shall be all those available under the law governing this *Contract*.

1.3 ARTICLE A-4 CONTRACT PRICE

- 1.3.1 Insert the number "13" into the blank in section 4.2.

ARTICLE A-5 PAYMENT

- 1.4.1 At section 5.1, replace "Subject to the provisions of the Contract Documents and Payment Legislation, and in accordance with legislation and statutory regulations respecting holdback percentages, the Owner shall:" with the following:

"5.1 Subject to applicable legislation and the provisions of the *Contract Documents*, and in accordance with the *Payment Legislation* and applicable statutory regulations respecting construction holdback and, where such legislation or regulations do not exist or apply, subject to a holdback of ten percent (10%), the *Owner* shall, in Canadian funds:"

- 1.4.2 At subsection 5.2.1, after "The prime rate shall be the rate of interest quoted by", add "The Bank of Canada"

- 1.4.3 Add new section 5.3 as follows:

"5.3 The *Owner* or the *Consultant* may withhold or nullify in whole or in part by application for payment represented by the *Contractor's* estimate or any Certificate for Payment to such extent as may be necessary to protect the *Owner* from loss because of:

- .1 Defective work not remedied,
- .2 Claims filed or reasonable evidence indicating probable filing of claims,
- .3 Failure of *Contractor* to make payment properly to *Subcontractors* or *Suppliers* for materials and/or labour,
- .4 The reasonable opinion of the *Owner* that the balance owing to the *Contractor* will be insufficient to ensure completion of the *Work*,
- .5 Damage to the work of *Other Contractor(s)*,
- .6 Erroneous or inflated estimates by the *Contractor* of value of work performed,
- .7 Unauthorized deviations by *Contractor* from *Contract Documents*,
- .8 Unsatisfactory progress of *Work* by *Contractor*,
- .9 Record drawings not current and up-to-date with changes, and
- .10 Legal costs related to any lien action by the *Contractor*, and *Subcontractors* or *Suppliers* for which the *Contractor* is responsible.

Payments withheld under this section shall be made when the above condition justifying such withholding has been cleared, removed or otherwise satisfied.

For certainty, notwithstanding section 5.2 of Article A-5 PAYMENT, no interest will accrue nor be paid on payments withheld under this section. In addition, a *Consultant's* determination as to any Certificate for Payment shall be final and binding, and subject *Consultant* to no liability whatsoever to *Owner*, *Contractor*, or any other related or non-related company, group or person."

1.4 **ARTICLE A-6 RECEIPT AND ADDRESSES FOR NOTICES IN WRITING**

1.4.1 Delete section 6.5 in its entirety and replace with the following:

"6.5 Contact information for a party may be changed by *Notice in Writing* to the other party setting out the new contact information in accordance with this Article."

1.5 **ARTICLE A-7 LANGUAGE OF THE CONTRACT**

1.5.1 Amend section 7.1 by striking out the word "French" after "between the English and French versions," in the second line.

1.5.2 Delete the second sentence of section 7.2.

1.6 **ARTICLE A-9 GENERAL**

1.6.1 Add new Article A-10 as follows:

10.1 The *Contract* shall be governed by and construed in accordance with the laws of the Province of Ontario and the federal laws of Canada applicable therein without regard to conflict of law rules that would direct application of the laws to another jurisdiction.

10.2 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.

10.3 The parties shall, from time to time, execute and deliver all such further documents and instruments and do all other acts and things as the other party may reasonably require to effectively carry out or better evidence or perfect the full intent and meaning of the *Contract*."

SC-2 DEFINITIONS

2.1 Amend the Definition of "Contract" by adding as the second sentence: "When this agreement is referred to herein as "Agreement", the term "Agreement" shall mean "Contract".

2.2 Add a new Definition, "Act", as follows:

"Act (or Act) means Ontario's *Construction Act*, R.S.O. 1990, c. C.30, as amended. Any reference to *Payment Legislation* in this *Contract* shall mean the Act."

2.3 Add a new Definition, "Competent Person", as follows:

"Competent Person means a person who,

(a) is qualified because of knowledge, training and experience to organize the *Work* and its performance,

- (b) is familiar with the OHSA and the regulations that apply to the *Place of the Work* and the *Work*, and
- (c) has knowledge of any potential or actual danger to health or safety in the *Place of the Work* and with respect to the *Work*.”

2.4 Add a new Definition, “OHSA”, as follows:

“OHSA (or *OHSA*) means Ontario’s *Occupational Health and Safety Act*, R.S.O. 1990, c. O.1.”

2.5 Add a new Definition, “Proper Invoice”, as follows:

“Proper Invoice” means a written bill or other request for payment from the *Contractor* for services or materials in respect of the improvement under this Contract that meets the requirements of subsection 6.3(2) of the *Act* and the Western University Payment Procedure and contains or is accompanied by the following information:

- .1 The contractor’s name and address;
- .2 The date of the *Proper Invoice* and the period during which the services or materials were supplied;
- .3 Information identifying the authority, whether in the contract or otherwise, under which the services or materials were supplied;
- .4 A description, including quantity where appropriate, of the services or materials that were supplied;
- .5 The amount payable for the services or materials that were supplied, and the payment terms;
- .6 The name, title, telephone number and mailing address of the person to whom payment is to be sent;
- .7 A construction schedule, updated as of the date of the *Proper Invoice*;
- .8 A copy of any notice of adjudication the *Contractor* has received in respect of the *Project* during the payment period covered by the *Proper Invoice*;
- .9 Evidence of compliance with workers’ compensation legislation at the *Place of the Work*, including a current certificate of clearance from the WSIB;
- .10 After the first invoice, a declaration by the *Contractor* as to the distribution made of the amounts previously received using document CCDC 9A ‘Statutory Declaration’;
- .11 A schedule of values for the parts of the *Work*, aggregating the total amount of the *Contract Price*, in such form as specified in the *Contract* and by the *Consultant* and supported by such evidence as the *Consultant* may require.
- .12 A copy of any minutes of meetings which the *Contractor* is obliged to record and maintain HST number; and any other information that may be prescribed under the *Act* or requested by the *Consultant* and the *Owner*.
- .13 HST number; and

- .14 Any other information that may be prescribed under the *Act* or requested by the *Consultant* and the *Owner*.

Any reference to "application(s) for payment" in this *Contract* shall mean *Proper Invoice*.

- 2.6 Add a new Definition, "Submittals", as follows:

"Submittals" means documents or items required by the *Contract Documents* to be provided by the *Contractor* such as: (1) *Shop Drawings*, samples, models, mockups to indicate details or characteristics, before the portion of the *Work* that they represent can be incorporated into the *Work*, and (2) As-built drawings and manuals to provide instructions to the operation and maintenance of the *Work*.

- 2.7 Add a new Definition, "WSIB", as follows:

"WSIB (or *WSIB*) means the *Workplace Safety and Insurance Board*."

GENERAL CONDITIONS

SC-3 PART 1 GENERAL PROVISIONS

- 3.1 GC 1.1 CONTRACT DOCUMENTS

- 3.1.1 Delete subsection 1.1.3 in its entirety and replace with the following:

"1.1.3 The *Contractor* is solely responsible for the coordination of *Subcontractors* and its own forces to ensure that the *Work* as described in the *Contract Documents* is performed in accordance with this *Contract*. The *Contractor* is solely responsible for the division and definition of *Work* between *Contractor* and *Subcontractor* and for any jurisdictional matters arising therefrom.

The *Contractor* shall review the *Contract Documents* for the purpose of facilitating and coordinating and executing the *Work* by the *Contractor*. The *Contractor* shall report promptly to the *Consultant* any ambiguities, design issues or other matters requiring clarification made known to the *Contractor* or that the *Contractor* may discover from such a review. Such review by the *Contractor* shall comply with the standard of care described in subsection 3.10.1 of the *Contract*."

- 3.1.2 Delete subsection 1.1.6 in its entirety and replace it with the new subsection 1.1.6:

1.1.6 Nothing contained in the *Contract Documents* shall create any contractual relationship between:

- .1 the *Owner* and a *Subcontractor*, a *Supplier*, or their agent, employee, or other person performing any portion of the *Work*.
- .2 the *Consultant* and the *Contractor*, a *Subcontractor*, a *Supplier*, or their agent, employee, or other person performing any portion of the *Work*.

The *Contractor* shall be an independent contractor performing its obligations under the *Contract*. For greater certainty, the *Contract* does not create any agency, partnership, joint venture, fiduciary or other relationship of the *Contractor* with the *Owner* other than the relationship of independent contractor. In addition, nothing contained in the *Contract* shall create any employment relationship between the *Owner* (or anyone acting on its behalf) and any *Contractor* personnel.

3.2 Add new subsection 1.1.12 as follows:

"1.1.12 Whenever the words "approved", "as directed", "submit", "make good", "inspected" or similar wording or phrases appear throughout the *Contract Documents*, they shall be understood, unless otherwise provided, to mean: materials or items referred to shall be "approved by the *Consultant*", "submit to the *Consultant*", "make good to the *Consultant's* satisfaction", or, "inspected by the *Consultant*", as applicable.

3.3 Add new subsection 1.1.13 as follows:

"1.1.13 The *Contractor* shall not disclose or provide any confidential, proprietary or personal information or data ("Confidential Information") obtained by the *Contractor* during the course of the *Work* to third parties who do not require that Confidential Information to complete any portion of the *Work* and shall comply with all relevant requirements of the *Personal Information Protection and Electronic Documents Act* or its equivalent legislation if any in the jurisdiction of this *Contract*. The *Contractor* shall take all necessary steps to protect, secure and keep confidential any such Confidential Information."

3.4 Add new subsection 1.1.14 as follows:

"1.1.14 "The *Consultant* shall furnish to the *Contractor* without charge, up to 2 sets of *Contract Documents*, exclusive of those required by jurisdictional authorities and the executed *Contract Documents*. The *Contractor* shall pay for additional copies at the *Consultant's* cost of reproduction, handling and applicable taxes."

3.5 **GC 1.4 ASSIGNMENT**

3.5.1 Delete article 1.4.1 in its entirety and replace it with the following:

"1.4.1 The *Contractor* shall not assign the *Contract*, either in whole or in part, without the prior written consent of the *Owner*."

SC-4 **SC-4 PART 2 ADMINISTRATION OF THE CONTRACT**

4.1 **GC 2.2 ROLE OF THE CONSULTANT**

4.1.1 Amend subsection 2.2.6 by deleting the words "except with respect to GC 5.1 – FINANCING INFORMATION REQUIRED OF THE OWNER."

4.1.2 Amend the first and second sentences of subsection 2.2.8 by adding ", written statements" after the word "Interpretations".

4.1.3 Add new subsection 2.2.19 as follows:

"2.2.19 The *Consultant*, at the *Owner's* request, will participate at any negotiation, mediation or arbitration as provided in GC-8 DISPUTE RESOLUTION".

4.2 **GC 2.4 DEFECTIVE WORK**

4.2.1 Add new subsections 2.4.1.1 and 2.4.1.2:

"2.4.1.1 The *Contractor* shall promptly rectify, in a manner acceptable to the *Owner* and the *Consultant*, all defective work and deficiencies in the *Work*, whether or not

they are specifically identified by the *Consultant*.

- 2.4.1.2 The *Contractor* shall prioritize the correction of any defective *Work* which, in the sole discretion of the *Owner*, adversely affects the day-to-day operations of the *Owner*.”

SC-5 **SC-5 PART 3 EXECUTION OF THE WORK**

5.1 **GC 3.1 CONTROL OF THE WORK**

- 5.1.1 Add new subsections 3.1.3, 3.1.4 and 3.1.5 as follows:

“3.1.3 Prior to commencing individual procurement, fabrication and construction activities, the *Contractor* shall verify, at the *Place of the Work*, all relevant measurements and levels necessary for proper and complete fabrication, assembly and installation of the *Work* and shall further carefully compare such field measurements and conditions with the requirements of the *Contract Documents*. Where dimensions are not included or contradictions exist, 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.

3.1.4 No approval or consent of, or certification, inspection, review, comment, verification, confirmation, acknowledgment 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, *Shop Drawings*, plans, procedures, programs or other *Products* of the *Contractor* require 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*.

3.1.5 Nothing contained in the *Contract* shall be construed as making the *Owner* or the *Consultant*, or anyone acting on their behalf, responsible for anything which is the responsibility of the *Contractor* under the *Contract*.”

5.2 **GC 3.2 CONSTRUCTION BY OWNER OR OTHER CONTRACTORS**

- 5.2.1 Delete subsections 3.2.2.3 and 3.2.2.4 in their entirety and insert “INTENTIONALLY BLANK”.
- 5.2.2 Revise subsection 3.2.3.3 by deleting the word “and” at the end of the subsection.
- 5.2.3 Revise subsection 3.2.3.4 by replacing the “.” at the end of the subsection with “; and”.
- 5.2.4 Add new subsection 3.2.3.5 as follows:

“.5 at all times remain solely responsible for construction safety in accordance with GC 9.4.1, and shall remain the “Constructor” as defined in the *OHSA*.”

5.3 **GC 3.3 TEMPORARY WORK**

- 5.3.1 Revise subsection 3.3.2 by inserting after the word "personnel" the following: "registered in the Province of Ontario and".

5.4 **GC 3.4 CONSTRUCTION SCHEDULE**

- 5.4.1 Add new subsection 3.4.2 as follows:

"3.4.2 At the commencement of the *Work*, the *Contractor* shall prepare for the review and acceptance of the *Owner* and the *Consultant*, a schedule indicating the times, within the construction schedule referred to in GC 3.4.1, that items that are specified to be *Owner*-purchased and *Contractor*-installed or hooked-up that are required at the *Place of Work*."

5.5 **GC 3.5 SUPERVISION**

- 5.5.1 Delete subsection 3.5.1 in its entirety and replace with the following:

"3.5.1 The *Contractor* shall provide all necessary supervision and appoint a competent representative, who shall be a *Competent Person* as the term is defined in the *OHSA*, and who shall be in attendance at the *Place of the Work* while the *Work* is being performed. The *Contractor* shall not be entitled to change the *Competent Person* without the prior written authorization of the *Owner*, whose authorization shall not be unreasonably withheld."

- 5.5.2 Add new subsection 3.5.3 as follows:

"3.5.3 In the event that the *Contract Price* is equal or greater than \$5 million, then the *Contractor* shall appoint a competent representative that is Gold Seal Certified in accordance with the Canadian Construction Association's guidelines and requirements; or a competent representative for which the *Contractor* can demonstrate has the requisite experience to the sole satisfaction of the *Owner*."

5.6 **GC 3.6 SUBCONTRACTORS AND SUPPLIERS**

- 5.6.1 Delete subsection 3.6.2 and replace with:

"3.6.2 Substitution of *Subcontractors* and/or *Suppliers* will not be accepted unless a valid reason is given in writing to and approved by the *Owner*, whose approval may be withheld at its sole discretion. The valid reason for substitution must be provided to the *Owner* and to the originally listed *Subcontractor* and/or *Supplier* and the *Subcontractor* and/or *Supplier* shall be given an opportunity to reply to the *Contractor* and *Owner*. The *Contractor* represents that it is fully aware of the capability and competence (e.g. technical, financial, safety, scheduling, etc.) of *Subcontractors* and/or *Suppliers* listed in its bid. For clarity, the use of the *Contractor's* "own forces" and the use of unlisted *Subcontractors* or *Suppliers* for any part of the *Work* which at the time of bidding was shown as to be performed by another *Subcontractor* and/or *Supplier* is not acceptable and, notwithstanding anything else in this *Contract*, is a ground for termination of this

Contract by the *Owner* at any stage without any consequential right or claim by the *Contractor* for damages.”

5.7 GC 3.7 LABOUR AND PRODUCTS

5.7.1 Add new subsection 3.7.4 as follows:

“3.7.4 The *Contractor* represents that it has a sufficient number of skilled employees to replace, subject to the *Owner*’s approval, acting reasonably, its designated supervisor, *Competent Person* and project manager in the event of death, incapacity, removal or resignation.”

5.7.2 Add new subsection 3.7.5 as follows:

“3.7.5 The *Contractor* shall not change the source of supply of any *Products* without the written authorization of the *Consultant*.”

5.7.3 Add new subsections 3.7.6 and 3.7.7 as follows:

“3.7.6 Labour and *Products* are further specified in Section 01 60 00 Material and Equipment.

3.7.7 The *Contractor* is responsible for the safe on-site storage and protection of *Products* (including, but not limited to, *Products* supplied by the *Owner* and other contractors to be installed under the *Contract*) in such ways as to avoid dangerous conditions or damage or contamination to the *Products* or other persons or property. *Products* shall be stored in locations and at the *Place of the Work* to the satisfaction of the and the *Consultant*. The *Owner* shall provide all relevant information regarding the *Products* to be supplied by the *Owner*.”

5.8 GC 3.8 SHOP DRAWINGS

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

5.8.2 Add the words “and *Submittals*” after the words “*Shop Drawings*” in subsections 3.8.1, 3.8.2, 3.8.3, 3.8.3.2, 3.8.5, 3.8.6, and 3.8.7.

5.8.3 Delete subsection 3.8.2 in its entirety and replace it with new subsection 3.8.2 as follows:

“3.8.2 Prior to the first *Proper Invoice*, the *Contractor* and the *Consultant* shall jointly prepare a schedule of the dates for submission and return of *Shop Drawings* and *Submittals* in an orderly sequence.”

5.8.4 Amend subsection 3.8.7 by adding after “*Shop Drawings*” the words “or *Submittals*” and adding to the end of the sentence the words “, and within ten (10) *Working Days* from

the *Consultant's* receipt of the *Shop Drawings* or *Submittals*. Any longer period of review that is reasonably required shall be notified in writing to the *Owner* and *Contractor*".

5.8.5 Add subsection 3.8.8:

"3.8.8 *Shop Drawings* and *Submittals* requirements are further specified in Section 01 33 00 - *Submittals*."

5.9 **GC 3.9 CLEANUP**

5.9.1 Add new General Condition 3.9 as follows:

"3.9.1 The *Contractor* shall maintain the *Place of 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.

3.9.2 The *Owner* shall have the right to back charge cleaning costs to the *Contractor* if the cleaning is not completed within 24 hours of *Notice in Writing* to clean and the *Owner* shall have the right to back charge the cost of damage to the *Place of the Work* caused by the *Contractor's*, its *Subcontractor's* or its *Supplier's* transportation in and out of the *Place of Work* if not repaired within the earlier of 5 *Working Days* following *Notice in Writing* to repair, or before final payment under GC 5.5."

5.10 **GC 3.10 PERFORMANCE BY CONTRACTOR**

5.10.1 Add new General Condition 3.10 as follows:

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

3.10.2 The *Contractor* further represents, covenants and warrants to the *Owner* that there are no pending, threatened or anticipated claims that would have a material effect on the financial ability of the *Contractor* to perform its *Work* under the *Contract*."

SC-6 **PART 4 ALLOWANCES**

6.1 **GC 4.1 CASH ALLOWANCES**

6.1.1 Amend subsection 4.1.4 by adding the following sentence to the end:

"The maximum mark up on the authorized overrun on cash allowances shall be 5%."

6.1.2 Add new subsection 4.1.8 as follows:

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

6.1.3 Add new subsection 4.1.9 as follows:

"4.1.9 Cash allowances are further specified in Section 01 21 00 of the *Specifications*."

SC-7 PART 5 PAYMENT

7.1 GC 5.1 FINANCING INFORMATION REQUIRED OF THE OWNER

7.1.1 Delete GC 5.1 in its entirety and insert "INTENTIONALLY BLANK".

7.2 GC 5.2 APPLICATIONS FOR PAYMENT

7.2.1 Delete GC 5.2 in its entirety and replace with the following:

"GC 5.2 PROPER INVOICES

5.2.1 The *Contractor* shall, within ten (10) calendar days of signing the *Contract*, and prior to the first *Proper Invoice*, submit to the *Owner* a detailed breakdown of the lump sum tender price and a monthly projected payment schedule based on the construction schedule for the *Contract*.

5.2.2 A *Proper Invoice* shall be delivered to the *Owner* and the *Consultant* simultaneously on the first *Working Day* of every month.

5.2.3 Delivery of the *Proper Invoice* to the *Owner* shall be by email to: feadmin@uwo.ca. Delivery of the *Proper Invoice* to the *Consultant* shall also be by email. The *Proper Invoice* shall be deemed to be received on the day that the *Owner* confirms receipt by reply email.

5.2.3 *Proper Invoices* shall be dated the last day of each payment period, which is the last day of the month or an alternative day of the month agreed in writing by the parties.

5.2.4 The amount claimed in a *Proper Invoice* shall be the value, proportionate to the amount of the *Contract*, of *Work* performed and *Products* delivered to the *Place of the Work* as of the last day of the payment period, having regard to the schedule of values, *Work* to complete and any deficiencies in the *Work*.

5.2.5 Claims for *Products* delivered to the *Place of Work* within the previous payment period, but not yet incorporated into the work, shall not be included in a *Proper Invoice*."

7.3 GC 5.3 PAYMENT

7.3.1 Delete GC 5.3.1 in its entirety and replace with:

"5.3.1 After receipt by the *Consultant* and the *Owner* of *Proper Invoice* submitted by the *Contractor* in accordance with GC 5.2 – PROPER INVOICES, the *Consultant* will issue to the *Owner* and copy to the *Contractor*, no later than ten (10) calendar days after the receipt of the *Proper Invoice*, a certificate for payment in the amount applied for, or in such other amount as the *Consultant* determines to be properly due.

5.3.2 If the *Consultant* certifies a different amount than claimed in the *Proper Invoice*, or rejects the *Proper Invoice* or part thereof, the *Owner* shall give a notice of non-payment to the *Contractor* within fourteen (14) calendar days after the receipt of a *Proper Invoice*, in accordance with the Act.

5.3.3 Unless the *Owner* has given a notice of non-payment in accordance with the Act, the *Owner* shall pay the *Contractor* the amount set out in the *Proper Invoice* within twenty-eight (28) calendar days of the receipt of the *Proper Invoice* in compliance with the Act and the Western University Payment Procedure.

5.3.4 Any notice of non-payment by the *Owner* may be given by email to the *Contractor*. For greater clarity, this provision constitutes the consent of the *Contractor* to delivery of the notice of non-payment by email.

5.3.5 If at any time the *Owner* is given written notice of a lien, or should a claim for lien be registered on title to the subject property, which notice of lien or claim for lien concerns work within the scope of the *Contract*, the *Contractor* shall forthwith and expeditiously thereafter, and in no event later than ten (10) calendar days, have the claim for lien vacated from title, discharged or withdrawn at the *Contractor's* sole expense, failing which the *Owner* may take such steps and set off and/or deduct from any amount owing to the *Contractor* all associated costs and associated expenses, including legal fees, disbursements, interest and costs of obtaining and posting a lien bond or other security. If no amounts are owing to the *Contractor*, the *Contractor* shall reimburse the *Owner* for all of the aforementioned associated costs and associated expenses."

7.4 "GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK

Delete the entirety of "GC 5.4 SUBSTANTIAL PERFORMANCE OF THE WORK AND PAYMENT OF HOLDBACK" and replace it with the following:

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 deliver to the *Consultant* and to the *Owner* a written application for a review by the *Consultant* to establish *Substantial Performance of the Work* or substantial performance of the designated portion of the *Work*, along with a WSIB certificate of clearance which clearly shows that the *Contractor* is in good standing and a comprehensive list of items to be completed or corrected. Failure to include an item on the list of items to be completed or corrected does not alter the responsibility of the *Contractor* to address the item or otherwise complete the *Contract*.

5.4.2 Prior to its written application for review to establish *Substantial Performance of the Work* or substantial performance of the designated portion of the *Work*, the *Contractor* shall submit to the *Consultant* all guarantees; warranties; certificates; testing and balancing reports; distributing system diagrams; spare parts; maintenance and operation manuals; training manuals; samples; reports and correspondence from authorities having jurisdiction in the *Place of the Work*; up to date *Shop Drawings* and any marked up *Drawings*; completed as-built drawings in an electronic format acceptable to the *Consultant*; inspection certificates; and any other materials or documentation required to be submitted under the *Contract* or otherwise reasonably requested by the *Consultant*. It is further required that any fire alarm panel and graphics under the *Contract* will be demonstrated to the satisfaction of the *Owner's* Facilities Management Electrical Engineer, to be complete, correct, and operational before *Substantial Performance of the Work* will be granted. The *Contractor* acknowledges that without providing the aforementioned documents and or demonstrating the equipment referenced herein, as may be required, the criteria for *Substantial Performance of the Work* or substantial performance of the designated portion of the *Work* may not be met and certification of the *Substantial Performance of the Work* may be withheld.

5.4.3 The *Consultant* will review the *Work* to certify or verify the validity of the application and shall promptly, and in any event, no later than ten (10) calendar days after receipt of the *Contractor's* application:

- .1 advise the *Contractor* in writing that the *Work* or the designated portion of the *Work* is not substantially performed and give reasons why, or
- .2 state the date of *Substantial Performance of the Work* or a designated portion of the *Work* in a certificate and issue a copy of that certificate to each of the *Owner* and the *Contractor*.

5.4.4 Immediately prior to the issuance of the certificate of *Substantial Performance of the Work*, the *Contractor*, in consultation with the *Consultant*, shall establish a schedule for completion of the *Work* and correcting deficient *Work*, and the construction schedule shall be deemed to be amended to include the completion schedule.

5.4.5 Subject to the requirements of the Act, all holdback amounts shall become due and payable to the *Contractor* no later than ten (10) Working Days following the expiration of the holdback period stipulated in the Act.

5.4.6 The *Contractor* shall submit an application for payment of the lien holdback amount in accordance with GC 5.3 – PAYMENT. For clarity, the application for payment of the lien holdback is not a *Proper Invoice* for the purposes of the Act.

5.4.7 There will be no progressive or early release of holdback. Release of holdback will occur as required by the Act after sixty-one (61) calendar days from the date of publication of the certificate of substantial performance in a bonafide trade publication where all liens in respect have expired or been satisfied, discharged, or otherwise provided for under the Act. 5.4.8 Notwithstanding any release of holdback, the *Contractor* shall ensure that such parts of the *Work* are protected pending the *Project* being *Ready-for-Takeover* and be responsible for the correction of defects or work not performed regardless of whether or not such was apparent when the holdback was released.”

7.5 GC 5.5 FINAL PAYMENT

- 7.5.1 Delete subsection 5.5.1 in its entirety and replace it with the following:

“5.5.1 When the *Contractor* considers that the *Work* is completed, the *Contractor* shall submit an application for final payment, which must include a current certificate of clearance from the WSIB demonstrating that the *Contractor* is in good standing and a statutory declaration, using CCDC 9A – 2018 Statutory Declaration of Progress Payment Distribution by Contractor. The application for final payment shall also meet the requirements of a *Proper Invoice* and shall be accompanied by any documents or materials not yet delivered pursuant to section 5.4. The *Work* shall be deemed not to be complete until all of the aforementioned documents or materials have been delivered, and the *Owner* may withhold payment in an amount determined by the *Consultant*.”

- 7.5.2 Revise subsection 5.5.3 by adding “or the *Consultant*” after the word “*Owner*” and adding to the end:

“Subject to the Act, if the *Consultant* rejects the *Contractor*’s application for final payment, the *Contractor* shall revise and resubmit the application when the *Contractor* has addressed the reasons for rejection given by the *Owner* or the *Consultant*.”

Amend subsection 5.5.4 by replacing “5 calendar days” with “sixty-one (61) calendar days”.

SC-8 PART 6 CHANGES IN THE WORK

8.1 GC 6.1 OWNER'S RIGHT TO MAKE CHANGES

8.1.1 Add new subsection 6.1.3 as follows:

"No claim whatsoever for a change in the *Contract Time*, delay, prolongation charges, remobilization or otherwise shall be permitted with respect to a change, unless authorized by the *Consultant* and approved by the *Consultant* and set out in the *Change Order* or *Change Directive*, as the case may be, executed by the *Owner*."

8.2 GC 6.2 CHANGE ORDER

8.2.1 Delete the second sentence of subsection 6.2.1 and replace it with the following:

"The *Contractor* shall promptly present to the *Consultant*, in a form acceptable to the *Consultant*, a detailed material and labour breakdown and a method of adjustment or an amount of adjustment for the *Contract Price*, if any, and the adjustment in the *Contract Time*, if any, for the proposed change in the *Work*."

8.2.2 Add new subsection 6.2.3 as follows:

"6.2.3 The following fee percentage and overhead charges shall be applied to hourly rates and material costs for additional or reduced *Work* ordered by the *Consultant*."

- .1 For those items understood to be directly part of the *Work*, the *Contractor* will be permitted to charge a maximum of 5% overhead plus a maximum 10% fee.
- .2 On items involving changes to *Work* of a *Subcontractor*, the *Contractor* may charge a 10% fee. Overhead shall not be charged on extras or credits applying to *Subcontractors'* work by the *Contractor*.
- .3 *Subcontractors* may charge a maximum of 5% overhead plus a maximum of 10% fee on *Work* to be provided by their own forces. They may charge only 10% fee on *Work* of other *Subcontractors* under their direct control and supervision.
- .4 Hourly rates are defined as being the charge out base labour rate cost including EI, CPP, Vacation Pay, and benefits. These rates may be requested at Bid time or at the Post Bid Review Meeting or at any time thereafter for review and agreement.
- .5 Materials are defined as being the actual cost.
- .6 Overhead is defined as being inclusive of, and not limited to, the following:
 - Head Office and site operations and facilities,
 - Head Office and site administration and supervision and scheduling,
 - All fees associated with Parking on Campus
 - All fees associated with Bonding and Insurance
 - All duties and taxes for permits and other licenses required by jurisdictional authorities,
 - All requirements of Submittals Section and as-built/maintenance manuals

requirements,

- All requirements of Quality Control Section, and
- Expenses related to site safety.

8.2.3 Add new subsection 6.2.4 as follows:

"6.2.4 Notwithstanding any other provision in the *Contract*, when a change in the *Work* is proposed or required, the *Contractor* shall within ten (10) calendar days issue to the *Consultant* for review and recommendation a claim for a change in *Contract Price* and or a change in *Contract Time* with appropriate supporting documentation as described herein and in sufficient detail and in a format acceptable to the *Consultant* and *Owner*. Should the specified date for receipt of an itemized quotation describing the change in *Contract Price* and or a change in *Contract Time* be insufficient, the *Contractor*, within five (5) calendar days of the above date shall advise the *Consultant* in writing of the proposed date of delivery of the claim. No additional claim for a change in *Contract Price* or *Contract Time* will be permitted with respect to the same change should the *Contractor* fail to advise the *Consultant* as prescribed herein."

8.3 GC 6.3 CHANGE DIRECTIVE

8.3.1 Delete subsections 6.3.7.7 to 6.3.7.19 in its entirety.

8.3.2 Add new subsection 6.3.14 as follows:

"6.3.14 For greater certainty, and without limitation, the cost of performing the *Work* attributable to the *Change Directive* does not include, and no payment shall be made for:

- .1 head office salaries and benefits and all other overhead or general expenses, except only for wages, benefits, compensation, contributions, assessments, or taxes described in subsection 6.3.7.1;
- .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 and extraordinary clean-up requirements;
- .4 wages paid for project managers, superintendents, assistants, watch persons and administrative personnel, provided the *Change Directive* does not result in extension of *Contract Time*;
- .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 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*."

8.3.3. Add a new subsection 6.3.15 as follows:

"6.3.15 The following fee percentage and overhead charges shall be applied to hourly rates and material costs for additional or reduced *Work* ordered by the *Consultant*.

- .1 For those items understood to be directly part of the *Work*, the *Contractor* will be permitted to charge a maximum of 5% overhead plus a maximum 10% fee.
- .2 On items involving changes to *Work* of a *Subcontractor*, the *Contractor* may charge a 10% fee. Overhead shall not be charged on extras or credits applying to *Subcontractors'* work by the *Contractor*.
- .3 *Subcontractors* may charge a maximum of 5% overhead plus a maximum of 10% fee on *Work* to be provided by their own forces. They may charge only 10% fee on *Work* of other *Subcontractors* under their direct control and supervision.
- .4 Hourly rates are defined as being the charge out base labour rate cost including EI, CPP, Vacation Pay, and benefits. These rates may be requested at Bid time or at the Post Bid Review Meeting or at any time thereafter for review and agreement.
- .5 Materials are defined as being the actual cost.
- .6 Overhead is defined as being inclusive of, and not limited to, the following:
 - Head Office and site operations and facilities,
 - Head Office and site administration and supervision and scheduling,
 - All fees associated with Parking on Campus
 - All fees associated with Bonding and Insurance- All duties and taxes for permits and other licenses required by jurisdictional authorities,
 - All requirements of Submittals Section and as-built/maintenance manuals requirements,
 - All requirements of Quality Control Section, and
 - Expenses related to site safety.

8.4 **GC 6.4 CONCEALED OR UNKNOWN CONDITIONS**

8.4.1 Add new subsection 6.4.5 as follows:

"6.4.5 The *Contractor* confirms that, prior to bidding the *Project*, it carefully reviewed the *Place of the Work* and applied to that review the degree of care and skill described in subsection 3.10.1, given the amount of time provided between the issue of the bid documents and the actual closing of bids, the degree of access provided to the *Contractor* prior to submission of bid, and the sufficiency and completeness of the information provided by the *Owner*. 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 review undertaken in accordance with this subsection."

8.5 **GC 6.5 DELAYS**

8.5.1 Amend subsection 6.5.1 and 6.5.2 by deleting the period at the end of each subsection, and substituting the following words, " , but excluding any consequential, indirect or

special damages, loss of profits, loss of opportunity or loss of productivity resulting from such delay."

8.5.2 Add new subsections 6.5.6, 6.5.7, 6.5.8, 6.5.9 and 6.5.10 as follows:

"6.5.6 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 *Contract Time* shall be extended for such reasonable time as the *Consultant* may decide in consultation with the *Contractor*. 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 but not limited to, the cost of the *Consultant's* services during the period between the date of *Ready-for-Takeover* stated in Article A-1 (as may be extended) and any later, actual date of *Ready-for-Takeover* achieved by the *Contractor*.

6.5.7 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 subsections 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 subsection 6.5.7, if any, shall be in addition to amounts, if any, to which the *Contractor* is entitled pursuant to subsections 6.5.1, 6.5.2 or 6.5.3.

6.5.8 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 the 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 subsections 6.5.1, 6.5.2 or 6.5.3.

6.5.9 In addition to the amount set out in subsection 6.5.6, the *Contractor* recognizes and agrees that the *Owner* will suffer a financial loss if the *Work* is not completed within the time prescribed by the *Contract*. The *Contractor* also recognizes the delays, expenses and difficulties involved in proving the actual loss suffered by the *Owner* if the *Work* is not completed on time. Accordingly, instead of requiring any such proof, the *Contractor* agrees that as liquidated damages for delay (but not as penalty) the *Contractor* shall pay the *Owner* 0.25% of the *Contract Price* per day for each and every day's delay from the specified time for *Ready-for-Takeover* until the actual date of *Ready-for-Takeover*, to a maximum of 10% of the *Contract Price*, and it is further expressly acknowledge and agreed by the *Contractor* that:

(a) this amount is a reasonable estimate of the actual damages that will be incurred by the *Owner* due to any failure to attain *Ready-for-Takeover* within the time required by this *Contract*;

(b) the *Owner* may deduct the amount due under this subsection from any monies that may be due or payable to the *Contractor*, whether under the *Contract* or any other agreement; and,

(c) the liquidated damages provided for in this subsection shall be without prejudice to any other remedy to which the *Owner* is entitled at law or in equity.

6.5.10 In the event that subsection 6.5.9 is held by a court of competent jurisdiction to be invalid, unenforceable or void, or if no liquidated damages are designated in the *Contract*, the *Contractor* shall be held responsible for the payment of the *Owner's* actual costs associated with the delay in achieving *Ready-for-Takeover*. The *Owner's* costs will include, but are not limited to, the amounts relating to the items set out in subsection 6.5.6 and all other costs directly or indirectly associated with the delay in the completion of the *Work* by the *Contractor*. The amounts payable pursuant to subsection 6.5.10 are in addition to the amounts payable by the *Contractor* to the *Owner* pursuant to subsection 6.5.6."

8.6 GC 6.5 CLAIMS FOR A CHANGE IN CONTRACT PRICE

- 8.6.1 Amend subsection 6.6.1 by deleting the period at the end of the subsection and adding the following:

"within thirty (30) *Working Days* of the commencement of the *Work* giving rise to the claim for an increase to the *Contract Price*."

- 8.6.2 Amend subsection 6.6.5 by adding the words "as noted in subsection 6.6.3" after the words "of the claim" and adding the words "and the *Consultant*.", after the word "parties" at the end of subsection 6.6.5.

SC-9 PART 7 DEFAULT NOTICE

9.1 GC 7.1 OWNER'S RIGHT TO PERFORM THE WORK, TERMINATE THE CONTRACTOR'S RIGHT TO CONTINUE WITH THE WORK OR TERMINATE THE CONTRACT

- 9.1.1 Delete subsection 7.1.2 in its entirety and replace it with the following:

"7.1.2 If the *Contractor* neglects to perform the *Work* properly or otherwise fails to comply with the requirements of the *Contract*, the *Owner* may, without prejudice to any other right or remedy the *Owner* may have, give the *Contractor Notice in Writing*, containing particulars of the default, including references to applicable provisions of the *Contract*, that the *Contractor* is in default of the *Contractor's* contractual obligations and instruct the *Contractor* to correct the default in the five (5) *Working Days* immediately following the receipt of such *Notice in Writing*. Failure by the *Owner* to provide such *Notice in Writing* shortly after the default has occurred shall not constitute condonation of the default."

- 9.1.2 Revise subsection 7.1.5.4 by deleting the "." at the end of the subsection and replacing it with ", and".

- 9.1.3 Add a new subsection 7.1.5.5 as follows:

".5 charge the *Contractor*, or set-off on any application for payment, the actual damages the *Owner* has sustained as a result of the default."

- 9.1.4 Add new subsection 7.1.7 as follows:

"7.1.7 The *Owner* may, for reasons other than as provided in subsections 7.1.1, 7.1.2 and 7.1.4 above, suspend performance of the *Work* or terminate the *Contract*, or parts thereof, for and at its convenience, by giving *Notice in Writing* to that effect to the *Contractor*. Such suspension or termination shall be effective in the manner specified in the said notice.

In the event of suspension of the *Contract* under this subsection, the *Owner* may provide, the reason for the suspension and the expected length of the suspension.

In the event of a full or partial termination of the *Contract* under this subsection, the *Owner* shall be liable to pay to the *Contract* only for the *Work* that the *Contractor* has completed to the date of termination specified in the *Notice in Writing*, along with the *Contractor's* reasonable costs of demobilization and shall not be liable for any other damages that the *Contractor* might otherwise claim, including, but not limited to, damages for delay and loss of profit. All other provisions of this *Contract* are subject to this subsection."

9.2 GC 7.2 CONTRACTOR'S RIGHT TO SUSPEND THE WORK OR TERMINATE THE CONTRACT

9.2.1 Delete subsection 7.2.1 in its entirety.

9.2.2 Delete subsection 7.2.3.1 in its entirety.

9.2.3 Amend subsection 7.2.3.4 by deleting ", except for GC 5.1 - Financing Information Required of the Owner,".

9.2.4 Delete subsection 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 subsection 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;
- .2 provides the *Contractor* with an acceptable schedule for such correction; and,
- .3 completes the correction in accordance with such schedule."

9.2.5 Add new subsection 7.2.6 as follows:

"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 costs associated with termination, including the costs of demobilization, losses sustained on *Products* and *Construction Equipment*. The *Contractor* shall not be entitled to any recovery for special, indirect or consequential losses, loss of use or loss of profit."

SC-10 PART 8 DISPUTE RESOLUTION

10.1 GC 8.2 ADJUDICATION

10.1.1 Amend subsection 8.2.1 by deleting the word "prescribed" and replacing it with the words "provided for".

10.2 GC 8.3 NEGOTIATION, MEDIATION and ARBITRATION

10.2.2 Add subsection 8.3.9:

"8.3.9 Any mediation or arbitration under the *Contract* shall take place in London, Ontario."

10.2.3 Add subsection 8.3.10:

"8.3.10 In the event a dispute is referred to arbitration in accordance with the terms hereunder and CCDC 40, and despite the wording of section 9 in CCDC 40, all arbitrations with claims totaling \$10,000,000.00 or higher shall be conducted before a panel of three arbitrators. The Parties shall make reasonable effort to reach agreement on the panel."

SC-11 PART 9 PROTECTION OF PERSONS AND PROPERTY

11.1 GC 9.1 PROTECTION OF WORK AND PROPERTY

11.1.1 Delete subsection, 9.1.1.1 in its entirety and replace it with the following:

"9.1.1.1 errors in the *Contract Documents* which the *Contractor* could not have discovered applying the standard of care described in GC 3.10 – PERFORMANCE BY CONTRACTOR."

11.1.2 Amend subsection 9.1.1.2 by adding the word "negligent" at the beginning of the thereof.

11.1.3 Delete subsection 9.1.2 in its entirety and replace it with the following:

"9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground utilities and structures indicated in the *Contract Documents*, or that are discoverable by applying to an inspection of the *Place of the Work* the degree of care and skill described GC 3.10 – PERFORMANCE BY CONTRACTOR."

11.1.4 Add new subsection 9.1.5 as follows:

"9.1.5 The *Contractor* shall neither undertake to repair and/or replace any damage whatsoever to the *Work*, including, but not limited to, the work of other *Contractors* or *Subcontractors*, 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, in circumstances where there is danger to life or public safety, the *Contractor* shall take such emergency action as it deems necessary to remove the danger."

11.2 GC 9.2 TOXIC AND HAZARDOUS SUBSTANCES

11.2.1 Amend GC 9.2, in all instances, by inserting the word "designated" in front of the words "toxic" and "substances".

11.2.2 Add new subsection 9.2.10 as follows:

"9.2.10 For clarity, designated toxic or hazardous designated substances or materials are deemed to be those listed under the most current version of the OHSA."

11.2.3 Add new subsection 9.2.11 as follows:

"9.2.11 Where the *Contract* expressly provides otherwise, or the written list required under subsection 9.2.2 is made available to the *Contractor*, the *Contractor* shall indemnify and hold harmless the *Owner*, the *Consultant*, and their agents and employees, from and against claims, suits, or proceedings arising out of or resulting from exposure to, or the presence of, designated toxic or hazardous substances or materials which were at the *Place of Work* prior to the *Contractor* commencing *Work*."

11.3 GC 9.4 CONSTRUCTION SAFETY

- 11.3.1 Delete subsection 9.4.1 in its entirety and replace with the following:

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

- 11.3.2 Add new subsections 9.4.6, 9.4.7 and 9.4.8 as follows:

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

- .1 a current *WSIB* clearance certificate.
- .2 documentation of the *Contractor*’s in-house safety-related programs; and,
- .3 a copy of the *Notice of Project* filed with the Ministry of Labour naming itself as “constructor” under the *OHSA*.

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

9.4.8 Construction safety and the *Contractor*’s construction safety obligations are further specified and set out in Section 01 54 03 - Safety Requirements.”

SC-12 PART 10 GOVERNING REGULATIONS

12.1 GC 10.1 TAXES AND DUTIES

- 12.1.1 Amend subsection 10.1.2 by adding the following sentence at the end of the subsection:

“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.”

- 12.1.2 Add new subsections 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, custom 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 the 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 subsection.

10.1.4 The *Contractor* shall maintain accurate records of *Construction Equipment*, *Product* and component costs reflecting the taxes, custom 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 if 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 for 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. The *Contractor* agrees to enable, assist with and submit to any reasonable audit requested by the *Owner* with respect to the potential refunds under GC 10.1.

10.1.6 Custom duties, penalties, or any other penalty, fine or assessment levied against the *Contractor*, shall not be treated as a tax or customs duty for the purpose of GC 10.1."

12.2 **GC 10.2 LAWS, NOTICES, PERMITS, AND FEES**

12.2.3 Amend subsection 10.2.4 by adding to the end of subsection the following:

"The *Contractor* shall notify the Chief Building Official or the registered code agency where applicable, of the readiness, substantial completion, and *Ready-for-Takeover* stages of construction. The *Contractor* shall be present at each site inspection by an inspector or registered code agency as applicable under the Ontario *Building Code*."

12.2.1 Amend subsection 10.2.5 by deleting "The" from the first sentence and replacing it with the words "Subject to subsection 3.10.1, the".

12.2.2 Delete subsection 10.2.6 and replace it with the following:

"10.2.6 If the *Contractor* fails to notify the *Owner* and the *Consultant* in writing, fails to request direction required in subsection 10.2.5, or performs work that contravenes any laws, ordinances, guidelines, standards, permits, statutes, by-laws, rules, regulations, or codes, the *Contractor* shall be responsible for and shall correct the violations thereof, and shall bear the full costs, expenses, and damages attributable to the failure to comply with the provisions of such laws, ordinances, guidelines, standards, permits, statutes, by-laws, rules, regulations, or codes and, notwithstanding any limitation described in Part 13, shall indemnify and hold harmless the *Owner* and the *Consultant* from and against any claims, demands, losses, costs, damages, actions, suits or proceeding resulting from failure or breach of law."

12.3 GC 10.3 PATENT FEES

- 12.3.1 Amend subsection 10.3.1 by adding the words, “indemnify and” before the words, “hold the”, in the second line.
- 12.3.2 Amend subsection 10.3.2 by adding the words, “by the *Owner*”, after the words, “supplied to the *Contractor*” in the last line.

SC-13 PART 11 INSURANCE

13.1 GC 11.1 INSURANCE

- 13.1.1 Amend subsection 11.1.1 by inserting the following before “Without restricting the generality of GC 13.1 – INDEMNIFICATION”:

“11.1.1 It is the responsibility of the *Contractor* and their insurance broker, agent or representative to review all potential *Project* operations and exposures to determine if the coverage and limits noted below and in CCDC 41 ‘CCDC Insurance Requirements’ are sufficient to address all insurance related exposures presented by the specifications of the *Project* and the *Work*. The *Contractor* shall insure its undertaking, business and equipment under the following coverage so as to protect and indemnify and save harmless the *Owner*.”

SC-14 PART 12 OWNER TAKEOVER

14.1 GC 12.1 READY-FOR-TAKEOVER

- 14.1.1 Amend subsection 12.1.3 by inserting the words “determination of” before the term “*Ready-for-Takeover*” in the second line.

14.2 GC 12.3 WARRANTY

- 14.2.1 Amend subsection 12.3.1 by adding the following at the end of the subsection, “With respect to equipment installed at the request of the *Owner*, and successfully operating at its intended design capacity before completion of the *Work*, the warranty period shall be one year from the date the equipment commenced its successful operations. This warranty is in addition to any other warranty specified in the Specifications.”
- 14.2.2 Amend subsection 12.3.2 by deleting the word “The” from the first line and replacing it with the words “In accordance with subsection 3.10.1, the” and deleting “to the extent that the design and Contract Documents permit such performance”.
- 14.2.3 Add new subsections 12.3.7, 12.3.8, 12.3.9, 12.3.10 and 12.3.11 as follows:

“12.3.7 The *Contractor* shall submit written warranty or guarantee certificates and extended warranty or guarantees for all work as required in the specifications. The guarantee and/or warranty shall be addressed to the *Owner* and shall, at a minimum, state the following:
 - .1 Date of substantial or total performance as applicable to the warranty or guarantee period;
 - .2 Name of Project to be same as indicated in the *Contract*;
 - .3 The terms and conditions; and

.4 The warranty or guarantee period.

12.3.8 The *Contractor* shall provide a list of all equipment, components, materials, systems, etc., for which specific warranty is required, implied, or offered at any post-bid review meeting for discussion. For greater clarity, the list shall adhere to and include, but not be limited to, the following:

.1 A warranty is generally for one (1) year from date of certification of *Ready-for-Takeover*, except as otherwise specified.

.2 Compressor warranty shall be not less than five (5) years.

.3 Elevators shall include a service agreement for six (6) months from *Ready-for-Takeover*; after which time the *Owner* will service the elevator under the direction of the *Contractor* for the remainder of the warranty period. The *Owner* will then assume full service.

.4 The list above is to include the names and telephone/fax number of the contracts for warranty service calls. All items regardless of origin of supply must be serviceable for warranty by service contractors in London, Ontario.

.6 Include the list in Operating and Maintenance Manuals.

12.3.9 For greater clarity, use of the building systems during construction for temporary heat shall not have any effect on the warranty period of those systems and equipment in use. The warranty period will not begin until *Ready-for-Takeover* has been obtained.

12.3.10 Any *Product* or equipment requiring excessive servicing during the warranty period (or free maintenance period, if applicable) shall be considered defective and the warranty (or free maintenance period) shall be deemed to take effect from the time that the defect has been corrected so as to cause excessive servicing to terminate.

12.3.11 Following *Ready-for-Takeover*, and without limiting the *Contractor's* warranty under GC 12.3, the *Contractor* shall assign to the *Owner*, to the extent assignable, the benefit of all warranties and guarantees relating to the *Work*.

12.3.12 The provisions of GC 12.3 shall not deprive the *Owner* of any action, right or remedy otherwise available to the *Owner* for the *Contractor's* failure to fulfill its obligations or responsibilities under the *Contract* and shall not be construed as a waiver of claims in favour of the *Contractor* or as limitation on the time in which the *Owner* may pursue such other action, right to remedy."

SC-15 GC 13.2 WAIVER OF CLAIMS

15.1 Delete subsection 13.2.5 in its entirety and insert "INTENTIONALLY BLANK".

SC-16 PART 14 OTHER PROVISIONS

16.1 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 – CONTRACTOR DISCHARGE OF LIABILITIES

- 14.2.1 In addition to the obligations assumed by the *Contractor* pursuant to GC 3.6 and 3.7, 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 14.3 – DAILY REPORTING/DAILY LOGS

- 14.3.1 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.
- 14.4.2 The *Contractor* shall also maintain records, either at its head office or at the job site, recording manpower and material resourcing on the *Project*. The *Contractor* shall make these records available to the *Owner* and/or the *Consultant* for inspection upon reasonable notice.

GC 14.4 – PUBLIC STATEMENTS

- 14.4.1 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 14.5 – OWNER SET-OFF

- 14.5.1 In addition to and without limiting any other rights the *Owner* may have under the *Contract* and at law, the *Owner* may retain from monies owing to the *Contractor* under the *Contract* an amount sufficient to cover any outstanding or disputed liabilities including the cost to remedy deficiencies, the reduction in value of substantial portion of the *Work*, claims for damages by third parties, and any assessment due to the WSIB."

----END OF AMENDMENTS TO CCDC2 - 2020--

01 00 00

GENERAL INSTRUCTIONS

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Preparation of Contract Documents
2.00	Owner Harassment Policy
3.00	Owner Policy on Smoking
4.00	City Inspections
5.00	Fire Extinguishers
6.00	Roof Access Restrictions
7.00	Negligent False Alarms
8.00	Backflow Prevention (Testing)
9.00	Keys

1.00 PREPARATION OF CONTRACT DOCUMENTS

- 1.01 The Consultant will prepare contract Documents within 7 working days of the issue of a letter of intent to the General Contractor. These Contract Documents will be delivered to the Owner for review who will in turn pass them on to the General Contractor within five working days. The General Contractor will be expected to sign and return the Contract Documents to the Owner within 10 working days of receipt.
- 1.02 No payments may be made without signed documents regardless of the issue of a letter of intent.

2.00 OWNER HARASSMENT/DISCRIMINATION POLICIES

- 2.01 All documents relating to construction projects are to include the following details as they relate to the Owner Policies on Harassment and Discrimination.
- .1 Please be advised that the Owner has policies on harassment and discrimination. Contractors are required to ensure that employees and those of subcontractors are advised of these policies.
 - .2 Details of the policies are included in the Owner Policies and Procedures: 1.35 Non-Discrimination/Harassment Policy (dated 27 April, 2005), copies of which are available from the Owner.

3.00 OWNER POLICY ON SMOKING

- 3.01 All documents relating to construction projects are to include the following details as they relate to the Owner Policy on Smoking.
- .1 Please be advised that the Owner has a Policy on Smoking. Contractors are requested to ensure that employees and those of subcontractors are advised of the policy.
 - .2 Details of the Policy are included in the Owner Policies and Procedures, Policy on Smoking 1.16, policies are available at www.uwo.ca/fm/who/policies.html.

4.00 CITY INSPECTIONS

- 4.01 The General Contractor will be required to complete the building inspections required for this project by using the City of London standard forms to facilitate all inspections required by the City of London. It should be extended to include any other inspections from any statutory authorities. The permit and list shall be displayed together in the site office and copies provided to the Consultant and Owner. As each inspection is arranged and completed the process is to be recorded appropriately and copies forwarded to both the Consultant and Owner for record.

5.00 FIRE EXTINGUISHERS

- 5.03 Fire extinguishers required for safety during construction is the Contractor's responsibility.

6.00 ROOF ACCESS RESTRICTIONS

- 6.01 The Contractor should be aware that some roof areas at Western University campus have fumehood exhaust outlets emitting toxic vapours.
- 6.02 The access to these roof areas is prohibited and for any work, the shutdown must be scheduled with the Owner.

7.00 NEGLIGENT FALSE ALARMS

- 7.01 The Corporation of the City of London Municipal Council has enacted a By-law which allows the

municipality to impose fees for certain services provided by the London Fire Department.

- 7.02 Negligent false alarms are described under Part 3 of the By-law. Part 3 and Schedule 'B' of the By-law describe False Alarm Response Fees.
- 7.03 The Contractor will be levied fees in the amount of \$900.00 plus an administration fee of \$117, both fees subject to applicable taxes, for a total of \$1,017.00 + applicable taxes for all false alarms for which the Contractor is responsible.

8.00 BACKFLOW PREVENTION - TESTING

The Mechanical Contractor, or the Contractor responsible for the plumbing system, is to be a certified Cross Connection and Backflow Prevention Tester who is registered with the City of London. Any testing and/or inspection of the backflow prevention devices (reduced pressure backflow preventers, double check valves, and pressure vacuum breakers) must adhere to the regulations specified by the City of London, including all testing procedures, and submittals of appropriate testing and inspection reports. The Contractor is to clearly indicate on the submitted forms, the location of the backflow assembly, i.e. building name, room number, and what system on which the device is installed.

9.00 KEYS

- 9.01 The Contractor is responsible for work area security.
- 9.02 The Contractor is to request keys as required to progress the work. A request form is to be completed with a \$100 deposit, returnable when key(s) are returned. A sub-master or master key will require a \$500 deposit.
- 9.03 The Contractor may choose to change cylinder(s) for the duration of the work. Provide five keys for Western University emergency use.
- 9.04 The Contractor will be held responsible for the loss of key(s) and any costs associated with building security due to the loss of key(s).

----END OF GENERAL INSTRUCTIONS---

01 10 00

SUMMARY OF WORK

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Description of Work
2.00	Specifications
3.00	Division One, General Requirements
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6.00	List of Materials and Manufacturers
7.00	Site Progress Records
8.00	Examination
9.00	Protection of Work, Property and Persons
10.00	Fastenings
11.00	Lighting Fixtures at Suspended Ceilings
12.00	Dielectric Separation
13.00	Embedded Conduit, Pipe and Sleeves
14.00	Thermal Expansion and Contraction
15.00	Finishes, Appearance
16.00	Cleaning During Construction
17.00	Adjusting
18.00	Salvage
19.00	Owner Occupancy
20.00	Equipment/Items Supplied by Owner for Installation by Contractor

1.00 DESCRIPTION OF WORK

- 1.01 This Project consists of renovation to portions of the ground floor, second floor, and third floor of the west wing at the Labatt Health Sciences Building. Project work will include (but not limited to) demolition and renovation of existing space, architectural, mechanical, and electrical. Detailed work as indicated in attached drawings and specification set (refer to list of drawings 00 01 05).

2.00 SPECIFICATIONS

- 2.01 Division 1, General Requirements, of the Specifications generally specifies work and coordination that is the direct responsibility of the Contractor but should not be interpreted to define absolutely the limits of responsibility that must be established between the Contractor and his Subcontractors.
- 2.02 Ensure that Subcontractors understand that the General Conditions of the Contract, Supplementary Conditions, and Division 1, General Requirements, apply to all sections of the Specifications governing their work.
- 2.03 Work in these Specifications is divided into descriptive sections which are not intended to identify absolute contractual limits between Subcontractors, nor between the Contractor and his Subcontractors. The Contractor shall organize division of labour and supply of materials essential to complete the Project in all its parts and provide a total enclosure and protection from weather of interior spaces, as established in the General Conditions of the Contract.
- 2.04 Wherever in the Contract Documents the words "approval", "approved", "direction", "directed", "selection", "selected", "request", "requested", "report", and similar words are used, such approvals, directions, selections, requests and reports shall be given by the Consultant.
- 2.05 Wherever in the Contract Documents the word "provide" is used in any form, it shall mean that the work concerned shall include both supply and installation of the products required for completion of specified work to which reference is made.
- 2.06 Wherever in the Contract Documents the word "include" is used in any form, the items of Work listed following shall not be interpreted to be restricted to only those items that are listed.
- 2.07 Wherever in the Contract Documents the words "indicated" or "shown" are used they shall apply as meaning "indicated on Drawings and/or Schedules" or "shown on Drawings and/or Schedules" unless the context expresses another meaning.
- 2.08 Wherever in these specifications it is specified that work to which reference is made shall proceed or shall meet approval, direction, selection or request of jurisdictional authorities or others, such approval, direction, selection or request shall be in writing.
- 2.09 Wherever in these specifications it is specified that work shall be repaired, made good or replaced, it shall be performed without any additional cost to the Owner.
- 2.10 Wherever in these specifications the term "exposed to view" is used it shall refer to surfaces that are within the line of vision of persons from any accessible viewpoint, both within and without the building. Where any part of a surface is exposed to view, all other portions of that surface shall also be considered as exposed to view.

3.00 DIVISION ONE, GENERAL REQUIREMENTS

- 3.01 The provisions of all Document 0 and Sections of Division 1 shall apply to each Section of Divisions 2 to 49, inclusive, which form a part of the specifications for this Project.

4.00 DRAWINGS

- 4.01 Drawings indicate scope of the Work and the general and approximate location, arrangement and size of fixtures, equipment, ducts, piping, conduit and outlets. Determine accurate locations, arrangements and sizes by study and coordination of architectural, structural, mechanical, electric and equipment Drawings and shop drawings. Before proceeding with the Work, ensure that spaces and arrangements which affect installations are adequate and coordinated. Where construction conditions require reasonable revisions to indicated locations and arrangements, make such revisions at no additional cost to the Owner.

5.00 WORK PERFORMED UNDER SEPARATE CONTRACTS

- 5.01 Work which is not to be included in this Contract and/or noted as "N.I.C." on the Drawings shall be governed by Amendments to CCDC 2-2020 GC 3.2 herein.
- 5.02 Work which may be performed under separate contracts or by Owner and which will affect the work of the Contract include:
- .1 The supply and installation of loose furniture.
 - .2 The supply and installation of some equipment.
 - .3 I.T.S. distribution wiring.
 - .4 Western Environmental Systems (WES) Controls
 - .5 Security
 - .6 Audio/Visual Systems

6.00 LIST OF MATERIALS AND MANUFACTURERS

- 6.01 Upon award of the Contract, the Contractor shall within fifteen (15) days submit to the Consultant a complete list of materials together with quality descriptions, manufacturers and the names of Sub-Contractors responsible for installation and delivery dates.
- 6.02 Such list must verify compliance with Specifications.
- 6.03 Materials not complying with Specifications will not be accepted.

7.00 SITE PROGRESS RECORDS

- 7.01 Maintain at site a permanent written record of progress of the Work. Make the record available at all times with copies provided when requested. Include in record each day:
- .1 Weather conditions with maximum and minimum temperatures.
 - .2 Conditions encountered during excavation.
 - .3 Commencement and completion dates of the work of each trade in each area of Project.
 - .4 Erection and removal dates of formwork in each area of Project.
 - .5 Dates, quantities, and particulars of each concrete pour.
 - .6 Dates, quantities, and particulars of waterproofing installation.
 - .7 Attendance of Contractor's and Subcontractor's work forces at Project and a record of the work they perform.
 - .8 Visits to site by Owner, Consultant, jurisdictional authorities, testing companies, Contractor, Sub- contractors, and suppliers.
- 7.02 Maintain a progress chart in a format approved from sample submitted. Show on chart proposed construction schedule and the Progress achieved by Contractor and each Sub-Contractor.

- 7.03 Refer to Section 01 33 00, Submittals, for requirements for Project Record Drawings. Refer also to Section 01 32 16, Construction Schedule.

8.00 EXAMINATION

- 8.01 Site: Examine the site and ensure that each Section performing work related to site conditions has examined it, so that all are fully informed on all particulars which affect Project Work.
- 8.02 Ensure by examination that all physical features at the Work, and working restrictions and limitations which exist are known, so that the Owner is not restricted in his use of the premises for his needs.
- 8.03 Previously Completed Work
- .1 Where dimensions are required for proper fabrication, verify dimensions of completed work in place before fabrication and installation of work to be incorporated with it.
 - .2 Verify that previously executed work and surfaces are satisfactory for installation or application, or both and that performance of subsequent work will not be adversely affected.
 - .3 Ensure that work installed in an unsatisfactory manner is corrected by those responsible for its installation before further work proceeds.
 - .4 Commencement of work will constitute acceptance of site conditions and previously executed work as satisfactory.
 - .5 Rejected work resulting from application to, or installation on, or incorporation with, unsatisfactory previous work will be considered the responsibility of those performing the later work.
- 8.04 Construction Measurements:
- .1 Before commencing installation of work, verify that the layout is accurate in accordance with intent of Drawings, and that positions, levels, and clearances to adjacent work are maintained.
 - .2 Before commencing any work, verify that all clearances required by jurisdictional authorities can be maintained.
 - .3 If work is installed in wrong location, correct it before construction continues.

9.00 PROTECTION OF WORK, PROPERTY AND PERSONS

- 9.01 Provide necessary methods, materials, and construction to ensure that no damage or harm to work, materials, property and persons results from the Work of this Contract. Temporary facilities relating to protection are specified in Section 01 50 00, Construction and Temporary Facilities.
- 9.02 Protect excavated areas from damage by frost, and water from natural sources and from backed up drain lines and sewers.
- 9.03 Keep excavations, basements, and pits free of water. Pump dry as required.
- 9.04 Protect building from damage by water and exposure to weather. Remove snow and ice immediately from interior of building.
- 9.05 Protect adjacent private and public property from damage and, if damaged, make good to match in all details. Re-sod and replant damaged lawns and planting to its original condition, except in areas designated to receive landscaping under this Contract or other contracts.
- 9.06 Keep surfaces, on which finish materials will be applied, free from grease, oil, and other contamination which would be detrimental in any way to the application of finish materials.

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- 9.07 Protect glass and other finishes against heat, slag and weld spatter by provision of adequate shielding.
- 9.08 Do not permit strippable tape or coatings to become baked on surfaces which they protect.
- 9.09 Do not apply visible markings to surfaces exposed to view in finished state or that receive transparent finishes.
- 9.10 Protect surfaces of completed work exposed to view from staining, disfigurement and all other damage by restriction of access or by use of physical means suitable to the material and surface location. Establish with each Subcontractor the suitability of such protection in each case.
- 9.11 Schedule finish work at end of construction when interference from tradesmen is at a minimum.
- 9.12 Brace and shore masonry walls until their designed lateral support is incorporated at both top and bottom. Do not permit backfilling at masonry walls below grade until floor systems are installed and lateral bracing is thus achieved.
- 9.13 Enforce fire prevention methods at site. Do not permit bonfires, open flame heating devices or accumulation of debris. Use flammable materials only if proper safety precautions are taken, both in use and storage.
- 9.14 Provide and maintain in working order, suitable U.L.C. labelled fire extinguishers and locate them in prominent locations and to approval of jurisdictional authorities.
- 9.15 Do not store flammable materials in the building. Take necessary measures to prevent spontaneous combustion. Place cloths and other disposable materials that are a fire hazard in closed metal containers and remove them from the building every night.
- 9.16 Where flammable materials are being applied, ensure that adequate ventilation is provided, spark-proof equipment is used, and smoking and open flames are prohibited.
- 9.17 Ensure that volatile fluid wastes are not disposed of in storm or sanitary sewers or in open drain courses.
- 9.18 Public Utilities and Services:
- .1 Verify location of and limitations imposed by, existing mechanical, electrical, telephone and similar services, and protect them from damage. If necessary, relocate active services to ensure that they function continuously in safety and without risk of damage.
 - .2 Cap off and remove unused utility services encountered during work after approval is given by the utilities concerned or jurisdictional authorities, whichever may apply. Relocation, removal, protection and capping of existing utility services shall be performed only by the applicable utility, and of other services by licensed mechanics.
 - .3 Coordinate the capping off, removal and reconnection of a utility with the utility concerned, and make payment for costs involved.
- 9.19 Ensure that precautions are taken to prevent leakage and spillage from plumbing and mechanical work that may damage surfaces and materials.
- 9.20 Give constant close supervision to roofing and/or waterproofing membranes following their installation, during the time they are temporarily protected or exposed, to ensure that no damage occurs to them before completion of building. Protect especially against damage from traffic or work performed on top of completed roofing when temperature is over 27°C (85°F).

- 9.21 Ensure that physical protection and barriers to prevent traffic are installed for waterproofing membranes. Provide barricades or guards to prevent traffic over horizontal membranes until permanent protection is provided. Inspect membranes with waterproofing Subcontractor before they are finally covered. Make good damaged membranes by Section 01 10 00, Summary of Work.
- 9.22 Floors:
- .1 Adequately protect trowelled concrete floors from damage. Take special measures when moving heavy loads or equipment on them.
 - .2 Keep trowelled concrete floors free from oils, grease or other materials likely to damage them, discolour them or affect bond of applied finishes. Once building is enclosed, keep floors as dry as possible after curing.
 - .3 To prevent soiling or damage to finish flooring where pedestrian traffic occurs after the flooring has been installed, install and maintain 0.152mm (6 mil) polyethylene membrane or reinforced kraft paper temporary protection, secured in place and with joints sealed by reinforced pressure sensitive tape.
 - .4 Install plywood panels of minimum 6mm (1/4") thickness over completed finish flooring materials on which further construction work is performed or delivery of products is made, or both. Seal joints between panels with reinforced pressure sensitive tape.
- 9.23 Protect metal deck on which construction personnel work, and on which materials are stored, with substantial planking.
- 9.24 Prevent spread of dust, dirt and other such materials beyond the construction site by wetting, or by other approved means, as it accumulates.
- 9.25 Provide safety helmets to loan to visitors to the site.

10.00 FASTENINGS

- 10.01 Include in the work of each Section necessary fastenings, anchors, inserts, attachment accessories, and adhesives. Where installation of devices is in work of other Sections, deliver devices in ample time for installation, locate devices for other Sections and cooperate with other Sections as they require.
- 10.02 Do not install fibre, plastic or wood plugs or blocking for fastenings in masonry, concrete, or metal construction, unless specified or indicated on Drawings.
- 10.03 Do not use fastenings which cause spalling or cracking of materials in which installed.
- 10.04 Do not use powder actuated fastening devices which are stressed in withdrawal on any part of this work without written approval of the Consultant. Take particularly stringent safety precautions when using powder actuated fastenings. Devices and use must comply with CSA A166-1961 "Safety Code for Explosive Actuated Tools" and latest amendment. Only low velocity plunger-type devices are permitted.
- 10.05 Use only approved driven fasteners.
- 10.06 Expansion Bolts:
- .1 Whenever expansion type fastening devices of any kind which rely upon friction forces created by expansion of the device in concrete or masonry are to be used, submit following data to Consultant for review:
 - a) load carrying capacity of device

- b) nature and magnitude of force to be applied to device with supporting data
- c) materials to which device is fastened
- d) whether device is self-drilling or, if not, the size of bit to be used to drill holes to receive the device
- e) installation procedure to ensure that fastener is secure and reliable, and that metal reinforcing is not damaged.

The Consultant may request that all such data bear the seal of a professional structural engineer licensed to practice at the location of the Work.

- .2 If requested by the Consultant, conduct on-site tests of installed fasteners using an approved independent testing company with properly designed and calibrated force measuring apparatus. Costs for such testing shall be borne by the Owner.

- 10.07 Install metal-to-metal fastenings fabricated of the same metal, or of a metal which will not set up electrolytic action causing damage to fastenings or components, or both. Use non-corrosive or hot dip galvanized steel fastenings for exterior work, and where attached to, or contained within, exterior walls and slabs, unless stainless steel or other material is specifically requested in the affected specification Section. Leave steel anchors bare where cast in concrete.
- 10.08 Install work with fastenings or adhesives in sufficient quantity to ensure permanent secure anchorage of materials, construction, components, and equipment. Space anchors within limits of load-bearing or shear capacity.
- 10.09 Space exposed fastenings evenly and in an organized pattern. Keep number to a minimum. Provide exposed fastenings and accessories in same material, texture, colour and finish as adjacent materials on which they occur, unless indicated otherwise.

11.00 LIGHTING FIXTURES AT SUSPENDED CEILINGS

- 11.01 Ensure that secure support for lighting fixtures is provided by suspended ceilings, or by separate hangers, or by both.
- 11.02 Coordinate the ceiling system and lighting fixture installations to provide adequate support.
- 11.03 Submit affidavits with acceptable design information confirming that the installation of the suspended ceiling system and/or separate fixture hangers provided by the lighting fixture installer will provide adequate support for the lighting fixtures without exceeding specified deflection tolerances for the ceiling system.
- 11.04 Conform to current requirements of the Electrical Inspection Department of Ontario Hydro.

12.00 DIELECTRIC SEPARATION

- 12.01 Ensure that a dielectric separator approved by the Consultant is provided in a permanent manner over entire contact surfaces to prevent electrolytic action (galvanic corrosion) between dissimilar metals. Similarly, prevent corrosion to aluminum in contact with alkaline materials such as contained in concrete, masonry and like construction.

13.00 EMBEDDED CONDUIT, PIPE AND SLEEVES

13.01 Slabs on Grade:

- .1 Conduits or pipes embedded in concrete slabs on grade shall not be larger in outside diameter than 1/3 the thickness of the slab and shall have minimum 50mm (2") concrete cover to finished surface.
- .2 Where crossovers occur, one conduit or pipe shall be depressed to pass under the other and subgrade depressed to increase the slab thickness locally.
- .3 Parallel conduits or pipes shall not be closer than three diameters centre to centre.
- .4 For conduits greater than 1/3 slab thickness, depress subgrade to maintain minimum 50mm (2") concrete above and below conduit, extend coverage 150mm (6") minimum each side of conduit.

13.02 Suspended Slabs, Beams or Walls:

- .1 Sleeves, conduits and pipes which pass through suspended slabs, beams or walls, shall be in approved locations which do not impair strength of construction. Space them at not less than 3 diameter o.c.
- .2 Conduits or other pipes which are continuously embedded in concrete slabs or walls, shall be installed in centre of slab or wall, shall have a maximum outside diameter of 50mm (2"), and shall, in parallel installation, be not less than 150mm (6") on centres. A maximum of 6 such conduits shall be run in any bay of slab or wall. Crossovers shall not be permitted within slab or wall thickness unless the crossing conduits can remain within the mid-third of slab or wall thickness. No conduit other than light (19mm (3/4") OD maximum) shall be embedded in suspended slabs or walls thinner than 150mm (6").

14.00 THERMAL EXPANSION AND CONTRACTION

- 14.01 Conform to manufacturer's recommended installation temperatures. If finishes such as tile, resilient flooring, stone, etc. are installed at temperatures different from operation of service temperatures, make provision for expansion and contraction in service as approved by Consultant. Repair all resulting damage should expansion provisions prove inadequate.

15.00 FINISHES, APPEARANCE

- 15.01 Exposed surfaces shall be finished to approval of Consultant. Colour, tone, texture, grain, pattern, smoothness, flatness, evenness, transparency and translucency matching and appearance of elements in finished surface and of surface shall be to Consultant's approval.

16.00 CLEANING DURING CONSTRUCTION

- 16.01 The General Contractor will be responsible to keep the site clean during construction to meet the requirements listed below.
- 16.02 Ensure that spatters, droppings, soil, labels, and debris are removed from surfaces to receive finishes, before they set up. Leave work and adjacent finished work in new condition.
- 16.03 Use only cleaning materials which are recommended for the purpose by both the manufacturer of the surface to be cleaned and of the cleaning material.
- 16.04 Maintain premises "broom clean" at all times. Vacuum clean interior areas immediately before finish painting commences.
- 16.05 Do not burn or bury waste material at site. Remove as often as required to avoid accumulation.

- 16.06 Do not allow waste material and debris to accumulate in an unsightly or hazardous manner. Sprinkle dusty accumulations with water. Provide containers in which to collect waste material and debris.
- 16.07 Control lowering of materials. Use as few handlings as possible. Do not drop or throw materials from storeys above grade.
- 16.08 Ensure that cleaning operations are scheduled to avoid deposit of dust or other foreign matter on surfaces during finishing work and until wet or tacky surfaces are cured.
- 16.09 Each Section shall supply the Contractor with instructions for final cleaning of his work, and for inclusion in Project Data Book as specified in each trade Section and in Section 01 33 00, Submittals.

17.00 ADJUSTING

- 17.01 Ensure that all components of assemblies fit snugly, accurately and in true planes, and that moving parts operate positively and freely, without binding and scraping.
- 17.02 Verify that work functions properly and adjust it accordingly to ensure satisfactory operation.
- 17.03 Lubricate products as recommended by the supplier.

18.00 SALVAGE

- 18.01 Unless otherwise specified, materials on the site at the time of signing of Contract shall remain property of Owner. The Contractor shall deliver those items indicated on the drawings to the Owner as directed by the Consultant.
- 18.02 Unless otherwise specified, salvaged material resulting from construction, and surplus materials and construction debris shall become property of Contractor, who shall dispose of it away from site.
- 18.03 Treasure, such as coins, bills, papers of value, and articles of antiquity, discovered during digging, demolition and cutting at the site shall remain property of Owner, and shall be delivered immediately into his custody.
- 18.04 When salvage items and materials are delivered to the Owner by the Contractor, the Contractor shall submit to the Owner a Certificate of Receipt which is to be endorsed by the Owner's representative. The Contractor shall incorporate copies of the Certificate of Receipt in the Project Data Books in accordance with Section 01 33 00, Submittals.

19.00 OWNER OCCUPANCY

- 19.01 The Owner reserves the right to occupy and use portions of the premises, whether partially or entirely completed, or whether completed on schedule or not, provided such occupancy does not interfere with the Contractor's continuing work.
- 19.02 Partial occupancy or installation by the Owner of his equipment shall not imply acceptance of the Work in whole, or in part, nor shall it imply acknowledgment that terms of the Agreement are fulfilled.

- 19.03 The Contractor shall not be entitled to indemnity for interference with performance of the Work due to Owner's occupancy of areas of Project prior to Total Performance but after date of Substantial Performance.

20.00 EQUIPMENT/ITEMS SUPPLIED BY OWNER FOR INSTALLATION BY CONTRACTOR

- 20.01 The Owner intends to supply for installation under this Contract certain pieces of equipment, fittings, furniture, etc.
- 20.02 Coordinate the shipping and delivery with the Owner.
- 20.03 Store on site protected from damage.
- 20.04 Install all pieces of equipment, fittings, furniture, etc. and leave in operating condition.
- 20.05 The Owner will supply the following items:
- .1 Vertical Headwalls.
 - .2 Wood doors.

----END OF SUMMARY OF WORK----

12 10 00

ALLOWANCES

INDEX

<u>Clause</u>	<u>Title</u>
1.00	General
2.00	Cash Allowance

1.00 GENERAL

- 1.01 The Contractor shall include in the Base Bid all cash allowances listed in the Specifications, which allowances shall be expended in whole or in part as the Consultant shall direct. The contractor shall not be required to employ for any such work, persons against whom he has a reasonable objection.
- 1.02 Material or work for such a cash allowance as made in the Specifications shall be subject to a price list or schedule approved by the Consultant.
- 1.03 Cash allowances shall be the net cost to the Contractor, f.o.b. the job, less trade discounts.
- 1.04 Include in each expenditure from cash allowance applicable taxes, except HST, specified in the General Conditions of the Stipulated Price contract.
- 1.05 Any variation to the cost shall be added to/or deducted from the cash allowance, but no adjustment will be made to the Contractor's cost of application, profit and overhead.
- 1.06 Deduct all expenditures from the cash allowance on applications for payment until the allowance is expended and before the contract amount is finally adjusted.

2.00 CASH ALLOWANCE

- 2.01 Expend cash allowances only as directed by Consultant.
- 2.02 Included in the Stipulated Price, a total cash allowance for each of the following items:
 - .1 Include the stipulated sum of \$150,000 for hardware allowance:
 - .1 Supply and installation of finish hardware at all new openings as per architectural drawings
 - .2 Commissioning of new card access openings
 - .3 Supply, installation and termination of all low voltage wiring from integration module to electric hardware
 - .4 Supply of electrical elevations
 - .5 Coordination with Division 26
 - .2 Include the stipulated sum of \$15,000 for signage and window film allowance:
 - .1 Supply and installation of signage and window film locations as per architectural drawings.
 - .3 Include the stipulated sum of \$15,000 for existing fire separation repair allowance:
 - .1 Repair existing fire separations as required by site conditions post demolition.
 - .4 The following allowance to be carried by the Mechanical Trade:
 - .1 Supply and commissioning of Section 25 00 00 "Controls" and Section 25 10 00 "Controls Commissioning" in Division 26 scope: \$60,000.00.
 - .2 Supply and commissioning of Section 23 25 00 "Water Treatment" in Division 26 scope: \$10,000.00.

----END OF ALLOWANCES----

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COORDINATION

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Cooperation Among Trades
2.00	Notification
3.00	Items to be Removed by Owner
4.00	Items to be Removed by Contractor and Turned Over to Owner
5.00	Items to be Removed by Contractor and Disposed
6.00	Items to be Removed and Re-Installed by Contractor
7.00	Items to Remain and to be Protected by Contractor
8.00	Cutting and Patching
9.00	Ceiling Access
10.00	Locates
11.00	Service Interrupts

1.00 COOPERATION AMONG TRADES

1.01 Cooperate and coordinate with other trades as required for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Provide forms, templates, anchors, sleeves, inserts and accessories required to be fixed to or inserted in work and set in place or instruct related trades as to their location. Pay cost of extra work caused by and make up time lost as result of failure to provide necessary cooperation information or items to be fixed to or built-in, in adequate time.

1.02 Co-operation with Owner Trades and Contractors

The General Contractor will be required to co-operate with Owner's trades persons or other Contractors who may be working within the designated construction site area.

2.00 NOTIFICATION

2.01 Request approval from Owner 7 – 10 days prior to necessary interruptions to building services such as fire systems, water supply, electrical services, heating system, communication, etc.

2.02 Give 7 - 10 days' notice to Owner prior to commencing work which would affect occupants, (e.g. locker room, lunch room, washroom, demolition, stairs, corridors, egress, sidewalks, vehicular access etc.)

3.00 ITEMS TO BE REMOVED BY OWNER

3.01 All loose furniture, furnishings and artwork.

4.00 ITEMS TO BE REMOVED BY CONTRACTOR AND TURNED OVER TO OWNER

4.01 See Drawings

5.00 ITEMS TO BE REMOVED BY CONTRACTOR AND DISPOSED

5.01 See Drawings

6.00 ITEMS TO BE REMOVED AND RE-INSTALLED BY CONTRACTOR

6.01 See Drawings

7.00 ITEMS TO REMAIN AND TO BE PROTECTED BY CONTRACTOR

7.01 See Drawings

8.00 CUTTING AND PATCHING

8.01 All cutting and patching shall be performed by trades skilled in the application of materials being altered.

8.02 Carry out all cutting and patching required for the work of this contract. Repair all wall and floor surfaces where items have been removed. Make good all finishes as required and agreed with Owner. Repaint damaged surfaces.

9.00 CEILING ACCESS

- 9.01 All the Owner's buildings are maintained by Facilities Management. All projects performed by internal or external personnel must be conducted by qualified people.
- 9.02 There is a policy, approved by the Occupational Health and Safety Committee, which prohibits entry into any ceiling space by unauthorized personnel.
- 9.03 Any personnel considering accessing any ceiling space must refer to the Owner's Ceiling Space Access Policy dated Jan. 21/97 before attempting access.
- 9.04 Any personnel entering any ceiling space known to contain asbestos must follow procedures described in Owner's Facilities Management Work Procedure 9 (Asbestos Ceiling Access) and Work Procedure 11 (Asbestos Type II), and refer to the Owner's Asbestos Control Policy, Safety Procedure Guidelines 96-01 and 96-02, and Asbestos Project Information Handout, all dated Jan. 21, 1997.
- 9.05 Failure to comply with Owner's procedures and governmental regulations could result in exposing building occupants to hazardous asbestos fibres as well as expensive decontamination procedures.
- 9.06 Contractor must coordinate with subcontractors for existing ceiling tile removal.
- 9.07 All tiles must be reinstalled, and damaged tiles replaced upon completion of such work.

10.00 LOCATES

- 10.01 Requests for locates (both Western and One Call) to be submitted to locates@uwo.ca, Western Project Manager / Project Coordinator to be included on the email request.
- 10.02 Locates are valid for sixty (60) days following locate completion and based on nothing being disturbed during that timeframe.
- 10.03 Lead time required – 7 to 10 business days.
- 10.04 Western trade support - on campus power, water, sewer, communication.
- 10.05 Ontario One Call – gas, cable, outside campus boundary services.

11.00 SERVICE INTERRUPTIONS

- 11.01 General Contractors to submit "Service Interruption Request Form" to Western Project Manager / Project Coordinator at least 7-10 business days prior to start of the requested work.
- 11.02 Western trade support is coordinated by Western project manager but is to be indicated if required on the above noted form.

-----END OF COORDINATION-----

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PROJECT MEETINGS

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Requirements Included
2.00	Related Requirements
3.00	Administrative
4.00	Meetings

1.00 REQUIREMENTS INCLUDED

- 1.01 Administrative.
- 1.02 Meetings.

2.00 RELATED REQUIREMENTS

- 2.01 Section 01 60 00: Material and Equipment.
Section 01 77 00: Contract Closeout.

3.00 ADMINISTRATIVE

- 3.01 The Owner will administer the Post Bid Review Meeting and the Contractor will administer the Progress Meetings. The first Contractor's progress (site) meeting will use the Post Bid Review Meeting Minutes as a basis for the Progress Meeting.
- 3.02 Schedule and administer progress meetings throughout the progress of the work at the call of the Consultant, until project completion.
- 3.03 Prepare agenda for meetings.
- 3.04 Distribute written notice of each meeting five (5) days in advance of meeting date to Owner, Consultant, Contractor, Subcontractors and Suppliers.
- 3.05 Provide physical space and make arrangements for meetings.
- 3.06 Preside at meetings.
- 3.07 Record the minutes. Include significant proceedings and decisions. Identify 'Action By' parties.
- 3.08 Reproduce and distribute copies of minutes within three (3) days after each meeting and transmit to meeting participants and affected parties not in attendance.
- 3.09 Representative of Contractor, Subcontractor and suppliers attending meetings shall be qualified and authorized to act on behalf of the party each represents.

4.00 MEETINGS

4.01 POST BID REVIEW MEETING

- .1 A Post Bid Review Meeting may be convened and chaired by the Owner who will invite the Consultant and Contractor under consideration along with associated major Subcontractors to review the Contract Documents and Bid submitted. This meeting will be prior to the Owner issuing a letter of intent or Contract and is subject to requisite Owner approvals. The award of any contract is at the Owner's sole discretion based on the bids received and subject to the results of this meeting. The Bid Bond will remain valid for the bid acceptance period until the Owner's decision is made. This meeting does not constitute or infer any contract award to the proposed contractor or any other contractor, nor that the project will proceed.
- .2 Agenda will include the following:
 - 1. BID REVIEW**
 - Contract Amount/HST
 - Separate Prices/Alternate Prices/Unit Prices/Labour Rates

- Itemized Prices
- Allowances
- Identified Prices
- List of Subcontractors & Suppliers
- Post Bid Addenda/Negotiations

2. APPROVALS

- Building Permit Status
- Site Plan Approval
- Development Agreement
- Owner Internal Approvals

3. SCHEDULE

- Mobilization
- Locates and Service Interrupts
 - Owner
 - Ontario One Call
- Long Delivery Items
- Phasing
- Completion

4. SITE SET UP

- Access & Staging Area
- Hoarding & Signage
- Security & Lighting
- Use of Temporary Services
 - power
 - elevators
 - water
 - washrooms
 - caretaking equipment/ladders, etc.
 - waste holding & removal
- Parking
- Keys & I.D.
- Site Contacts
 - Contractor (24 hrs.)
 - Consultants
 - Owner
- Hours of Work
- Building/Ground/Road Closures

5. CONTRACT ADMINISTRATION

- Testing & Inspection
 - Owner
 - Consultants
 - Contractor
- Shop Drawings
- Contractors Purchase Orders
- Site Meetings - set date for 1st
- Change Orders, Change Instructions, and Supplemental Instructions
- Progress Draws
- Maintenance Retention Fund
- Correspondence
- Contract Closeout

- As Builts & Manuals
- Substantial Completion and Holdback
- WSIB & Stat. Declaration
- Commissioning
- Warranties (extended)
- Spare Materials & Parts
- Building Permit Inspections
- Backflow Prevention
- Balancing & Testing

6. OWNER POLICIES & PROCEDURES

- Work Area Protection
- Confined Space Entry
- Asbestos
- Ceiling Space Entry
- WHMIS (MSD Sheets)
- Harassment/Smoking
- High Voltage Room Access & Training
- PPE Requirements
- Trenching and Excavations
- Safety Reminder Program
- Accident/Visit Notification
- Elevating Work Platforms
- Fall Protection
- Propane Fuelled Equipment User Certification
- Safety Contacts & Committees & Meetings
- Lock Out/Tag Out
- Verification of energy source isolation
- Designated Substances
- High velocity (>90 m/s) Powder Actuated Tools not allowed on campus
- Gas Engines (ventilation, etc.)
- Hot or Open Flame Work

7. AWARD

- Letter of Intent
- Purchase Order
- Documents Required for CCDC 2 2020 - Contract Preparation
 - Issued for Tender Specifications & Drawings
 - Issued for Tender Addenda
 - Contractors Executed Bid Submission
 - Western University Issued Purchase Order (and / or) Letter of Intent
 - Certificate of Insurance (Must name Western & Consultant)
 - Notice of Project – Ministry of Labour (MOL)
 - Contractor Safety Policies and Procedures
 - Performance Bond
 - Labour & Materials Payment Bond
 - WSIB Clearance Certificate
 - WISR
 - Cash Flow Schedule
 - Schedule of Values
 - Construction Schedule
 - Constructor Agreement
 - List of sub-contractors and suppliers

- CCDC 2 - 2020 Contract
- Payments with Contract only

4.02 DESIGNATED SUBSTANCE MEETINGS

- .1 When working in areas of known and/or identified designated substances, or when required to provide abatement services, a separate meeting will be convened with the Owner to discuss work strategies prior to work starting.
- .2 No work may commence without first attending this meeting, to ensure a clear understanding of procedures, policies, training, etc. that the Contractor will employ.
- .3 When an unexpected discovery of any designated substance is made, all work must stop and the procedures outlined above and those identified in Section 01 54 03, Safety Requirements, properly followed.

4.03 PROGRESS MEETINGS

- .1 During course of Work, the Contractor shall schedule progress meetings as may be required and at the call of the Consultant until Project Completion.
- .2 Contractor to prepare minutes and distribute to all parties. Agenda to include the following:
 - i Review, approval of minutes of previous meeting.
 - ii Review of Work progress since previous meeting.
 - iii Field observations, problems, conflicts.
 - iv Problems which impede construction schedule.
 - v Review of off-site fabrication delivery schedules.
 - vi Corrective measures and procedures to maintain projected schedule.
 - vii Revisions to construction schedule.
 - viii Progress schedule during succeeding work period and affect on occupants.
 - ix Review submittal schedules: expedite as required.
 - x Maintenance of quality standards.
 - xi Pending changes and substitutions.
 - xii Review proposed changes for effect on construction schedule and on completion date.
 - xiii Other business.
- .3 The Contractor is to provide updated and current lists of PO's (for contract, sub-contract, sub-sub-contract, and suppliers, etc.); change notices/orders, and site instruction registers; and shop drawing register. These lists and registers are to be attached to each issue of Meeting Minutes.

4.04 COMMISSIONING MEETINGS

- .1 Arrange for and schedule meetings for commissioning and demonstration of equipment and systems.

4.05 CONFINED SPACE ENTRY MEETINGS

- .1 When work is required in confined spaces, a separate meeting will be convened with the Owner to discuss work strategies prior to work starting.
- .2 No work may commence without first attending this meeting to ensure a clear understanding of procedures, policies, training, etc. that the Contractor will employ.

----END OF PROJECT MEETINGS---

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CONSTRUCTION SCHEDULE

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Schedules Required
2.00	Format
3.00	Submission
4.00	Construction Schedule
5.00	Submittals Schedule

1.00 SCHEDULES REQUIRED

- 1.01 Submit the following schedules:
 - .1 Construction Progress Schedule
 - .2 Submittal Schedule for Samples, Mock-ups and Shop Drawings review.
 - .3 Product Delivery Schedule

2.00 FORMAT

- 2.01 Prepare schedule in the form specified in General Conditions
- 2.02 Provide a separate bar for each trade or operation.
- 2.03 Provide horizontal time scale identifying the first work day of each week.
- 2.04 Format for listing: The chronological order of the start of each item or work.
- 2.05 Identification of listing: By systems description.

3.00 SUBMISSION

- 3.01 Submit in accordance with requirements of General Condition GC3.5.
- 3.02 Distribute copies of the schedules to concerned parties except Consultants and Owner before final submission for review.
- 3.03 Submit cop to be retained by the consultant and Owner for review.
- 3.04 Submit updated Construction Schedule with applications for payment in accordance with GC 3.5.

4.00 CONSTRUCTION SCHEDULE

- 4.01 Provide a detailed logic driven manpower loaded schedule for the work in electronic and hard copy format, as per GC 3.4, updated and delivered as per GC 3.4.
- 4.02 Include the complete sequence of construction activities, including provision for climate and weather.
- 4.03 Include the dates for the commencement and completion of each major element of construction according to specification Sections list.
- 4.04 Show projected percentage of completion for each item as of the first day of each week.
- 4.05 Submit draft Schedule for review, and incorporate responses to comments identified by Consultant and/or Owner.
- 4.06 Show dates for commencement and completion of inspection and testing.
- 4.07 At each date of submission of Schedule, indicate progress of each activity.
 - .1 Show changes occurring since previous submission of Schedule:
 - .1 Major changes in scope.
 - .2 Activities modified since previous submission.
 - .3 Revised projections of progress and completion.

- .4 Other identifiable changes.
- .2 Provide a narrative report to define:
 - .1 Problem areas, anticipated delays, and the impact on the schedule.
 - .2 Corrective action recommended and its effect.

5.00 SUBMITTALS SCHEDULE

- 5.01 Include time allowed for review of submittals by consultant, and for samples and finishes by Consultant and Owner.
- 5.02 Indicate dates for submitting, review time, re-submission time, float time, last date for Meeting Construction Progress Schedule.

----END OF CONSTRUCTION SCHEDULE----

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CONSTRUCTION PHOTOGRAPHS

INDEX

<u>Clause</u>	<u>Title</u>
1.00	General
2.00	Digital Progress Photographs

1.00 GENERAL

- 1.01 Provide construction photographs in digital format in accordance with procedures and submission requirements specified in this Section.

2.00 DIGITAL PROGRESS PHOTOGRAPHS

- 2.01 Provide monthly digital progress photographs from a minimum of four distinct locations, as directed by the Consultant. Photographs must be high-resolution (minimum 300 DPI) and taken by a professional photographer or a designated individual with demonstrated capability in construction photography.
Submit photographs in a common digital format (e.g., JPEG or PNG) via secure file transfer, cloud-based project management platform, or as otherwise directed by the Consultant.
Each image must be clearly labeled with the date taken, location, project name, and photographer's name in the file name or embedded metadata.
- 2.02 The Owner reserves the right to engage a third-party firm to document construction progress and other project milestones for record-keeping, communications, and use in conjunction with as-built documentation and operation manuals.

----END OF CONSTRUCTION PHOTOGRAPHS---

01 33 00

SUBMITTALS

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Requirements Included
2.00	Related Requirements
3.00	Administrative
4.00	Shop Drawings and Product Data
5.00	Samples
6.00	Operating and Maintenance Manuals
7.00	Record Drawings
8.00	Certificates and Transcripts
9.00	Pressure Vessel Certification
10.00	Interference Drawings

1.00 REQUIREMENTS INCLUDED

- 1.01 Administrative.
- 1.02 Shop drawings and product data.
- 1.03 Samples.
- 1.04 Operating and maintenance manuals.
- 1.05 Record Drawings.
- 1.06 Certificates of transcripts.

2.00 RELATED REQUIREMENTS

- 2.01 Section 01 77 00: Contract Closeout.

3.00 ADMINISTRATIVE

- 3.01 Submit to Consultant submittals listed for review. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work. Failure to submit in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- 3.02 Work affected by the submittal shall not proceed until review is complete.
- 3.03 Review submittals prior to submission to the Consultant. This review represents that necessary requirements have been determined and verified and that each submittal has been checked and coordinated with the requirements of the Work and the Contract Documents. Submittals not stamped, signed, dated and identified as to the specific project will be returned without being examined and shall be considered rejected.
- 3.04 Verify that field measurements and affected adjacent Work are coordinated.
- 3.05 Contractor's responsibility for errors, omissions and deviations from requirements of Contract Documents in submission is not relieved by Consultant's review.
- 3.06 Keep one reviewed copy of each submission on site.

4.00 SHOP DRAWINGS AND PRODUCT DATA

- 4.01 Refer to GC 3.8 - Shop Drawings.
- 4.02 Indicate materials, methods of construction and attachment of anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or other equipment attach or connect to other articles or equipment, indicate that such items have been coordinated, regardless of the Section under which the adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications. Contractor's responsibility for errors and omissions in submission is not relieved by Consultant's review.
- 4.03 Adjustments made on shop drawings by the Consultant are not intended to change the Contract Price. If adjustments affect the value the Work, state such in writing to the Consultant prior to proceeding with the Work.

- 4.04 Submit electronic copies of product data sheets or brochures for requirements requested in Specification Sections and as the Consultant may reasonably request where shop drawings will not be prepared due to standardized manufacture of product.
- 4.05 Shop drawings must bear the date, stamp and signature of the Contractor indicating their review and acceptance before issuance to the Consultant and Owner.

5.00 SAMPLES

- 5.01 Submit for review samples in triplicate as requested in respective Specification Sections. Label samples as to origin and intended use in the Work.
- 5.02 Deliver samples prepaid to Consultant's business address.
- 5.03 Notify the Consultant in writing at the time of submission of deviations in samples from the requirements of Contract Documents.
- 5.04 Adjustments made on samples by the Consultant are not intended to change the Contract Price. If adjustments affect the value of the Work, state such in writing to the Consultant prior to proceeding with the Work.
- 5.05 Make changes in samples which the Consultant may require consistent with Contract Documents.

6.00 OPERATING AND MAINTENANCE MANUALS

- 6.01 Provide electronic copies of manuals to contain operational information on equipment, cleaning and lubrication schedules, filters, overhaul and adjustment schedules, certificates, testing procedures, pressure tests, inspection reports, and similar maintenance information. Instruction in this manual shall be in simple language so as to guide the Owner in the proper operation and maintenance of building components.
- 6.02 Operation and maintenance manuals and associated drawings shall be submitted electronically.
- 6.03 Submitted Documents to include the following details, including: Building Name, Project Name, Project Number, Date, Names of Consultants, Service Discipline, Name of Contractor(s)
- 6.04 In addition to information specified, include the following:
 - .1 Title sheet, labelled 'Operating and Maintenance Instructions', containing project name and date.
 - .2 List of names, addresses and phone numbers of Subcontractors and suppliers who can repair or maintain equipment, and who will be responsible for warranty. See Supplementary GC 12.3.7.
 - .3 List of contents.
 - .4 Final shop drawings and product data of equipment.
 - .5 Record drawings of mechanical and electrical installation.
 - .6 Full description of building systems and operation.

6.04 Retention for Operation and Maintenance Manuals

Include the following in Contract Documents:

Provide Operations and Maintenance Manuals in accordance with details in the documents.

Provide electronic copy for the Owner's use two weeks prior to the issue of the substantial completion certificate. This manual is to be complete with the exception of certain items which

cannot be provided prior to substantial completion, such as final warranty details, engineering reports, Ontario Hydro Certificate, Fire Alarm Verification, Coordination Study, Substantial Performance Certificate, etc.

Provide electronic copy before the end of the 60 day lien period complete with extra copies of those items that could not previously be provided in the first manual.
Manuals which are not complete at the above times will not be accepted. The Owner will retain \$3,000.00 until acceptable completion and delivery of all manuals. This sum is in addition to and bears no relation to the 10% Lien Holdback.

7.00 AS-BUILT DRAWINGS

- 7.01 After award of Contract, the Consultant will provide a set of drawings for the purpose of maintaining as built drawings. Accurately and neatly record deviations from Contract Documents caused by site conditions and changes ordered by the Consultant.
- 7.02 As-Built drawings are to include locations of concealed components of mechanical and electrical services.
- 7.03 Identify drawings as 'Project As-Built Copy'. Maintain in new condition and make available for inspection on site by Consultant. The Consultant will review the As-Built drawings each month prior to release of payments to the Contractor.
- 7.04 On completion of Work and prior to final inspection, submit As Built documents to Consultant.
- 7.05 Retention for As Built Information

Include information in accordance with Owner's Facilities Management Department data sheets.

In addition, include the following:

Provide the information relating to AS-BUILT conditions to the Consultant(s) ten (10) days prior to the end of the 60 day lien period.

The Owner will retain \$3,000.00 per discipline until expeditious completion and delivery of AS-BUILT information for review by the Consultant(s). The Consultant(s) will be expected to review the AS-BUILTS for content within ten (10) days of receipt and advise the Owner accordingly. If information is incomplete, the \$3,000.00 per discipline will be retained until the information is deemed complete. This sum is in addition to and bears no relation to the 10% Lien Holdback.

8.00 CERTIFICATES AND TRANSCRIPTS

- 8.01 Immediately after issue of letter of intent, or contract, submit Workplace Safety & Insurance Board status and transcripts of Insurances.

9.00 PRESSURE VESSEL CERTIFICATION

- 9.01 Any component requiring a Certificate to be issued by the Technical Standards and Safety Authority (TSSA), Pressure Vessels Safety, (formerly the Ministry of Consumer and Commercial Relations, Pressure Vessels Safety Branch) must be identified in writing by the Contractor to the Owner.
- 9.02 The Contractor shall be sure to quote the Western project number and Building in which the certified component will reside, and the discreet serial number that the Manufacturer has assigned to the pressure vessel(s).

- 9.03 The fee for the certification will be paid by the Contractor. Any invoices directed to the Owner from the Technical Standards and Safety Authority will be paid by the Owner and back charged to the Contractor.

10.00 INTERFERENCE DRAWINGS

- 11.01 The Contractor shall prepare Revit interference drawings in order to properly coordinate the work of all trades, such as, but not restricted to, sleeves, plumbing and fire protection, sheet metal and air conditioning, electrical and building structure.
- 11.02 Bear all costs involved for the preparation of these drawings and the changes necessitated due to interference discovered by their preparation. Advise all trades and the Consultant of any rerouting or relocation required.
- 11.03 If interferences are discovered advise Consultant immediately and do not proceed until adjustments are approved.
- 11.04 Submit copies of Revit drawings for the Consultant's records.

----END OF SUBMITTALS---

01 41 00

REGULATORY REQUIREMENTS

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Jurisdictional Authorities
2.00	Building Construction Requirements
3.00	Definitions
4.00	Fire Prevention and Safety
5.00	Fire Protection of Structure
6.00	Fire Separations
7.00	Requirements of Regulatory Agencies
8.00	Reference Standards

1.00 JURISDICTIONAL AUTHORITIES

- 1.01 Where reference is made to jurisdictional authorities, it shall mean all authorities who have within their constituted powers the right to enforce the laws of the place of building.
- 1.02 Requirements of jurisdictional authorities shall apply to the Work in precedence to the requirements of the Contract Documents, except that more stringent requirements of the Contract Documents shall take precedence over requirements or jurisdictional authorities.

2.00 BUILDING CONSTRUCTION REQUIREMENTS

- 2.01 Jurisdictional authority governing construction:
 - .1 Ontario Building Code
 - .2 Ontario Fire Code
- 2.02 Building type by Use and Occupancy:
 - .1 Group A, Division 2 – Assembly Occupancy
- 2.03 Construction type:
 - .1 non combustible
- 2.04 Refer to the Architectural Drawing A1.01 for the location and continuity of the fire separations.

3.00 DEFINITIONS

- 3.01 The "Constructor" named in the Occupational Health and Safety Act, 1978 of the Province of Ontario, including any amendments, shall mean the "Contractor" for the Work.

4.00 FIRE PREVENTION AND SAFETY

- 4.01 Enforce fire protection methods, good housekeeping, and adherence to local and underwriter's fire regulations. Provide ULC approved fire extinguishers, and other firefighting services and equipment except where more explicit requirements are specified as the responsibility of individual Sections.
- 4.02 Maintain clear emergency exit paths for personnel at all times.
- 4.03 Use only fire-resistant tarpaulins and similar protective covering on site.
- 4.04 Ensure that volatile waste is stored in closed containers and removed from premises daily.

5.00 FIRE PROTECTION OF STRUCTURE

- 5.01 Ensure that nothing subverts the integrity of fire protection provided for the building structure.
- 5.02 Provide fire protection of structural members for their entire length and girth.
- 5.03 Coordinate work of all Sections so that they do not encroach on space required for fire protection and its installation. Ensure that fire protection damaged during construction is totally replaced.

6.00 FIRE SEPARATIONS

- 6.01 Ensure that fire separations are installed to maintain total integrity and that they are not diminished or breached by work following their installation.

- 6.02 Replace fire separations which have suffered a lessening of their required rating during construction.

7.00 REQUIREMENTS OF REGULATORY AGENCIES

- 7.01 Work shall include protection measures consisting of materials, constructions and methods required by The Occupational Health and Safety Act, 1978, of the Province of Ontario, and as otherwise imposed by jurisdictional authorities to save persons and property from harm.
- 7.02 Ensure that pollution and environmental control of construction activities are exercised as required during the Work.
- 7.03 Except where special permission is obtained, maintain clear access for roads and sidewalks on public property.
- 7.04 Maintain roads and sidewalks clear of construction material and debris, to the satisfaction of the Owner and City including excavated material. Clean roads and sidewalks as frequently as required to ensure that they are cleared of materials, debris and excavated material.
- 7.05 Remove snow, ice and mud from roads and sidewalks as required by the Owner and the municipality.
- 7.06 Standards, specifications, associations and regulatory bodies are generally referred to throughout the specifications by their abbreviated designations. These are, but not necessarily, limited to:

AA	-	The Aluminum Association
AAMA	-	Architectural Aluminum Manufacturers Association
ACI	-	American Concrete Institute
AISI	-	American Iron and Steel Institute
ANSI	-	American National Standards Institute
ASTM	-	American Society for Testing and Materials
AWI	-	Architectural Woodwork Institute
AWMAC	-	Architectural Woodwork Manufacturers' Association of Canada
CGSB	-	Canadian General Standards Board (designated CAN/CGSB)
CISC	-	Canadian Institute of Steel Construction
CPMA	-	Canadian Paint Manufacturers Association
CSA	-	Canadian Standards Association (designated CAN/CSA)
CSSBI	-	Canadian Sheet Steel Building Institute
MFMA	-	Maple Flooring Manufacturers Association
MTC	-	Ministry of Transportation and Communications, Ontario
NBC	-	National Building Code
OAA	-	Ontario Association of Architects
OBC	-	Ontario Building Code
OGCA	-	Ontario General Contractors Association
SAE	-	Society of Automotive Engineers
ULC	-	Underwriters Laboratories of Canada
ULI	-	Underwriters Laboratories Incorporated
USAS	-	United States of America Standards, of American National Standards Institute

8.00 REFERENCE STANDARDS

- 8.01 Where edition date is not specified, consider that references to manufacturer's and, published codes, standards and specifications are made to the latest edition (revision) approved by the issuing organization, current at the date of the Specifications.

- 8.02 Reference standards and specifications are quoted in the Specifications to establish minimum standards. Work of quality or of performance characteristics that exceeds these minimum standards will be considered to conform.
- 8.03 Should the Contract Documents conflict with specified reference standards or specifications, the more stringent in each case shall govern.
- 8.04 Where reference is made to manufacturer's directions, instructions or specifications, they shall include full information on storing, handling, preparing, mixing, installing, erecting, applying, or other matters concerning the materials pertinent to their use and their relationship to materials with which they are incorporated.
- 8.05 Have a copy of each code, standard and specification, and manufacturer's directions, instructions and specifications, to which reference is made in the Specifications, always available at construction site.

----END OF REGULATORY REQUIREMENTS----

01 45 00

QUALITY CONTROL

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Requirements Included
2.00	Related Requirements
3.00	Independent Inspection Agencies
4.00	Access to Work
5.00	Procedures
6.00	Mock-Ups
7.00	Equipment/Systems

1.00 REQUIREMENTS INCLUDED

- 1.01 Independent inspection agencies.
- 1.02 Access to work.
- 1.03 Procedures.
- 1.04 Mock-ups.
- 1.05 Equipment/systems.

2.00 RELATED REQUIREMENTS

- 2.01 Section 01 33 00: Submittals.
- 2.02 Section 01 60 00: Materials and Equipment.

3.00 INDEPENDENT INSPECTION AGENCIES

- 3.01 Independent Inspection/Testing Agencies may be engaged by the Owner for the purpose of inspecting and/or testing portions of Work. Cost of such services will be borne by the Owner.
- 3.02 Co-operate with inspection and testing by the appointed agencies.
- 3.03 Employment of inspection/testing agencies does not relieve the Contractor's responsibility to perform Work in accordance with the Contract Documents.
- 3.04 If defects are revealed during inspection and/or testing, the appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defects and irregularities as advised by Consultant at no cost to the Owner. Pay costs for retesting and reinspection.

4.00 ACCESS TO WORK

- 4.01 Allow inspection/testing agencies access to the Work, off-site manufacturing and fabrication plants.
- 4.02 Co-operate to provide reasonable facilities for such access.

5.00 PROCEDURES

- 5.01 Notify the appropriate agency and Consultant in advance of the requirement for tests, in order that attendance arrangements can be made.
- 5.02 Submit samples and/or materials required for testing, as specifically requested in Specification. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in the Work.

6.00 MOCK-UPS

- 6.01 Prepare mock-ups for Work specifically requested in the Specification. Include for Work of all Sections required to provide mock-ups.
- 6.02 Construct in locations acceptable to the Owner.

- 6.03 Prepare mock-ups for Consultant's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in the Work.
- 6.04 Failure to prepare mock-ups in ample time is not considered sufficient reason for an extension of Contract Time and no claim for extension by reason of such default will be allowed.
- 6.05 Remove mock-ups when requested by the Consultant if not incorporated into the Work.

7.00 EQUIPMENT/SYSTEMS

- 7.01 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems as directed in the Specifications.
- 7.02 Refer to specific Section for definitive requirements.

----END OF QUALITY CONTROL---

01 50 00

TEMPORARY FACILITIES

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Requirements Included
2.00	Related Requirements
3.00	General
4.00	Barriers
5.00	Construction Parking
6.00	Utilities
7.00	Protection
8.00	Site Offices
9.00	Construction Aids
10.00	Security
11.00	Project Identification
12.00	Access Roads
13.00	Cleaning
14.00	Shut-Down of Equipment/Systems & Interruption of Public Access

1.00 REQUIREMENTS INCLUDED

- 1.01 Related Requirements.
- 1.02 Barriers.
- 1.03 Construction Parking.
- 1.04 Utilities.
- 1.05 Protection.
- 1.06 Site Offices.
- 1.07 Project Identification.
- 1.08 Cleaning.
- 1.09 Shutdowns

2.00 RELATED REQUIREMENTS

- 2.01 Section 01 45 00: Quality Control.
- 2.02 Section 01 57 13: Dust and Water Controls.
- 2.03 Section 01 77 00: Contract Closeout.

3.00 GENERAL

- 3.01 Include in the Work construction facilities and temporary controls required as construction aids and by jurisdictional authorities, or as otherwise specified. Install to meet needs of construction as it progresses. Maintain construction facilities and temporary controls during use, repair them when damaged, relocate them as required by the Work, remove them at completion of need, and make good adjacent construction and property affected by their installation.
- 3.02 Construct temporary facilities of new materials unless otherwise approved.
- 3.03 Ensure that structural, mechanical, and electrical characteristics of temporary facilities are suitable and adequate for use intended. Be responsible that no harm is caused to persons and property by failure of temporary facilities, because of placing, location, stability, protection, structural sufficiency, removal or any other cause.
- 3.04 Prepare shop drawings and specifications of temporary work, and submit for approval of jurisdiction authorities if so required. Submit duplicate copy to Consultant for his information.
- 3.05 Locate temporary facilities where shown on Drawings or as directed by Consultant.
- 3.06 Apply two coats of paint, in approved colours, to temporary constructions that are not prefinished, such as storage sheds; offices; supports, bracing and back side of signs; barricades; and where otherwise specified.

4 00 BARRIERS

- 4.01 Fencing

- .1 Enclose work site with 8 foot high chain link fencing as indicated on Drawings. Install secure gates at access points. Maintain fencing throughout the construction period.
 - .2 Maintain fencing in good repair until Work is complete, and then remove fencing and all components and turn over to Owner.
- 4.02 Hoarding will be in accordance with drawings.
- 4.03 Guard Rails and Barricades
- .1 Provide secure railings and barricades to protect public and keep them safe from working areas.
 - .2 Comply with the Owner's Work Procedure WP.41 Work Area Protection, available from the Owner.

5.00 CONSTRUCTION PARKING

- 5.01 A parking permit is required for all vehicles parking on campus.
- 5.02 Contractor permits can be purchased through Parking Services. Parking Services is located in the Support Services Building, Room 4150.
- 5.03 Parking for contractors is only available in areas designated by Parking Services. Please see the Parking website for the most up to date list of approved areas:
<https://www.uwo.ca/parking/permits/commercial.html>
- 5.04 Laydown areas are not to be used for contractor parking. If contractors are permitted to park in laydown areas (advance approvals required from both Parking Services and FM Project Manager), a permit will still need to be purchased.
- 5.06 Supervisor parking may be allowed closer to the project site, with Western approval. A commercial permit can be purchased and issued for these areas. These permits are typically limited to a maximum of 2 per contractor. Exceptions may be made if a company has multiple, active job sites on campus.
- 5.07 Contractor vehicles cannot park in designated Western service vehicle spaces regardless of the type of parking permit held. Service vehicle spaces are for marked Western service vehicles only.
- 5.08 Costs associated with purchasing a contractor or commercial permit can be found here:
<https://www.uwo.ca/parking/permits/commercial.html>

6.00 UTILITIES

- 6.01 Sanitary Facilities
- .1 The Owner will identify which existing washroom facilities may be used by workers.
 - .2 Ensure facilities are left in clean condition. Make arrangements with Owner. ♦
- 6.02 Water Supply
- .1 Source of water will be designated by the Owner and the tie-in through a shut-off valve will be made by the Owner. All water extensions from this point to the job site will be by the Contractor and these extensions must be approved by the Owner to avoid possible accidental reverse flow.
- 6.03 Temporary Power and Light

- .1 The Owner will pay for temporary power and lighting required during construction for construction lighting and the operating of power tools, to a maximum supply of 230 volts, 30 amps. Temporary power in excess of above is the responsibility of the Contractor.
- .2 Arrange for connection with utility company as appropriate. Pay all costs for installation, maintenance and removal.

Provide lighting for:

- .1 Temporary emergency evacuation, safety and security throughout the Project at intensity levels required by jurisdictional authorities.
- .2 Temporary performance of work throughout the Project as required, evenly distributed, and at intensities to ensure that proper installations and applications are achieved.
- .3 Temporary performance of finishing trades in areas as required, evenly distributed, and of an intensity of at least 15 foot candles.
- .4 Permanent lighting may be used during construction, provided lamps, fluorescent tubes and ballasts that are so used are replaced with new at time the Work is turned over to Owner.

6.04 Telephone

- .4 The office of the General Contractor and major subcontractors, responsible for this project, if not located in the London area, must be accessible by local telephone, or by toll free number.
- .5 The site superintendent must have on his person throughout the work, a cell telephone. This number is to be shared with the Owner and the Consultants.
- .6 A 24-hour emergency number will be given to the Owner and Consultant on behalf of the Contractor.

6.05 Temporary Heat

- .1 Heat the building during construction and finishing ensure a minimum temperature of 15°C (60°F) and to maintain temperature for working, surface, and curing conditions required by all specified materials. Use only oil, natural gas or propane fired heaters with enclosed combustion chamber vented to exterior in accordance with good practice and safety regulations.
- .2 Take care that heating units are placed so that formwork and its supports are not endangered and that no material is damaged by excessive heat.
- .3 If possible, and when approved, the permanent heating system may be used to provide heat during construction. If it is used, the Contractor shall be totally responsible for its operation, and for replacing and repairing damage it may suffer, and shall assume operation and maintenance of the system in all its parts and payment for fuel consumed. Operation and maintenance shall include inspection at least every two weeks of thermostats; valves; switches; lubrication, fan, belt and motor adjustment; cleaning and/or replacement of filters; and replacement of filters and re-servicing of system at completion of the Work. Connect electric motors only to permanent source of power, or otherwise provide proper source with correct design characteristics and with no fluctuation in voltage. Commence warranty period after re-servicing and from time of substantial performance of the total Work.
- .4 Use of the building systems during construction for temporary heat shall not have any effect on the warranty period of those systems and equipment in use. The warranty period will not begin until substantial performance has been attained.

6.06 Connections to Utilities

- .1 Make arrangements for connections to water, sewer, gas, electric and telephone utilities as required for temporary use during construction.

- .2 Pay connection and disconnection charges, and for use of services required by construction. The Owner is responsible for payment of final connection charges that are part of service contracts between the Owner and each utility.

7.00 PROTECTION

7.01 Protection of Work and Property

- .1 Refer to GC 9.
- .2 Provide protection required to enable existing building to remain in continuous and normal operation and maintain construction schedule.
- .3 Workers are permitted only into those areas of existing building where their work is affected. Contractors trespassing into existing building other than to execute work shall be immediately dismissed from this project. The Owner will provide identification badges as identified during the Post Bid Review Meeting.
- .4 Provide temporary construction as required by the Work to protect it from damage. Provide protection by materials of sufficient thickness to prevent all damage to structure and finish, and to waterproofing qualities of membranes, whenever each of these individual components are exposed. Damage shall include harm resulting from all construction work, such as falling objects, wheel and foot traffic, failure to remove debris, operation of machinery and equipment, and scaffolding and hoisting operations. Positively secure protection to prevent displacement from any cause.
- .5 Box with wood or otherwise protect from damage, by continuing construction, finished sills, jambs, corners and the like.

8.0 SITE OFFICES

- 8.01 Offices may be located within existing building. Coordinate location with Owner and Consultant.

9.00 CONSTRUCTION AIDS

9.01 Hoists and Cranes

Select, operate and maintain hoisting equipment and cranes as may be required. Operate such equipment only by qualified hoist or crane operators. Make hoist available as required by each Section.

9.02 Building Enclosure

Include in the Work, temporary enclosure for building as required to protect it, in its entirety or in its parts, against the elements, to maintain environmental conditions required for work within the enclosure, and to prevent damage to material stored within. Design enclosures that are structurally self-sufficient and that do not overload the building structure. Design enclosures to withstand wind pressures required for the building by jurisdictional authorities. Use structural framing of building for support of temporary enclosure framing only upon verification exceeded. Keep surfaces of enclosures free of snow and ice to avoid overloading of building structure. Erect enclosures to allow complete accessibility for installation of materials during the time enclosures remain in place.

9.03 Scaffolding

- .1 Erect scaffolds clear of walls and ensure that they do not interfere with continuing work.
- .2 Each user of scaffolding shall be responsible for its examination for sufficiency before using it. He shall make it secure if necessary, or shall notify the Contractor in writing that he will not commence work until it is made secure; otherwise, they will be held

responsible for, and shall indemnify and save the Contractor harmless from and against, all damages or injuries sustained as a consequence of its insufficiency.

10.00 SECURITY

- 10.01 Maintain security of construction site by control of access through enclosing fences, barricades, and hoardings during time work is in progress, and by locking hardware otherwise.
- 10.02 After new building is enclosed, maintain its security by adequate barriers to entry, and by temporary doors equipped with locking hardware.
- 10.03 Maintain security at all times construction is shut down because of a strike or a lockout.
- 10.04 Install sufficient illumination of site so that security can be maintained.

11.00 PROJECT IDENTIFICATION

- 11.01 .1 Install a project sign on overlaid plywood, framed, and mounted on braced posts. Only owner's project, consultant's, subconsultant's and contractor's names shall appear on sign. Submit shop drawings for review. Size of sign shall be 3660 mm x 2440 mm as indicated on Drawings.
 - .2 Erect sign as directed.
 - .3 Place only specified project sign and notices regarding safety, caution, or instructions on or near site.
 - .4 No other signs/signage will be allowed on site.
-
- 11.02 Construction Sign
 - .1 Signs or advertisements are permitted on site, subject to owner approval.
 - .2 Provide warning signs as required by governing authorities.

12.00 ACCESS ROADS

- 12.01 Access roads and walks
 - .1 Include in the Work access roads and walks required by construction. Remove when no longer required, or at completion of project, making good disturbed surfaces. Maintain roads and remove snow during use.
 - .2 Temporary roads may be provided by the base of permanent roads. Make good the bases so used, to meet requirements of the Specifications, before applying finish surfaces.
 - .3 Install protective bridges at access roads and walks where they cross temporary excavations, and water mains, sewers, heating lines, gas lines, telephone and electrical conduits, or any other buried services.
 - .4 Install culverts and ditches at temporary roads to provide adequate drainage courses without the site.
 - .5 Provide for access of emergency vehicles at all times.
- 12.02 The exact location of the access shall be coordinated with and agreed to by the owner and the consultant.

13.00 CLEANING

13.01 Project Cleanliness

- .1 Maintain the Work in tidy condition, free from the accumulation of waste products and debris, other than that caused by the Owner.
- .2 Remove waste material and debris from the site and deposit in waste container at the end of each working day. Broom and mop clean all public areas affected by construction.
- .3 Clean interior area prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.
- .4 Provide all required cleaning and waste handling equipment and materials. Use of Owner's equipment is prohibited.

14.00 SHUT-DOWN OF EQUIPMENT/SYSTEMS & INTERRUPTION OF PUBLIC ACCESS

- 14.01 All shut-downs of building systems and equipment shall be coordinated with the Owner. A minimum of seven (7) days advance notice is required.
- 14.02 Closure of public access ways such as stairwells, corridors, sidewalks, and roads must be planned to include proper means of access and egress is maintained through alternate routes. A minimum of seven (7) days notice is required.

----END OF TEMPORARY FACILITIES---

01 54 03

SAFETY REQUIREMENTS

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Construction Safety Measures
2.00	Fire Protection
3.00	Overloading
4.00	Falsework
5.00	Scaffolding
6.00	Environmental Protection
7.00	Confined Space Entry Procedures
8.00	Owner Policies and Procedures

1.00 CONSTRUCTION SAFETY MEASURES

- 1.01 The Contractor will comply with all regulatory and statutory Occupational Health and Safety Acts and Regulations including the Owner Policies and will be responsible to take all necessary steps to protect personnel (workers, visitors, general public, etc.) and property, from any harm during the course of the contract.
- 1.02 All work procedures and equipment will be in accordance with Owner and legislated standards.
- 1.03 Only competent personnel will be permitted on site. The Owner will determine during the "site introduction" who is competent and will cause to remove from the site any persons not observing or complying with safety requirements.
- 1.04 The contractor shall supply competent personnel to implement their safety program and ensure that the Owner's standards, and those of the OHSA, are being complied with.
- 1.05 The Owner will monitor to ensure that safety requirements are met, and that safety records are properly kept and maintained. Initial disregard for safety standards will cause the contract to be reviewed and a written record of the review will become part of the contract documents. A second infraction can lead to loss of contract.
- 1.06 The contractor will report to the Owner, and jurisdictional authorities, any accident or incident involving contractor, university or public; personnel and/or property, arising from the contractor's execution of the work.
- 1.07 The contractor will include all provisions of this contract in any agreement with subcontractors, and hold all subcontractors equally responsible for safe work performance.
- 1.08 If the contractor is responsible for a delay in the progress of the work due to an infraction of legislated or Owner health and safety requirements, the contractor will, without additional cost to the Owner, work such overtime, acquire and use for the execution as to be necessary, in the opinion of the Owner's representative to avoid delay in the final completion of the work or any operations thereof.
- 1.09 Provide flag persons as required under the OH&S Act.
- 1.10 **Occupational Health and Safety Policy**
 - .1 The Owner has a Health and Safety Policy. Contractors are to ensure that employees and those of Subcontractors are advised of this Policy. Details of the Policy are included in the Owner's Policies and Procedures, number 3.1.
 - .2 The General Contractor shall carry out this project in strict accordance with Occupational Health and Safety Acts; the regulation for construction projects, Ontario Regulation 213/91 as amended by Ontario Regulation 631/94, and other prescribed regulations as they may pertain to the work.
 - .3 This Contractor shall also provide full time supervision of on-site activities by all workers to ensure applicable regulations and specification requirements are followed at all times.
 - .4 This Contractor shall take all necessary precautions to ensure the continuous safety of the contract workers, the Owner, and general public at large on the Owner's property.
 - .5 To allow the Owner to properly participate in site safety the following information will be requested from the General Contractor:
 - Assurance that all employed on this project are complying with the requirements of the Occupational Health and Safety Act, and prescribed regulations.
 - A copy of letters of confirmation or register of requisite worker training.
 - Copies of all rules posted.

- A list of all manuals, certificates, etc. in place in the site office on site as required under the Act.
- Copies of all regular safety meetings minutes.
- The number of people employed at the site.
- Composition of Health and Safety and Trade Committees in place as appropriate.
- A description of a discipline program.
- A copy of all Ministry of Labour and Construction Safety Inspectors Reports to be forwarded to the Owner.
- A copy of scheduled regular safety meetings from now until the end of this project.

1.11 Internal Combustion Engines and Toxic Fumes

Include the following in Contract Documents:

Before use of internal combustion engines on site or where any toxic vapours may be produced the precautions required by law are to be in place for review and the Owner must be advised.

The Owner will then arrange to visit the site for the Contractor to demonstrate that the proper procedures and requirements are in place before work commences.

The Owner will request that continuous or intermittent air sample monitoring be provided by either or both the Owner and the Contractor. The need for either or both to provide continuous or intermittent air monitoring will be mutually determined dependent on the complexity of the work and site conditions.

The duration of the work will be predetermined by the Contractor for everyone's information.

The above procedure and policy shall be adopted each and every time a new operation is to be undertaken.

It is the Contractor's responsibility to ensure that his own forces, subtrades, and their subtrades and all other appropriate personnel are advised of this policy.

- 1.12** All Contractors working in or in proximity to high voltage electrical rooms will be required to have had Electrical Awareness Training in accordance with Owner's requirements.

- 1.13** No powder activated tools allowed on Campus.

2.00 FIRE PROTECTION

- 2.01** Provide and maintain temporary fire protection equipment during performance of Work required by insurance companies having jurisdiction and governing codes, regulations and bylaws of the City of London.

- 2.02** The following equipment shall be considered as a minimum. Provide additional equipment as required.

- .1 One (1) fire extinguisher at each tool house, temporary works office, storage room and workshop on site.
- .2 Provide and maintain temporary fire protection during construction as required by Fire Insurance Company regulations and municipal fire prevention authorities.
- .3 Maintain fire hydrants in operating order in existing building areas. (if applicable).
- .4 Extinguishers, generally, shall be 22 gallon capacity of soda acid type. Where subject to lower temperatures, they shall be antifreeze type.
- .5 In proximity to gas, oil, grease, or paint storage locations extinguishers shall be 10# CO-2.
- .6 Keep extinguishers fully charged.

- 2.03 Provide continuous fire watch when torching roofing, 24 hours per day, every day. Provide 24 hour continuous fire watch once work is complete. No exception to this requirement will be considered.

3.00 OVERLOADING

- 3.01 Ensure no part of Work is subjected to a load which will endanger its safety or will cause permanent deformation.

4.00 FALSEWORK

- 4.01 Design and construction falsework in accordance with CSA S269.1-1975.

5.00 SCAFFOLDING

- 5.01 Design and construct scaffolding in accordance with CSA S269.2-M1980.

6.00 ENVIRONMENTAL PROTECTION

- 6.01 Comply with Municipal and Provincial regulations governing handling and disposal of demolished material.

7.00 CONFINED SPACE ENTRY PROCEDURES

- 7.01 Refer to Western Safety Procedures S-8.
- 7.02 Be aware of other policies such as (but not limited to) high voltage vault training, and asbestos policies.

8.00 OWNER POLICIES AND PROCEDURES

- 8.01 The Owner strongly supports safety practices for personnel working on campus.
- 8.02 In addition to Occupational Health and Safety Act requirements, the Owner has work procedures which must be fully complied with by all Contractors and their personnel.
- 8.03 The Contractor is responsible for training, etc., for their employees to ensure the requirements of the Occupational Health and Safety Act and the Owner's work procedures are followed.
- 8.04 Any person who violates the requirements of the Occupational Health and Safety Act and the Owner's work procedures is subject to dismissal from the site.
- 8.05 Be aware of the Owner's Policies and Procedures. Copies of these are available from the Owner.
- 8.06 The following list is of particular reference, some of which may have been already referred to in other clauses:
- S-1 Safety Footwear
 - S-3 First Aid Qualification
 - S-4 Roof Maintenance Procedure
 - S-6 Reporting and Following-up of Health and Safety Concerns
 - S-7 Safety Tag
 - S-8 Confined Space
 - S-9 Rabies Immunization Policy
 - S-10 Mercury Control Program
 - S-11 Accident Investigation Reports
 - S-12 Guideline for Handling Fluorescent Light Ballasts with Tar or Oil Dripping Out

S-15	Receiving WHMIS Controlled Products
S-20	Clean up of spills of Human Blood or Bodily Fluids
S-21	Vehicle Accident Reporting Procedures
S-24	Pesticide Use
S-25	Emergency Showers and Eye Wash Installations
S-26	Roof Access Policy
S-27	Sharps Disposal
S-29	Safety Advisory / Safety Alert
S-30	Restricted Space Access Policy
WP-18	Lock-out and Tag-out
WP-21	Notice of Service Interruption
WP-23	Fire Alarm System Maintenance & Shutdown Communications
WP-23.1	Response to Fire Alarm
WP-37	Handling and Disposal of Filters Contained in the Fume Hood Cabinet Collector Exhaust System in the Siebens-Drake Institute Building
WP-41	Work Area Protection
WP-42	Elevating Work Platforms
WP-43	Hot or Open Flame Work
WP-44	Fall Protection
WP-45	Mould Remediation Procedure
WP-46	Handling of Drops and Sink Traps in Labs
WP-47	Lead Based Abatement and Work Procedures
WP-49	Breaches in Fire Separations
WP-51	Handling of Fumehoods and Duct Work in Research Laboratories
WP-53	Man Made Mineral Fibre
WP-55	Incinerator Cleaning
WP-58	Asbestos - Type 1 Operations
WP-59	Asbestos - Type 2 Operations
WP-61	Visitor Policy for Services Building & Power Plant
WP-62	Procedure for Removal of Asbestos Flex Connection
WP-63	Driver Policy
WP-64	Procedure for Minor Alterations to HVAC Ducts and Associated Fittings in Buildings Containing Asbestos Fireproofing
WP-65	Procedure and Guidelines for Working Over and Near Water
----	Ceiling Space Access Policy (Jan 21/97)
----	Asbestos Control Policy (Jan 21/97)
----	Safety Procedure Guide Lines 96-01 (Jan 21/97)
----	Safety Procedure Guide Lines 96-02 (Jan 21/97)

- 8.07 No high velocity (i.e.>90 m/s) powder actuated tools are allowed on Campus. Refer to Reg. 213/91.

----END OF SAFETY REQUIREMENTS----

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DUST AND WATER CONTROLS

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Related Requirements
2.00	General
3.00	Dustproof Partitions

1.00 RELATED REQUIREMENTS

- 1.01 Section 01 50 00: Temporary Facilities

2.00 GENERAL

- 2.01 Include in contract price for protective measures necessary to ensure that the existing building will remain free from the entry of dust or water at all times.
- 2.02 Provide temporary dustproofing to underside of concrete slabs, metal deck, including all shoring, where new construction will take place in the existing building.
- 2.03 Provide temporary dustproofing for equipment not protected by dustproofing partitions and where new openings are made in existing walls, floors or ceilings.
- 2.04 Provide temporary dustproofing partitions as indicated on drawings prior to demolition. Treat openings, joints and cracks in enclosures to prevent any dust and moisture, from entering existing areas.
- 2.05 Remove existing walls with care, avoid damage to Owner's equipment. Obtain Consultant's approval before commencing with partition or wall removal. Minimize dust.
- 2.06 Where dustproof partitions are relocated for tying in of materials, install partition from floor to ceiling and from ceiling to underside of slab without damaging finishes.
- 2.07 Render doors leading into construction areas dust tight.
- 2.08 Damp mop all surfaces in construction areas continually during demolition and daily during normal construction.

3.00 DUSTPROOF PARTITIONS

- 3.01 Type 'A'
- .1 Framing minimum 38mm x 38mm wood studs or steel studs at 600mm o.c. with top and bottom runners and intermediate horizontal supports at 1/3 points.
 - .2 Fasten 0.1 mm polyethylene film to studs on side away from the work. Lap joints minimum 100mm and seal with double sided adhesive tape.
 - .3 Provide felt gaskets and caulk around perimeter of partition.
 - .4 Fasten 12.5 mm square edge gypsum board over polyethylene film on same side. Fasten to vertical framing at minimum of 10mm from edges of each sheet and space at 300mm o.c. Seal joints of board with plastic film tape.
- 3.02 Type 'B'
- .1 As per Type 'A'.
 - .2 Install sound attenuation batts between studs after erection of polyethylene.
- 3.03 New Temporary Doors and Frames for Dustproof Partitions
- .1 New temporary doors and frames in locations shown.
 - .2 Equip doors with lockset, closer, weather stripping and automatic door bottom.

----END OF DUST AND WATER CONTROLS----

01 60 00

MATERIAL AND EQUIPMENT

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Requirements Included
2.00	Related Requirements
3.00	Reference Standards
4.00	Products and Materials
5.00	Manufacturer's Instructions
6.00	Workmanship

1.00 REQUIREMENTS INCLUDED

- 1.01 Reference standards.
- 1.02 Products and materials.
- 1.03 Manufacturer's instructions.
- 1.04 Workmanship.

2.00 RELATED REQUIREMENTS

- 2.01 Section 01 45 00: Quality control.

3.00 REFERENCE STANDARDS

- 3.01 Conform to the standards, in whole or in part, as specifically requested in the Specification.
- 3.02 If there is question as to whether any product or system is in conformance with applicable standards, the Consultant reserves the right to have such products or systems tested to prove or disprove conformance.
- 3.03 The cost for such testing will be borne by the Owner in the event of conformance with Contract Documents or by the Contractor in the event of non-conformance.

4.00 PRODUCTS AND MATERIALS

- 4.01 Quality
 - .1 Refer to GC 3.9
 - .2 Unless otherwise indicated in the Specification, maintain uniformity of manufacture for any particular or like item throughout the work.
- 4.02 Availability
 - .1 Immediately upon receipt of letter of intent, review Product delivery requirements and anticipate foreseeable supply delays for any items. If delays in supply of Products are foreseeable, notify the Consultant of such, in order that substitution or other remedial action may be authorized in ample time to prevent delay in performance of Work.
 - .2 In the event of failure to notify the Consultant at commencement of Work and should it subsequently appear that Work may be delayed for such reason, the Owner reserves the right to substitute more readily available products of similar character, at no increase in Contract Price.
- 4.03 Storage, Handling and Protection
 - .1 Handle and store Products in a manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
 - .2 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 the Work.
 - .3 Store products subject to damage from weather in weatherproof enclosures.
 - .4 Store cementitious products clear of earth or concrete floors and away from walls.
 - .5 Keep sand, when used for grout or mortar materials, clean and dry. Store sand on wooden platforms and cover with waterproof tarpaulins during inclement weather.

- .6 Store sheet materials and lumber on flat, solid supports and keep clear of ground. Slope to shed moisture.
- .7 Store and prepare paints in a heated and ventilated room. Provide metal pans or adequate tarpaulins to protect floors in these areas.
- .8 Remove oily rags and other combustible debris from site daily. Take every precaution necessary to prevent spontaneous combustion.

5.00 MANUFACTURER'S INSTRUCTIONS

5.01 Compliance

- .1 Unless otherwise indicated in the Specification, install or erect Products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with Products. Obtain written instructions directly from manufacturers.
- .2 Notify the Consultant in writing, of conflicts between the Specification and manufacturer's instructions, so that the Consultant may establish the course of action.
- .3 Improper installation or erection of Products, due to failure in complying with these requirements, authorizes the Consultant to request removal and re-installation at no increase in Contract Price.

6.00 WORKMANSHIP

6.01 Concealment

6.02 Fastenings

- .1 Provide fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in the affected Specification Section.
- .4 Space anchors within their load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.
- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.
- .7 The use of explosive actuated tools is not permitted.

6.03 Structural Integrity

- .1 Prevent overloading of any part of the building. Do not cut, drill or sleeve any load bearing structural member, unless specifically indicated, without written approval of Consultant.

6.04 Existing Utilities

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with a minimum of disturbance to Work and/or building occupants and pedestrian and vehicular traffic.
- .2 Protect, relocate and maintain existing active services. When inactive services are encountered, cap off in a manner approved by authority having jurisdiction and stake or otherwise record location of capped service.

6.05 Cutting and Remedial Work

- .1 Perform cutting and remedial work required to make the parts of the Work come together. Co-ordinate the Work to ensure this requirement is maintained.
- .2 Should work performed outside this contract necessitate cutting and/or remedial work to be performed, the cost of such work will be valued by the Consultant as provided in GC 6, Valuation and Certification of Changes in the Work.
- .3 Perform cutting and remedial work by specialists familiar with the materials affected. Perform in a manner to neither damage nor endanger any portion of Work.
- .4 Obtain Consultant's approval before cutting, boring or sleeving load-bearing members.
- .5 Make cuts with clean, true, smooth edges. Make patches inconspicuous in final assembly.
- .6 Fit work airtight to pipes, sleeves, ducts and conduits.

NOTE: Prior to cutting any structural concrete structure, coordinate and layout for hole location and have the concrete scanned to locate concealed services locations and report the findings to the Consultant.

6.06 Location of Fixtures

- .1 Consider the location of fixtures, outlets, and mechanical and electrical items indicated as approximate.
- .2 Inform the Consultant of a conflicting installation. Install as directed.
- .3 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with manufacturer's recommendations for safety, access and maintenance.

----END OF MATERIAL AND EQUIPMENT----

01 71 23
FIELD ENGINEERING
INDEX

<u>Clause</u>	<u>Title</u>
1.00	Layout and Survey Information
2.00	Work Adjacent to Public Property
3.00	Drainage

1.00 LAYOUT AND SURVEY INFORMATION

- 1.01 Line, levels and locations for building:
- .1 Existing grades, lines and site conditions shown on Drawings were taken from survey information established by persons engaged directly by the Owner. The accuracy of survey information is not the Consultant's responsibility.
 - .2 The Contractor shall establish necessary lines and levels, and provide batter boards and other means to control the accurate positioning of all building elements.
 - .3 Employ an Ontario Land Surveyor to perform the following:
 - .1 lay out building on site,
 - .2 verify elevations of floor levels as construction proceeds, and relate to bench mark datum,
 - .3 verify that present, or known future restrictions, are not violated by construction on the site or lines of transverse to all public utilities,
 - .4 correlate geodetic elevation of bench mark datum with elevations in use by public utilities adjacent to Project,
 - .5 provide a Survey "Building Location" to verify location of building on site,
 - .6 establish a permanent bench mark, or markers, as widely separated as possible,
 - .7 verify the accuracy of site dimensions shown on Drawings, and
 - .8 provide a Survey "Building Location" to verify the location of building related to property lines when foundation walls are completed to grade level.
 - .9 Lay out and confirm the location of underground site services and infrastructure including storm, sanitary, water, gas, electrical, and telecommunications, in coordination with civil and utility drawings.
 - .10 Identify and document all utility connection points and coordinate with the appropriate authorities to ensure alignment with as-constructed records.

2.00 WORK ADJACENT TO PUBLIC PROPERTY

- 2.01 Verify that no plans for altering clearances, set-backs, easements, grade or other have been made by local authorities, subsequent to their approval of the Contract Documents and which would affect the original intent of this work.
- 2.02 Pay all charges made by local authorities for the rental of street and sidewalk space and for any work required on public property.

3.00 DRAINAGE

- 3.01 Ensure that positive drainage is provided to roof, floor, and site drains and catch basins, as set in their final positions. Provide constant slopes for drained surfaces to drains and drainage courses.
- 3.02 Ensure that allowable construction tolerances and structural tolerances do not permit ponding of water.
- 3.03 Verify the extent of each area served by a drain, or drainage course, to eliminate possible undrained surfaces. Coordinate the work of involved Sections before each proceeds.

----END OF FIELD ENGINEERING----

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CONTRACT CLOSEOUT

INDEX

<u>Clause</u>	<u>Title</u>
1.00	Requirements Included
2.00	Related Requirements
3.00	Systems Demonstration
4.00	Documents
5.00	Project Commissioning
6.00	Inspection/Takeover Procedures
7.00	Final Cleaning

1.00 REQUIREMENTS INCLUDED

- 1.01 Systems Demonstration.
- 1.02 Documents.
- 1.03 Project Commission.
- 1.04 Inspection and Takeover Procedures.

2.00 RELATED REQUIREMENTS

- 2.01 Section 01 33 00: Submittals.
- 2.02 General Conditions of Contract and Document 00800 Amendments and Supplementary Conditions.

3.00 SYSTEMS DEMONSTRATION

- 3.01 Prior to final inspection, demonstrate operation of each system to Owner and Consultant.

4.00 DOCUMENTS

- 4.01 Collect reviewed submittals, as per (Section 01 33 00) submittals, and assemble documents executed by Subcontractors, suppliers and manufacturers.
- 4.02 Submit material prior to Final Application for Payment. For equipment put into use with Owner's permission during construction, submit within ten days after start-up. For items of Work delayed materially beyond date of Substantial Performance, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.
- 4.03 Provide warranties fully executed.
- 4.04 Submit a final statement of accounting giving total adjusted Contract Sum, previous payments and monies remaining due.
- 4.05 Consultant will issue a final change order reflecting approved adjustments to Contract Sum not previously made.

5.00 PROJECT COMMISSIONING

- 5.01 Expedite and complete deficiencies and defects identified by the Consultant.
- 5.02 Review maintenance manual contents (operating, maintenance instructions, record 'as-built' drawings, spare parts, materials) for completeness.
- 5.03 Review cash allowances in relation to Contract Price, change orders, holdbacks and other Contract price adjustments.
- 5.04 Submit required documentation such as statutory declarations, Indemnification Form, Workplace Safety & Insurance Board Clearance Certificates, warranties, certificates of approval or acceptance from regulating authorities.
- 5.05 Attend 'end-of-work' testing and break-in or start-up demonstrations.

- 5.06 Review inspection and testing reports to verify conformance to the intent of the documents and that changes, repairs or replacements have been completed.
- 5.07 Review condition of equipment which have been used in the course of the work to ensure turning over at completion in 'as new' condition with warranties, dated and certified from time of Substantial Performance of the Work.
- 5.08 Arrange and co-ordinate instruction of Owner's staff in care, maintenance and operation of building systems and finishes by suppliers or Subcontractors.
- 5.09 When partial occupancy of uncompleted project is required by the Owner, co-ordinate Owner's uses, requirements, access with Contractor's requirements to complete project.
- 5.10 Co-ordinate building accessibility, traffic, and Contractor's and Subcontractor's cleaning -up and completion activities with the Owner's moving-in of staff, furnishings, and equipment, all to suit Owner's work schedule and not disrupt Owner's productivity.
- 5.11 Provide on-going review, inspection and attendance to building call back, maintenance and repair problems during the Warranty periods.

6.00 INSPECTION/TAKEOVER PROCEDURES

- 6.01 Prior to application for certificate of Substantial Performance, carefully inspect the Work and ensure it is complete, that major and minor construction deficiencies are complete and/or corrected and the building is clean and in condition for occupancy. Notify the Consultant in writing, of satisfactory completion of the Work and request an inspection.
- 6.02 During inspection, a list of deficiencies and defects will be tabulated by the Consultant. Correct same.
- 6.03 When the Consultant considers deficiencies and defects have been corrected and it appears requirements of the Contract have been performed, make application for certificate of Substantial Performance. Refer to General Conditions, Article GC 5 for specifics to application.
- 6.04 At completion of work, remove waste materials, rubbish, tools, equipment, machinery, and surplus materials, and clean all surfaces exposed to view; leave project clean and ready for occupancy.

7.00 FINAL CLEANING

- 7.01 Be responsible for final cleaning of both new work areas and existing areas affected by new work; including but not limited to the following:
- 7.02 Employ experienced workers, or professional cleaners, for final cleaning.
- 7.03 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from all sight-exposed interior and exterior finished surfaces; polish resilient and ceramic surfaces so designated to shine finish. Vacuum carpet.
- 7.04 Clean and polish new and existing glass and mirrors.
- 7.05 Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.
- 7.06 Broom-clean paved surfaces; rake clean other surfaces of grounds.
- 7.07 Clean filters, exposed ductwork and structure.

- 7.08 Clean bulbs, lamps and lenses and replace those burned out or damaged.
- 7.09 Clean new doors and existing doors to remain. Refinish existing wood doors with an oil stain to match existing.
- 7.10 Clean inside and out of new and existing millwork.
- 7.11 Cleaning and Final Treatment of Floors
 - .1 Clean all floor surfaces in accordance with manufacturer recommendations for the specific floor type, including but not limited to:
 - Luxury Vinyl Tile (LVT)
 - Sheet Vinyl
 - Rubber flooring
 - Ceramic or porcelain tile
 - Polished concrete
 - Engineered wood or laminate
 - Epoxy
 - Terrazzo
 - Carpet tiles (vacuum and spot clean only)
 - .2 Remove construction residue, dust, adhesive, and surface film using appropriate non-abrasive, non-corrosive cleaners approved by the flooring manufacturer.
 - .3 Where specified, apply protective sealers (e.g., for porous surfaces like concrete or stone) in accordance with the flooring product data. Do not apply wax unless explicitly required in the specifications.
 - .4 Use clean, dedicated equipment appropriate to each flooring type.
 - i. Use microfiber mops or auto-scrubbers for hard flooring.
 - ii. Avoid paint rollers or fiber heads that may shed.
 - iii. For small or detailed areas, use soft-bristle brushes or manufacturer-approved hand tools.
 - .5 Ensure no residue, streaking, or damage is left on flooring. Final cleaning must meet the acceptance of the Consultant and flooring manufacturer's warranty requirements.
- 7.12 Cleaning of Resilient Base (e.g., Vinyl or Rubber Baseboards)
 - .1 Wash and rinse with a neutral pH cleaner to leave a clean, streak-free surface.
 - .2 Remove any adhesive residue or scuff marks.
 - .3 Avoid excessive moisture at floor-to-wall transitions.
- 7.13 Final cleaning will be done to the Owner's satisfaction before substantial performance can be claimed.

----END OF CONTRACT CLOSEOUT----

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GENERAL REQUIREMENTS FOR BUILDING ENVELOPE

INDEX

<u>Clause</u>	<u>Title</u>
1.00	General
2.00	Design and Performance

1.00 GENERAL

- 1.01 The contractor is fully responsible for continuous examination and inspection of the work related to the exterior assemblies to ensure compliance with the contract documents.
- 1.02 Materials and workmanship shall be subject to inspection and testing at any time. Cooperate in permitting access for inspection and testing to places where work is being done or stock is being stored.
- 1.03 In addition to consultant site review, the owner is providing quality control inspection and testing as specified in Section 01 45 00.
- 1.04 Allow sufficient time for testing, evaluation, alterations and retesting so as not to affect the progress schedule for the work.
- 1.05 The consultant or owner's inspection and testing agency may require testing of connections and special prefabricated inserts, as part of the work of this Section.

2.00 DESIGN AND PERFORMANCE

- 2.01 Building envelope includes, but is not limited to, slabs-on-grade, foundation walls, cladding systems, glazing systems, louvres, doors, frames, mechanical and electrical penetrations of assemblies, sealants, air and vapour barrier materials, roofing and waterproofing.
- 2.02 Design and engineer as required by applicable Section of the Specifications, fabricate, erect or install building envelope in compliance with the Ontario Building Code, other regulations and requirements of authorities having jurisdiction, with the most stringent requirements to govern.
- 2.03 Take into account tolerance limitations of the structure, creep, deflection and other movements of the structure, both during the work and in service.
- 2.04 Allow for expansion and contraction of components caused by ambient, temperature range and surface temperature variation of components, and structural movements, without causing distortion, failure of fastening, joints and/or air/vapour barrier seals, undue stress or other defects detrimental to appearance and/or performance.
- 2.05 Accommodate, by means of expansion and contraction provisions, any movements in the building assemblies themselves and between the assemblies and the building structure, caused by structural movements, both deflection and racking; and/or thermal expansion and contraction, without distortion, damage, misalignment of joints, breakage of air/vapour barriers, water and air penetration through the assembly, or glass breakage.
- 2.06 Method of attachment to the structure shall take into account site peculiarities such that there shall be no possibility of site and air vibrations or normal temperature movements of the building to loosen, weaken and/or fracture the connection between building envelope assembly components and the structure or between the components themselves.
- 2.07 Reinforce building envelope assembly components, as required, so that the members can safely sustain design loads.
- 2.08 Assemble and secure assemblies in manner which will keep stresses on sealants within the sealant manufacturers' recommended maximum.
- 2.09 Construct building envelope wall and window assemblies based on A Rain Screen® principle as advocated by the National Research Council of Canada. All voids between the assembly components as well as those between components and the structure shall have:

- .1 Gaskets, baffles, overlaps, seals and compartmentalization as required to provide a barrier ~~A~~Rain Screen~~@~~ to effectively prevent excessive rain water entry into any of the building envelope cavities but allow pressure equalization of cavity air spaces.
 - .2 Air barriers and seals as required to prevent entry of interior building air into building envelope cavities, and exterior air into the building. Air barriers and seals shall be able to withstand design pressures.
 - .3 Such provisions in the form of openings between cavities and the building exterior of sufficient cross sections to provide adequate pressure equalization. Openings shall be effectively baffled against direct rain water entry.
 - .4 Thermal separators, isolators and seals placed to eliminate contact between interior humid air and a cold surface or structural component to prevent condensation and ice build-up on such surfaces during cold weather.
- 2.10 Comply with the design and performance requirements specified in the Ontario Building Code, with the most stringent requirements to govern, and as specified herein, including the following principles:
- .1 Drain to exterior face of the wall or window assembly, any water entering at joints and any condensation occurring within the building envelope assembly.
 - .2 Design, fabricate and install the assembly to minimize specified materials' ability to transmit moisture through capillary action.
 - .3 Design, fabricate and install the assembly to be watertight to the interior under the interior and exterior design conditions in combination with the movements occurring due to loads imposed.
- 2.11 The requirements for an air barrier and a vapour barrier are intended to be provided at same plane in the building envelope design unless otherwise indicated or specified. In such cases, the drawings and specifications refer to air/vapour barrier. The definition of the air/vapour barrier for the purpose of these specifications is a continuous membrane including joints of membrane between components and to adjacent construction which prevents or retards passage of moisture laden air and the diffusion of water vapour through it~~@~~.
- 2.12 Design sealant joints with strict regard for sizing of joint and parallel orientation of contact surfaces. Ensure support for both sealant and backer rod.
- 2.13 This project incorporates the design principles of positive air and vapour leakage control at the building enclosure line. Drawing details illustrate continuity of air/vapour barrier at penetrating elements such as door, window and louver frames.
- 2.14 The barrier extends nominally from foundation line, vertically along exterior walls and to positive contact with roof air/vapour barrier.
- 2.15 In order to maintain the continuity of the envelope, the interfacing of various building elements requires close coordination by all trades involved with the exterior building elements. The positive mechanical connections and seal of transition medium extending from the primary wall air/vapour barrier to the insulation line of window or door frame, shall be made with proper construction sequencing established by contractor to ensure such interfacing. All such transition installation shall be inspected by consultant prior to concealing with subsequent construction.
- 2.16 Manufacturers of such window or door frames shall ensure that correctly design and positioned metallic legs, extensions or recesses are provided at the thermal break line to facilitate connections of rigid or flexible transition medium as indicated prior to setting such elements in their allotted openings.

- 2.17 Provide completed installations free from vibrations, wind whistles, and noise due to thermal and structural movement and wind pressure.
- 2.18 Design building envelope assemblies to prevent damage due to earthquake forces as required by the Ontario Building Code.

----END OF GENERAL REQUIREMENTS FOR BUILDING ENVELOPE---

PROJECT NO. 9E7401
LHSB 1st and 3rd Floor Renovations
Labatt Health Sciences Building

APPENDIX A

Prequalified General Contractors

Allied Construction Corporation
Allyant Design and Construction
Aveiro Constructors Ltd.
Baribeau Construction Ltd
Bronnenco Construction Ltd.
D. Grant Construction Limited
Dewar Industrial Services
Elgin Contracting and Restoration Ltd.
EllisDon Corporation
Graceview Enterprises Inc.
K&L Construction
MARANT Construction
Magil Construction
Mavcor Inc
Michael & Clark Construction
MJ Dixon Construction Limited
Norlon Builders
PK Construction Inc.
S.E.M. Construction
Tonda Construction
Zehr Construction

Prequalified General Subtrades & Suppliers

Doors and Frames

JPW Systems Inc.
Pro-Able Doors
Siroski Door & Hardware
Southwest Doors & Hardware Ltd.

Drywall, Plastering, Acoustic

Ataide's Painting & Drywall
Hi-Tek Drywall & Acoustics
HSH Contracting Services
Venco Construction (London) Limited
Westac Drywall & Acoustics

Electrical

General Commercial Electrical

3E Power Services
ABC Electric Inc.
AIM Industrial
Angton Electric
Arcon Electric Ltd.
Capson Electrical
Culliton Inc
Dielco Electric Ltd
G&S Electric Ltd.
Gordon Electric
J.M.R. Electric Ltd.
KWS Electric Services Inc
Modern Niagara
Sutherland Schultz Ltd.
Trade-Mark Industrial
Wilson & Associates

Flooring

Andrigo Tile
Flatout Flooring
FloorSource
Great Floors
Tradeworks Interiors

Glass and Glazing

Eco Architectural Glass
Glass Canada Limited
Southwest Windows & Glass Ltd.
Thames Glass Limited

HVAC-R

Ainsworth Inc.
Art Blake Refrigeration Ltd.
Besterd Mechanical

Carmichael Engineering
CIMCO Refrigeration
Culliton Inc
Dean-Lane Contractors
Dielco Industrial Contractors Ltd
Jayden's Mechanical Ltd
JMR Electrical
Kelson Mechanical Inc.
Linde Mechanical Inc
Mattina Mechanical Limited
Modern Niagara
SCT Mechanical
Superior Boil Work and Welding Limited
Sutherland Schultz Ltd
Trade Mark Industrial

Mechanical

Ainsworth Inc.
Besterd Mechanical
Culliton Inc
Curney Mechanical
Dean-Lane Contractors
Dielco Industrial Contractors Ltd
Jayden's Mechanical Ltd
JMR Electrical
Kelson Mechanical Inc
Linde Mechanical Inc
LJ Barton Mechanical
Mattina Mechanical Limited
Modern Niagara
SCT Mechanical
Sutherland Schultz Ltd
Trade Mark Industrial

Fire Sprinklers

Classic Fire and Life Safety Inc.
Western Fire Protection
Troy Life and Fire Safety Ltd.

Millwork (Architectural)

Alliance Millwork
G&S Electric Ltd. (O/A G&S Woodworking/NG)
Gregus Millwork Ltd.

Painting

Ataide's Painting & Drywall
CertaPro Painters London
Four Star Painting
H.D. Painting Contractor
J&A Master Painters
M&M Painting & Decorating (London) Inc.
Paul Hales Painting & Decorating Ltd.
Platinum Paints & Design Inc.

Plumbing

Ainsworth Inc.
Besterd Mechanical
CIMCO Refrigeration
ComTrade
Culliton Inc
Curney Mechanical
Dean-Lane Contractors
Dielco Industrial Contractors Ltd
Jayden's Mechanical Ltd
JMR Electrical
Kelson Mechanical Inc
Linde Mechanical Inc
LJ Barton Mechanical
Mattina Mechanical Limited
Modern Niagara
SCT Mechanical
Soan Mechanical
Sutherland Schultz Ltd
Trade Mark Industrial

Sheet Metal

Ainsworth Inc.
Besterd Mechanical
CIMCO Refrigeration
Culliton Inc
Dean-Lane Contractors
Dielco Industrial Contractors Ltd
JMR Electrical
Kelson Mechanical Inc
Linde Mechanical Inc
LJ Barton Mechanical

Mattina Mechanical Limited

Modern Niagara

Roberts Bros. Sheet Metal Contractors

SCT Mechanical

Soan Mechanical

Sutherland Schultz Ltd

Trade Mark Industrial

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 - General Requirements.

1.2 Related Sections

- .1 Not Applicable

1.3 References

- .1 CSA S350-M1980(R2003), Code of Practice for Safety in Demolition of Structures.
- .2 Occupational Health and Safety Act and Regulations for Construction Projects; Ontario Reg. 213/91, as amended by Reg. 145/00.

1.4 Existing Conditions

- .1 Assume responsibility for demolition of structures in the condition they are at time notified of award of contract.
- .2 Inspect adjacent existing rooms and buildings to extent possible to ensure that its condition and stability is recorded in a manner suitable for evaluation of possible damage caused by work of this Section.

1.5 Designated Substances

- .1 No designated substances anticipated in the existing building. Advise consultant of any suspicious materials.

1.6 Work Included

- .1 Refer to Demolition Drawings; Architectural, Mechanical and Electrical for extent and scope of demolition work.

1.7 Protection

- .1 Demolition work shall be performed with adequate care being taken to prevent damage to surrounding work or material which is to remain the property of the Owner.
- .2 Prevent movement, settlement or damage of adjacent structures, services, existing elements to remain. Provide bracing, shoring, underpinning, as required. Make good all damage caused by demolition.
- .3 Take precautions to support affected structures, and if safety of building being demolished or adjacent structures or services appears to be endangered, cease operations and notify Consultant.
- .4 Prevent debris from blocking surface drainage system and mechanical and electrical systems which must remain in operation.
- .5 Provide protection from elements for all interior parts affected by demolition.
- .6 Fires and burning of waste or materials are not permitted.
- .7 **Do not bury waste or materials on site.**
- .8 Do not dispose of waste or volatile materials such as: mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.
- .9 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.

- .10 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.
- .11 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .12 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .13 Cover or wet down dry materials to prevent blowing dust and debris. Control dust on all temporary roads.

1.8 Scheduling of Work

- .1 Demolition of structure and appurtenances as indicated on the Drawings is to be undertaken at times and dates as directed by the Consultant or as otherwise listed in this Specification.
- .2 Cooperation with subcontractors is necessary to prevent delays.

1.9 Subcontractor Qualifications

- .1 Execute the work of this Section by a subcontractor who has adequate plant, equipment and skilled tradespeople to perform the work expeditiously and who is known to have been responsible for similar satisfactory work for a period of the last five (5) years.
- .2 Performance of all demolition work shall be in accordance with all regulations under the Ministry of Labour, including the Occupational Health and Safety Act, Ministry of the Environment and the Ontario Building Code.

PART 2 - PRODUCTS

2.1 Equipment

- .1 Equipment and heavy machinery to meet or exceed all applicable emission requirements.
- .2 Leave machinery running only while in use, except where extreme temperatures prohibit shutting machinery down.

PART 3 - EXECUTION

3.1 Examination

- .1 Before commencing any demolition, ensure thorough examination of the site and work to be demolished so that all possible factors concerning demolition are investigated and that the following are known:
 - .1 Methods and means available for materials handling, disposal, storage and transportation.
 - .2 Construction of structures to be demolished.

3.2 Preparation

- .1 Install protection consisting of barricades, signs and substantial constructions to provide physical protection.
- .2 Erect shoring and other structures to prevent collapse, settlement and movement.
- .3 Post danger signs. Barricade all access by unauthorized persons to areas in which demolition is in progress.
- .4 Re-route electrical and mechanical services entering/ leaving the building and which are to be reconnected to new building. Post warning signs and erect barricades on electrical

lines and equipment which may remain energized to serve parts of the buildings during period of demolition. Refer to Drawings.

- .5 Employ rodent and vermin control and comply with health regulations during any such control procedures.

3.3 General

- .1 Perform all demolition under the direction of a competent foreman at all times.
- .2 Water down debris frequently to prevent the spread of dust.
- .3 Provide for complete and safe access at all times to areas adjacent to demolition work.

3.4 Demolition

- .1 Demolish complete structures as indicated and remove existing equipment and services as indicated. Refer to Drawings. Contractors are required to view prior to Bidding.
- .2 Carefully remove materials and equipment, and store, protect, and reinstall in new building, using qualified tradesmen those items designated in the specifications or on Drawings to be reinstalled.
- .3 Carefully remove materials and equipment to be retained by the Owner as indicated on Drawings. Refer also to Mechanical and Electrical Sections of the Specifications and Drawings for equipment to be handed over to the Owner.
- .4 At the end of each day's work, leave work in a safe condition so that no part is in danger of collapse or falling.
- .5 Demolish masonry and concrete walls in small sections. Carefully remove and lower structural framing and other heavy or large objects.
- .6 Stockpile materials in a location within the Project Area which will not impede demolition activity. Eliminate double handling where possible.
- .7 Selling or burning of materials on site is not permitted.

3.5 Disposal

- .1 Unless otherwise specified in this Section, remove completely from the site, all debris resulting from demolition.
- .2 Designate an area on site for the separation and storage of waste materials. Allow enough space for multiple bins.
- .3 At a minimum, provide storage bins onsite for concrete, metal, wood, cardboard, plastic, gypsum board and mixed waste. Land clearing debris, asphalt and concrete can be stockpiled onsite, for further processing.
- .4 Remove debris daily, or as it accumulates. Do not overload trucks, take means to prevent spillage.
- .5 Remove contaminated or dangerous materials from site and dispose of in a safe manner to minimize danger on site or at any time during disposal.

3.6 Clean Up

- .1 Upon completion of work, remove debris, trim surfaces and leave work site clean.
- .2 Backfill open excavations as required by grading and surface materials.
- .3 Use only cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent watercourses or ground water.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 – General Requirements.

1.2 Related Sections

- .1 Miscellaneous wood blocking, furring – Divisions 06, 07, 08, 09.

1.3 References

- .1 Canadian Standards Association (CSA)
 - .1 CSA B111, Wire Nails, Spikes and Staples.
 - .2 CAN/CSA-G164-M, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA O121-M, Douglas Fir Plywood.
 - .4 CAN/CSA-O141, Softwood Lumber.
 - .5 CSA O151-M, Canadian Softwood Plywood.
 - .6 CAN/CSA-O325.0, Construction Sheathing.
- .2 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber.

1.4 Quality Assurance

- .1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.
- .2 Plywood identification: by grade mark in accordance with applicable CSA standards.
- .3 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

- .1 Lumber: unless specified otherwise, SPF species softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 S2S.
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.

2.2 Panel Materials

- .1 Panel standards: type, grade and thickness as indicated, in accordance with following standards:
 - .1 Douglas fir plywood (DFP): to CSA O121, standard construction, exterior grade.
 - .2 Canadian softwood plywood (CSP): to CSA O151, standard construction.
 - .3 Poplar plywood (PP): to CSA O153, standard construction.
 - .4 Waferboard and strandboard: to CAN3-O437.

2.3 Pressure Treated Lumber and Plywood

- .1 Pressure treated lumber: to CSA 080.1 - "Preservative Treatment of all Timber Products by Pressure Processes".

2.4 Fasteners

- .1 Nails, spikes and staples: to CSA B111.
- .2 Bolts: 12.7mm diameter unless indicated otherwise, complete with nuts and washers.
- .3 Proprietary fasteners: toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, explosive actuated fastening devices, recommended for purpose by manufacturer.
- .4 Galvanizing: to CSA G164, use galvanized fasteners for exterior work, interior highly humid areas, and pressure-preservative treated lumber.

2.5 Accessories

- .1 Polyethylene film: to CAN 2-51.33 Type 1, 0.15mm thickness.

2.6 Wood Preservative

- .1 Surface applied wood preservative: copper naphthenate or 5% pentachlorophenol solution, water repellant preservative.

PART 3 - EXECUTION

3.1 Preparation

- .1 Treat surfaces of material with wood preservative, before installation.
- .2 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.
- .3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.
- .4 Treat material as indicated as follows:
 - .1 Wood cants, fascia backing, curbs, nailers, sleepers on roof deck.
 - .2 Wood furring for on outside surface of exterior masonry and concrete walls.

3.2 Installation

- .1 Comply with requirements of NBC, supplemented by the following paragraphs.
- .2 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, facings, fascia, soffit, siding, washroom accessories and other work as required. Install required provisions for fastening located and secured to suit site conditions, and adequate for intended support.
- .3 Align and plumb faces of furring and blocking to tolerance of 1:600.
- .4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.
- .5 Except when indicated otherwise, use material at least 38mm thick and secured with 9mm bolts located within 300mm from ends of members and uniformly spaced at 1200mm between.
- .6 Install continuous air seal under wood blocking under wood cants and extend 75mm minimum beyond top of cant on to roof, and above top of cant. Lap joints 100mm minimum sealed with bituminous compound.

- .7 Install wood cants, fascia backing, nailers, curbs, sleepers, and other wood supports for roofing and sheet metal work, and roof mounted equipment, access hatches as indicated.
- .8 Secure with galvanized 9mm bolts where indicated, galvanized nails elsewhere. Locate fastenings within 300mm from ends and uniformly spaced between. Space bolts at 1200mm and nails at 600mm centres except where indicated otherwise.
- .9 Staple vapour retardant sheet strip to underside of nailers before installation. Apply strip continuous with 200mm overlap at joints, free of wrinkles and tears, with at least 200mm exposed for overlap on roof deck.
- .10 Install wood nailers for roof hopper, dressed, tapered and recessed slightly below top surface of roof insulation.

3.3 Erection

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

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 1 - General Requirements.
 - .1 Note: product requirements of 01 61 00 are applicable to this section.

1.2 Related Work

- .1 Section 06 20 00 - Finish Carpentry.
- .2 Section 06 47 00 - Plastic Laminates.
- .3 Section 07 92 00 – Joint Sealants.
- .3 Section 09 91 00 - Painting.
- .4 Section 10 80 00 - Other Specialties

1.3 References

- .1 All standards in accordance with latest issue including amendments.
- .2 American National Standards Institute (ANSI)
 - .1 ANSI A208.2, Medium Density Fiberboard for Interior Use.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM E 1333-90, Standard Test Method for Determining Formaldehyde Levels From Wood Products Under Defined Test Conditions Using a Large Chamber.
- .3 Architectural Woodwork Manufacturers Association of Canada (AWMAC)
 - .1 AWMAC Architectural Woodwork Standards Manual.
- .4 Canadian Standards Association (CSA)
 - .1 CAN3-A172- M79, High Pressure Paper Base, Decorative Laminates.
 - .2 CSA B111- 1974, Wire Nails, Spikes and Staples.
 - .3 CSA O115- M1982, Hardwood and Decorative Plywood.
 - .4 CSA O121- M1978, Douglas Fir Plywood.
 - .5 CAN/CSA O141- 91, Softwood Lumber.
 - .6 CSA O151- M1978, Canadian Softwood Plywood.
 - .7 CSA O153- M1980, Poplar Plywood.
 - .8 CAN3-O188.1- M78, Interior Mat-Formed Wood Particleboard.
 - .9 CAN/CGSB-11.3- M87, Hardboard.
- .5 National Hardwood Lumber Association (NHLA)
 - .1 Rules for the Measurement and Inspection of Hardwood and Cypress January.
- .6 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber.

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate details of construction, profiles, jointing, fastening and other related details.
- .3 Indicate all materials, thicknesses, finishes and hardware.
- .4 Indicate locations of all service outlets in casework, typical and special installation conditions, and all connections, attachments, anchorage and location of exposed fasteners.

1.5 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate colour samples of laminated plastic for colour selection.

1.6 Delivery, Storage, and Handling

- .1 Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Protect millwork against dampness and damage during and after delivery.
- .3 Store millwork in ventilated areas, protected from extreme changes of temperature or humidity.

PART 2 - PRODUCTS

2.1 Materials

- .1 Softwood lumber: unless specified otherwise, S4S, moisture content 15 % or less in accordance with following standards:
 - .1 CAN/CSA O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWMAC custom grade, moisture content as specified.
- .2 Machine stress-rated lumber is acceptable for all purposes.
- .3 Hardwood lumber: moisture content 9 % or less in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 AWMAC custom grade, moisture content as specified.
- .4 Douglas fir plywood (DFP): to CSA O121, standard construction.
- .5 Canadian softwood plywood (CSP): to CSA O151, standard construction.
- .6 Hardwood plywood: to CSA O115.
- .7 Poplar plywood (PP): to CSA O153, standard construction.
- .8 Interior mat-formed wood particleboard: to CAN3-0188.1.
- .9 Hardboard: to CAN/CGSB-11.3.
- .10 Medium density fibreboard (MDF): to ANSI A208.2, density 769 kg/m³.
- .11 Laminated plastic: to CAN3-A172, refer to Section 06 47 00.
- .12 Melamine: prefinished particle board to CSA 0115, Grade 5.
- .13 Nails and staples: to CSA B111.
- .14 Wood screws: Type and size to suit application.
- .15 Splines: As recommended by manufacturer.
- .16 Sealant: Mildew resistant silicone.
- .17 Edging: PVC, 3 mil thickness.

2.2 Manufactured Units

- .1 Casework.
 - .1 Fabricate caseworks to AWMAC conventional flush overlay construction custom quality grade.
 - .2 Furring, blocking, nailing strips, grounds and rough bucks and sleepers.
 - .1 S2S is acceptable for the above.
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.
 - .3 Framing species, NLGA grade.
 - .4 ALL exposed edges – 3mm PVC
 - .5 Case bodies (ends, divisions and bottoms).
 - .1 Concealed from view: Melamine, 19 mm thick.
 - .2 Exposed to view: Refer to Drawings.
 - .6 Backs.
 - .1 Concealed from view: Melamine, 6mm thick.
 - .2 Exposed to view: Refer to Drawings.
 - .7 Shelving.
 - .1 Fixed, refer to drawings:
 - .1 Thickness: 19mm
 - .2 Face: Refer to Drawings.
 - .3 Core: Particle.
 - .2 Adjustable unless noted otherwise.
 - .8 Kicks.
 - .1 Fixed, refer to drawings:
 - .1 Thickness: 19mm
 - .2 Face: Refer to Drawings
 - .3 Core: Particle.
 - .9 Leveler.
 - .1 Leveler: HAFELE 637.76.353
 - .2 Mounting Plate: HAFELE 637.76.333
- .2 Drawers
 - .1 Fabricate drawers to AWMAC custom grade supplemented as follows:
 - .2 Sides, Bottoms and Backs.
 - .1 Melamine: 19mm thick.
- .3 Fronts.
 - .1 Refer to Drawings:
 - .1 Thickness: 19 mm.
 - .2 Face: Refer to Drawings.
 - .3 Core: Particle.
- .4 Casework Doors
 - .1 Fabricate doors to AWMAC custom grade supplemented as follows:
 - .2 Refer to Drawings:
 - .1 Thickness: 19 mm.
 - .2 Face: Refer to Drawings.
 - .3 Core: Particle.

- .5 Tops
- .1 Fabricate tops to AWMAC custom grade supplemented as follows.
 - .1 Solid surface, 20mm or 30mm thick with eased edge: Silestone, Cesarstone or approved alternate. Refer to Drawings.
 - .1 Basis of design colour to be:
 - .1 SS-1: Caesarstone 5003 Piatra Grey

2.3 Fabrication

- .1 Set nails and countersink screws, apply stained and/or plain wood filler, to suit application, to indentations, sand smooth and leave ready to receive finish.
- .2 Shop install cabinet hardware for doors, shelves and drawers. Recess shelf standards unless noted otherwise.
- .3 Shelving to cabinetwork to be adjustable unless otherwise noted.
- .4 Provide cut-outs for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .5 Shop assemble work for delivery to site in size easily handled and to ensure passage through building openings.

2.4 Hardware

- .1 The following hardware is to be supplied and installed by millwork fabricator:
 - .1 For doors:
 - .1 Hinges:
 - .1 Blum 'Model 110°', with mounting plate for 110° Opening with BLUMOTION Clip top for soft-close, two per door, or approved alternate.
 - .2 Barrier-Free Retractable Door Slides:
 - .2 Accuride Series CB1332 Light-duty Slide for Tall Pocket Doors with 35mm Hinges, or approved alternate.
 - .3 Pulls
 - .1 Berenson Versa Pull, 160mm, Matte Black, BP36914FB, or approved alternate.
 - .4 Locks: Pin tumbler cylinder type with mortised strike to suit door thickness. Matte Black Finish. Refer to drawings for locations.
 - .5 Clear resilient bumpers, two per door.
 - .2 For drawers:
 - .1 Drawer runners: full extension synchronized concealed undermount slide with soft-close; Richelieu 828500, or approved alternate.
 - .2 Pulls:
 - .1 Berenson Versa Pull, 160mm, Matte Black, BP36914FB, or approved alternate.
 - .3 Locks: Pin tumbler cylinder type with mortised strike to suit drawer front thickness. Matte Black Finish. Refer to drawings for locations.
 - .4 Clear resilient bumpers: two per drawer.
 - .3 For shelving:
 - .1 Standards:
 - .1 HAFELE 283.18.902, zinc plated, recessed, length to suit millwork.
 - .2 Shelf supports:
 - .1 HAFELE 283.19.983, zinc plated. Provide four supports per adjustable shelf.

- .4 Cabinet Keying:
 - .1 Confirm with owner prior to manufacturing.
- 2.5 Finishing
 - .1 Refer to Millwork Finish Schedule.
 - .2 Deliver casework finished in accordance with Section 06 40 00 – Architectural Wood Casework.
 - .3 Deliver wall panelling finished in accordance with Section 06 20 00 – Finish Carpentry.

PART 3 - EXECUTION

- 3.1 Installation
 - .1 Do architectural woodwork to Quality Standards of the Architectural Woodwork Manufacturers Association of Canada (AWMAC), except where specified otherwise.
 - .2 Install prefinished millwork at locations shown on drawings. Position accurately, level, plumb straight.
 - .3 Fasten and anchor millwork securely. Provide heavy duty fixture attachments for wall mounted cabinets.
 - .4 Use draw bolts in countertop joints.
 - .5 Scribe and cut as required to fit abutting walls and to fit properly into recesses and to accommodate piping, columns, fixtures, outlets or other projecting, intersecting or penetrating objects.
 - .6 At junction of counter back splash and adjacent wall finish, apply small bead of sealant.
 - .7 Apply water resistant building paper over wood framing members in contact with masonry or cementitious construction.
 - .8 Fit hardware accurately and securely in accordance with manufacturer's directions.
- 3.2 Cleaning
 - .1 Clean millwork and cabinet work inside cupboards and drawers and outside surfaces.
- 3.3 Protection
 - .1 Protect millwork and cabinet work from damage until final inspection.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 1 - General Requirements.
 - .1 Note: product requirements of 01 61 00 are applicable too this section.

1.2 Related Sections

- .1 Section 06 20 00 - Finish Carpentry.
- .2 Section 06 40 00 - Architectural Woodwork.

1.3 References

- .1 All standards in accordance with latest issue including amendments.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN3-O188.1-M78, Interior Mat-Formed Wood Particle Board.
 - .2 CAN3-O188.3-M82, Exterior Bond Mat-Formed Wood Particleboard.
 - .3 CAN/CGSB-71.20-M88, Adhesive, Contact, Brush-able.
- .3 Canadian Standards Association (CSA)
 - .1 CAN3-A172-M79, High Pressure, Paper Base, Decorative Laminates.
 - .2 CSA O112.4-M1977, Standards for Wood Adhesives.
 - .3 CSA O112.5-Series-M-1977, Urea Resin Adhesives for Wood (Room- and High-Temperature Curing).
 - .4 CSA O112.7-Series M-1977, Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing).
 - .5 CSA O121-M1978, Douglas Fir Plywood.
 - .6 CAN/CSA O141-91, Softwood Lumber.
 - .7 CSA O151-M1978, Canadian Softwood Plywood.
 - .8 CSA O153-M1980, Poplar Plywood.

1.4 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate samples of joints, edging, cut-outs and post-formed profiles.

1.5 Closeout Submittals

- .1 Provide maintenance data for laminate work for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 Storage and Protection

- .1 Deliver, handle, store and protect materials of this section in accordance with Section 01 61 00 - Common Product Requirements.
- .2 Maintain relative humidity between 25 and 60% at 22°C during storage and installation.

PART 2 - PRODUCTS

2.1 Materials

- .1 Laminated plastic for flatwork: to CAN3-A172, Grade GP, 1.2 mm thick; based on solid, wood grain, and printed pattern colour range with matt finish unless noted otherwise.
 - .1 Basis of design colour to be:
 - .1 MEL-1: Wilsonart White 1570 Standard Matte
 - .2 PLAM-1: Wilsonart Fairchild 8238-05 Timbergrain Finish
 - .3 PLAM-2: Wilsonart Crystal D388-01 High Gloss Finish
 - .4 PLAM-3: Colour to be confirmed
- .2 Laminated plastic for post-forming work: to CAN3-A172, Grade PF, 1.0 mm thick, based on solid, wood grain, and printed pattern colour range with matt finish.
- .3 Laminated plastic backing sheet: Grade BK, not less than 0.5 mm thick, or same thickness and colour as face laminate.
- .4 Laminated plastic liner sheet: Grade GP, same thickness and colour as face laminate.
- .5 Water Resistant Medium Density Fibreboard Core: Industrial Grade Medium Density Fiberboard (MDF), manufactured with a formaldehyde-free adhesive system which meets physical properties of ANSI A208.2 Grade 155 specifications, 19 mm thick.
- .6 Particleboard core: to CAN3-O188.1, sanded faces, of thickness indicated.
- .7 Laminated plastic adhesive: water-based contact cement adhesive as recommended by manufacturer.
- .8 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.
- .9 Sealants: Refer to Section 07 92 00 – Joint Sealants.
- .10 Draw bolts and splines: as recommended by fabricator.

2.2 Fabrication

- .1 Comply with CAN3-A172, Appendix 'A'.
- .2 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .3 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .4 Veneer laminated plastic to core material in accordance with adhesive manufacturer's instructions. Ensure core and laminate profiles coincide to provide continuous support and bond over entire surface. Use continuous lengths up to 3000 mm. Keep joints 600 mm from sink cut-outs.
- .5 Form shaped profiles and bends as indicated, using post-forming grade laminate to laminate manufacturer's instructions.
- .6 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.
- .7 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .8 Apply laminated plastic liner sheet to interior of cabinetry where indicated.

PART 3 - EXECUTION

3.1 Installation

- .1 Install work plumb, true and square, neatly scribed to adjoining surfaces.
- .2 Make allowances around perimeter where fixed objects pass through or project into laminated plastic work to permit normal movement without restriction.
- .3 Use draw bolts and splines in countertop joints. Maximum spacing 450 mm oc, 75 mm from edge. Make flush hairline joints.
- .4 Provide cut-outs for inserts, grilles, appliances, outlet boxes and other penetrations.

- .5 Round internal corners, chamfer edges and seal exposed core.
- .5 At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant.
- .6 Site apply laminated plastic to units as indicated. Adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where approved. Slightly bevel arrisses.
- .7 For site application, offset joints in plastic laminate facing from joints in core.

3.2 Protection

- .1 Cover finished laminated plastic veneered surfaces with heavy Kraft paper or put in cartons during shipment. Protect installed laminated surfaces by approved means. Do not remove until immediately before final inspection.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 – General Requirements.

1.2 Related Sections

- .1 Section 09 22 16 – Non-Structural Metal Framing.

1.3 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 1320-99, Standard Practice for Installation of Mineral Fibre Batt and Blanket Thermal Insulation for Light Frame Construction.
- .2 Canadian Standards Association (CSA)
 - .1 CSA B111, Wire Nails, Spikes and Staples.

PART 2 - PRODUCTS

2.1 Insulation

- .1 Batt and blanket mineral fibre: to CAN/ULC S702-97, Type 1, thickness as indicated on Drawings.
- .2 Sound attenuation blanket, friction fit; thicknesses as indicated on Drawings.
 - .1 “Thermafibre” by CGC Inc.
 - .2 “SAB” by Fibrex Insulations Inc.
 - .3 “Safe’n’Sound” by Roxul.
 - .4 “MinWool Sound Attenuation Fireq Batt” by Johns Manville.
- .3 Acoustic blankets: Owens Corning SelectSound FF-Black Acoustic Board Next Generation insulation (black); NRC 0.70, in wall behind perforated wall panels, refer to Drawings.

2.2 Accessories

- .1 Insulation clips:
 - .1 Impale type, perforated 50mm x 50mm cold rolled carbon steel 0.8mm thick, adhesive back, spindle of 2.5mm diameter annealed steel, length to suit insulation, 25mm diameter washers of self-locking type.
- .2 Nails: galvanized steel, length to suit insulation plus 25mm, to CSA B111.
- .3 Staples: 12mm minimum leg.
- .4 Tape: as recommended by manufacturer.

PART 3 - EXECUTION

3.1 General

- .1 Comply with the requirements of Section 01 83 16.
- .2 Install materials in accordance with manufacturer’s installation instructions.

3.2 Examination

- .1 Examine substrates and immediately inform Consultant in writing of defects.
- .2 Take measurements of the Place of Work to ensure that work is fabricated to fit structure; surrounding construction; around obstructions and projections in place, or as indicated; and to suit locations of services.
- 3 Verify that backup construction is aligned for proper installation of Work before commencing erection.

3.3 Insulation Installation

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces.
- .2 Install insulation with vapour barrier facing warm side of building spaces. Lap ends and side flanges of membrane over framing members. Retain in position with staples, installed as recommended by manufacturer. Tape seal butt ends and lapped side flanges. Do not tear or cut vapour barrier.
- .3 Install sound attenuation batts where indicated on Drawings, **full height of wall**.
- .4 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
- .5 Do not compress insulation to fit into spaces.
- .6 Keep insulation minimum 75mm from heat emitting devices such as recessed light fixtures, and minimum 50mm from sidewalls of CAN/ULC-S604 Type A chimneys and CAN/CGA-B149.1 and CAN/CGA-B149.2 Type B and L vents.
- .7 Do not enclose insulation until it has been inspected and approved by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 – General Requirements.

1.2 Related Work

- .1 Fire stopping and smoke seals within mechanical assemblies (i.e. inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Division 22 through 28 respectively.

1.3 References

- .1 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-05, Fire Test of Firestop Systems.

1.4 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate 300mm x 300mm samples showing actual firestop material proposed for project.

1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.

1.6 Product Data

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 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.

PART 2 - PRODUCTS

2.1 Materials

- .1 Fire stopping and smoke seal systems: in accordance with ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended.
 - .2 Firestop system rating: as indicated on Drawings for each condition.
- .2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.
- .3 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.
- .4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

- .5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.
- .6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.
- .7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .8 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .10 Sealants for vertical joints: non-sagging.

PART 3 - EXECUTION

3.1 Preparation

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 Installation

- .1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to a neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.3 Inspection

- .1 All firestopping must be thoroughly reviewed by the Technical Representative of the system manufacturer on site before any firestopping is concealed and submit a report of compliance with the rating requirements. Submit a copy of the report to the Consultant.
- .2 After the Manufacturer has completed review of the firestopping, notify the Consultant when ready for inspection and prior to concealing or enclosing firestopping material and service penetration assemblies.

3.4 Schedule

- .1 Firestop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Top of fire-resistance rated masonry and gypsum board partitions.
 - .3 Intersection of fire-resistance rated masonry and gypsum board partitions.

- .4 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
- .5 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
- .6 Openings and sleeves installed for future use through fire separations.
- .7 Around mechanical and electrical assemblies penetrating fire separations
- .8 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

3.5 Clean Up

- .1 Remove excess materials and debris and clean adjacent surfaces immediately after application.
- .2 Remove temporary dams after initial set of firestopping and smoke seal materials.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 - General Requirements.

1.2 References

- .1 CAN/CGSB-19.1-M87, Putty, Linseed Oil Type.
- .2 CAN/CGSB-19.2-M87, Glazing Compound, Nonhardening, Modified Oil Type.
- .3 CGSB 19-GP-5M-76, Sealing Compound, One Component, Acrylic Base, Solvent Curing.
- .4 CAN/CGSB-19.6-M87, Caulking Compound, Oil Base.
- .5 CAN/CGSB-19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.
- .6 CGSB 19-GP-14M-76, Sealing Compound, One Component, Butyl-polyisobutylene Polymer Base, Solvent Curing.
- .7 CAN/CGSB-19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.
- .8 CAN/CGSB-19.18-M87, Sealing Compound, One Component, Silicone Base, Solvent Curing.
- .9 CAN/CGSB-19.20-M87, Cold-applied Sealing Compound, Aviation Fuel-resistant.
- .10 CAN/CGSB-19.21-M87, Sealing and Bedding Compound Acoustical.
- .11 CAN/CGSB-19.22-M89, Mildew Resistant, Sealing Compound for Tubs and Tiles.
- .12 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.

1.3 Samples

- .1 Submit samples in accordance with General Requirements.
- .2 Submit duplicate samples of each type of material and colour.

1.4 Mock-up

- .1 Construct mock-up in accordance with General Requirements.
- .2 Construct mock-up to show location, size, shape and depth of joint s complete with back-up material, primer, caulking and sealant. Mock-up may be part of finished work.
- .3 Allow 24 hours for inspection of mock-up by Consultant before proceeding with sealant work.

1.5 Delivery, Storage and Handling

- .1 Deliver, handle, store and protect materials in accordance with General Requirements.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

1.6 Environmental and Safety Requirements

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

PART 2 - PRODUCTS

2.1 Sealant Materials

- .1 Sealants and caulking compounds must:
 - .1 meet or exceed all applicable governmental and industrial safety and performance standards; and
 - .2 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, by laws and regulations including, for facilities located in Canada, the fisheries Act and the Canadian Environmental Protection Act (CEPA).
- .2 Sealant and caulking compounds must not be formulated or manufactured with: aromatic solvents, fibrous talc or asbestos, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium, barium or their compounds, except barium sulfate.
- .3 Sealant and caulking compounds must not contain a total of volatile organic compounds (VOCs) in excess of 5% by weight as calculated from records of the amounts of constituents used to make the product.
- .4 Sealant and caulking compounds must be accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance, and information describing proper disposal methods.
- .5 Caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant shall not be used in air handling units.
- .6 When low toxicity caulks are not possible, confine usage to areas which off gas to the exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off-gas time.
- .7 The manufacturing process must adhere to Lifecycle Assessment Standards as per ISO 14040/14041 LCA Standards (to be published by 1998), CSA Z760-94 LCA Standards.
- .8 Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.

2.2 Sealant Material Designations

- .1 Urethanes One Part.
 - .1 Non-Sag to CAN/CGSB-19.13, Type 2, colour as selected by Consultant.
- .2 Silicones One Part.
 - .1 To CAN/CGSB-19.22 (Mildew resistant).
- .3 Acrylic Latex One Part.
 - .1 To CAN/CGSB-19.17.
- .4 Acoustical Sealant.
 - .1 To CAN/CGSB-19.21.
- .5 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
 - .2 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

2.3 Sealant Selection

- .1 Exterior: Urethane.
- .2 Interior control and expansion joints: Silicone.
- .3 Perimeters of interior frames and millwork: Acrylic Latex.

- .4 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, stools, waterclosets, basins, vanities):
Sealant type: Mildew Resistant Silicone.
- .5 Exposed interior control joints in drywall: Acrylic Latex.
- .6 Perimeter of walls to ensure continuity of sound proofing: Acoustical.

2.4 Joint Cleaner

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .2 Primer: as recommended by manufacturer.

PART 3 - EXECUTION

3.1 Protection

- .1 Protect installed work of other trades from staining or contamination.

3.2 Preparation of Joint Surfaces

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants; depth ratio $\frac{1}{2}$ of joint width with minimum width and depth of 6mm, maximum width 12mm
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.

3.3 Priming

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 Backup Material

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30 % compression.

3.5 Mixing

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 Application

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.

- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.
- .5 Use sufficient pressure to fill voids and joints solid.
- .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
- .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
- .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.
 - .3 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 – General Requirements.

1.2 Related Sections

- .1 Section 06 10 00 – Rough Carpentry: Built-In.
- .2 Section 07 92 00 – Joint Sealants.
- .3 Section 08 14 10 – Flush Wood Doors.
- .4 Section 08 71 00 – Finish Hardware.
- .5 Section 08 80 50 – Glazing
- .6 Section 09 21 16 – Gypsum Wallboard Assemblies.
- .7 Section 09 22 16 – Non-Structural Metal Framing.
- .8 Section 09 91 00 – Painting.

1.3 References

- .1 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.181-92, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.
 - .3 CAN/CGSB-51.20-M87, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .4 CGSB 51-GP-21M-78, Thermal Insulation, Urethane and Isocyanurate, Unfaced.
- .2 Canadian Standards Association (CSA).
 - .1 CSA A101-M1983, Thermal Insulation, Mineral Fibre, for Buildings.
 - .2 CAN/CSA-G40.21-M92, Structural Quality Steels.
 - .3 CSA W59-M1989, Welded Steel Construction (Metal Arc Welding).
- .3 Canadian Steel Door and Frame Manufacturers' Association, (CSDFMA).
 - .1 CSDFMA, Specifications for Commercial Steel Doors and Frames, 1990.
 - .2 CSDFMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 1990.
- .4 National Fire Protection Association (NFPA).
 - .1 NFPA 80-1992, Fire Doors and Windows.
 - .2 NFPA 252-1990, Door Assemblies, Fire Tests of.
- .5 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN4-S104M- M80(R1985), Fire Tests of Door Assemblies.
 - .2 CAN4-S105M-M85, Fire Door Frames.

1.4 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed, arrangement of hardware fire rating and finishes.
- .3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and fire rating finishes.
- .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.5 Requirements of Regulatory Agencies

- .1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M NFPA 252 for ratings specified or indicated.

PART 2 - PRODUCTS

2.1 Manufacturers

- .1 Products of following manufacturers are acceptable subject to conformance to requirements of drawings, schedules and specifications:
 - .1 Artek Door Limited; www.artekdoor.com
 - .2 Davbar Industries Limited; www.daybar.com
 - .3 De La Fontaine; delafontaine.com
 - .4 Fleming Door Products Limited; www.flemingdoor.com
 - .5 Gensteel Doors; gensteeldoors.com
 - .6 Shanahan's; www.shanahans.com
 - .7 All Steel Doors 2000 Ltd.; www.allsteeldoors.com

2.1 Materials

- .1 Hot dipped galvanized steel sheet: to ASTM A 653M; minimum base steel thickness in accordance with CSDFMA Table 1 – Thickness for Component Parts.
- .2 Reinforcement channel: to CAN/CSA-G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.

2.2 Door Core Materials

- .1 Honeycomb construction:
 - .1 Structural small cell, 24.5mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m³ minimum sanded to required thickness.

2.3 Adhesives

- .1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement.

2.4 Primers

- .1 Touch-up prime CAN/CGSB-1.181.

2.5 Paint

- .1 Steel doors and frames shall be field painted in accordance with Sections 09 91 00. All hardware shall be protected from paint. Finish shall be free of scratches or other blemishes.

2.6 Accessories

- .1 Door silencers: single stud rubber/ neoprene type.
- .2
- .3 Fabricate glazing stops as formed channel, minimum 16mm height; 0.9mm (20g) base thickness sheet steel with ZF75 (interior) zinc finish to ASTM A 653M, accurately fitted, butted at corners and fastened to frame sections with counter-sunk oval head sheet metal screws.
- .4 Metallic paste filler: to manufacturer's standard.
- .5 Fire labels: metal rivetted.
- .6 Sealant: Refer to Section 07 92 00.
- .7 Glazing: Refer to Section 08 80 50 and Door Schedule for sizes and types of glazing.
- .8 Make provisions for glazing as indicated and provide necessary glazing stops.
 - .1 Provide low profile slimline Vision Lite by Air Louvres Inc. 20ga cold rolled steel standard factory primed for field painting lite kit material. Not through bolted.

2.7 Frames Fabrication General

- .1 Fabricate frames in accordance with CSDFMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Interior frames: 1.6mm welded construction, ZF 75 (A25) finish.
- .4 Blank, reinforce, drill and tap frames for mortised, templated hardware, using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Protect mortised cutouts with steel guard boxes.
- .6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .7 Provide fire labelled frames for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104, ASTM E 152 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .8 Conceal fastenings except where exposed fastenings are indicated.
- .9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .10 Frame manufacturer to weld in place mortar boxes supplied by finish hardware supplier as instructed on finish hardware schedule

2.8 Frame Anchorage

- .1 Provide appropriate anchorage to floor and wall construction.
- .2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .3 Provide 2 anchors for rebate opening heights up to 1520mm and 1 additional anchor for each additional 760mm of height or fraction thereof.

2.9 Frames: Welded Type

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.

- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.10 Door Fabrication General

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Interior doors: honeycomb construction.
- .3 Fabricate doors with longitudinal edges locked seam welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .4 Blank, reinforce, drill doors and tap for mortised, templated hardware based on approved Finish Hardware Schedule and template package provided by hardware supplier.
- .5 Reinforce doors where required, for surface mounted hardware.
- .6 Factory prepare holes 12.7mm (1/2") diameter and large, except for mounting and through-bolt holes which are to be made at time of hardware install.
- .7 Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .8 Doors to be beveled 3mm in 50mm (1/8" in 2") on both door edges, unless required to suit finish hardware
- .9 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .10 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104, ASTM E 152 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.
- .11 Manufacturer's fire labels to be located on hinge side of door between first and second hinge for butt hinges, top end channel on strike side for continuous hinges
- .12 Where electrified hardware is specified, provide minimum 3/8" raceway through door from power transfer devise to electrified hardware

2.11 Doors: Core Construction

- .1 Form each face sheet for interior doors from 1.6mm sheet steel with honeycomb - core laminated under pressure to face sheets.

PART 3 - EXECUTION

3.1 Installation General

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install frames to CSDFMA Installation Guide.

3.2 Frame Installation

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

- .5 Caulk perimeter of frames between frame and adjacent material.

3.3 Door Installation

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions. Typical hardware may include three butt hinges or continuous hinges, floor or wall stops, rim or concealed panic or mortise passage/ locksets, door closers, weatherstripping, kick plates, signs and rebated automatic door bottoms.
- .2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
 - .1 Hinge side: 3.0mm.
 - .2 Latchside and head: 3.0mm.
 - .3 Finished floor, top of carpet, noncombustible sill and thresholds: 13mm.
- .3 Adjust operable parts for correct function.

3.4 Finish Repairs

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.5 Glazing

- .1 Install glazing for doors and frames in accordance with Section 08 80 50 – Glazing.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 – General Requirements.

1.2 Related Sections

- .1 Section 07 92 00 – Joints Sealers.
- .2 Section 08 80 50 – Glazing.
- .3 Division 26 – Electrical.

1.3 References

- .1 Aluminum Association Designation System for Aluminum Finishes-1997.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM E 330-97, Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.40-M89, Primer, Structural Steel, Oil Alkyd Type.
 - .2 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
- .4 Canadian Standards Association (CSA)
 - .1 CAN/CSA-G40.21-98, Structural Quality Steels.
 - .2 CSA G164-M92, Hot Dip Galvanizing of Irregularly Shaped Articles.

1.4 Approved Manufacturers

- .1 To establish a standard for tendering purposes, the Drawings are based upon Windspec Inc.;
 - .1 Interior Doors: Windspec 500 Series.
 - .2 Interior Screens: Windspec 630 Series.
 - .3 Sliding Doors: Windspec 630 Series Top Hung Medium Stile.
- .2 The following manufacturers are approved, subject to total compliance with this Specification:
 - .1 Kawneer Company of Canada Limited.
 - .2 Commdoor.
 - .3 Alumicor Limited.

1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittals Procedure.
- .2 Indicate each type of door and frame, extrusion profiles, method of assembly, section and hardware reinforcement, locations of exposed fasteners, finishes and location of manufacturer's nameplates.
- .3 Submit catalogue details for each type of door and frame illustrating profiles, dimensions and methods of assembly.

1.6 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittals Procedure.
- .2 Submit one 300mm x 300mm corner sample of each type door and frame.

1.7 Closeout Submittals

- .1 Provide maintenance data for cleaning and maintenance of aluminum finishes for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.8 Protection

- .1 Apply temporary protective coating to finished surfaces. Remove coating after erection. Do not use coatings that will become hard to remove or leave residue.
- .2 Leave protective covering in place until final cleaning of building.

1.9 Warranty

- .1 Provide a written warranty, signed and issued in the name of the Owner and Project, stating that the Contractor warrants aluminum doors, frames and screens against leakage, defects and malfunction under normal usage in accordance with GC 12.3 as amended by the Supplementary General Conditions but for a period of three years.

PART 2 - PRODUCTS

2.1 Materials

- .1 Aluminum extrusions: Aluminum Association alloy AA6063-T5 anodizing quality.
- .2 Sheet aluminum: Aluminum Association alloy AA1100-H14 anodizing quality.
- .3 Steel reinforcement: to CAN/CSA-G40.21, grade 300 W.
- .4 Fasteners: aluminum, cadmium plated steel or stainless steel, finished to match adjacent material.
- .5 Weatherstrip: Metal backed wool pile.
- .6 Hardware: Supplied under hardware allowance and installed by this Section.
- .7 Door bumpers: black neoprene.
- .8 Isolation coating: bituminous paint.
- .9 Glass and glazing materials: Refer to Section 08 80 50.
 - .1 Glass in interior units: 6mm thick tempered safety glass.
- .10 Structural Glazing Sealant: At butt-joint glazing locations shown on Drawings; Ultraglaze "SSG4400" silicone manufactured by General Electric, "Proglaze II" manufactured by Tremco and conforming to CAN/CGSB-19.13-M87, or "995" manufactured by Dow Corning. Provide system with black gaskets.
- .11 Sealants: Refer to Section 07 92 00.

2.2 Aluminum Doors

- .1 Construct doors of porthole extrusions with minimum wall thickness of 3.0mm.
- .2 Door stiles nominal 146mm wide, plus or minus 6mm; meeting stiles to be bevelled.
- .3 Top rail nominal 143mm high, plus or minus 6mm.
- .4 Bottom rail nominal 178mm high, plus or minus 6mm.
- .5 Reinforce mechanically-joined corners of doors to produce sturdy door unit.
- .6 Glazing stops: interlocking snap-in type for dry glazing.
- .7 Hardware: As provided by hardware allowance, including pulls, pushes, automatic door operators, continuous hinges, cylinder locks, door stops, door closures, exit devices.

2.3 Aluminum Frames

- .1 Construct frames of aluminum extrusions with minimum wall thickness of 3.0mm, to provide structural strength to meet specified performance requirements, size 45mm x 115mm for flush glazing.
- .2 Frame for doors and screens to be by same manufacturer as aluminum doors.

2.4 Aluminum Sliding Doors

- .1 Construct doors of porthole extrusions with minimum wall thickness of 3.0mm.
- .2 Door stiles: Refer to Aluminum Doors.
- .4 All joints shall be accurately machined and assembled to provide neat hairline joints.
- .5 Panel weight shall be carried on two heavy duty tandem roller assemblies per panel, top hung.
- .6 Glazing stops: interlocking snap-in type for dry glazing.
- .7 Provide tandem rollers, top track with sweeps, meeting and terminating stiles to allow smooth function of sliding door.

2.5 Aluminum Finishes

- .1 Finish exposed surfaces of aluminum components in accordance with Aluminum Association Designation System for Aluminum Finishes, AA-A41/A44, Class 1, 0.018mm minimum thickness.
- .2 Integral colour hardcoat anodic finish; CLEAR ANODIZED. Refer to Door & Frame Schedule.
- .3 Appearance and properties of anodized finishes designated by the Aluminum Association as Architectural Class 1 shall meet requirements of CGSB 63-GP-2M+Amdt-Jul-80, for coating class 1.

2.6 Steel Finishes

- .1 Finish steel clips and reinforcing steel with zinc coating to CSA G164.

2.7 Hardware

- .1 All hardware excluding weatherstripping and sweeps shall be supplied under Hardware Allowance listed in Section 01 21 00.
- .2 Weatherstripping: mohair, replaceable spline type.
- .3 Sweeps: Adjustable, combination extruded aluminum and black solid neoprene.

2.8 Fabrication

- .1 Doors and framing to be by same manufacturer.
- .2 Fabricate doors and frames, transom panels and screens to profiles and maximum face sizes as shown.
- .3 Provide structural steel reinforcement as required.
- .4 Design frames and screens in exterior walls to:
 - .1 Accommodate expansion and contraction within service temperature range of - 35°C to 75°C.
 - .2 Limit deflection to 1/175th clear span tested to ASTM E330, latest revised edition, under wind loads for building locality as ascertained by NBC Supplement, Climatic Information for Building Design in Canada.
- .5 Make allowances for deflection of structure. Ensure that structural loads are not transmitted to aluminum work.
- .6 Fit intersecting members to flush, hairline, weather tight joints and mechanically fasten

- together, except where indicated otherwise.
- .7 Conceal fastenings from view. Exposed fastenings where indicated.
- .8 Form cut-outs, recesses, mortising or milling for finishing hardware to templates supplied. Reinforce with aluminum or galvanized steel plates.
- .9 Provide replaceable weatherstripping at exterior and vestibule door openings. Weatherstrip bottom of doors with pile sweep strip applied to door rail.
- .10 Mortise, reinforce, drill and tap doors, frames and reinforcements to receive hardware using templates provided by hardware supplier.
- .11 Isolate aluminum from direct contact with dissimilar metals, concrete and masonry with bituminous paint.

PART 3 - EXECUTION

3.1 Installation

- .1 Set frames plumb, square, level at correct elevation in alignment with adjacent work and free from warp, twist and superimposed loads.
- .2 Secure work in required position. Do not restrict thermal movement.
- .3 Isolate from cementitious materials.
- .4 Maintain integrity of vapour retarder and air barrier system within systems installed by this Section and between systems and adjoining construction.
- .5 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.
- .6 Adjust operable parts for correct function.
- .7 Make allowances for deflection of structure to ensure that structural loads are not transmitted to frames.

3.2 Glazing

- .1 Glaze aluminum doors and frames in accordance with Section 08 80 50 - Glazing.

3.3 Caulking

- .1 Seal joints to provide weathertight seal at outside and air, vapour seal at inside.
- .2 Apply sealant in accordance with Section 07 92 00 - Joint Sealers. Conceal sealant within the aluminum work except where exposed use is permitted by Consultant. Provide aluminum panning if caulk joint is larger than 6mm.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 - General Requirements.

1.2 Work Included in This Section

- .1 Supply & installation of finishing hardware by allowance; reference Section 01 21 00.

1.3 Coordination

- .1 Coordinate the hardware with other allied trades such as carpentry, millwork, aluminium door and screens, hollow metal doors and frames, electrical and others.

1.4 Handling and Storage

- .1 Handle and store materials on job site in such a manner that no damage will be done to the materials.
- .2 Deliver and store materials undamaged in a dry area.
- .3 Wrap all hardware in separate packages complete with all trimming and screws required for each item, distinctly labelled and numbered for each opening to correspond with the final reviewed Finish Hardware Schedule.

1.5 Hardware Reinforcement

- .1 Reference *Door Schedule* for typical hardware to be used on this project. Provision of hardware reinforcing required providing a firm support for hardware is under other sections of these specifications. Report any doors, frames or panels which have not been adequately reinforced.

1.6 Fire and Building Codes

- .1 All hardware shall comply with applicable fire and building codes and requirements of local authority having jurisdiction over hardware. All electrical items must have CSA approval.

1.7 Barrier Free Requirements

- .1 The building is designed to meet the needs of barrier free access. All hardware shall be supplied and installed in accordance with the Ontario Building Code (OBC).

1.8 Submittals

- .1 Shop Drawings
 - .1 Prepare and submit to the Consultant for review, 1 electronic copy of the hardware schedule & 1 electronic copy of the electrical elevation coordination drawings showing all hardware required for each opening.
- .2 For Maintenance Use: Submit the following to the Consultant:
 - .1 One set wrenches for locksets, exit devices and door closers.
 - .2 Three sets of manufacturer's installation instructions for locksets.
 - .3 Three sets of manufacturer's instructions in regard to proper care of hardware including lubrication of locksets, exit devices and door closers.
 - .4 One complete set of template schedules.
 - .5 Catalogue cuts of all hardware installed.

1.9 Warranty

- .1 Submit a warranty in accordance with Section 01 77 00, covering the repair or replacement of defective work within specified periods.
- .2 Provide total warranty of 5 years for locksets and exit devices, 10 years for door closers, and 2 years for other hardware. Hinges require a written warranty from the manufacturer for the lifetime of the hinges.
- .3 State in the warranty that any defective (material and operation) item of hardware shall be replaced immediately upon notification that item is defective.

PART 2 - PRODUCTS

2.1 Hardware by Cash Allowance – Reference Section 01 21 00.

- .1 The approved finishing hardware schedule will govern final door and frame preparations.

2.2 Keying

- .1 Review and establish keying system with Owner.

2.3 Templates

- .1 All hardware applied to metal doors and frames shall be made to template. Furnish templates, together with instructions necessary for door and frame preparation.

2.4 Fasteners

- .1 Provide screws, rivets, bolts, expansion shields, and other fastening devices as required for the satisfactory installation and operation of the hardware. Provide Robertson or Phillips heads.
- .2 Fastening devices shall be of the same finish as the hardware which is to be fastened.
- .3 Where a pull is scheduled on one side of the door and a pushplate on the other side, issue installation directions to the trade responsible for fixing, so that the pull is secured through the door from the reverse side, and the pushplate installed to cover the screws. Supply flush pulls with machine screws for attaching as specified above.
- .4 For fastenings in concrete for floor stops and thresholds, use machine screws in expansion shields.

PART 3 - EXECUTION

3.1 Installation

- .1 As specified in Section 01 21 00 – supply and installation of finishing hardware is by Cash Allowance.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 - General Requirements.

1.2 Related Sections

- .1 Section 08 11 13 – Steel Door Frames.
- .2 Section 08 11 16 – Aluminum Doors & Frames.
- .3 Section 08 14 10 – Flush Wood Doors.
- .4 Section 08 44 13 – Glazed Aluminum Curtain Walls.
- .5 Section 08 50 50 – Windows.

1.3 References

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ASTM E 330-97e1, Test Method for Structural Performance of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 542-94, Specification for Lock-Strip Gaskets.
- .3 Canadian Door and Window Manufacturers, Certification Program.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
 - .2 CAN/CGSB-12.2-M91, Flat, Clear Sheet Glass.
 - .3 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
 - .4 CAN/CGSB-12.4-M91, Heat Absorbing Glass.
 - .5 CAN/CGSB-12.5-M86, Mirrors, Silvered.
 - .6 CAN/CGSB-12.8-97, Insulating Glass Units.
 - .7 CAN/CGSB-12.9-M91, Spandrel Glass.
 - .8 CAN/CGSB-12.10-M76, Glass, Light and Heat Reflecting.
- .5 Canadian Standards Association (CSA)
 - .1 CSA A440.2-98, Energy Performance Evaluation of Windows and Sliding Glass Doors.
- .6 Flat Glass Manufacturers Association (FGMA), Glazing Manual
- .7 Laminators Safety Glass Association, Standards Manual.

1.4 Performance Requirements

- .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:
 - .1 Utilize inner light of multiple light sealed units for continuity of air and vapour seal.
- .2 Size glass to withstand wind loads, dead loads and positive and negative live loads as measured in accordance with ANSI/ASTM E 330.

1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

1.6 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate 300mm x 300mm size samples of glass types.

1.7 Closeout Submittals

- .1 Provide maintenance data including cleaning instructions for incorporation into manual specified in Section 01 77 00 – Closeout Procedures.

1.8 Quality Assurance

- .1 Perform work in accordance with FGMA Glazing Manual IGMAC and Laminators Safety Glass Association - Standards Manual for glazing installation methods.

1.9 Environmental Requirements

- .1 Install glazing when ambient temperature is 10°C minimum. Maintain ventilated environment for 24 hours after application.
- .2 Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

PART 2 - PRODUCTS

2.1 Materials: Flat Glass

- .1 Safety glass: to CAN/CGSB-12.1, transparent, 5mm thick.
 - .1 Type 2-tempered.
 - .2 Class B-float.
- .2 Laminated Glass: ASTM C1172, and complying with testing requirements in 16 CFR 1201 for Category II materials, and with other requirements specified in this Section. Use materials that have a proven record of no tendency to bubble, discolour, or lose physical and mechanical properties after fabrication and installation.
 - 1. Interlayer Thickness: Provide thickness indicated in specific assemblies and as needed to comply with requirements, but not less than 1.5 mm (60 mil).
 - 2. Interlayer Colour: Clear unless otherwise indicated.
 - 3. STC: Minimum 36
 - 4. Glass construction: 5mm fully tempered glass; 1.52 mm PVB interlayer; 5mm fully tempered glass. Refer to Drawings and Schedules for locations.
- .3 Mirrors: ASTM C1503, or equivalent to CAN/CGSB-12.5; manufactured using copper-free, low-lead mirror coating process. Provide Mirror Select Quality; annealed glass with film backing as specified.

2.2 Materials

- .1 Sealant: to glass manufacturers standard.
 - .1 Acceptable material: ECP-45.

2.3 Accessories

- .1 Setting blocks: Neoprene, 80-90 Shore A durometer hardness to ASTM D 2240, to suit glazing method, glass light weight and area.
- .2 Spacer shims: Neoprene, 50-60 Shore A durometer hardness to ASTM D 2240, 75mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.
- .3 Glazing tape: Preformed butyl, 10-15 Shore A durometer hardness to ASTM D 2240; coiled on release paper; 3 x 13mm size; black colour.

- .4 Lock-strip gaskets: to ASTM C 542.

PART 3 - EXECUTION

3.1 Examination

- .1 Verify that openings for glazing are correctly sized and within tolerance.
- .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.

3.2 Preparation

- .1 Clean contact surfaces with solvent and wipe dry.
- .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- .3 Prime surfaces scheduled to receive sealant.

3.3 Installation: Interior - Dry Method (Tape and Tape)

- .1 Cut glazing tape to length and set against permanent stops, projecting 1.6mm above sight line.
- .2 Place setting blocks at 1/4 points, with edge block maximum 150mm from corners.
- .3 Rest glazing on setting blocks and push against tape for full contact at perimeter of light or unit.
- .4 Place glazing tape on free perimeter of glazing in same manner described.
- .5 Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- .6 Knife trim protruding tape.

3.4 Protection

- .1 Provide safety markings to installed glass by attaching streamers or tape to face of sash. Do not apply tape directly to glass. Do not mark the glass with paint or any other substance that is hard to remove or could leave permanent stains.
- .2 Take all precautions necessary to protect stored glass and installed glass from lime mortar, water run-off from concrete or copper, weld splatter, acids, roofing tar, solvents, abrasive cleaners, careless handling of construction machinery and equipment, and any other activities that could permanently damage the glass.
- .3 Install protective cover to glass where there is a high risk of damage. Use plywood, heavy kraft paper, or non-staining transparent plastic sheet. Do NOT let protective materials contact surface of glass.
- .4 Do not rely on use of adhesive plastic films to protect installed glass. When plastic is sheeting is used, it must be transparent, suspended away from the surface of the glass, and be provided with adequate ventilation holes to prevent heat build-up.

3.5 Cleaning

- .1 Remove glazing materials from finish surfaces.
- .2 Remove labels after work is complete.
- .3 Clean all glass and mirrors.
- .4 Remove and replace glass that is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 – General Requirements.

1.2 Related Sections

- .1 Section 05 41 00 – Light Gauge Structural Metal Framing.
- .2 Section 07 21 16 – Sprayed Foam Insulation.
- .3 Section 07 27 10 – Air Barriers.
- .4 Section 07 92 00 – Joint Sealers.
- .5 Section 07 95 13 – Expansion Joint Assemblies.
- .6 Section 09 22 16 – Non-Structural Metal Framing.
- .7 Section 09 91 00 – Painting.
- .8 Divisions 21-25 – Mechanical.
- .9 Divisions 26-28 – Electrical.

1.3 References

- .1 Aluminum Association
 - .1 Designation for Aluminum Finishes.
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 36, Specification for Gypsum Wallboard.
 - .2 ASTM C 79, Specification for Gypsum Sheathing Board.
 - .3 ASTM C 442, Specification for Gypsum Backing Board and Coreboard.
 - .4 ASTM C 475, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .5 ASTM C 514, Specification for Nails for the Application of Gypsum Board.
 - .6 ASTM C 557, Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 - .7 ASTM C 630, Specification for Water-Resistant Gypsum Backing Board.
 - .8 ASTM C 840, Specification for Application and Finishing of Gypsum Board.
 - .9 ASTM C 931/931, Specification for Exterior Gypsum Soffit Board.
 - .10 ASTM C 954, Specification for Steel Drill Screws for the Application of Gypsum Board.
 - .11 ASTM C 960, Specification for Predecorated Gypsum Board.
 - .12 ASTM C 1002, Specification for Steel Drill Screws for the Application of Gypsum Board or Metal Plaster Bases.
 - .13 ASTM C 1047, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .14 ASTM C 1280, Specification for Application of Gypsum Sheathing Board.
 - .15 ASTM C 1177, Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
 - .16 ASTM C 1178, Specification for Glass Mat Water-Resistant Gypsum Backing Board.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .2 CAN/CGSB-71.25-M, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.
- .4 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Building Materials and Assemblies, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
- .5 Gypsum Association (GA)
 - .1 GA-216, Application and Finishing of Gypsum Board.
 - .2 GA-600, Fire Resistance Design Manual.

1.4 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit 300mm long samples of corner and casing beads, and reveals.

1.5 Site Environmental Requirements

- .1 Maintain temperature minimum 15°C, maximum 21°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.
- .2 Apply board and joint treatment to dry, frost free surfaces.

1.6 Quality Assurance

- .1 Subcontractor executing the Work of this Section shall have a minimum of 10 years continuous experience in successful installation of work of this type and quality indicated and specified.
- .2 Single source responsibility: Obtain gypsum board products from single manufacturer, or from manufacturers recommended by prime manufacturer of gypsum boards.
- .3 Fire resistance rating: Where gypsum board systems with fire resistance ratings are indicated or required, provide materials and installations that are identical with those of applicable assemblies tested by fire testing laboratories acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 Materials

- .1 Standard board (GB): to ASTM C36 regular, 15.9mm thick 1220mm wide x maximum practical length, ends square cut, edges tapered.
- .2 Fire resistant board (GB): Type X to ULC Guide No. 40 U18.23, thickness as noted on drawings, 1220mm wide x maximum practical length, ends square cut, edges tapered.
- .3 Glass mat wall board (GMWB): to ASTM C1177 regular, 15.9mm thick, 1220mm wide x maximum practical length, ends square cut, edges tapered, glass mat faced, water resistant treated core.
 - .1 Acceptable material:
 - .1 Georgia Pacific 'DensArmor Plus High Performance Interior Panel'.
 - .2 CertainTeed 'Glasroc Sheathing'.
 - .3 CGC Sheetrock Glass Mat Mold Tough.
- .4 Tile-backer board (TBB): to ASTM C1178; thicknesses as indicated on Drawings x maximum practical length.
 - .1 Acceptable material:
 - .1 Georgia Pacific 'DensShield Tile Backer'.
 - .2 CertainTeed 'Diamondback Tile Backer'.
 - .3 CGC Durock Glass Tile Backer Board.
- .5 Metal furring runners, hangers, tie wires, inserts, anchors: to ASTM C 841.
- .6 Drywall furring channels: 0.5mm core thickness galvanized steel channels for screw attachment of gypsum board.
- .7 Resilient clips drywall furring: 0.5mm base steel thickness galvanized steel for resilient attachment of gypsum board.
- .8 Steel drill screws: to ASTM C 1002.
- .9 Stud adhesive: to CAN/CGSB-71.25 ASTM C 557.
- .10 Laminating compound: as recommended by manufacturer, asbestos-free.
- .11 Casing beads, corner beads, control joints and edge trim: to ASTM C 1047, Zinc metal, zinc-coated by electrolytic process, 0.5mm base thickness, perforated flanges, one piece length per location.

- .12 Reveal joints: rigid PVC, sizes as indicated on Drawings.
 - .1 Acceptable manufacturer:
 - .1 Trimtex, or approved alternate.
- .13 Sealants: in accordance with Section 07 92 00 - Joint Sealers.
- .14 Acoustic sealant: Refer to Section 07 92 00.
- .15 Polyethylene: to CAN/CGSB-51.34, Type 2.
- .16 Insulating strip: rubberized, moisture resistant, 3mm thick closed cell neoprene strip, 12mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .17 Joint reinforcement tape: 50mm wide, glass fibre mesh.
- .18 Joint compound: to ASTM C 475, asbestos-free.

PART 3 - EXECUTION

3.1 Erection

- .1 Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.
- .2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C 840 except where specified otherwise.
- .3 Support light fixtures by providing additional ceiling suspension hangers within 150mm of each corner and at maximum 600mm around perimeter of fixture.
- .4 Install work level to tolerance of 1:1200.
- .5 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles, etc.
- .6 Install furring channels parallel to, and at exact locations of steel stud partition header track.
- .7 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .8 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .9 Install wall furring for gypsum board wall finishes in accordance with ASTM C 840, except where specified otherwise.
- .10 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .11 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .12 Erect drywall resilient furring transversely across studs, spaced maximum 600mm o.c. and not more than 150mm from ceiling/wall juncture. Secure to each support with 25mm drywall screw.
- .13 Install 150mm continuous strip of 12.7mm gypsum board along base of partitions where resilient furring installed.

3.2 Application

- .1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved.
- .2 Apply single layer gypsum board to metal furring or framing using screw fasteners. Maximum spacing of screws 300mm o.c.
- .3 Apply single layer gypsum board to concrete/ concrete block surfaces, where indicated, using laminating adhesive.
- .4 **Apply glass mat board on all vertical surfaces.**
- .5 Apply tile backer wall board on interior walls identified to receive ceramic tile finish.
- .6 Apply 12mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, etc., in partitions where perimeter sealed with acoustic sealant.

3.3 Installation

- .1 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 oc.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated. Seal joints with sealant.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.
- .5 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .6 Provide continuous polyethylene dust barrier behind and across control joints.
- .7 Locate control joints where indicated on Drawings, at changes in substrate construction, **and** at approximate 10m spacing on long corridor runs and at approximate 15m spacing on ceilings. **Submit layout of control joints to Consultant for approval prior to commencement of the Work of this Section.**
- .8 Install control joints straight and true.
- .9 Install access doors to electrical and mechanical fixtures specified in respective Sections.
 - .1 Rigidly secure frames to furring or framing systems.
- .10 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.
- .11 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.
- .12 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.
- .13 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .14 Completed installation to be smooth, level, plumb, free from waves and other defects and ready for surface finish. Surface to be prepared to a Level 5 finish per the Gypsum Association Publication GA-214.
- .15 Mix joint compound slightly thinner than for joint taping.
- .16 Where required by surface imperfections, apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.
- .17 Allow skim coat to dry completely.
- .18 Remove ridges by light sanding or wiping with damp cloth.

3.4 Fire Dampers

- .1 Refer to Mechanical Drawings for locations of fire dampers.
- .2 Coordinate opening sizes for dampers to ULC clearance requirements.
- .3 Line openings for dampers with type X board prior to damper installation.

3.5 Cleaning

- .1 Clean adjacent surfaces and remove excess materials, droppings and debris.
- .2 Protect unfinished work.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 – General Requirements.

1.2 Related Sections

- .1 Section 07 92 00 – Sealants.
- .2 Section 07 95 13 – Expansion Joint Assemblies.
- .3 Section 09 21 16 – Gypsum Board Assemblies.

1.3 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C 645-99, Standard Specification for Nonstructural Steel Framing Members.
 - .2 ASTM C 754-98a, Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .2 CAN/CGSB-19.21-M87, Sealing and Bedding Compound Acoustical.

1.4 Quality Assurance

- .1 ***Retain a Professional Engineer registered in the Province of Ontario to design Lightweight Steel Framing System; to prepare, seal and sign all shop drawings; and to perform field review. Shop drawings shall show both design and installation requirements.***

1.5 Submittals

- .1 Submit two certified copies of mill reports covering chemical and mechanical properties, and coating designation of steel used in this work.
- .2 Submit two signed and sealed copies of engineering calculations or data verifying the capacity of the members and the ability of the assemblies to meet the design requirements.

PART 2 - PRODUCTS

2.1 Materials

- .1 Non-load bearing channel stud framing: to ASTM C 645, stud size as indicated on drawings, roll formed with minimum base steel thickness 0.455mm of hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460mm centres. For walls over 3000mm in height, and high level bulkheads, minimum base steel thickness to be 0.836mm.
- .2 Floor and ceiling tracks: to ASTM C 645, in widths to suit stud sizes, 32mm flange height.
- .3 Metal channel stiffener: 19mm x 9.5mm size, 1.4mm thick cold rolled steel, coated with rust inhibitive coating.
- .4 Sheet steel reinforcing: 0.9mm thick (20 gauge) galvanized sheet steel; 1220mm x 2440mm, or optimal size.
- .5 Acoustical sealant: to CAN/CGSB-19.21. Refer also to Section 07 92 00.

- .6 Insulating strip: rubberized, moisture resistant 3mm thick foam strip, 12mm wide, with self sticking adhesive on one face, lengths as required.

PART 3 - EXECUTION

3.1 Erection

- .1 Align partition tracks at floor and ceiling and secure at 600mm o.c. maximum. Allow for 20mm deflection of floor and roof slabs.
- .2 Install dampproof course under stud shoe tracks of partitions on slabs on grade.
- .3 Place studs vertically at 400mm o.c. and not more than 50mm from abutting walls, and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .4 Erect metal studding to tolerance of 1:1000.
- .5 Attach studs to bottom and ceiling track using screws.
 - .6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
 - .7 Co-ordinate erection of studs with installation of door/ window frames and special supports or anchorage for work specified in other Sections.
 - .8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.
 - .9 Install heavy gauge single jamb studs at openings.
 - .10 Erect track at head of door/ window openings and sills of sidelight/ window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
 - .11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.
 - .12 Provide 40mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.
 - .13 Install steel studs or furring channel between studs for attaching electrical and other boxes.
 - .14 **Install sheet steel reinforcing in all locations shown on Drawings.**
 - .15 Extend **all** partitions to underside of structural deck.
 - .16 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50mm leg ceiling deflection tracks, with 75mm leg top track within. Attach studs to 75mm track.
 - .17 Install continuous insulating strips to isolate studs from uninsulated surfaces.
 - .18 Install two continuous beads of acoustical sealant under studs and tracks around perimeter of **all** partitions.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 - General Requirements.

1.2 Related Sections

- .1 Section 09 21 16 – Gypsum Board Assemblies.
- .2 Section 09 51 13 – Acoustical Panel Ceilings.
- .3 Divisions 21-25 – Mechanical: Trim for recessed mechanical fixtures.
- .4 Divisions 26-28 – Electrical: Trim for recessed light fixtures.

1.3 References

- .1 ASTM C 635-91, Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
- .2 ASTM C 636-91, Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

1.4 Design Requirements

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

PART 2 - PRODUCTS

2.1 Materials

- .1 Intermediate duty system to ASTM C 635.
- .2 Basic materials for suspension system: commercial quality cold rolled steel zinc-coated.
- .3 Suspension system: non fire rated, for acoustical ceilings, made up as follows:
 - .1 main tees:
 - .1 0.53mm thick cold rolled steel, double web, with rectangular bulb section at least 38mm high. Fabricate with punched cross tee holes at not greater than 150mm o.c. and hanger wire holes at 50mm o.c. Exposed flange shall be 23.8mm wide cold rolled steel.
 - .2 cross tees:
 - .1 double web design with rectangular bulb, web extending to form a positive interlock with main tees, lower flange extended and offset to provide a flush intersection.
 - .3 Exposed tee bar grid components: die cut, shop painted satin sheen white.
 - .4 Acceptable material: "Prelude" by Armstrong or equivalent system approved by Consultant.
- .4 Suspension system: non fire rated for gypsum board ceilings, made up as follows:
 - .1 main beams:
 - .1 0.53mm thick cold rolled steel, double web, with peaked roof top bulb at least 42.8mm high. Fabricate with punched cross tee holes at not greater than 150mm o.c. and hanger wire holes at 50mm o.c. Flange shall be 38mm wide knurled cold rolled steel.
 - .2 cross tees:
 - .1 double web design with peaked roof top bulb 38mm high, web extending to form a positive interlock with main tees. Flange shall be 38mm wide knurled cold rolled steel.
 - .3 Acceptable manufacturer: Armstrong or equivalent system approved by Consultant.
- .5 Hanger wire: galvanized soft annealed steel wire.
 - .1 3.6mm diameter to support max. weight of 110 kg/hanger.

- .2 2.6mm diameter to support max. weight of 68 kg/hanger.
- .3 galvanized annealed steel rod: 4.8mm diameter to support max. weight of 250kg/hanger.
- .6 Hanger inserts: purpose made.
- .7 Trim:
 - .1 Type 1: AXIOM Knife Edge Straight Trim: refer to drawings for height; extruded aluminum alloy 6063 Trim Channel, factory applied baked polyester paint finish to match Armstrong colour, by Armstrong, or equivalent product approved by Consultant.
- .8 Accessories: splices, clips, wire ties, retainers, and angle wall moulding.

PART 3 - EXECUTION

3.1 Installation

- .1 Installation: in accordance with ASTM C 636 except where specified otherwise.
- .2 Install suspension system to manufacturer's instructions and Certification Organizations tested design requirements.
- .3 Do not erect ceiling suspension system until work above ceiling has been inspected by Consultant.
- .4 Secure hangers to overhead structure powder actuated. Do not use fasteners that will fracture structural members.
- .5 Install hangers spaced at maximum 1200mm centres and within 150mm from ends of main tees.
- .6 Lay out centre line of ceiling both ways, to provide balanced borders at room perimeter with border units not less than 50% of standard unit width if no reflected ceiling plan is provided.
- .7 Ensure suspension system is co-ordinated with location of related components.
- .8 Install wall moulding and trim to provide correct ceiling height.
- .9 Completed suspension system to support super-imposed loads, such as lighting fixtures diffusers, grilles and speakers.
- .10 Support at light fixtures and diffusers with additional ceiling suspension hangers within 150mm of each corner and at maximum 600mm around perimeter of fixtures.
- .11 Interlock cross member to main runner to provide rigid assembly.
- .12 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.
- .13 Finished ceiling system to be square with adjoining walls and level within 1:1000.

3.2 Cleaning

- .1 Touch up scratches, abrasions, voids and other defects in painted surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 1 – General Requirements.

1.2 Related Sections

- .1 Section 03 30 00 – Cast-in-Place Concrete.
- .2 Section 09 31 00 – Ceramic Tile.
- .3 Division 25 – Heating, Ventilating, and Air Conditioning (HVAC).

1.3 References

- .1 American National Standards Institute (ANSI)
 - .1 ANSI A118.1 - latest revision, Specifications for Dry-Set Portland Cement Mortar.
 - .2 ANSI A118.6 – latest revision, Specifications for Ceramic Tile Grouts.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20 – latest revision, Surface Sealer for Floors.
 - .2 CAN/CGSB-75.1 – latest revision, Tile, Ceramic.
- .3 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A5/A8/A362 – latest revision, Portland Cement/Masonry Cement/Blended Hydraulic Cement.
- .4 Terrazzo, Tile and Marble Association of Canada (TTMAC) Tile Installation Manual 2006-2007.

1.4 Submittals

- .1 Manufacturer's Instructions: Provide to indicate special handling criteria, installation sequence and cleaning procedures.

1.5 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate 600mm x 600mm sample panels of each colour, texture, size and pattern of porcelain tile c/w transition trims, including transition to terrazzo and salvaged travertine treads.
- .3 Adhere tile samples to 11mm thick plywood and grout joints to represent project installation.

1.6 Delivery, Storage and Handling

- .1 Deliver, store, handle and protect materials in accordance with Section 01 61 00 – Product Requirements.
- .2 Deliver, store and handle products in manner to avoid damage.
- .3 Have materials delivered to job site just prior to installation.
- .4 Deliver all products to job site in manufacturer's unopened cartons with all labels intact and legible.
- .5 Keep cartons dry and protected from vandalism and away from heavy traffic areas.
- .6 Store cartons in upright position.

1.7 Environmental Requirements

- .1 Safety: Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of materials.
- .2 Temperature.
 - .1 Maintain ambient temperature of not less than 12°C from 72 hours before installation until fully cured.
 - .2 Maintain ambient temperature of not less than 5°C from 72 hours before installation until fully cured.
 - .3 Maintain ambient temperature of not less than 20°C or above 35°C from 72 hours before installation until fully cured.

1.8 Extra Materials

- .1 Provide maintenance materials of resilient tile flooring, base and adhesive in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide 2% of each colour, pattern and type flooring material required for this project for maintenance use.
- .3 Extra materials to be from same production run as installed materials.
- .4 Clearly identify each container of floor tile and each container of adhesive.
- .5 Deliver to site, upon completion of the work of this section.
- .6 Store where directed by Consultant.

PART 2 - PRODUCTS

2.1 Tiles

- .1 Porcelain tile (PT): 600mm x 600mm x 9mm thick, (refer to room finish schedule and drawings for location); matt finish. Colour as selected by Consultant.
 - .1 GLOCAL SERIES, as distributed by Centura Wall and Floor Fashions.

2.2 Mortar, Grout and Adhesive Materials

- .1 Setting compound: TEC ULTIMATE LARGE TILE 3821G, grey colour, distributed by Centura, or approved alternate.
- .2 Grouting compound: TEC POWER GROUT, colour as selected by Consultant, or approved alternate.
- .3 Latex adhesives: TEC, or approved alternate.
- .4 Control joint sealant: in accordance with materials and procedures specified in section 07 92 00.

2.3 Accessories

- .1 Divider strips: 6mm thick anodized aluminum with anodized aluminum shelf angle to correct depth to receive flooring at all locations where tile abuts another material, specifically designed and engineered by Schluter Systems Inc.
 - .1 Transitions between tile and sheet flooring: RENO-U, colour to be confirmed by consultant through sample submission.
- .2 Tile Spacers: PVC, X spacers, to provide 3mm wide joints. Use ratchet system for keeping tile flush, equal to RLS RAIMONDI Leveling System.

PART 3 - EXECUTION

3.1 Workmanship

- .1 Do tile work in accordance with Installation Manual 200, "Ceramic Tile", produced by Terrazzo Tile and Marble Association of Canada (TTMAC), except where specified otherwise.
- .2 Apply or bond coat to clean and sound surfaces.
- .3 Fit tile units around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Make cut edges smooth and even.
- .4 Maximum surface tolerance: 1:800.
- .5 Make joints between tiles uniform and 3mm wide, plumb, straight, true, even and with adjacent units and joints flush to create smooth surface.
- .6 Lay out units so perimeter tiles are minimum 1/2 size.
- .7 Sound tiles after setting and replace hollow sounding units to obtain full bond.
- .8 Provide edges and trims at all interior and exterior corners.
- .9 Construct base with base cap at walls.
- .10 Install divider strips at junction of tile flooring and dissimilar material.
- .11 Clean installed tile surfaces after installation cured.
- .12 Seal flooring with penetrating sealer to sealer manufacturer's recommendations.

3.2 Setting System

- .1 Install tile and bases on substrate in accordance with TTMAC details.

3.3 Control Joints

- .1 Provide control joints 6mm wide at 5000mm intervals each way.
- .2 Provide control joints around perimeter of large areas, around columns, in locations where area changes direction and where tile abuts other hard material. Place control joints directly over subfloor expansion/control joints.
- .3 Provide control joints for all exterior areas at 3600mm intervals each way where indicated. Minimum width of control joints 10mm.
- .4 Fill joints with sealant.

3.4 Protection of Finished Work

- .1 Protect new floors from time of final set of adhesive until final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 - General Requirements.

1.2 Related Sections

- .1 Section 09 21 16 – Gypsum Board Assemblies.
- .2 Section 09 22 27 – Acoustical Suspension: Suspension system.
- .3 Divisions 21-25 - Mechanical.
- .4 Divisions 26-28 - Electrical.

1.3 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate full size samples of acoustical units.

1.4 Environmental Requirements

- .1 Permit wet work to dry before commencement of installation.
- .2 Maintain uniform minimum temperature of 15°C and humidity of 20-40% before and during installation.
- .3 Store materials in work area 48 hours prior to installation.

PART 2 - PRODUCTS

2.1 Materials

- .1 Acoustic Units for suspended ceiling system:
 - .1 ACT; Symphony *m* High NRC, white, square edge, 610 x 610 x 19mm tiles, by CertainTeed.

PART 3 - EXECUTION

3.1 Examination

- .1 Do not install acoustical panels and tiles until work above ceiling has been inspected by Consultant.

3.2 Installation

- .1 Install acoustical panels in ceiling suspension system.

3.3 Application

- .1 Install acoustical units parallel to building lines with edge unit not less than 50% of unit width. Refer to Reflected Ceiling Plans.
- .2 Remove damaged and badly marked units and replace with new unmarked material.
- .3 Install components to form a level ceiling with all parts flush and true, parallel to the module lines and the pattern shown. Install panels in level, uniform plane free from twist, warp, dents and flush, without gaps. Fit border units neatly against abutting surfaces.
- .4 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.
- .5 Install retention clips at each panel as indicated in Room finish Schedule. Adapt installation to provide ceiling access where required for services.

3.4 Interface with Other Work

- .1 Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.

3.5 Cleaning

- .1 After installation, clean and touch up minor surface defects on acoustical tile.
- .2 Remove damaged and badly marked units and replace with new unmarked material.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 - General Requirements.

1.2 Related Sections

- .1 Divisions 22-23 and 26-28: Floor access covers.

1.3 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM F 1066- 95a, Specification for Vinyl Composition Floor tile.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20- 95, Surface Sealer for Floors.

1.4 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate tile in size specified, 300mm long base, nosing, treads, edge strips.

1.5 Closeout Submittals

- .1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.6 Environmental Requirements

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hours before, during and for 48 hours after installation.

PART 2 - PRODUCTS

2.1 Materials

- .1 Resilient Sheet Flooring (RSF): to ASTM F 1913, 2000mm wide x 25000mm long roll, 2mm thickness homogenous sheet vinyl flooring, in standard colour selected by Consultant. Note, two colours will be selected as represented by the RSF-1 and RSF-2 designations on the Room Finish Schedule.
 - .1 Basis of Design:
 - .1 RSF-1: Mipolam Affinity Grey Opal 4429 as manufactured by Gerflor
 - .2 RSF-2: Mipolam Affinity Matte Grey 4409 as manufactured by Gerflor
 - .2 Luxury Vinyl Plank (LVP): ASTM F1700, Class III, Type B, 3.0mm thick x 1500mm wide x 915mm long, with PUR surface treatment and 30 or 32 mil wear layer in standard colour selected by Consultant.
 - .1 Tarkey Contour Series Series Abstract Techtonic
 - .1 LVP-1: C113 Moonlight.
 - .2 LVP-2: C121 Flannel.
 - .3 LVP-3: C100 Urchin.
 - .3 Resilient Athletic Floor (RAF)
 - .1 Prefabricated rubber athletic floor tiles, calendared and vulcanized with natural and synthetic rubbers, stabilizing agents and pigmentation, 610mm x 610mm x 10mm thick, hammered texture.
 - .2 Colours: As selected by the Consultant from the manufacturer's full colour range.

- .3 Acceptable product and manufacturer: 'Ramflex Rubber Tiles' by Mondo; Tuflex Spartus by Roppe, Replay by Johnsonite, or approved alternative.
- .4 Resilient base (RB-1): to ASTM F 1861, toeless rubber, minimum 2440mm length and 114mm high x 9.525mm thick, with mitered corners, of standard colour selected by Consultant.
 - .1 Acceptable Material: Millwork by Tarkett or Approved alternate.
 - .2 Profile: Mandalay MW-XX-H
 - .3 Acceptable alternate: Roppe Contours Vertical #65 PV4065
- .5 Resilient base (RB-2): to ASTM F 1861, rubber, minimum 2440mm length and 100mm high x 3.175mm thick, of standard colour selected by Consultant.
 - .1 Acceptable Material: Baseworks by Tarkett.
 - .2 Profile: 4" with toe to match existing.
 - .3 Acceptable alternate: Roppe Pinnacle Wall Base or Approved alternate.
- .5 Primers and adhesives: waterproof, recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade.
- .6 Sub-floor filler and leveller: white premix latex requiring water only to produce cementitious paste as recommended by flooring manufacturer for use with their product.
- .7 Metal edge strips: aluminum extruded, smooth, polished with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
- .8 Reducer strips: wheelchair accessible rubber reducer strips by Johnsonite. Colour to be selected.
- .9 Sealer: type as recommended by flooring manufacturer.
- .10 Wax: type as recommended by flooring manufacturer.

PART 3 - EXECUTION

3.1 Inspection

- .1 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer.

3.2 Sub-floor Treatment

- .1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.
- .2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.
- .3 Prime concrete to flooring manufacturer's printed instructions.

3.3 Application: Sheet

- .1 Provide a high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours 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.
- .2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .3 Lay flooring to produce a minimum number of seams. Border widths to be minimum 1/3 width of full material.
- .4 Run sheets in direction of traffic. Double cut sheet joints and heat weld joints according to manufacturer's written instructions.
- .5 As installation progresses, and after installation roll flooring with 45kg minimum roller to ensure full adhesion.
- .6 Cut flooring neatly around fixed objects.
- .7 Install flooring in pan type floor access covers. Maintain floor pattern.
- .8 Continue flooring over areas which will be under built-in furniture.

- .9 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .10 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.4 Application: Planks

- .1 Provide a high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours 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.
- .2 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturer's instructions. Do not spread more adhesive than can be covered by flooring before initial set takes place.
- .3 Lay flooring with joints parallel to building lines to produce symmetrical plank pattern. Border planks minimum half tile width.
- .4 Confirm flooring patterns, joints and layout with consultant prior to install.
- .5 Cut tile and fit neatly around fixed objects.
- .6 Install flooring in pan type floor access covers. Maintain floor pattern.
- .7 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.
- .8 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.5 Base

Application

- .1 Lay out base to keep number of joints at minimum. Base joints at maximum length available or at internal corners.
- .2 Clean substrate and prime with one coat of adhesive.
- .3 Apply adhesive to back of base.
- .4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.
- .5 Install straight and level to variation of 1:1000.
- .6 Scribe and fit to door frames and other obstructions.
- .7 Mitre all corners base type RB-1.

3.6 Initial Cleaning

- .1 Remove excess adhesive from floor, base and wall surfaces with products and procedures recommended by manufacturer, without damage.
- .2 Clean floor and base surface to flooring manufacturer's instructions.

3.7 Protection of Finished Work

- .1 Protect new floors from time of final set of adhesive to after initial waxing until final waxing to final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

PART 1 - GENERAL

1.1 Description of Work

1. Work Included: Provide labor, materials and equipment necessary to complete the work of this Section including the following.
 - .1 Walls: Panels.
 - .2 Accessories: Mounting Hardware as applicable to the project.

1.2 Submittals

1. Product Data: Submit for each product indicating materials, dimensions, profiles, textures and colors. Include installation instructions.
2. Shop Drawings: Submit shop drawings indicating plans, elevations, details of construction, and relationship with adjacent construction.
3. Verification Samples: Submit representative sample of specified products.

1.3 Quality Assurance

1. Manufacturer: 1 Year Warranty

1.4 Delivery, Storage and Handling

1. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
2. Storage and Handling: Comply with manufacturer's recommendations for storage and handling. Protect from weather damage.

1.5 Warranty

1. Warranty: Provide manufacturer's standard limited warranty against defects in manufacturing.

PART 2 - PRODUCTS

2.1 Materials

.1 Acoustic Panels (AP)

1. Basis of Design: ezoBord by Arysonics Inc., 825 Trillium Drive, Kitchener ON N2R 1J9, Contact: Darrin Snider, 226-220-7772, darrins@mcintyregroup.com.
2. Wall Product: Panels.
 1. Description: Acoustical panels.
 2. Thickness: 9mm, refer to Drawings for details.
 3. Edges: Straight.
 4. Surface: Plain.
 5. Color:
 1. AP.1: EzoCarve; Custom Etch Pattern; Exofelt on backer (colour to be selected by Consultant from standard range).
 2. AP.2: EzoCarve; Custom Etch Pattern; Exofelt on backer (colour to be selected by Consultant from standard range).
 3. AP.3: EzoCarve; Custom Etch Pattern; Exofelt on backer (colour to be selected by Consultant from standard range).
3. Product Properties:
 - .1 Composition: 100% polyester with +/- 50 percent recycled PET fibre.

- .2 Stiffness: 70 Shore Durometer.
 - .3 Surface: Tackable, impact-resistant, bacteria-resistant, moisture-resistant.
 - .4 VOCs and Formaldehyde: None.
 - .5 Fire Testing: ASTM E 84 Class A / CAN ULC S102.
 - .6 Sound Absorption: Averages NRC 0.40 (no air gap), 1.0 NRC in high frequencies.
- 4. Accessories: Mounting Hardware as applicable to the project.
 - 5. Acceptable Alternatives: as accepted by Consultant to match specified products.

PART 3 - EXECUTION

3.1 Examination

- 1. Examine existing conditions to determine that they are suitable for installation. Proceed with installation only when unsatisfactory conditions have been corrected.

3.2 Installation

- 1. Clean substrates of projections and substances detrimental to application.
- 2. Install units in accordance with manufacturer's instructions, approved submittals, and in proper relationship to adjacent construction.

3.3 Adjusting and Cleaning

- 1. Adjust units for proper position, uniform appearance and operation.
- 2. Clean exposed and semi-exposed surfaces using materials acceptable to manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 – General Requirements.

1.2 Related Sections

- .1 Section 00 41 00 – Bid Form – Separate Prices.
- .2 Section 05 10 00 – Structural Steel.
- .3 Section 05 50 00 – Metal Fabrications.
- .4 Section 06 40 23 – Interior Architectural Woodwork.
- .5 Section 08 11 13 – Steel Door Frames.
- .6 Section 09 21 16 – Gypsum Board Assemblies.
- .7 Divisions 21 - 28: Mechanical and Electrical.

1.3 References

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM D 3960- 93, Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.36- 97, General Purpose Interior Varnish.
 - .2 CAN/CGSB-1.38- M91, Interior Enamel Undercoater.
 - .3 CAN/CGSB-1.100- 95, Interior Latex Type, Flat Paint.
 - .4 CAN/CGSB-1.119- 95, Primer-Sealer, Wall, Interior Latex Type.
 - .5 CAN/CGSB-1.145- 97, Solvent-Based Pigmented Stain.
 - .6 CAN/CGSB-1.146- 92, Cold Curing, Gloss Epoxy Coating.
 - .7 CAN/CGSB-1.150- M91, Clear Lacquer for Wood Furniture.
 - .8 CAN/CGSB-1.165- M89, Cold Curing Epoxy Primer.
 - .9 CAN/CGSB-1.188- 96, Emulsion Type Filler Masonry Block.
 - .10 CAN/CGSB-1.195- 95, Interior Semigloss Latex Paint.
 - .11 CAN/CGSB-1.198- 95, Cementitious Primer (for Galvanized Surfaces).
 - .12 CAN/CGSB-1.209- 93, Low Sheen Latex Interior Paint.
 - .13 CGSB 85-GP-10M- 79, Shop Painting Structural Steel.
 - .14 CGSB 85-GP-11M- 80, Painting Steel for Protection Against Continuous Wetting.
 - .15 CGSB 85-GP-16M- 79, Painting Galvanized Steel.
 - .16 CGSB 85-GP-18M- 80, Painting, Maintenance, Exterior, Steel, for Protection Against Continuous Wetting.
 - .17 CGSB 85-GP-32M- 79, Painting Concrete Floors.
 - .18 CGSB 85-GP-33M- 79, Painting Interior Plaster and Wallboard.
 - .19 CAN/CGSB-85.100- 93, Painting.
- .3 Master Painters Institute (MPI).
 - .1 Architectural Painting Specification Manual 2012.
- .4 Canadian Standards Association (CSA)
 - .1 CSA Z760- 94, Life Cycle Assessment.
- .5 Society for protective Coatings (SSPC).
 - .1 SSPC Painting Manual.

1.4 Description

- .1 Read carefully all other Sections of the Specifications to determine the extent of prime and finish coats applied by other Sections.
- .2 See Mechanical Divisions 22-25 and Electrical Division 26 for instructions on painting work to be done by Section 09 91 00 on surface provided by those Divisions.
- .3 Gloss range: paint and varnish textures are specified by their gloss type, which is defined by the dried film sheen factor. Refer to:

- .1 MPI Painting Specification Manual - GLOSSARY OF TERMS to determine Sheen Factor for various gloss types.
- .2 Locations A: Vest. / Corridors/ Stairs/ Washrooms/ Custodial/ Storage Areas
 - (1) block - MPI Gloss Level 7 (high gloss)
 - (2) gypsum board - MPI Gloss Level 3 (eggshell)
 - (3) doors/ frames - MPI Gloss Level 5 (semi gloss)
 - (4) wood - MPI Gloss level 5 (semi-gloss)
- .3 Locations B: Remaining Areas
 - (1) block - MPI Gloss Level 5 (semi-gloss)
 - (2) gypsum board - MPI Gloss Level 3 (eggshell)
 - (3) doors/ frames - MPI Gloss Level 5 (semi-gloss)
 - (4) wood - MPI Gloss level 5 (semi-gloss)

1.5 Product Data

- .1 Submit product data in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit full records of all products used. List each product in relation to finish formula and include the following:
 - .1 Finish formula designation.
 - .2 Product type and use.
 - .3 CGSB number.
 - .4 Manufacturer's product number.
 - .5 Colour numbers.
 - .6 Manufacturer's Material Safety Data Sheets (MSDS).
 - .7 Maximum VOC classification.
- .3 Submit manufacturer's application instructions for each product specified.

1.6 Samples

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate 300mm x 200mm sample panels of each paint, stain, clear coating, formula, type, colour, and texture specified.
- .3 Submit full range of available colours where colour availability is restricted.
- .4 Use 3mm plate steel for finishes over metal surfaces. Use 12.5mm maple plywood for finishes over wood surfaces. Use 12.5mm gypsum board for finishes over gypsum board and other smooth surfaces.

1.7 Quality Assurance

- .1 Retain purchase orders, invoices and other documents to prove that all materials utilized in this contract meet requirements of the specifications. Produce documents when requested by Consultant.
- .2 Standard of Acceptance:
 - .1 Walls: No defects visible from a distance of 1000mm at 90° to surface.
 - .2 Ceilings: No defects visible from floor at 45° to surface when viewed using final lighting source.
 - .3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

1.8 Delivery, Storage and Handling

- .1 Deliver, store, handle and protect materials in accordance with Section 01 60 00 – Product Requirements.
- .2 Deliver and store materials in original containers, sealed, with labels intact.
- .3 Indicate on containers or wrappings:
 - .1 Manufacturer's name and address.
 - .2 Type of paint.

- .3 Compliance with applicable standard.
- .4 Colour number in accordance with established colour schedule.
- .4 Remove damaged, opened and rejected materials from site.
- .5 Provide and maintain dry, temperature controlled, secure storage.
- .6 Observe manufacturer's recommendations for storage and handling.
- .7 Store materials and supplies away from heat generating devices.
- .8 Store materials and equipment in a well-ventilated area with temperature range 7 - 30°C.
- .9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of Consultant. After completion of operations, return areas to clean condition to approval of Consultant.
- .11 Remove only in quantities required for same day use.
- .12 Fire Safety Requirements:
 - .1 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.9 Environmental Requirements

- .1 Safety: comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .2 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
- .3 Substrate and ambient temperature must be within limits prescribed in paint standard and by manufacturer to approval of Consultant.
- .4 Maintain minimum substrate and ambient air temperature of 7°C for latex paints. Maximum relative humidity 85%. Maintain supplemental heating until paint has cured sufficiently.
- .5 Provide temporary heating where permanent facilities are not available to maintain minimum recommended temperatures.
- .6 Apply paint finish only in areas where dust is no longer being generated by related construction operations such that airborne particles will not affect the quality of the finished surface.
- .7 Apply paint only when surface to be painted is dry, properly cured and adequately prepared.
- .8 Provide minimum 270 lx on surfaces to be painted.

PART 2 - PRODUCTS

2.1 Paint Materials

- .1 Qualified products: only paint materials listed on the MPI Qualified Products List are acceptable for use on this project. DULUX LIFEMASTER/ DULUX DIAMOND products only.
- .2 Qualified products: only varnish, stain, enamel, lacquer and filler materials listed on the MPI Approved Product Lists are acceptable for use on this project producing a flame spread rating of less 150.
- .3 Paint materials for each coating formula to be products of a single manufacturer.
- .4 Low odour products: Whenever possible, select products exhibiting low odour characteristics.

2.2 Paint Colours

- .1 Colours will be selected by Consultant. Note: There will be up to 6 different colours used.
- .2 Perform **all** colour tinting operations prior to delivery of paint to site.
- .3 Second coat in a three-coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 Paint Finishes - INTERIOR

- .1 Gypsum Drywall – walls below 2400mm above finish floor – INT 9.2B Latex, Interior, High Performance Architectural, MPI Gloss Level 3 (eggshell)
 - .1 One coat MPI #50; Interior, Latex.
 - .2 Two coats MPI #153; Interior, Acrylic.
- .4 Gypsum Drywall – bulkheads/ ceilings – INT 9.2M Latex, Interior, Institutional, Low Odour/ VOC, MPI Gloss Level 1 (flat)
 - .1 One coat MPI #149; Interior, Latex.
 - .2 Two coats MPI #143; Interior, Acrylic.
- .5 Metal (Ferrous) – INT5.1B – Light Industrial Coating, Interior, Water Based, MPI Gloss Level 5 (semi-gloss)
 - .1 One coat MPI #79; approved Devoe Devflex 4020 DTM
 - .2 Two coats MPI #153; approved – Interior, Acrylic.
- .6 Wood – exposed and concealed surfaces, clear finish (CF) INT 6.3K – Varnish, Water Based, MPI Gloss Level 7 (gloss)
 - .1 Three coats MPI #56; approved Water-Based Polyurethane Clear Varnish.
- .7 Exposed Insulated Pipes and Ductwork – INT 10.1A – Latex, Interior, Institutional, Low Odour/ VOC, MPI Gloss Level 1 (flat)
 - .1 One coat MPI #149; Interior, Latex.
 - .2 Two coats MPI # 143; Interior Acrylic.
- .8 Interior Copper and Aluminum (Mill Finish) – INT 5.4M - Latex, Interior, High Performance Architectural, MPI Gloss Level 5 (semi-gloss)
 - .1 One coat MPI #95; approved Devoe Devguard #4630, Low VOC
 - .2 Two coats MPI #153; approved DULUX Diamond, Interior.
- .9 High Temperature Pipe and Fittings – INT 5.2 - Heat Resistant Enamel, 205°C (400°F)
 - .1 Two coats MPI #21; approved Devoe HT-4H High Temperature Silicone Acrylic

PART 3 - EXECUTION

3.1 General

- .1 Perform all painting operations in accordance with CAN/CGSB-85.100 except where specified otherwise.
- .2 Perform all painting operations in accordance with MPI Painting Specifications Manual except where specified otherwise.
- .3 Apply all paint materials in accordance with paint manufacturer's written application instructions.

3.2 Preparation

- .1 Remove electrical cover plates, light fixtures, surface hardware on doors, door stops, bath accessories and all other surface mounted fittings and fastenings prior to undertaking any painting operations. Store for re-installation after painting is completed.
- .2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

- .3 As painting operations progress, place "WET PAINT" signs in occupied areas to approval of Consultant.

3.3 Protection

- .1 Protect existing building surfaces not to be painted from paint spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by Consultant.
- .2 Cover or mask floors, windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.
- .3 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .4 Protect factory finished products and equipment.
- .5 Protect passing pedestrians, building occupants and the general public in and about the building.

3.4 Conditions of Work

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report all damage, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Investigate moisture content of surfaces to be painted and report findings. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Plaster and wallboard: 12%.
 - .2 Masonry/Concrete: 12%.
 - .3 Concrete Block/Brick: 12%.
 - .4 Wood: 15%.

3.5 Cleaning

- .1 Clean all surfaces to be painted as follows:
 - .1 Remove all dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with solution of T.S.P. and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
 - .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 To prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.
- .2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.
- .3 Sand existing surfaces with intact, smooth, high gloss coatings to provide adequate adhesion for new finishes.

3.6 Surface Preparation

- .1 Prepare new wood surfaces to CGSB 85-GP-1M.
- .2 Where possible, prime all surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
- .3 Prepare previously painted wood surfaces to CGSB 85-GP-2M.

- .1 Apply vinyl sealer to CAN/CGSB-1.126 over knots, pitch, sap and resinous areas.
- .2 Apply wood filler to nail holes and cracks.
- .3 Tint filler to match stains for stained woodwork.
- .4 Prepare stucco, brick, concrete masonry and concrete surfaces to CGSB 85-GP-31M.
- .5 Prepare concrete floors to CGSB 85-GP-32M. Prepare new concrete floor by acid etching. Rinse with clean water and thoroughly dry.
- .6 Prepare plaster and wallboard surfaces to CGSB 85-GP-33M.

3.7 Surface Preparation - Metal

- .1 Clean new metal surfaces to be painted by: removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with the following:
 - .1 Solvent cleaning: SSPC-SP-1.
 - .2 Hand tool cleaning: SSPC-SP-2.
 - .3 Power tool cleaning: SSPC-SP-3.
 - .4 Commercial blast cleaning: SSPC-SP-6.
 - .5 Brush-off blast cleaning: SSPC-SP-7.
- .2 Touch up shop primer to CGSB 85-GP-10M with primer as specified in applicable section. Touch-up to include cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas.
- .3 Prepare galvanized steel and zinc coated steel surfaces to CGSB 85-GP-16M.
- .4 Prepare copper and copper alloys surfaces to CGSB 85-GP-20M.
- .5 Prepare new steel surfaces exposed normally to dry conditions to CGSB 85-GP-14M.
- .6 Prepare previously painted steel surfaces exposed normally to dry conditions to CGSB 85-GP-15M.
- .7 Prepare steel surfaces exposed to industrial environments to CGSB 85-GP-13M.
- .8 Prepare steel surfaces exposed to water or high humidity levels to CGSB 85-GP-11M CGSB 85-GP-18M.
- .9 Ductwork:
Wash thoroughly all ductwork to be exposed and painted in completed work with mineral spirits and wipe dry with completely clean cloths. Phosphatize galvanized metal surfaces using CGSB-31-GP-116 pretreatment or prime with galvanized metal primer.
- .10 Do not apply paint until prepared surfaces have been accepted by Consultant.

3.8 Mixing Paint

- .1 Mix ingredients in container before and during use and ensure breaking up of lumps, complete dispersion of settled pigment, and uniform composition.
- .2 Thin paint for spraying according to manufacturer's instructions. If directions are not on container, obtain instructions in writing from manufacturer and provide copy of instructions to Consultant.
- .3 Do not use kerosene or any such organic solvents to thin water-based paints.

3.9 Application

- .1 Method of application to be as approved by Consultant. Apply paint by brushroller except where spraying is necessary to achieve acceptable finish. Conform to paint manufacturer's application instructions unless specified otherwise.
- .2 Brush/ roller application.
 - .1 Work paint into cracks, crevices and corners. Paint surfaces not accessible to brushes by spray, daubers or sheepskins.
 - .2 Brush out runs and sags.
 - .3 Remove runs, sags and brush marks from finished work and repaint.
- .3 Spray application.
 - .1 Provide 6mil poly dust curtains around rooms being sprayed to prevent transfer of paint and odour to other rooms.
 - .2 Provide and maintain equipment that is suitable for intended

- purpose, capable of properly atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.
- .3 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
- .4 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
- .5 Brush out immediately all runs and sags.
- .6 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Consultant.
- .5 Apply each coat of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .7 Sand and dust between each coat to remove visible defects.
- .8 Finish tops of cupboards, cabinets and projecting ledges, both above and below sight lines as specified for surrounding surfaces.
- .9 Finish inside of cupboards and cabinets as specified for outside surfaces.
- .10 Finish closets and alcoves as specified for adjoining rooms.
- .11 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.
- .12 Apply final coat of paint after inspection and correction of deficiencies and installation of flooring have been completed.

3.10 Mechanical and Electrical Equipment

- .1 In finished areas: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment. Colour and texture to match adjacent surfaces, except as noted otherwise.
- .2 In boiler room, mechanical and electrical rooms: paint exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment.
- .3 In other unfinished areas: leave exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment in original finish and touch up scratches and marks.
- .4 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.
- .5 Do not paint over nameplates.
- .6 Keep sprinkler heads free of paint.
- .7 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.
- .8 Paint disconnect switches for fire alarm system and exit light systems in red enamel.
- .9 Paint all fire protection piping red, unless directed otherwise.
- .10 Paint all-natural gas piping yellow, unless directed otherwise.
- .11 Paint both sides and edges of backboards for telephone and electrical equipment before installation. Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.11 Field Quality Control

- .1 Field inspection of painting operations to be carried out by independent inspection firm as designated by Consultant.
- .2 Advise Consultant when each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Co-operate with inspection firm and provide access to all areas of the work.

3.12 Restoration

- .1 Clean and re-install all hardware items that were removed before undertaken painting operations.

- .2 Remove protective coverings and warning signs as soon as practical after operations cease.
- .3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.
- .4 Protect freshly completed surfaces from paint droppings and dust to approval of Consultant. Avoid scuffing newly applied paint.
- .5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition as approved by Consultant.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Confirm to Division 01 – General Requirements.

1.2 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00.
- .2 Indicate location, type, size, panel arrangement, backing, hardware, anchor or mounting details, frame or trim and accessories.

1.3 Maintenance Data

- .1 Provide maintenance data for chalkboards for incorporation into Operating and Maintenance manual specified in Section 01 33 00.

PART 2 - PRODUCTS

2.1 Basic Materials

- .1 Galvanized steel sheet: Commercial grade to ASTM A526-80, with Z275 designation zinc coating.
- .2 Laminating adhesive: To manufacturer's standard.
- .3 Joint reinforcements: Concealed mechanical jointing system to provide straight, rigid, continuously supported, tight butt, flush joints at surface.
- .4 Mounting adhesive: Panel adhesive to manufacturer's standard.
- .5 Anchor clips, brackets and fasteners: concealed type recommended by manufacturer for fixed mounting.

2.2 White Boards (WB)

- .1 Facing: to comply with Porcelain Enamel Institute Standards PEI S104 regards durability, smoothness of texture, colour continuity, gloss factor of 6-8 as measured by 45° glossometer, minimum 0.076mm (.003") porcelain enamel coating fused to 0.76mm (0.03"/22 gauge) steel base sheet.
- .2 Writing surfaces:
 - .1 Whiteboards; colour white.
 - .2 Surface to act as a projection screen.
- .3 Core: fibreboard to CSA A247-M1978, 11mm (0.44") thick, impregnated.
- .4 Back sheet: 0.46mm (26 gauge) stretcher-leveled zinc coated steel.

2.3 Fabrication

- .1 Fabricate board panels to sizes indicated.
- .2 Factory laminate boards to provide 12.7mm (0.5") total thickness.
- .3 Make finished panels flat and rigid and fit with joint reinforcement.
- .4 Fit joints between abutting board panels with joint reinforcement except where covering trim is required.

2.4 Trim and Framing

- .1 Trim and framing to be ASI Visual Display Products Elite Reveal, Global School Products Type 200 Reveal, or Martack Specialties Slim Square, and as per the following specifications.
- .2 Extruded aluminum: Aluminum Association alloy AA6063-T5. Minimum 1.5mm (0.06") thickness; clear anodized finish.
- .3 Tray: ASP 18" Magnetic Tray. Provide one for each white board.

2.5 Glass Marker Boards (GMB)

- .1 Fabricated of low iron 6mm tempered with white back-painted glass with steel backing for use with magnets.
- .2 Edge Treatment: Smooth polished edge with eased corners.
- .3 Surface: Glossy
- .4 Attachment System: Adhesive backed Z Clips
 - .1 Material: 6063-T6 Aluminum
 - .2 Maximum Projection: 7.5mm
 - .3 Adhesive: Pre-applied strips of 3M VHB Tape for peel-and-stick application.
 - .4 Basis-of-Design: MFTAPE by Monarch Metal or approved equivalent.
- .5 Approved Products: Glasswrite™ by Egan, Wall2Wall™ by Clarus or approved equivalent.

PART 3 – EXECUTION

3.1 Installation

- .1 Install white boards in accordance with manufacturer's instructions, to provide rigid secure surface.
- .2 Exact mounting height to be determined on site by Owner.
- .3 Install trim and framing around board panels.
- .4 Make mitres and intersecting joints to hair-line fit, free of rough edges.
- .5 Use concealed brackets to reinforce and hold joints tight and flush.
- .6 No exposed fasteners permitted.
- .7 Overlap trim 6mm (0.25") minimum into panels.
- .8 Mechanical attachment:
 - .1 to concrete or solid masonry use lag screw and expansion bolts or screws and fibre plugs as appropriate for stresses involved
 - .2 to hollow masonry use toggle bolts or equivalent
 - .3 to wood or sheet metal use screws
 - .4 to framing members in stud walls

3.2 Cleaning

- .1 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 01 – General Requirements.

1.2 Related Sections

- .1 Section 05 12 23 – Structural Steel: Structural steel framing and supports.
- .2 Section 09 21 16 – Gypsum Board Assemblies.
- .3 Section 09 91 10 – Painting.
- .4 Division 26 – Electrical.

1.3 References

- .1 ASTM E90 – 09(2016), Test Method for Laboratory Measurement of Airborne-Sound Transmission Loss of Building Partitions.
- .2 ASTM E336 – 16, Method for Measurement of Airborne Sound Insulation in Buildings.
- .3 CSA O115-M1982 (R2001), Hardwood and Decorative Plywood.

1.4 Design Requirements

- .1 Design and fabricate folding partitions with minimum STC of 50 tested to ASTM E90.
- .2 Panel finish to have maximum flame spread rating of 150.

1.5 Shop Drawings

- .1 Submit shop drawings in accordance with Section 01 33 00 Submittal Requirements.
- .2 Indicate installation requirements including dimensions, head and jamb conditions, track layout, stacking arrangement, switching, hardware, finish and colour, operating mechanism, and location.

1.6 Samples

- .1 Submit samples in accordance with Section 01 33 00 Submittal Requirements.
- .2 Submit duplicate 300mm x 300mm samples of partition finish.

1.7 Test Data

- .1 Submit test data indicating compliance with design criteria regarding sound transmission and fire hazard classification.

1.8 Closeout Submittals

- .1 Provide operation and maintenance data for folding partitions, hardware for incorporation into manual specified in Section 01 78 00 – Closeout Submittals.

1.9 Warranty

- .1 Provide a written warranty, signed and issued in the name of the Client and Project, stating that the Contractor, Sub-contractor and/or manufacturer jointly and severally warrant the complete folding wall system against defects and malfunction under normal usage in accordance with GC 12.3 as amended by the Supplementary General Conditions, but for eight years.

PART 2 - PRODUCTS

2.1 Materials

- .1 Folding Partition (between SKILLS LAB: SEMINAR A & SKILLS LAB: SEMINAR B):
 - .1 Basis of Design: Acousti-seal Legacy by Modernfold: Manually operated paired panels operable partition, top supported with operable floor seals. Unidirectional panels to operate as a single unit. Refer to Drawings for Details.
 - .1 Approved Alternate: equivalent by Modernco Inc., Hufcor Inc., Creatif Wall Systems, or Corflex.
 - .2 Panel core: Nominal 108mm thick panels in widths to suit configuration. Widths to be maximized to limit joints. All panel horizontal and vertical framing members fabricated from minimum 16-gage formed steel with overlapped and welded corners for rigidity. Top channel is reinforced to support suspension system components. Frame is designed so that full vertical edges of panels are of formed steel and provide concealed protection of the edges of the panel skin.
 - .3 Panel skin: Roll-formed steel wrapping around panel edge. Panel skins shall be lock formed and welded directly to the frame for unitized construction. Acoustical ratings of panels with this construction minimum: 52 STC.
 - .4 Panel Trim: No vertical or horizontal trim required or allowed on edges of panels; minimal groove appearance at panel joints.
 - .5 Panel finish:
 - .1 Full height steel markerboard work surface; colour: white.
 - .2 Panel trim: Exposed panel trim of one consistent colour, as selected by Consultant. Trim is not acceptable on vertical edges to provide uninterrupted work surface.
 - .6 Panel joints to be continuously hinged. Concealed laminated hinge with antifriction segments mounted between each heat-treated link. Hinge to be attached directly to panel frame. Welded internal hinge bracket shall support the hinge and allow for adjustment of hinge panels. Lifetime warranty on hinges. Concealed hinges mount into panel edge or vertical astragal are not acceptable.
 - .7 Egress: Single Pass Door
 - .1 Matching pass door same thickness and appearance as panels. ADA compliant pass door to be trimless and equipped with friction latch and flush pulls for panic operation. No threshold will be permitted.
 - .2 Hardware
 - .1 Hand pull with push plate.
 - .2 Level handles both sides of door.
 - .3 Aluminum window frame, glazed with 6mm low iron tempered glass.

2.2 Components

- .1 Overhead suspension system.
 - .1 #17 Suspension System - "Smart Track™":
 - .1 Suspension Tracks: Minimum 11-gauge, 3.04mm roll-formed steel track, by adjustable steel hanger brackets, supporting the load-bearing surface of the track, connected to existing structural steel beams by pairs of 10mm diameter threaded rods. Aluminum track is not acceptable.
 - .2 Exposed track soffit: Steel, integral to track, and pre-painted off-white.
 - .3 Carriers: Two all-steel trolleys with steel tired ball bearing wheels. Non-steel tires are not acceptable. Suspension system shall provide automatic

indexing of panels into stack area using preprogrammed switches and trolleys without electrical, pneumatic, or mechanical activation.

- .2 Sound seals.
 - .1 Vertical Interlocking Sound Seals between panels: Aluminum astragals, with tongue and groove configuration in each panel edge. Rigid plastic astragals are not acceptable.
 - .2 Horizontal Top Seals shall be automatic operable top seals, manually operated top seals not required or permitted.
 - .3 Horizontal bottom floor seals shall be manually activated seals providing nominal 51mm operating clearance with an operating range of 13mm to -38mm. Seal shall be operable from panel edge or face. Extended seal shall exert nominal 265 kg downward force to the floor throughout operating range.

2.3 Accessories

- .1 Edge cap on end panel to provide continuous acoustic seal against interior partition when in closed position.

PART 3 - EXECUTION

3.1 Installation

- .1 General: Comply with ASTM E557, operable partition manufacturer's written installation instructions, Drawings and approved Shop Drawings.
- .2 Install operable partitions and accessories after other finishing operations, including painting have been completed.
- .3 Match operable partitions by installing panels from marked packages in numbered sequence indicated on Shop Drawings.
- .4 Broken, cracked, chipped, deformed or unmatched panels are not acceptable.

3.2 Cleaning and Protection

- .1 Clean partition surfaces upon completing installation of operable partitions to remove dust, dirt, adhesives, and other foreign materials according to manufacturer's written instructions.
- .2 Provide final protection and maintain conditions in a manner acceptable to the manufacturer and Installer that ensure operable partitions are without damage or deterioration at time of Substantial Completion.

3.3 Adjusting

- .1 Adjust operable partitions to operate smoothly, easily, and quietly, free from binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Lubricate hardware and other moving parts.

3.4 Examination

- .1 Examine flooring, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable partitions. Proceed with installation only after unsatisfactory conditions have been corrected.

3.5 Demonstration

- .1 Demonstrate proper operation and maintenance procedures to Owner's representative.
- .2 Provide Operation and Maintenance Manual to Owner's representative.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 1 - General Requirements.
 - .1 Note: product requirements of 01 61 00 are applicable to this section.

1.2 Related Sections

- .1 Conform to Division 1 - General Requirements
- .2 Section 06 10 00- Rough Carpentry.

1.4 Shop Drawings

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate, by large scale details, all materials, finishes, dimensions, anchorage and assembly.

1.5 Samples

- .1 Submit samples in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit duplicate 300 mm long samples of profiles for corner guards.
- .3 Submit duplicate 300mm x 300mm samples of wall protection.

PART 2 - PRODUCTS

2.1 Materials

- .1 Surface Mounted Vinyl Corner Guards (CG-1): 50mm x 50mm from top of base height to underside of ceiling. Surface mounted installation. Colour as selected by Consultant.
 - .1 Subject to conformance with the requirements of this Section provide Model No 'SM-20' manufactured by Construction Specialties or approved alternate by one of the following manufacturer's:
 - .1 InPro Corporation.
 - .2 Koroseal Wall Protection Systems.
 - .3 Pawling Corporation.
- .2 Wall Panels: Rigid high-impact protective wallcovering.
 - .1 Fire Rating: Class A
 - .2 Thickness: 9.52mm particle board core laminated with 1.02mm Acrovyn 4000
 - .3 Edge: Wrapped Square Edge
 - .4 Mounting: Demountable Sure Snap System hardware & spacers to suit.
 - .5 Colour: To be selected by Consultant
 - .6 Texture: Cashmere
 - .7 Subject to conformance with requirements of this Section provide Protective Wallcovering by Construction Specialties or approved alternate by one of the follow manufacturer's:
 - .1 InPro Corporation.
 - .2 Koroseal Wall Protection Systems.
 - .3 Pawling Corporation.

PART 3 - EXECUTION

3.1 Installation

- .1 Ensure substrate is clean and dry before application. Application of material implies acceptance of substrate.
- .2 Install units on solid backing and erect with materials and components straight, tight and in alignment.

3.2 Locations

- .1 Locations are as indicated on drawings.

END OF SECTION

PART 1 - GENERAL

1.1 General

- .1 Conform to Division 1 - General Requirements.

1.2 Related Sections

- .1 Bid Form – Identified Prices.
- .2 Section 061000 – Rough Carpentry.
- .3 Section 064000 – Architectural Millwork.
- .4 Section 092216 – Non-Load Bearing Wall Framing.
- .5 Section 092116 – Gypsum Board.
- .6 Section 092227 – Acoustical Suspension

1.3 Shop Drawings

- .1 Submit shop drawings in accordance with Section 013300 - Submittal Requirements.
- .2 Clearly indicate fabrication and erection details including materials, finishes, accessories and anchorage.

PART 2 - PRODUCTS

2.1 Materials

- .1 Privacy Curtain Track: Construction Specialties Type 6062 extruded aluminum track, 1.5mm minimum wall thickness, complete with fasteners, connectors and end caps. Provide type Carrier 1062N nylon hooks, 1 per 150mm of track.
- .2 Privacy Curtains:
 - .1 Resident Rooms: 100% polyester, hidden Mesh, Snaps, 10% fullness with hidden 560mm mesh top, chrome grommets, bottom weights with 300mm from floor. Colour to be selected by the Consultant from Tier 1 pattern and colour.
- .3 Projector Mount: CMA 100 by Chief Manufacturing Inc.
- .4 Projection Screen: Access E Ceiling-Recessed Projection Screens. Provide mounting hardware to suit site condition. Location and sizing as per Drawings.
- .5 Curved J-Hooks for Pegboard: ULINE Industrial 38mm, 6mm thick, zinc-plated, H-2695; Quantity: 1 carton of 50. Confirm with Owner prior to ordering.

PART 3 - EXECUTION

3.1 Installation

- .1 Provide manufacturer's information and templates required for installation of specialties specified in this Section, and assist or supervise, or both, the setting of anchorage devices, and construction of other installations incorporated with specialty products in order that they function as intended.
- .2 Install specialty products to meet manufacturer's recommended specifications, true, tightly fitted, and level or flush to adjacent surfaces, as suitable for installation.

- .3 Include all fittings and hardware to complete installation.
- 3.2 Adjustment and Cleaning
 - .1 Verify that installed specialty products function properly and adjust them accordingly to ensure satisfactory operation.
 - .2 Refinish damaged or defective work so that no variation in surface appearance is discernible. Refinish specialty products at site only if approved.
- 3.3 Curtain Track
 - .1 Install curtain track where indicated on Drawings.
- 3.4 Privacy Curtains
 - .1 Install privacy curtains where indicated on Drawings, including all trims and mounting accessories to be compatible with adjacent finishes.
 - .2 Establish level line for installation.
- 3.5 Projector Mount
 - .1 Install projector mount at projector locations noted on Drawings.
 - .2 Provide blocking for mounting as required to suit site condition.
- 3.6 Projection Screens
 - .1 Install projection screens at locations noted on Drawings.
 - .2 Provide blocking for mounting as required to suit site condition.
- 3.7 Curved J-Hooks for Pegboard
 - .1 Provide for Pegboard at Strength and Conditioning Lab 13.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

- .1 Roller window shades including:
 - .1 Roller window shade, manual operated (RWS)
 - .2 Roller window shade, motorized (RWS-M)
- .2 Extruded aluminum shade fascia:
 - .1 Prefinished extruded aluminum fascia within exposed locations as indicated on drawings.
 - .2 Recessed pocket locations indicated on drawings complete with anodized aluminum closer panels.
- .3 Accessories and brackets.

1.2 System Descriptions

- .1 Provide for infinite positioning of window shade.
- .2 Provide for smooth and quiet operation.
- .3 Removable Closure Panel: One-piece continuous extruded anodized aluminum trim.

1.3 Administrative Requirements

- .1 Coordination:
 - .1 Coordinate with other work having a direct bearing on work of this section.
 - .2 Coordinate the work of above ceiling or behind wall finish for blocking and anchor support and positioning.
 - .3 Coordinate with Division 26 - Electrical.

1.4 Submittals for Review

- .1 Product Data: Indicate descriptions of components, accessories, dimensions, tolerances for window openings required, colours and textures.
- .2 Shop Drawings:
 - .1 Indicate dimensions in relation to window jambs, operator details, top rail, conditions between adjacent blinds, corner conditions anchorage details, hardware and accessories details, and required clearances.
 - .2 Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings and include opening sizes and typical mounting details. Indicate location of each shade type.
- .3 Samples:
 - .1 Submit two sets of 300 mm long samples of each visible-to-view component, indicating colour, surface texture and sheen.
 - .2 Submit two 300 x 300 mm size samples of shadeband material. Mark inside face of material.

1.5 Submittals for Information

- .1 Qualifications Data: For Manufacturer and Installer.

1.6 Closeout Submittals

- .1 Maintenance Data:
 - .1 Indicate methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.
 - .2 Include list of susceptible parts replaceable by user.

1.7 Quality Assurance

- .1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum ten (10) years' documented experience.
- .2 Installer Qualifications: Company specializing in performing the work of this section with minimum ten (10) years' documented experience, and trained and certified by the manufacturer.
- .3 Shadeband Material Flame-Resistance Rating: Conform to NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- .4 Anti-Microbial Characteristics: 'No Growth' per ASTM G 21 results for fungi ATCC9642, ATCC 9644, ATCC 9645.
- .5 Environmental Certification: Submit written certification from the manufacturer, including third party evaluation, recycling characteristics, and perpetual use certification as specified below. Initial submittals, which do not include the Environmental Certification, below will be rejected. Materials that do not identify their inputs shall not qualify as meeting the intent of this specification and shall be rejected.

1.8 Regulatory Requirements

- .1 Conform to applicable code for fire performance requirements of shade cloth.

1.9 Mock-Up

- .1 Provide mock-up of each type of roller shade assembly.
- .2 Locate where directed.
- .3 Mock-up may remain as part of the work

1.10 Delivery, Storage, and Handling

- .1 Deliver shades in factory-labelled packages, marked with manufacturer and product name, fire-test-response characteristics, and location of installation using same room designations indicated on Drawings and Schedules.

1.11 Environmental Requirements

- .1 Do not install roller shades until finish work, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.12 Warranty

- .1 Provide a five (5) year warranty to include coverage for failure to meet specified requirements.
- .2 Provide 25-year manufacturer's warranty for roller shade hardware, chain and shade cloth.

PART 2 – PRODUCTS

2.1 Manufacturers

- .1 Subject to conformance to the requirements of this Section provide basis of design system as listed below for each roller window shade type:
 - .1 Roller window shade, motorized (RWS-M)
 - .1 'Motorized FlexShade AC' by Draper

- .2 Refer to Division 26 - Electrical for power and controls.
- .2 Roller window shade, manual (RWS)
 - .1 'Clutch Operated FlexShade' by Draper
- .2 Or approved alternative product by one of the following manufacturers:
 - .1 Solarfective Products Ltd,
 - .2 ALTEX Roller Shades,
 - .3 Elite Solar Shading Systems,
 - .4 Hunter Douglas Contract,
 - .5 Sun Glow.
 - .6 MechoSystems

2.2 Components

- .1 Shade fabric: 100% polyester composition, VC-free and low VOC shade fabric. Colour and pattern as selected by Consultant from Manufacturer's full range.
 - .1 Shade fabric for roller window shades. 1% percent open factor tested to EN14500: 2008 and ASTM 903:
 - .1 Basis-of-Design Products:
 - .1 'THEIA' by Lutron Electronic Co, Inc.
 - .2 Fabric Colour:
 - .1 To be later selected by Consultant from manufacturer full range.
 - .2 Shadeband Bottom (Hem) Bar: Manufacturer's standard extruded aluminum; single length for each shade panel; exposed type with end caps. Colour and finish as selected by Consultant from Manufacturer's standard range.
- .2 Shade Orientation: Shade cloth to roll at window side of roller.
- .3 Provide for infinite positioning of window shade.
- .4 Accessories: Provide the following manufacturer's standard items as selected by Consultant.
 - .1 Roller aluminum shade pocket for shade type selected by Consultant.
 - .2 Continuous cassette system with anodized aluminum finish for use with two or more shade bands.

2.3 Motorized Operating System

- .1 Refer to Section 26 09 71 Window Shades for motorized window shades operating system.

2.4 Finishes

- .1 Finish Coatings: Conform to AAMA 611.
- .2 Exposed Aluminum Surfaces:
 - .1 Colour Anodic Coating: AA-M12C22A32/A34, Class II, 0.010 mm or thicker.
 - .2 Colour: As selected by consultant.
 - .3 Location: Exposed aluminum surfaces.
- .3 Concealed Aluminum Surfaces: Mill finish.

PART 3 - EXECUTION

3.1 Examination

- .1 Verify existing conditions before starting work.
- .2 Examine substrate and conditions for installation.

3.2 Installation

- .1 Install units and their accessories to manufacturer's instructions.
- .2 Locate shadebands with dimension to interior face of glass as in indicated on Shop Drawings.
- .3 Securely screw end plugs to conceal exposed cut aluminum of exterior hem bar.
- .4 Securely anchor units plumb and level, using hardware and accessories to provide smooth operation without binding.

3.3 Installation Tolerances

- .1 Maximum variation of gap at window opening perimeter: 6 mm per 2.4 m of shade height.
- .2 Maximum offset from level: 3 mm.

3.4 Adjusting

- .1 Adjust units for smooth and quiet operation.
- .2 Adjust shade and shade cloth to hang flat without waves, folds, or distortion.
- .3 Replace units or components which do not hang properly or operate smoothly.

3.5 Cleaning

- .1 Clean installed work.
- .2 Touch up damaged finishes and repair minor damage in a manner to eliminate evidence of repair. Remove and replace work that cannot be satisfactorily repaired.
- .3 Clean exposed surfaces and edges/ends, including metal and shade cloth, using non-abrasive materials and methods recommended by manufacturer. Remove and replace work which cannot be satisfactorily cleaned.

END OF SECTION



Chorley+Bisset
CONSULTING ENGINEERS

WESTERN UNIVERSITY

LHSB RENOVATIONS

LONDON

ONTARIO

CHORLEY + BISSET LTD
CONSULTING ENGINEERS
LONDON ONTARIO

FILE NO. 10500.2
MAY 2026

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1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 This Section and Division 01 apply to and govern the work of all Sections of Divisions 21, 22, 23 and 25.

1.2 **VISITING SITE**

1.2.1 Visit the site and be familiar with working conditions and work involved before submitting Bids. No extras will be granted due to lack of a thorough preliminary investigation of the site.

1.2.2 Where applicable, remove and replace existing ceiling tile to inspect ceiling space for existing Mechanical, Electrical and Structural obstructions. Include cost of all necessary changes in Bid Price. No extras will be granted due to lack of a thorough preliminary investigation of accessible ceiling spaces.

1.2.3 For renovation projects, Contractors visiting for site investigation must sign in at the facility's main office and register with facility staff. Where required by the Owner, review and sign any on-site Designated Substances Reports prior to site investigation in any area potentially containing Designated Substances or Hazardous Materials.

1.3 **CONTRACT DRAWINGS**

1.3.1 Mechanical Drawings show Mechanical work only and are not intended to show Structural details, Electrical details, or Architectural features. Take building dimensions and details from Architectural or Structural Drawings or from job measurements. Any dimensions shown on Drawings are approximate. Verify dimensions by reference to Shop Drawings and field measurement.

1.3.2 Only the general location and route of piping and ductwork is shown. Install all piping and ductwork neatly to conserve headroom. All piping and ductwork to be installed parallel to building lines unless shown otherwise.

1.3.3 The Consultant reserves the right to revise the locations of equipment and outlets within any given room without altering the Contract Price provided Notice of Change is given prior to roughing-in.

1.3.4 In case of conflict between work of other trades and work of these Divisions, clarify the location of these items with the Consultant before roughing-in.

1.3.5 In the event of any discrepancies or ambiguity of any symbol, note, abbreviation, etc., used in this Specification or on the Contract Drawings, obtain clarification, in writing, from the Consultant prior to submitting Bid. No allowance will be made for additional costs arising from failure to obtain proper clarification of conflicting information before Bid.

1.3.6 Quantities or lengths indicated in any of the Contract Documents are approximate only and will not be held to gauge or limit the work. No adjustment to the Contract Price will be allowed to complete the work.

- 1.3.7 Verify equipment access and coordinate with equipment supplier to ensure equipment can be physically transported to installation location. Under no circumstances will any claim be allowed for extra cost to disassemble and/or assemble equipment at the final location which will be considered as part of equipment installation.
- 1.3.8 Provide labour, products, and services specified, but not shown on Drawings and vice versa, and all other labour, products, and services necessary for completion of the work.
- 1.3.9 Where dimensions and sizes are presented in the documents in SI units, generally, units are in millimetres. All exceptions to this are noted. Pipe sizes on Drawings and within Specifications refer to nominal pipe size (IP) and/or nominal diameter (SI) and are in accordance with ANSI Standards.
- 1.4 **SHOP DRAWINGS**
 - 1.4.1 Submit manufacturers' Shop Drawings, electrical wiring diagrams and control system drawings to the Consultant for review, prior to ordering any equipment or devices. Prior to submission of any Shop Drawings, provide a complete list of Shop Drawings to be submitted, in Microsoft Excel format. List all Shop Drawings, as well as approximate date of submission.
 - 1.4.2 Provide title sheet for each Shop Drawing submitted. Include project name, Shop Drawing item (including Specification paragraph and subparagraph reference) and Contractor and Subcontractor approval stamps. The Consultant reserves the right to have samples submitted of any specified products.
 - 1.4.3 Submit all Shop Drawings electronically in PDF format. Email, file transfers and file links will be accepted. If multiple items are submitted in a single PDF file, Shop Drawings must be from the same Specification Section and each individual piece of equipment, report, document, etc, must be bookmarked, using equipment labels as per Design Drawings. Do not submit compressed files.
 - 1.4.4 Catalogues, manuals, or price lists will not be accepted as Shop Drawings. Before submission, review and check Shop Drawings, make necessary corrections, apply stamp "Reviewed and Certified Correct", sign and date. The Contractor is to document any differences between the Shop Drawing submission and the description listed in the Specification. If there are no differences listed, the Contractor implicitly declares the Shop Drawing meets all requirements of the Specification.
 - 1.4.5 The review of Shop Drawings by Chorley + Bisset Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Chorley + Bisset Ltd. approves the detail design inherent in the Shop Drawings, responsibility for which remains with the Contractor. Such review does not relieve the Contractor of his responsibility for errors or omissions in the Shop Drawings or of his responsibility for meeting all requirements of the Construction and Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all subtrades.
 - 1.4.6 Ensure at least one copy of the reviewed Shop Drawings is kept on site at all times for reference.

- 1.4.7 Shop Drawings are to be prepared and presented in either SI or IP units, as required to match the units presented on the Drawings. Shop Drawings that include both SI and IP units will also be accepted.

1.5 **FIELD DRAWINGS**

- 1.5.1 Submit, to the General Contractor, Drawings accurately showing all openings for ducts, pipes, etc. Drawings must include the size of openings and their locations by dimensions, including the location of the structural members framing these openings. Each trade will be responsible for detail layout of their own work.

- 1.5.2 Assume full responsibility for the detailed coordination of all Mechanical Trades work. Prepare Field Drawings to determine the exact location of each service. On these Drawings, include all mechanical and electrical services, architectural features, and structural details. If a conflict becomes apparent after the installation of services, pay all costs associated with removing and reinstalling these services.

- 1.5.3 For Buildings equipped with Sprinkler Systems, if the General Contractor separates the Fire Protection Sprinkler System work from the other work of Mechanical Trades, the General Contractor assumes full responsibility for this coordination work, including the preparation of the Field Drawings.

1.6 **AS-BUILT DRAWINGS**

1.6.1 **General**

- 1.6.1.1 The Contractor will be provided with Mechanical Drawing files used to produce the contract documents. The following digital formats were used and are to be maintained: PDF, AutoCAD and/or Revit. The Contractor is to print Drawings from the PDF files provided. A waiver will need to be signed by the Contractor before the Revit model will be transmitted.

1.6.2 **Transfer of As-Built Information to Electronic Format**

- 1.6.2.1 Revise and maintain the prints as work progresses. Show all revisions, relocations, and changes, to scale. Use colour markings. At the end of the project, provide a complete PDF redline mark-up set of As-Built Drawings to the Consultant, for record purposes. Printed hard copies will not be accepted.

- 1.6.2.2 For the purposes of Contract payments, the PDF redline mark-up set of As-Built Drawing files will be assumed to have a value of \$2,500.00. This will not be released until As-Built Drawing files have been accepted as complete and acceptable by the Consultant. This amount is in addition to the normal 10% holdback required by the Construction Lien Act, 2018.

- 1.6.2.3 Refer to cash allowances Section of Division 01 Specifications. Where a cash allowance is included for the Consultant to transfer As-Built information to the AutoCAD files and/or Revit model, the Consultant will transfer As-Built information from the PDF redline mark-up set of As-Built Drawings to AutoCAD files and/or the Revit model.

- 1.6.2.4 If a cash allowance is not included in the Division 01 Specifications for the Consultant to transfer As-Built information the AutoCAD files and/or Revit model, the contractor will be responsible for doing so, in accordance with the instructions below.

1.6.3 **Electronic As-Built Deliverables**

- 1.6.3.1 Transfer information from the marked prints to AutoCAD and/or Revit files on a monthly basis to match the software version the original files were created in. Have the marked prints and updated AutoCAD and/or Revit prints on site for review by the Consultant at all times. Monthly draws will not be approved unless all changes have been shown.
- 1.6.3.2 Prior to testing, balancing and final commissioning, complete the transfer of marked prints to the AutoCAD and/or Revit files. Fill in the Owner's equipment numbering system in the Schedules on the Drawings and on the plans wherever blank placeholder tags have been shown.
- 1.6.3.3 AutoCAD and/or Revit files are to match exactly the layering system, format, and symbology of the Consultant. Bind all external references.
- 1.6.3.4 Mark Drawings with As-Built stamp, update revision column, and insert name and logo of Contractor. Submit one set of printed As-Built Drawings for review by the Consultant. Remove Engineer's Stamp.
- 1.6.3.5 Submit completed As-Built Drawings on USB memory sticks, DVDs, or electronic transfer, in the same digital data software program and version as original contract documents. Also provide one set of As-Built Drawings with the Operating and Maintenance Manuals.
- 1.6.3.6 For the purposes of Contract payments, electronic As-Built Drawing files will be assumed to have a value of \$2,500.00. This will not be released until As-Built Drawing files have been accepted as complete and acceptable by the Consultant. This amount is in addition to the normal 10% holdback required by the Construction Lien Act, 2018.

1.6.4 **Revit/Bim Deliverable (Where Applicable)**

- 1.6.4.1 As-Built updates to the Revit model are to be completed in accordance with the project Revit/BIM deliverable. If no deliverable is defined, the minimum deliverable requirement is that the Sheets included under the "02-Construction" subset in the model properly display the As-Built condition. Bind/Insert all linked files in the Revit model.
- 1.6.4.2 Model developed by the Consultant will not include engineering, analytics, or systems symmetry functionality (i.e. defined or totally connected systems).
- 1.6.4.3 All engineering and manufacturer information contained in the model will only be considered accurate for identification purposes, with regard to the corresponding Specifications and drawing schedules. The Contractor is not to rely on any engineering, dimensional or other manufacturer information contained in the model.
- 1.6.4.4 Mechanical, electrical, plumbing, and sprinkler system components should be modelled by the Contractor to be as close as possible to As-Built conditions, but must still produce an acceptable and legible printed As-Built document.

- 1.6.4.5 The Sheets included under the "02-Construction" subset in the model should properly display the As-Built condition.
- 1.6.4.6 Mechanical, electrical, plumbing, and sprinkler system components in the model (i.e. piping, conduit) may not be modelled the proper size, but will be identified correctly.
- 1.6.4.7 Mechanical, electrical, plumbing, and sprinkler system components in the model will be represented properly on floor plans (i.e. symbology) but not necessarily in elevations.
- 1.6.4.8 Mechanical, electrical, plumbing, and sprinkler equipment and other items that are generally required for coordination among disciplines (i.e. ceiling components) will be included in the model (approximate size shown). Many services will be shown in schematic fashion (i.e., not necessarily at correct elevation or in exact position required).
- 1.6.4.9 Due to the schematic nature of many portions of the model, services are likely to conflict and clash with various other services and structure. In some cases this is intentional, so that services display properly and legibly on Sheets.
- 1.6.4.10 The Consultant will not be responsible for providing to the Contractor a detailed, accurate, or clash free model without additional compensation, as the Owner has not required or paid for this work to be done by the Consultant. In turn, the Consultant will not require the Contractor to provide a more detailed, accurate, or clash free model for the project As-Built documentation, than was originally provided to the Contractor.
- 1.6.4.11 Responsibility for creation of accurate Field Drawings and resolving interferences, conflicts and clashes between services, structure, etc, remains with the Contractor.

1.7 **CONFLICTS AND PRECEDENCE**

- 1.7.1 Immediately upon discovery of any conflict, ambiguity, error, or omission in the Contract Documents, request clarification in writing from Consultant prior to starting the work in questions.
- 1.7.2 Failure to give such written notice will constitute an irrevocable waiver and release of any claim for additional compensation or delays incurred.
- 1.7.3 Where work fails to conform to Contract Documents, as clarified by Consultant, promptly remove and replace such work as directed, without adjustment to Contract Price.

1.8 **FIRESTOPPING**

- 1.8.1 Before starting any work on site, submit detailed Shop Drawings to the Consultant for review and comments. Include:
 - 1.8.1.1 Manufacturer's technical product data and installation instructions for each specific type and location of penetration.
 - 1.8.1.2 Certification that proposed firestopping materials and assemblies comply with latest version of CAN-ULC S115 "Standard Method of Fire Test for Firestop Systems".
 - 1.8.1.3 For each specific type and location of penetration, provide installation instructions from a recognized independent testing agency.

- 1.8.2 Mark penetration and system number types and locations on set of white prints. At completion of project, transfer this information to As-Built Drawings.
- 1.8.3 Comply with all requirements of Ontario Building Code Clause 3.1.9, "Building Services in Fire Separations and Fire Rated Assemblies".
- 1.8.4 Submit one sample of the components of each firestop system to the Consultant for review.
- 1.9 **MAINTENANCE AND OPERATING INSTRUCTIONS**
 - 1.9.1 **General**
 - 1.9.1.1 Assemble and provide Maintenance and Operating Instruction Manuals for the Owner, that are comprehensive and adequate to inform Owner of all maintenance and operating activities required for the project equipment and systems.
 - 1.9.1.2 Submit manuals to Consultant for review and approval, prior to submittal to Owner. Make changes or submit additional information as required to obtain approval. Final Certificate of Completion will not be issued until Manuals have been approved by the Consultant and provided to the Owner or Consultant.
 - 1.9.2 **Manual Content**
 - 1.9.2.1 Maintenance and Operating Instruction Manuals are to include equipment literature (data sheets), installation instructions, operating instructions, maintenance instructions, pressure test results, certificates, other pertinent data, as well as Contractor's Letter of Warranty. Include copies of approved Shop Drawings and name and address of Spare Parts' Suppliers with manuals.
 - 1.9.2.2 Divide the maintenance manuals into Sections, including both a General Section at the start of the manual, and remaining Sections which correspond with Specification Sections.
 - 1.9.2.3 The following information is to be contained within the General Section: a comprehensive list of names, addresses and telephone numbers of the Consultants, General Contractor, Mechanical Contractor, and all mechanical subcontractors. Include the Mechanical Contractor's Letter of Warranty for the Mechanical systems. Include a copy of all equipment extended warranties. Include a copy of the valve directory, which shows the valve number, location, normal valve position, and the purpose of the valve. Include a copy of all natural gas fitter's tags for natural gas systems. Include a copy of owner's asset tag information form for all equipment.
 - 1.9.2.4 Each Section corresponding to a Specification Section is to include, as applicable, a list of names, addresses and telephone numbers of all suppliers, as well as a copy of all approved Shop Drawings for that Section. Include a copy of all pressure tests and operational tests for piping systems, leakage tests for duct systems, and startup reports for all equipment. Include all equipment warranties. Include a copy of report data for degreasing and flushing of heating, cooling and other piping systems, analysis of system water taken at time system was put into operation, hydrostatic or air tests performed on piping systems, equipment alignment certificates, valve tag identification, and pipe colour code chart. Include a complete list of all air filter sizes, quantities, and types, corresponding with unit designations. Include Testing and Balancing Report.

- 1.9.2.4.1 In each Section, provide a preventive maintenance schedule for each of the major components and equipment items. Include daily, weekly, monthly, semi-annual, and yearly checks and tasks. Include this information as a separate preventive maintenance schedule. Copies of manufacturer's Shop Drawings will not be accepted as the required preventive maintenance schedule. Provide lubrication information and instructions which will explain the varied bearings and lubrication procedures.
- 1.9.2.4.2 Controls Section is to include all items listed above, as well as complete As-Built control diagrams and drawings, wiring diagrams, points lists, final control sequences, descriptions of system functions and all commissioning, checkout and test reports.

1.9.3 **Manual Formats**

- 1.9.3.1 Refer to Division 01 Specifications for Operating and Maintenance Manuals required quantities and formats. If not specified in Division 01, provide three hardcopy sets of manuals and one electronic format set.
- 1.9.3.2 Include As-Built Drawing sets with the Operating and Maintenance Manuals, in matching format required by Owner (i.e. quantities of soft and hard copies matching manuals). Where hardcopies are provided, As-Built Drawing sets are to be printed and neatly bound.
- 1.9.3.3 Electronic manuals are to be prepared in PDF format. Manual to be provided as one file formatted with bookmarks, in accordance with the Sections of the hard copy manuals. Do not include separate files in sub folders. Submission is to be either on a USB Drive or through electronic transfer, in accordance with Owner's preference.
- 1.9.3.4 Where required, hardcopies of Maintenance and Operating Instruction Manuals are to be placed in three ring binders, complete with index pages, indexing tabs and cover identification at front and side.
- 1.9.3.5 Where required by Building Owners with multiple facilities, manuals and associated Drawings are to be supplied as a quality electronic publication on Optical Media (DVD ROM). DVD Optical Media will be write once and read only, containing all specified electronic files including index, and supplied in a protective storage case complete with printed details for case cover and spine as follows:

Front Cover of Case: Clearly print details including, Building Name, Project Name, Project Number, Date, Names of Consultants, Service Discipline and Name of Contractor(s).

Spine of Case: Clearly print Project Name and Service Discipline.

1.10 **REGULATIONS AND PERMITS**

- 1.10.1 Carry out all work in accordance with the latest editions of applicable municipal and provincial codes, regulations, bylaws, and requirements of local Authority Having Jurisdiction. In no instance, however, is the standard established by the Drawings and Specifications to be reduced by the codes referred to above. Apply for and obtain any necessary permits. Pay any necessary fees.

- 1.10.2 Enforce all prevailing Provincial and local safety regulations at all times. Abide by all Owner's safety and security policies and procedures and conform to all regulations of the current Occupational Health and Safety Act.
- 1.10.3 Submit copies of CRN Certificates for all boilers and registered pressure vessels. Arrange and pay for TSSA certification of all boilers with a heating surface area greater than 2.78 m² (30 ft²).
- 1.10.4 Fill out TSSA forms and pay all costs associated with removal of existing boilers and other equipment, wherever equipment is currently registered with TSSA.
- 1.10.5 Arrange and pay for TSSA inspection and certification for all piping systems and equipment regulated by TSSA.
- 1.10.6 TSSA will forward certificates and invoice for certificates to Owner. Owner will forward certificates and invoice to certificates to this contractor. Pay TSSA invoice for the certificates. Insert a copy of each certificate into the Operating and Maintenance Manual. Frame and hang the original certificates in the Utility Room near the equipment.
- 1.11 **MATERIAL AND EQUIPMENT**
 - 1.11.1 Where an item of material or any equipment is specifically identified by a manufacturer's trade name and/or catalogue number, make no substitution except as provided for in paragraphs 3, 4 and 5 below.
 - 1.11.2 In the case of some items of equipment, one or more additional names of acceptable equal manufacturers are listed in the Clause describing an item or a group of items. The design, layout, space allocation, connection details, etc., are based on the products named first in the description of each item. The products named first in the description of each item establish the quality of manufacture and design standards for all other manufacturers of that item. The general approval indicated by listing the names of other manufacturers is subject to final review of Shop Drawings, performance data, test reports, production samples (if required) by Consultant, and equipment shipped to site. Ensure that the products used meet the requirements specified and as shown on the Contract Drawings.
 - 1.11.3 Suppliers wishing to submit other items of equipment for approval as an equal to those specified must apply to the Consultant at least 8 working days before Bid closing date. Requests must be accompanied by complete description and technical data on the items proposed. Approval for substitution of equipment will only be given on the understanding that all details, accessories, features, and performance meet the Specifications unless otherwise stated. Deviations from the Specifications must be stated in writing at time of application for approval.
 - 1.11.4 Include in the Bid, the equipment named in the Specifications or approved as an equal as in paragraph 3 above. This will form the Base Bid. Any number of alternative bids, as defined below, may be included in addition to the Base Bid.
 - 1.11.5 Items of equipment by Manufacturers not named in the Specifications may be offered as alternatives to the manufacturers named in the Specifications. The alternative proposals must be accompanied by full descriptive and technical data, together with the statement

of amount of addition or deduction from the Base Bid, if the alternative is accepted. Prior approval by the Consultant is not required on items submitted as alternative bids.

1.11.6 After execution of the Contract, substitution of equipment will be considered only if equipment accepted cannot be delivered in time to complete the work in proper sequence, or if the manufacturer has stopped production of the accepted item. In such cases, requests for substitution must be accompanied by proof of equality and difference in price and delivery, in the form of Certified Quotations from Suppliers of both specified and proposed equipment. Credit any decrease in price involved in substitution to the Owner by reduction of the Contract Price. The Contractor will not be reimbursed for any such increase in price.

1.11.7 Where equipment other than the equipment used as a basis for design, layout and space allocation is used, produce and submit revised layouts of equipment, pipes, ducts, etc., in the areas affected. Submit these Drawings with the Shop Drawings. Failure to produce these Drawings is indication by the Contractor that they are not required and the original space allocations are adequate for the substituted equipment.

1.11.8 Name the Subcontractors and Manufacturers in the Bid as indicated in Clause "List of Mechanical Subcontractors and Manufacturers".

1.12 **INTERPRETATION OF CONTRACT DOCUMENTS**

1.12.1 The decision as to which trade provides required labour or materials rests solely with the Contractor. Extra payments will not be considered based on a difference in interpretation of the Contract Documents as to which trade involved provides materials or labour for specific items of work. The Consultant will not enter into such discussions.

1.13 **SITE VISITS**

1.13.1 The Mechanical Contractor shall have an office representative (not site personnel) at each site meeting and deficiency review. Attendance at these meetings is mandatory.

1.14 **PROGRESS DRAWS**

1.14.1 Mechanical Contractor shall review all supplier and subcontractor draws submitted to their office to ensure they are fair and reasonable for the amount of work completed on site to date prior to submitting to the General Contractor. Mechanical Contractor will be responsible for the validity of supplier and subcontractor draw claims.

1.15 **WARRANTY**

1.15.1 Warranty all workmanship and make good any defects for one year after Ready for Takeover except where specified otherwise. Warranty material and equipment supplied by the manufacturers for one year after Ready for Takeover. Make good damage caused due to defects and workmanship.

1.15.2 Where equipment specified in Sections of Divisions 21, 22, 23 and 25 to have an extended warranty period, e.g. five years, the first year of the warranty period will be governed by the terms and conditions of the warranty in the Contract Documents, and the remaining years of the warranty will be direct from the manufacturer and/or supplier to the Owner.

Submit signed and dated copies of the extended warranties to the Consultant before applying for a Certificate of Substantial Performance of the Work.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Clause "Material and Equipment".

2.2 **PIPING**

2.2.1 **Supports and Hangers**

2.2.1.1 Use Anvil beam clamps.

2.2.1.2 For horizontal piping 32 mm (1-1/4") and less, use line size adjustable wrought steel clevis type hangers. For copper pipe, wrap pipe with tape at all hangers or use Anvil Figure CT-99C adjustable tubing ring hangers.

2.2.1.3 For piping 40 mm (1-1/2") and larger, use adjustable wrought steel clevis type hangers large enough for pipe insulation. See Section 22 07 00 for insulation shields.

2.2.1.4 For boiler feedwater and condensate and steam piping 75 mm (3") and larger, use adjustable roller hangers (Anvil Fig 181) or base-mounted pipe rollers (Anvil Fig 274). Use steel pipe covering protection saddle for each location.

2.2.1.5 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Anvil
Taylor Pipe Supports

2.2.2 **Provision for Expansion**

2.2.2.1 Provide pipe guides in accordance with "Standards of the Expansion Joint Manufacturers Association, Inc.".

2.2.2.2 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Anvil
Flexonics
Flex-Pressions

2.3 **BACKFILL**

2.3.1 Use backfill material in accordance with the requirements of General Trades Specification Sections, unless specified or shown otherwise.

2.4 **CONCRETE**

- 2.4.1 Use concrete in accordance with the requirements of General Trades Specification Sections, unless specified or shown otherwise.

2.5 **SLEEVES**

- 2.5.1 In general, sleeves are not required through walls or floors except for penetrations through Service Room walls or floors, foundation walls, or for steam and condensate piping system wall or floor penetrations.
- 2.5.2 For all pipes passing through foundation walls, use Link-Seal pre-engineered mechanical seals between sleeves and pipes.
- 2.5.3 For sleeves through mechanical room floors, use Schedule 40 steel pipes with annular fins continuously welded at midpoint.
- 2.5.4 For rated separation requiring a FT firestopping rating, use materials in conformance with manufacturer's recommendations.

2.6 **FIRESTOPPING**

- 2.6.1 Use only service penetration firestop components and assemblies tested in accordance with latest version of CAN/ULC S115 Fire Tests of Firestop Systems and listed in most recent ULC "List of Equipment and Materials" or by another recognized independent testing and certification agency acceptable to the Consultant.
- 2.6.2 All pipe insulation passing through the fire separation to be approved with the listing of the firestop system.
- 2.6.3 Fire stopping installers must be trained by the fire stopping manufacturer and be able to provide proof of training by providing Fit Level 1 certificate when requested, while working on site.
- 2.6.4 Pipe sleeves through fire separations requiring a rating are to be installed as per firestopping manufacturer's recommendations, as some firestopping manufacturers do not allow pipe sleeves within their approved system. Confirm pipe sleeve compatibility prior to starting work on site.
- 2.6.5 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

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2.7 **FIRE RATED FOAM SEALANT**

- 2.7.1 Use ULC Classified fire rated foam sealants.

- 2.7.2 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

3M Fire Barrier
Metacaulk
Dow Fire Stop

2.8 FIRE CLOSURES

- 2.8.1 Use only fire damper assemblies tested in accordance with CAN/ULC S115 Fire Tests of Firestop Systems and listed in most recent ULC "List of Equipment and Materials" or by another recognized independent testing and certification agency acceptable to the Consultant.

2.9 ESCUTCHEON PLATES

- 2.9.1 Provide one piece brushed aluminum escutcheon plates at all points where pipes pass into finished areas through walls, floors, or ceilings.

2.10 ACCESS DOORS

- 2.10.1 Access doors to be flush to edge of frame, concealed continuous hinge with screwdriver operated cam latch. Non fire-rated door construction to be minimum 14 gauge, with 16 gauge frame. Fire-rated door construction to be a minimum 20 gauge insulated door with 16 gauge frame. Insulation thickness to provide required rating.

- 2.10.2 Size doors to allow adequate operating/maintenance clearance for devices. Doors to be a minimum 600 mm x 600 mm (24" x 24") for body entry, and 300 mm x 300 mm (12" x 12") for hand entry, unless noted otherwise. Use the following access doors:

Masonry Walls	Acudor UF-5000
Drywall Walls and Ceilings	Acudor DW-5040
Fire-Rated	Acudor FW-5050/FB-5060 to match fire separation
All Other Locations	Acudor UF-5000 (stainless)

- 2.10.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Cendrex
Elmdor

2.11 ELECTRICAL EQUIPMENT

- 2.11.1 In buildings equipped with automatic sprinkler systems, use sprinkler proof electrical equipment. Where electrical equipment provided by Mechanical Trades is not of sprinkler proof design, fabricate and provide galvanized steel shields and hoods to prevent sprinkler system water from entering the electrical equipment and/or interfering with its operation.

2.12 **ELECTRIC MOTORS**

- 2.12.1 Provide motors of adequate size and type for intended service. Use CSA approved motors with the following characteristics:
- 250 watts (1/3 hp) and under - 115 volt, 60 hertz, single phase.
 - 370 watts (1/2 hp) and over - 60 hertz, three phase, voltage as shown on Drawings.
- 2.12.2 Motors are to be the voltage specified. Step down or step up transformers will not be accepted.
- 2.12.3 Motors 250 watts (1/3 hp) and under: Use continuously rated squirrel cage induction type with capacitor start, NEMA Design Class B with NEMA Class N or better starting characteristics and a minimum of Class B insulation, unless specified otherwise.
- 2.12.4 Motors 370 watts (1/2 hp) and over: Use continuously rated squirrel cage induction type, NEMA Design Class B with NEMA Class B or better starting characteristics and a minimum of Class B insulation. Where motor is installed in an area that could see higher ambient temperatures, higher insulation class will be required. Use a minimum of Class F insulation for 41 °C to 65 °C (106 °F to 149 °F) ambient temperature and a minimum of Class H insulation for 66 °C to 90 °C (150 °F to 194 °F) ambient temperature.
- 2.12.5 Use open drip-proof type motor with a 1.15 service factor for motors located in dry locations indoors, unless specified or required otherwise by the motor location.
- 2.12.6 Use totally enclosed motors outdoors and in locations subject to water spray. Totally enclosed motors must be fan cooled and have a 1.0 service factor.
- 2.12.7 Use totally enclosed explosion-proof (TEXP) motors where indicated to prevent ignition of external gas.
- 2.12.8 All enclosures shall be rolled steel band or cast iron construction. Motor nameplate shall be mounted on enclosure with stainless steel fastening pins and shall have, as a minimum, all information as described in CSA C22.2 No 100-04 (R2009).
- 2.12.9 Unless specified otherwise, starters for electric motors will be provided by Division 26. Where multi-speed motors are specified, ensure that motors are compatible with starters supplied under Division 26.
- 2.12.10 All two speed motors to be single winding, unless specified otherwise. Provide inverter duty motors where indicated on Drawings.
- 2.12.11 All motors 0.75 kW (1 hp) and above, use premium efficiency type motors in accordance with NEMA Premium efficiency standard.
- 2.12.12 Basis of design is Baldor motors, unless specified otherwise. Leeson/Marathon, WEG, or TECO will be considered equivalent. Acceptable motor manufacturers for equipment at Western University are Leeson/Marathon, WEG, or TECO only.

2.13 ELECTRICAL WIRING

- 2.13.1 Meet all requirements of Division 26 for all wiring included in Division 21, 22, 23 and 25 and pre-wired equipment provided by Division 21, 22, 23 and 25.
- 2.13.2 Ensure all pre-wired electrical equipment is CSA approved. Where this is not possible, arrange and pay for special Electrical Safety Authority approval.
- 2.13.3 All electrical wiring, both line voltage and low voltage, for equipment supplied by Division 21, 22, 23 and 25 is the responsibility of Division 21, 22, 23 and 25. Line voltage wiring from power panels to starters and from starters to motors will be supplied and installed by Division 26.

2.14 IDENTIFICATION NAME LABELS

- 2.14.1 Identification name labels, directional arrows, and colour bands for ductwork and piping to be plastic coated pressure sensitive "Brady" or "Westline" selfstick labels, waterproof, colourfast, dirt and grease resistant. For pipes up to and including 65 mm (2-1/2") diameter, use markers 28 mm (1-1/8") high. For pipes 75 mm (3") diameter and over, and all ductwork, use markers 57 mm (2-1/4") high. For all piping exposed to view, use Smillie McAdams Summerlin Coil - Mark pipe covers.
- 2.14.2 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Visionmarker

2.15 VALVE AND CONTROLLER TAGS

- 2.15.1 Use brass valve and controller tags with 32 mm (1-1/4") stamped code lettering and numbers filled with black paint. Hang a copy of the valve chart in Mechanical Room.

2.16 EQUIPMENT NAMEPLATES

- 2.16.1 Use minimum size 90 mm x 40 mm x 2.4 mm (3-1/2" x 1-1/2" x 3/32") thick laminated phenolic plastic nameplates with black face and white lettering. Lettering to be minimum 6 mm (1/4") high.

2.17 BELT AND MACHINE GUARDS

- 2.17.1 Provide Ontario OHSA compliant expanded metal guards in steel frames to protect drives of all belt driven equipment and all equipment with exposed rotating or moving parts. Firmly bolt guards in place and make easily removable for servicing. Provide openings in metal guards to permit use of a tachometer without removing the guard.

2.18 FLASHING

- 2.18.1 For locations with multiple roof penetrations serving equipment, such as for roof mounted, split system condensing units, use Portals Plus, Inc. Alumi-Flash system consisting of 330 mm (13") high, one piece spun aluminum base with deck flange and EPDM rubber cap. Use caps suitable for required number and diameter of service penetrations. Flashing

is for Division 21, 22, 23, 25 and 26 use only. Coordinate with Division 26 to minimize the number of flashings required.

- 2.18.2 For plumbing vent roof penetrations, use Portals Plus, Inc. Alumi-Flash system consisting of 330 mm (13") high, one piece spun aluminum base with deck flange and EPDM rubber cap. Size cap to suit pipe diameter.

3 Execution

3.1 **GENERAL**

- 3.1.1 Instruct and supervise other Sections doing related work.

- 3.1.2 Supply the measurements of equipment to other Sections to allow for necessary openings to be left in the work of other Sections.

- 3.1.3 Install pipes, ducts, and tubing, which are to be concealed, neatly and close to building structure so that the necessary furring can be kept as small as possible.

- 3.1.4 Install all ceiling components in direct accordance with reflected ceiling plans.

- 3.1.5 Mechanical Drawings show approximate locations for wall-mounted devices and fixtures. Clarify exact location and mounting height with Consultant prior to roughing-in.

- 3.1.6 All serviceable equipment installed on the roof (including boiler vents) to be installed minimum 3 m (10'-0") from roof edge.

- 3.1.7 Pack all roof penetration flashings with mineral wool insulation after service installation is complete, to prevent condensation.

3.2 **DISSIMILAR METALS**

- 3.2.1 Separate dissimilar metals by means of gaskets or shims of approved material or use dielectric unions or flanges in order to prevent electrolytic action. Where piping of dissimilar metals is connected, use approved dielectric unions or couplings. A brass fitting or brass valve may also be used in making connections between copper and steel piping.

3.3 **STORAGE OF MATERIALS**

- 3.3.1 Provide proper weatherproof storage for the protection of materials and equipment on site. Blank off openings in all equipment until required for use. Consultant may require materials which are not properly stored to be discarded and removed from the site.

3.4 **PIPING**

3.4.1 **General**

- 3.4.1.1 Conceal all piping except in equipment rooms, unfinished areas, and where specifically noted. Unless shown otherwise, install all above ground piping parallel to building walls and partitions.

- 3.4.1.2 Where piping is exposed, install escutcheon plates at walls, floors, and ceilings. Install piping to conserve headroom.
- 3.4.1.3 In locations where space is provided for future or other equipment requiring connection to systems installed under this Contract, install services with isolation valves and caps to allow connection to the system without interruption.
- 3.4.2 **Drain Hose Connections:** Provide drain hose connections at the base of all risers, on the suction side of all pumps and in all locations shown on Drawings.
- 3.4.3 **Supports and Hangers**
- 3.4.3.1 Provide all hangers, supports and sway braces in accordance with ANSI B31.1 and the Ontario Building Code. Support all piping in accordance with the Ontario Building Code.
- 3.4.3.2 Where specified and/or shown on Drawings and in schedules, use spring hangers. See Drawings for details.
- 3.4.3.3 Unless specified otherwise, support piping at maximum spacing as shown and within 450 mm (18") of each side of all valves and bends.
- 3.4.3.4 Support horizontal cast iron drainage piping at 1.5 m (5') maximum spacing. Where the drain has successive fittings with no straight piping run between the fittings of at least 800 mm (32") in length, support the drain at intervals not exceeding 900 mm (3'). Where mechanical joints are used, provide double hangers and sway bracing.
- 3.4.3.5 Where cast iron pipe with mechanical joints is used, support piping on both sides of horizontal joints within 450 mm (18") of joint on each side, at all branch ends, and at all points where there is a change in direction. Where the pipe is 150 mm (6") or larger in horizontal runs, brace to prevent horizontal movement at each branch or change in direction. Use braces, blocks, rodding, or other suitable method recommended by the joint manufacturer. For piping sizes of 150 mm (6") and larger, provide Inspection Report from the manufacturer's representative certifying the installation is in accordance with their published installation data.
- 3.4.3.6 Do not support piping from other piping or equipment, or from metal roof decking.
- 3.4.3.7 **Schedule:**

Pipe Size mm	20	25	32	40	50	65	75	100 to 200	250 & Over
Max. Span m	1.8	2.1	2.4	2.4	3	3.4	3.7	4.3	6.1

Pipe Size in	3/4	1	1-1/4	1-1/2	2	2-1/2	3	4 to 8 incl.	10 & Over
Max. Span ft	6	7	8	8	10	11	12	14	20

- 3.4.4 **Anchors:** Install anchors where shown and where required. Use "U" bolts for piping 75 mm (3") in diameter and less. For piping over 75 mm (3") diameter, use steel fabricated anchors welded directly to pipe.
- 3.4.5 **Provision for Expansion:** Make proper allowance for thermal expansion and contraction whether shown on the Drawings or not. Use adequate offsets on all takeoffs to allow for expansion and contraction of mains. Weld all steel pipe forming an expansion loop regardless of size. Silver solder all copper pipe forming an expansion loop regardless of size. Use pipe alignment guides where shown and where required. Provide pipe guides for piping on either side of expansion loops, expansion joints and expansion compensators in accordance with "Standards of the Expansion Joint Manufacturers Association, Inc.".
- 3.4.6 **Elevators:** In elevator machine rooms, do not locate any piping above any elevator equipment.
- 3.5 **EXCAVATION AND BACKFILL**
- 3.5.1 Be responsible for any excavation and backfill required for work of Division 21, 22, 23 and 25. Slope or shore all trenching in accordance with all current regulations and safety standards. Where any pipes pass under building footings, backfill under footings with lean concrete.
- 3.5.2 Use materials and standards of compaction for backfill in accordance with General Trades Specifications, unless specified otherwise.
- 3.5.3 If changes are required in locations, depth of excavating or related data, advise the Consultant in reasonable time to avoid disruption of work sequence.
- 3.6 **SUPPORTS AND BASES**
- 3.6.1 Provide structural work required for installation of equipment provided under this Division.
- 3.6.2 Where piping and/or equipment is to be supported by steel stud walls, use brackets and supports which attach to steel studs. Support equipment independently of wall sheathing.
- 3.6.3 Set all floor-mounted equipment on concrete bases at least 100 mm (4") high. Provide bases, anchor bolts and any special isolation bases. Concrete bases for air handling equipment are to be sized to suit unit drain air seal requirements, but 100 mm (4") to remain as minimum. Size concrete equipment bases to suit the equipment actually supplied and in accordance with the Shop Drawings of such equipment. Do not start concrete work until anchor bolts and other embedded parts required for the complete installation, as well as Shop Drawings, are available at the site.
- 3.6.4 Carry out all concrete work in accordance with requirements of General Trades Specifications. Provide wire mesh, rebar, and all necessary reinforcing.
- 3.6.5 For new concrete bases or pads on existing floors, first scrape and remove existing floor finish. Scarify existing floor so that new concrete adheres to it. Dowel new pads to existing floors.

3.7 CONCRETE INSERTS

3.7.1 General

3.7.1.1 Anchors for the support of pipes, ducts, and equipment from the underside of suspended structural concrete systems may be either cast-in-place type, placed prior to the pouring of concrete, or wedge type anchors, placed in holes drilled after the forms are stripped. The use of inserts cast into the concrete is the preferred option.

3.7.1.2 The safe load capacity of concrete anchors is affected by a number of variables such as specific anchor type, embedment, spacing between individual anchors, edge distances, direction of loading, concrete strength and "prying action". Refer to the manufacturer's recommendations for each specific insert proposed, including any dynamic or vibratory loads.

3.7.1.3 Be responsible for the proper selection and installation of inserts, including number, type, spacing, and accurate placement to provide the necessary safe load capacity and satisfactory long term performance.

3.7.2 **Installation of Cast in Place Inserts:** Ensure that anchors are accurately placed and "fixed" in position with sufficient rigidity to maintain their position during the placement of concrete. Do not displace reinforcing to install anchors without the prior permission of the Consultant.

3.7.3 Installation of Inserts in Hardened Concrete:

3.7.3.1 Use inserts placed in pre-drilled holes. Do not use powder driven inserts or self-drilling inserts. Before drilling holes, accurately locate all reinforcing bars in the affected areas using an electro-magnetic locator.

3.7.3.2 Do not drill through or otherwise damage reinforcing bars. If reinforcing is encountered, the inserts must be relocated. Ensure that hole diameter, depth of penetration, spacing, etc., are in strict accordance with the insert manufacturer's recommendations for the specific insert type and load condition.

3.7.3.3 Due to the relatively close spacing of reinforcing bars in the bottom of many of the beams and girders, the preferred location of drilled-in-place anchors in beams and girders is into the sides of these members, rather than upwards into the bottom.

3.7.3.4 Inserts to be zinc plated female concrete anchors. Nylon or plastic anchors are not acceptable.

3.7.4 Concrete screws without anchors are not acceptable.

3.8 SLEEVES

3.8.1 Except as approved otherwise by the Consultant, install sleeves embedded in concrete in accordance with the following general guidelines:

3.8.1.1 Centre to centre spacing to be not less than 3 diameters of the maximum size adjacent sleeve.

- 3.8.1.2 Provide additional reinforcing at points of congestion as directed by the Consultant.
- 3.8.1.3 Sleeves through beams will be permitted only as directed by the Consultant.
- 3.8.1.4 The reinforcing in beams, slabs, and columns must not be displaced from its intended position under any circumstances unless prior written approval is obtained from the Consultant.
- 3.8.1.5 Within mechanical rooms and other service spaces, install floor sleeves with top of sleeve 20mm (3/4") above floor, to reduce the risk of water on floor draining through the sleeve to the level below.
- 3.8.2 Provide sleeves for insulated pipe large enough to permit free movement of pipe without crushing the insulation.
- 3.8.3 Provide sheet metal framing around ducts through masonry walls in exposed areas to ensure a clean finish around ducts.
- 3.9 **FIRESTOPPING AND CLOSURES**
- 3.9.1 Provide a listed firestop system in accordance with the Ontario Building Code to seal around all piping, tubing, ducts, conduits, electrical wires and cables, and other similar mechanical services which penetrate part of a building assembly required to have a fire resistance rating or a fire separation. All penetrations throughout the building are to be considered 2 hour rated, unless noted or specified otherwise.
- 3.9.2 Where applicable, refer to Architectural Drawings and/or Specification Section "Firestopping and Smoke Seals", for building assembly and fire separation types and locations.
- 3.9.3 For all penetrations through fire separations required to have a fire resistance rating, use firestop systems with an F rating not less than the fire resistance rating for the fire separation. This includes the sealing of any sleeves provided for future uses.
- 3.9.4 Provide an FT rated firestop where required by the Ontario Building Code.
- 3.9.5 For all penetrations through a Service Room floor, provide a minimum W rating - Class 1 in addition to the fire resistance rating.
- 3.9.6 At each fire stopping penetrating location, provide a fire stopping identification label indicating the system number installed, products used, date installed and installer's name. Locate label on penetrating service at the penetration location, on both sides.
- 3.9.7 All firestopping must be reviewed by the Consultant on site before any firestopping is concealed. Complete three destructive tests to confirm compliance with ULC listing, minimum one floor test and one wall test, third test to be Contractor's choice. Contractor to replace fire stopping system after destructive test has been completed. Submit a copy of the testing report to the Consultant. Report to include as a minimum: confirmation fire stopping Shop Drawings were used during review, locations where destructive testing was completed, confirmation that all fire stopping locations were reviewed, and that installed systems meet the manufacturer requirements.

3.9.8 Install duct fire damper assemblies in strict accordance with manufacturer's instructions provided with each assembly.

3.10 **ACCESS DOORS**

3.10.1 Supply access doors wherever equipment, valves, dampers, life safety devices, etc., are concealed behind walls or inaccessible ceilings. All devices installed requiring periodic maintenance to be made accessible. Doors will be installed by General Trades.

3.11 **ELECTRICAL WORK**

3.11.1 Perform all electrical work included in the work of this Division in accordance with the requirements of Division 26.

3.12 **IDENTIFICATION**

3.12.1 **Piping and Ductwork**

3.12.1.1 Identify all new piping and ductwork using name labels. Apply labels at 7 m (24') intervals and at all branch connections and access panel locations. Mark each pipe in a space or area less than 7 m (24') at least once with a name label. Apply flow directional arrows beside each name label. Identify fan system number at each ductwork label.

3.12.1.2 To ensure permanent bond, apply 3M Adhesive EC-1341, or equivalent, to the surface of the insulation or pipe material. Apply the label with its own adhesive on this surface. Remove any labels that are "lifting" or "peeling". Clean the surface and repeat the procedure specified with a new label. Where labels do not adhere, use pipe banding tape spirally wrapped for full length of label. Apply label over the banding tape.

3.12.1.3 Provide colour bands on all piping. Use colours in accordance with current CGSB Publication for identification of piping systems. Submit list with all proposed colours and materials to the Consultant for review before ordering any materials.

3.12.2 **Valves and Dampers**

3.12.2.1 Identify all manual and automatic control valves on all systems using brass tags attached with non-ferrous chains. For existing buildings, obtain copies of the existing valve tag schedules and follow the existing numbering system format using higher numbering sequential to existing numbers. Prepare a schedule of all tags for each system showing designating number, service, and function. Include these schedules in the Operating and Maintenance Manuals and in the Mechanical Room.

3.12.2.2 Provide identification of all duct balancing dampers. Identify both support points of balancing damper and bottom of duct. Fluorescent orange spray paint is acceptable.

3.12.3 **Equipment**

3.12.3.1 Where equipment is concealed above accessible ceilings, indicate location using coloured-coded marking devices, approved by Consultant, fastened to the ceiling components.

3.12.3.2 Provide nameplate identifying equipment type, identification number, service, and area served on each piece of mechanical equipment. For heat pumps, exhaust fans, condensing units, roof top air handling units, etc. list the rooms served by each piece of equipment.

3.12.3.3 Contractor is to complete owner's asset tag information form for all new and/or relocated equipment.

3.13 **CUTTING AND PATCHING**

3.13.1 Where pipes and ducts are shown on the Mechanical Drawings passing through existing walls, floor slabs, and roof, cut and patch the necessary openings.

3.13.2 Before drilling holes through floors or roof slabs, accurately locate and note sizes for each required hole. Obtain approval from Consultant before any cutting is started. Electrical conduits with live wiring may be embedded in concrete floor slabs. Scan testing is required.

3.13.3 Flash holes through walls and roof to make weatherproof.

3.13.4 For penetrations through walls not required to have a fire rating, seal all spaces between pipe or pipe and surrounding wall construction with a fire-rated foam sealant. Do this as the work progresses, to avoid leaving inaccessible holes at completion of the job. For penetrations through parts of the building assembly required to have a fire resistance rating or acting as a fire separation, see Clause "Firestopping" in this Section.

3.13.5 Where equipment, ductwork, piping, or other service is removed, repair and patch wall, roof, ceiling, and floor openings to match existing materials and finishes.

3.13.6 Include the cost of all cutting and patching in the Lump Sum Contract Price for the work of Division 21, 22, 23 and 25. All cutting and patching to be done by the trade specializing in the materials to be cut.

3.13.7 Remove, modify, cut, patch, and replace ceilings where necessary to complete the work of this Division, unless this work is specifically included in another Division.

3.14 **PAINTING**

3.14.1 Refer to General Trades Specifications for materials and methods for painting of piping, ductwork, walls, floors, and ceilings. Primer and paint applied inside the building must comply with the VOC content limitations of Division 01 Section "Material and Product Requirements".

3.14.2 Touch up minor damage to finish on equipment supplied with factory applied baked enamel finish. Completely refinish items suffering damage which, in the opinion of the Consultant, is too extensive to be remedied by touchup.

3.14.3 Paint all steel framework provided by this Division with a chromium oxide primer. Exposed non-galvanized hangers, racks, struts, and fasteners to be thoroughly degreased and primed, ready for painting. All steel framework outside the building is to be hot dipped galvanized.

- 3.14.4 Paint all exterior piping, including both new and existing natural gas piping. Use two coats of paint. Use colours as selected by the Consultant.
- 3.14.5 In existing mechanical rooms, where uninsulated piping, ductwork and conduit is painted, paint all new services to match.
- 3.14.6 Where walls are cut and patched for mechanical work, paint walls to match existing. For walls less than 9.3 m² (100 sq. ft), paint entire wall. For walls larger than 9.3 m² (100 sq. ft), paint area of patch. Painting to be completed by painting contractor.
- 3.14.7 Include the cost of all painting in the Lump Sum Contract Price for the work of Division 21, 22, 23 and 25.
- 3.15 **WELDING**
- 3.15.1 All pipe and pressure vessel welding and brazing (including for non-registered pipe systems) must be performed in accordance with TSSA approved Welding/Brazing Procedure Specifications. All individuals performing welding or brazing must hold a valid TSSA Welding or Brazing Certificate, that is appropriate and approved for the welding and brazing procedures performed.
- 3.15.2 All other welding performed on the project is to be compliant with CSA W59-03 (for steel) or CSA W59.2-M (for aluminum). Welding and cutting tasks shall also be carried out in accordance with CSA 117.2. Welding is to be performed by tradesmen certified to CSA W47.1 (steel), or CSA W47.2 (aluminum) as appropriate. Welding inspectors shall be qualified to CSA W178.2. Provide proof of certification to Consultant upon request.
- 3.15.3 All welding of stainless steel to be performed in accordance with the requirements of the American Welding Society Standard AWS D1.6/1.6M. When provisions of this standard conflict with the provisions of the applicable CSA standards, the CSA standard requirements shall take precedence.
- 3.16 **USE OF FANS**
- 3.16.1 Do not use any fan supplied under this Contract for ventilation while the building is under construction. The building must be "broom clean" and all painting finished before permission will be granted for testing fans.
- 3.16.2 The Consultant reserves the right to use any piece of equipment, device, or material for such reasonable lengths of time and at such times as may be required to make a complete and thorough test of the same before final completion and acceptance of the work. Such tests are not to be construed as evidence of acceptance of the work, and it is agreed and understood that no claim for damage will be made for injury or breakage to any part or parts of the equipment and/or materials due to the aforementioned tests, where such injuries or breakage are caused by a weakness or inaccuracy of parts, or by defective materials and/or workmanship of any kind. Supply all labour and equipment required for such tests. Trial usage will not initiate or affect in any way the warranties required for devices being tested.

3.17 **PIPING SYSTEMS INSPECTION AND TESTING**

3.17.1 **General**

3.17.1.1 Inspect and test all piping systems. Do not cover, conceal, or close in piping until inspection and tests are completed. Thoroughly test all systems before making arrangements for the final demonstration in the presence of the Owner's staff.

3.17.1.2 Coordinate and schedule all tests with the Consultant and/or Owner. Document all tests immediately after the work is completed. Note all deficiencies and malfunctions. Promptly rectify and complete testing before issuing reports. Provide completed approved test reports, signed by the technical representative doing the work.

3.17.1.3 At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found and retest.

3.17.2 **Soil, Waste, Vent and Building Drains:** Seal all openings in section under test, then fill with water to a height of 3 m (10') above top of section. Maintain water level for at least two hours. Test in sections as the work progresses. After all fixtures have been placed, apply a smoke test to the satisfaction of the local Plumbing Inspector.

3.17.3 **Fire Protection Systems:** Test in accordance with current NFPA and Fire Underwriter's Survey (FUS) recommendations. Where Factory Mutual is referenced in Fire Protection System Specifications, test in accordance with Factory Mutual Requirements.

3.17.4 **Water and Compressed Gas Systems**

3.17.4.1 Unless specified otherwise, apply a hydrostatic test of 1050 kPa (150 psig) or 1-1/2 times working pressure, whichever is greater, for two hours.

3.17.4.2 Compressed air, gases and steam systems are to be inspected by the Technical Standards and Safety Authority (TSSA). Contractor to submit three sets of Piping Drawings and Specifications to the TSSA for review, contact the TSSA for a site visit to review materials and installation methods, and contact the TSSA after the piping is installed for a final inspection. All costs required for the TSSA inspections are to be included in the Bid Price.

3.18 **PERFORMANCE VERIFICATION**

3.18.1 All major equipment and systems must be thoroughly tested by the Technical Representative of the equipment or system manufacturer. This testing will occur before arrangements are made for the final demonstration in the presence of the Owner's staff.

3.18.2 At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found.

3.18.3 Systems to be tested include air handling units, all major heating and cooling equipment, any specialty plant equipment such as air compressors or medical gas equipment, terminal units such as fan coils or heat pumps, and control system. The manufacturer's representative must be present for the test period and submit a Certificate of Operation to the Consultant.

3.19 START-UP SERVICES

- 3.19.1 Provide the services of a qualified person to be on call and available to the site within one hour, for four weeks after work of this Contract is taken over by the Owner. Assist Owner's staff to become familiar with the system operation. Provide a similar service for one week after switchover to the opposite air conditioning cycle (heating or cooling).

3.20 PLACING IN OPERATION

- 3.20.1 Upon completion of all work and before turning over the job, test each system for proper operation.
- 3.20.2 Flush through all drains and properly adjust flush valves and other fixtures.
- 3.20.3 Open and clean all new and existing traps, strainers, and scale pockets after two weeks' operation.
- 3.20.4 Clean out all new and existing room heating units, terminal heating and cooling units, volume boxes and all air handling equipment with a vacuum cleaner when building is completed.
- 3.20.5 Steam clean all existing convectors and wall-fin elements in the rooms where changes have been made. Do this after all other work has been completed.

3.21 SPARE PART TURNOVER TO OWNER

- 3.21.1 For each new filter bank, provide one extra set of filters.
- 3.21.2 Refer to equipment Specifications for provision of spare parts, terminal units, etc.

3.22 COOPERATION BETWEEN TRADES

- 3.22.1 Cooperate and coordinate with other trades as required for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Pay cost of extra work caused by and make up time lost as result of failure to provide necessary cooperation information or items to be fixed to or built-in, in adequate time. Cost of labour and materials for rework, and costs arising from time delay, required due to lack of cooperation or coordination between trades, will not be compensated by owner.
- 3.22.2 Ensure required minimum service clearances for equipment and devices installed by other Trades, such as Electrical, are respected and accommodated. Do not install equipment or services within these required clearances, or blocking access to electrical junction boxes or pull boxes, access doors, etc. Notify consultant if clearance requirements cannot be met.

3.23 MAINTENANCE OF EXISTING SERVICES

- 3.23.1 Take every precaution to locate and protect existing services so that no unscheduled interruption occurs. If any existing service is damaged due to the work of this Division, arrange and pay for repair. Bear any costs due to interruption of existing services.

3.23.2 The operation of the building by the Owner for day-to-day activities takes precedence over all construction related activities, particularly those activities that require system or service shutdown, or that generate noise, dust, or odour. The Contractor may be asked to cease work immediately in these instances and directed to work at another time. Assume all construction related activities which will impact the day-to-day operations of the facilities will be performed after regular building occupied hours, either at night or on weekends. Include all costs associated with after hours and overtime hours in the Base Bid. Additional cost claims related to after hours or overtime hours after contract award, will not be entertained.

3.23.3 Permission from the Owner is required before making any connections to or rerouting of existing services. Before any interruptions of service or restriction of use of any service, provide seven days prior written notice to the Consultant and Owner.

3.24 **PROTECTING AND MAKING GOOD**

3.24.1 Be responsible for protection of Owner's property, as well as finished and unfinished work, from damage due to execution of work under this Contract. Repair damage resulting from failure to provide such protection to the satisfaction of the Consultant, at no expense to the Owner.

3.24.2 Attach and fasten fixture and fittings in place in safe, sturdy, secure manner so that they cannot work loose or fall or shift out of position during occupancy of building, as the result of vibrating or other causes in normal use of building.

3.25 **REMOVAL OF EXISTING MATERIAL AND EQUIPMENT**

3.25.1 Remove existing material and equipment where shown or specified. Unless noted or specified otherwise, all material and equipment which is removed becomes the property of the Contractor and must be immediately removed from the site.

3.26 **CONNECTING TO EXISTING SERVICES**

3.26.1 Prior to starting the work, and prior to any related demolition work, field review and locate all points of connection to existing services. Investigate and determine existing services sizes, service locations and flow directions, and confirm compatibility with the work shown on the Drawings. Alert the Consultant to any conflicts or inconsistencies prior to proceeding with any work. Contracting team is responsible for connecting all new services to the correct existing piping and ductwork, in order to achieve correct flow direction and system operation.

3.26.2 For existing sewers, contractor to use a camera or complete a scan to confirm exact location of sewers prior to excavation. Prior to connecting to an existing sewer, the contractor is to perform dye test or camera investigation to confirm whether the sewer serves a sanitary or storm system. Connect to the appropriate sewer.

3.27 **EXAMINATION OF EXISTING EQUIPMENT**

3.27.1 Report all damaged, defective, and non-functioning equipment shown for reinstallation or relocation to the Consultant prior to removal and storage. All equipment will be assumed to be fully functional unless reported otherwise prior to removal.

3.27.2 Devices and equipment damaged during removal, storage, or reinstallation will be replaced at no cost to the Owner.

3.28 **PHASING**

3.28.1 The work on this project is to be phased to enable continuous operation of the Owner's facilities. See the Architectural Drawings and Specifications regarding the proposed phasing of the work. Provide for temporary services, connections, bypasses, etc. to enable the phasing as described. Carry all associated costs in the Bid.

3.29 **FIRE SAFETY IN EXISTING BUILDINGS**

3.29.1 Where temporary shutdown of sprinkler systems, standpipe systems, or other fire protection systems is required, do all work in compliance with Clause 1.1.1.1, Clause 2.8.2.1.5, and Subsections 6.4.1 and 6.5.2 of the Fire Code.

3.30 **DEFICIENCY REVIEW**

3.30.1 The Mechanical Contractor shall confirm in writing that the work is complete and ready for inspection. The Consultant will schedule a site visit to review the work and provide a written deficiency list. Once deficiencies have been corrected, the Mechanical Contractor shall confirm in writing to the Consultant that all deficiencies have been corrected. The Consultant will schedule a second site visit to review the correction of noted deficiencies. Should any noted deficiencies be found to be still outstanding, the Mechanical Contractor shall correct them and again notify the Consultant in writing. Charges to the Mechanical Contractor may result from repeat visits after the second visit.

3.30.2 The Mechanical Contractor is required to complete all work above ceilings and allow time for deficiency reviews and correction of noted deficiencies in a timely manner in order to accommodate the current Construction Schedule. This includes time for reinspection as required prior to concealing (drywall enclosures, drywall ceilings and acoustic tile ceilings) of any service. The Mechanical Contractor will be responsible for uncovering any concealed services for inspection.

3.31 **HOURLY LABOUR RATE**

3.31.1 Hourly labour rate shall be the actual rate paid to the worker as posted by the local Union Agreement plus a burden mark-up of 100% to compensate for contributions, assessments, employment insurance, health insurance, pension plans, WSIB, taxes, vacation pay, travel, parking, welfare, union package and membership dues, supervision, material handling, training, rest periods, down time, breaks, personal hygiene, small tools, clean up time, profit, other benefits paid to the worker and all other costs incurred by the Company including meetings, office time, project warranty updates and office project management time. Travel time to and from the site shall be at no charge to the Owner. For the purpose of mechanical work, the journeyman plumber union rate will be used for all trades completing any mechanical work.

3.32 **TEMPORARY WATER SERVICE**

- 3.32.1 Provide a Reduced Pressure type backflow preventer at each temporary water service connection used for construction purposes. Completely remove all temporary facilities once permanent systems are tested and operational.

3.33 **ALTERNATIVE, SEPARATE, UNIT AND IDENTIFIED PRICES**

- 3.33.1 Refer to Division 01 Specifications.

3.34 **CASH ALLOWANCES**

- 3.34.1 Include in the Base Bid price, cash allowances of:

3.34.1.1 \$60,000.00 to cover the cost of the work of Section 25 00 00 "Controls".

3.34.1.2 \$10,000.00 to cover the cost of the work of Section 23 25 00 "Water Treatment".

3.34.2 Any amounts in excess of the cash allowances will be paid by the Owner. Return any unused portions of the cash allowances in full to the Owner.

3.35 **WORK OF SECTION 25 00 00**

- 3.35.1 The Controls Contractor has been preselected by the Owner. The Mechanical Contractor is to subcontract the controls contractor portion of the work of Section 25 00 00 to Durrell Controls.

3.36 **LIST OF MECHANICAL SUBCONTRACTORS AND MANUFACTURERS**

- 3.36.1 In the Bid documents, name the Subcontractors and Manufacturers for the items listed below. Use only one name for each item. See Clause "Material and Equipment". Where the name of a manufacturer is not entered on the Bid Form, the Contractor will be required to use the base specified manufacturer.

3.36.2 **Subcontractors**

Insulation
Sheet Metal
Sprinkler System
Testing and Balancing

3.36.3 **Manufacturers**

Fans - Exhaust Air
Grilles, Registers and Diffusers
Plumbing Brass
Plumbing Fixtures
Sprinkler Heads
Variable Air Volume Boxes

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 21 05 01, "Common Work Results for Mechanical".

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Sprinkler System:** Provide a wet type automatic sprinkler system to completely protect and serve new and renovated areas, as shown on the Drawings. Design and build the system in accordance with the requirements of NFPA 13, the Ontario Building Code and Fire Underwriter's Survey (FUS). Follow FUS guidelines for occupancy hazard classification. Extend and modify existing systems where shown or noted on the Drawings.

1.3 **SHOP DRAWINGS**

1.3.1 Submit Shop Drawings in accordance with the Clause "Shop Drawings" in Section 21 05 01 for the following equipment and materials:

- Sprinkler Heads

1.3.2 See requirements for Design Drawings in Part 3 of this Section.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 21 05 01, "Common Work Results for Mechanical" Clause "Materials and Equipment".

2.1.2 Use only material and equipment which is Underwriters' Laboratories of Canada Listed and FUS approved for the application.

2.2 **PIPE AND FITTINGS**

2.2.1 Unless specified otherwise, use standard black steel pipe with screwed or flanged cast iron sprinkler fittings suitable for 1210 kPa (175 psig) pressure, cold water, non-shock. Use screwed or flanged type joints between pipe and fittings or valves. Mechanical type Victaulic or Gruvlok couplings, Canadian Underwriter's Listed and FUS approved, may be used. Ensure wall thickness of pipe is in accordance with NFPA 13 and 14 for the type of connections used.

2.2.2 If required due to system pressures, use black steel pipe with welded, screwed, or flanged sprinkler fittings suitable for 2070 kPa (300 psig) pressure cold water, non-shock.

2.3 **SPRINKLER HEADS**

2.3.1 Use ULC listed Tyco quick response sprinkler heads as follows:

- Model RFII concealed sprinkler with white finish in all areas with suspended ceilings, unless shown or noted otherwise
- Model RFII concealed sprinkler with finish chosen by Architect in all areas with wood or other specialty decorative suspended ceilings, unless shown or noted otherwise
- Upright sprinkler, chrome finish in all areas without suspended ceilings, unless shown or noted otherwise

2.3.2 Use wire sprinkler guards with baked synthetic red enamel finish where shown on the Drawings.

2.3.3 The following manufacturers of the above equipment will be considered equal, subject to the requirements of Clause "Material and Equipment":

Reliable Automatic Sprinkler Co.
Victaulic
Viking Corp.

3 Execution

3.1 **INSTALLATION**

3.1.1 **Sprinkler Systems:** Modify and extend complete systems designed, constructed, installed, and tested in accordance with NFPA 13, FUS and the Ontario Building Code.

3.2 **COOPERATION**

3.2.1 Cooperate with other trades on the job and so arrange work that no delay is caused to any other trade. Examine all Drawings paying particular attention to lighting fixtures, structural steel, heating and plumbing piping, ductwork, and electrical conduit, so that the installation of the sprinkler system will not interfere with other work.

3.3 **DRAWINGS**

3.3.1 The Fire Protection Drawings show sprinkler types and locations, main piping layouts and zoning. Use this information as a basis to produce a set of Fabrication Drawings for a sprinkler system which will completely protect all of the building areas. Coordinate the preparation of these Drawings with all other trades to avoid conflict with other services.

3.3.2 Sprinkler systems are to be designed by a Fire Protection Engineer using hydraulic calculations. Engage an Engineer registered with Professional Engineers Ontario who specializes in Fire Protection Engineering and is both qualified and insured in accordance with the requirements of Division C of the 2024 OBC. That individual will be designated herein as the Fire Protection Engineer for the project. Submit Fire Protection Engineer's proof of liability insurance with Shop Drawings.

3.3.3 The Fire Protection Engineer will apply his or her seal to all Fire Protection Drawings prepared for construction. The Fire Protection Engineer will be responsible for General Review during Construction for the work of this Section, in accordance with the 2024 OBC.

- 3.3.4 The Fire Protection Engineer is to size all piping and indicate sprinkler head and pipe locations on working Drawings. Sprinkler head locations and quantities shown in the Bid Documents are for general layout purposes only, to identify approximate locations and quantities and sprinkler head types to be used. The Contractor is responsible for determining exact locations and quantities of sprinkler heads. Piping locations are shown where critical only. The Contractor is responsible for determining exact locations for piping.
- 3.3.5 Piping is to be sized to suit available pressure from the municipal water system without use of a fire pump. Use low pressure requirement sprinkler heads where required.
- 3.3.6 Provide sufficient number of sprinkler heads, whether shown on the drawings or not, to achieve coverage as required by NFPA 13 and FUS.
- 3.3.7 Prepare the Drawings in AutoCAD, matching software format of design files provided. Show sprinkler heads on Architectural Reflected Ceiling Plans. Architect will provide AutoCAD drawing files for overlays.
- 3.3.8 Before starting installation, submit six copies of Fabrication Drawings and Hydraulic Calculations to Fire Underwriter's Survey (FUS) for approval (email planreview@fireunderwriters.ca). Pay all costs for FUS review. Submit copies of Drawings, duly approved by FUS, to the Consultant for final review prior to commencing work. Submit two copies to local Building Department for plan review.
- 3.3.9 Use sprinkler heads, piping, and fittings suitable for the temperature of the environment (e.g. extremes of hot or cold, humidity). Use high temperature heads in Mechanical and Electrical Rooms.
- 3.3.10 Where architectural reflected ceiling plans show ceilings which are not continuous from wall to wall, provide sprinkler coverage both above and below ceiling.
- 3.4 **SPACING OF SPRINKLERS**
- 3.4.1 Sprinkler heads must be centred both ways within each 610 mm x 610 mm (24" x 24") portion of ceiling tile.
- 3.5 **DRAINS, AIR VENTS AND TEST CONNECTIONS**
- 3.5.1 Provide drain cocks with hose thread at all low points of the system not drainable through the main drain valve at service entrance, in accordance with NFPA 13 requirements. Provide air vents, flushing and test connections as required by NFPA 13 and FUS.
- 3.6 **EXPOSED AREAS**
- 3.6.1 In all areas exposed to view, provide a decorative grade installation. Pay particular attention to neat pipe layout. Degrease all pipe and fittings, to be suitable for painting.
- 3.7 **SPRINKLER GUARDS**
- 3.7.1 Provide guards where shown and in all mechanical rooms, electrical rooms, and service spaces.

3.8 **ELEVATORS**

- 3.8.1 Install sprinkler heads and piping in elevator hoistways and machine rooms to meet "Safety Code for Elevators and Escalators".

3.9 **SYSTEM FLUSHING**

- 3.9.1 Flush the complete sprinkler and standpipe systems after installation.

3.10 **TESTING**

- 3.10.1 Test complete system in accordance with Underwriters' Laboratories of Canada, NFPA 13 and FUS requirements. Notify Consultant a minimum of 48 hours in advance of each test so arrangements can be made to have these tests witnessed. Note that work may progress in a phased manner and the systems will need to be tested and made operational in phases.
- 3.10.2 Test the operation of every valve supervisory device, flow alarm switch and pressure switch.
- 3.10.3 Operate one fire hose cabinet on each riser to ensure lines are free of air, oil and debris as directed by the Consultant. Provide facilities for discharge of the hose stream.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 21 05 01, "Common Work Results for Mechanical".

1.1.2 All products used must have a flame spread rating less than 25 and a smoke developed classification not more than 50 when tested in accordance with CAN/ULC-S102.

1.1.3 **Environmental Requirements:** Maintain ambient temperature and conditions required by manufacturers of adhesives, mastics, and insulation cements.

1.1.4 **Quality Assurance:** Insulation materials must be manufactured at facilities certified and registered to ISO 9000 Quality Standard.

1.1.5 **Storage of Materials:** Protect materials from dirt, water, chemical and mechanical damage before, during and after installation. Provide and install waterproof sheeting to protect insulation in unfinished areas as required. Remove damaged materials from the site immediately and discard. Remove and replace at no additional cost any installed materials which are damaged.

1.1.6 **Delivery:** Deliver insulation, coverings, cements, adhesive coatings, etc., to the site in Manufacturer's original containers with the manufacturer's stamp or label affixed showing flame and smoke ratings of the products, name of manufacturer and brand.

1.1.7 **Insulating Contractor Qualifications:** Insulating contractors and thermal insulation installers for the work of this project must be members of the Thermal Insulation Association of Canada (TIAC).

1.2 **DEFINITIONS**

1.2.1 In this Specification, "exposed to view" means all surfaces of all services within Equipment Rooms, Service Corridors, plus all other areas of the building where the services are not enclosed within ceilings or shafts.

1.3 **SHOP DRAWINGS**

1.3.1 Provide shop drawings which include product description, list of materials and thickness for each service and manufacturers' installation instructions.

1.3.2 Submit Shop Drawings in accordance with the Clause "Shop Drawings" in Section 21 05 01 for the following equipment and materials:

- Piping Insulation Types (note application for each product)
- Finishing Cement
- Lagging Adhesive
- Pipe Insulation Coverings
- Piping Insulation Inserts
- Vapour Barrier Mastic

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 21 05 01, "Common Work Results for Mechanical", Clause "Material and Equipment".

2.2 **PIPING INSULATION INSERTS**

2.2.1 Use Johns Manville Thermo-12 Gold calcium silicate rigid piping insulation inserts. Inserts to be equal in thickness to the adjoining insulation and to extend up to pipe centreline on both sides. Quarter diameter size inserts will be accepted for copper piping only. Use the following insert lengths:

Nominal Pipe Size		Insert Length	
mm	(inches)	mm	(inches)
40 - 65	(1-1/2 - 2-1/2)	250	(10)
75 - 150	(3 - 6)	300	(12)
200 - 250	(8 - 10)	400	(16)

2.3 **PIPING INSULATION INSERT SHIELDS**

2.3.1 Use minimum 18 gauge galvanized metal shields. Form shields to fit insulation and extend up to the pipe centre line. Shield length to be 100 mm (4") less than length of associated insert. Shield colour is to match pipe finish colour when exposed to view.

2.3.2 Use steel pipe covering protection saddles at roller hangers and pipe roll supports.

2.4 **PIPE INSULATION**

2.4.1 **Piping:** Use formaldehyde-free Knauf Earthwool 1000° glass fibre pipe insulation with factory applied ASJ+ all-service jacket. Insulation conductivity and thickness in accordance with Pipe Insulation Schedule. Jacket to consist of aluminum foil vapour barrier reinforced with glass scrim and laminated to a fire resistant kraft facing.

2.4.2 **Valves and Fittings:** Insulate valves and fittings with formaldehyde-free factory precut Johns Manville Zeston Hi-Lo Temp insulation inserts or Knauf Earthwool 1000° formaldehyde-free glass fibre pipe insulation 16 kg/m³ (1 lb/ft³) density glass fibre insulation.

2.4.3 The following manufacturers of the above equipment will be considered as equal, provided products are formaldehyde free, subject to requirements of Clause "Material and Equipment":

CertainTeed
Johns Manville
Knauf
Manson

2.4.4 Pipe, Valve and Fitting Insulation Covering for Piping Exposed to View

2.5 Use Proto LoSmoke, Johns Manville, Knauf or Walton Plastics equivalent, minimum 0.51 mm (20 mil) thickness PVC jacketing and fitting coverings. Use manufacturer's solvent welding adhesive to permanently seal all PVC joints. Use white jackets unless specified otherwise in Execution Section below.

2.6 PIPING INSULATION THICKNESS SCHEDULE

Fluid Design Operating Temperature Range °C (°F)	Insulation Conductivity		Nominal Diameter mm (in)				
	Conductivity Range W/m°C (Btu-in/hr-ft²-°F)	Mean Rating Temperature °C (°F)	less than 25 (1)	25 (1) and 32 (1-1/4)	40 (1-1/2) to 75 (3)	100 (4) to 150 (6)	200 (8) and up
Domestic and Service Hot Water Systems							
40 and up (105 and up)	0.032 - 0.040 (0.22 - 0.28)	38 (100)	25 (1.0)	25 (1.0)	40 (1.5)	40 (1.5)	40 (1.5)
Domestic Cold Water (Sanitary Drains)							
4 - 24 (40 - 75)	0.030 - 0.039 (0.21 - 0.27)	24 (75)	15 (0.5)	15 (0.5)	25 (1.0)	25 (1.0)	25 (1.0)

2.7 VAPOUR BARRIER MASTIC

2.7.1 Use white Foster 30-33 or Childers CP-33 water based vapour barrier mastic. Permeance shall be 0.07 perms or less as tested by ASTM F 1249. Reinforcing mesh shall be Foster Mast a Fab or Childers Chil Glas #10.

2.8 FINISHING CEMENT

2.8.1 Use Ryder hydraulic setting finishing cement.

2.9 LAGGING ADHESIVE

2.9.1 Use white Childers CP-50AMV1 or Fosters 81-42/30-36 water based fire retardant lagging adhesive.

3 Execution

3.1 GENERAL

3.1.1 Install all insulation in strict accordance with manufacturer's published recommendations.

3.1.2 Install all insulation continuous through walls and sleeves. Insulate all components of insulated systems unless specifically excluded. Extend all surface finishes to protect all surfaces, ends, and raw edges of insulation.

3.1.3 Do not apply insulation until piping has been tested and approved.

3.1.4 Do not insulate unions or flanges at connections to equipment. In these locations, and in all other locations where insulation ends, finish with vapour resistant mastic.

3.1.5 Patch and make good any existing insulation and covering which is damaged during the work of this Contract. Use material of the same quality as existing.

3.2 PIPING SYSTEMS

3.2.1 General Requirements

3.2.1.1 **Sanitary Drainage System:** Insulate horizontal sections from combination drains, floor drains, open hub drains, water closets, urinals, and flushing rim sinks from fixture to point of connection with soil stacks. Insulate discharge piping from sewage pumps to point of connection with building drainage system.

3.2.1.2 Other Piping Systems

3.2.1.2.1 Insulate the following piping systems in their entirety:

- Domestic Cold Water (potable and non-potable)
- Domestic Hot Water (potable and non-potable)
- Domestic Hot Water Recirculating (potable and non-potable)

3.2.2 Insulation Application

3.2.2.1 **General:** Seal all joints in accordance with manufacturer's recommendations.

3.2.2.2 **Firestopping:** Where an insulated pipe passes through a fire separation, use only ULC labelled piping insulation in accordance with ULC Listed firestop system being used. See Section 21 05 01, Clause "Firestopping". Extend ULC labelled pipe insulation through fire separation and 50 mm (2") beyond fire separation on both sides. Tightly butt joints and wrap with approved joint tape.

3.2.2.3 **Hanger Points:** Provide an insulation insert and shield at each hanger point on all piping 40 mm (1-1/2") and larger on all systems. On cold lines, vapour seal butt joints on each side of insert with vapour barrier mastic.

3.2.2.4 **Pipe:** Apply insulation over clean dry pipe. Butt all joints firmly together. Seal all jackets neatly in place. Wrap butt joints with a minimum 75 mm (3") wide strip of the jacketing material. Use a vapour barrier adhesive on all "cold" lines.

3.2.2.5 Fittings and Valves

3.2.2.5.1 For pipe sizes 40 mm (1-1/2") and smaller, insulate with fibreglass blanket wrapped firmly under compression (minimum 2:1) to a thickness matching adjoining insulation. Insulation ends may be mitred at elbows and sealed with tape.

3.2.2.5.2 For pipe sizes 50 mm (2") and larger, insulate with factory precut insulation inserts or with fibreglass blanket wrapped firmly under compression (minimum 2:1) to a thickness matching adjoining insulation. Insulation ends may be mitred at elbows and sealed with tape.

3.2.2.5.3 **Cold Systems:** Apply vapour barrier mastic and reinforcing mesh on all cold service insulated elbows, fittings, flanges, valves, as well as on all cold service line size hangers less than 40 mm (1-1/2"). All vapour retarder jacket seams shall be vapour sealed with vapour barrier mastic in addition to jacket self-seal adhesive. Provide a continuous vapour barrier on the insulation for the following systems:

- domestic cold water (potable and non potable)

3.2.2.5.4 On components which require service, fabricate easily removable and reusable insulation sections e.g. suction guides for circulating pumps and pump casings. Test ports on balancing valves to be accessible outside of insulation.

3.2.3 **Pipe Insulation Finishes Exposed to View**

3.2.3.1 In all locations where the insulation will be exposed to view, finish with pipe insulation coverings. Follow strictly manufacturer's installation procedures for cold and hot systems.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 21 05 01, "Common Work Results for Mechanical".

1.2 **SHOP DRAWINGS**

1.2.1 Submit Shop Drawings in accordance with Section 21 05 01, "Shop Drawings" for the following equipment and materials:

- Cleanouts
- Valves

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 21 05 01, "Common Work Results for Mechanical" Clause "Material and Equipment".

2.2 **PIPE AND FITTINGS**

2.2.1 Select the most economical use of the materials named below. Unless specified or shown otherwise, either material may be used or a combination of materials, whichever provides the greatest economy.

2.2.2 For all piping systems, use only solder and fluxes containing no lead.

2.2.3 **Above Grade Domestic Water Piping (Hot, Cold, HW Recirc. System, Potable, Non-potable, and Soft Water)**

2.2.3.1 For all sizes, use hard drawn copper, Type "L" to ASTM B88, with soldered or flanged joints and bronze or copper fittings.

2.2.3.2 Use Class 150 cast copper solder fittings to ANSI/ASME B16.18 or wrought copper and lead free copper alloy solder fittings to ANSI/ASME B16.22. Use Class 150 lead free cast bronze flanged fittings to ANSI/ASME B16.24.

2.2.3.3 For sizes 100 mm (4") and larger, grooved couplings and associated fittings to CSA B242 may be used. All grooved products to be of one manufacturer, either Victaulic, or Gruvlok.

2.2.3.4 Grooved couplings to be ductile iron with EHP gasket and copper coloured finish. Fittings to be Class 150, wrought copper to ANSI/ASME B16.22, or lead free cast bronze to ANSI/ASME B16.24. Flange adapters to be ductile iron with EPDM gasket and copper coloured finish.

2.2.3.5 For sizes 75 mm (3") and larger, welded or grooved (rolled only) stainless steel piping (304/304L) may be used. Piping to conform to ASME B36.19M and ASTM A312M. Use butt weld pipe fittings. Fittings to conform to ASME B16.9 and ASTM A403/A403M. In all

cases fittings shall be manufactured of the same material grade of the piping material used.

2.2.4 **Above Grade Sanitary Drainage Piping (Including Vent Piping):**

2.2.4.1 **Cast Iron/Copper:** Use cast iron pipe and fittings to CSA B70, with mechanical joints, or seamless copper Type DWV pipe to ASTM B306 with cast or wrought copper fittings and soldered joints. Mechanical joint couplings to be heavy duty Husky model HD2000 or equivalent, rubber compression gasket type with minimum four stainless steel gear clamps and stainless steel hardware. For 75 and 100 mm (3" and 4") pipe sizes, use a liquid neoprene adhesive/lubricant to fill any gaps between pipe ends within the couplings. All sanitary drainage above ground in vertical shafts (vertical service spaces) shall be cast iron.

2.3 **CLEANOUTS**

2.3.1 Use cleanouts of the same size as drainage pipe on piping up to 100 mm (4") diameter, not less than 100 mm (4") on size 150 mm (6") and 200 mm (8"), and not less than 150 mm (6") on larger size pipe. No aluminum components will be permitted.

2.3.2 For line cleanouts, use Watts CO-450-RD epoxy coated cast iron cleanout ferrule complete with countersunk threaded brass plug, stainless steel wall access cover and stainless steel vandal resistant screw.

2.3.3 For stack cleanouts, use Bibby Ste Croix cast iron Barret style stack cleanout with gasketed cast iron cover.

2.3.4 In porcelain, ceramic, and other quarry tile floors, and in floors with vinyl or similar finish, use Watts CO-200-S-1-34 epoxy coated cast iron floor cleanout with square adjustable nickel bronze access cover and frame, and secondary closure plug.

2.3.5 In concrete floors, use Watts CO-200-RX-4-34 epoxy coated cast iron floor cleanout with round adjustable heavy duty ductile iron access cover and frame, and secondary closure plug.

2.3.6 In carpeted floors, use Watts CO-200-RX-4-34 epoxy coated cast iron floor cleanout with round adjustable heavy duty ductile iron access cover and frame, and secondary closure plug.

2.3.7 In wood floors, use Watts CO-200-R-1-34 epoxy coated cast iron floor cleanout with round adjustable nickel bronze access cover and frame and secondary closure plug.

2.3.8 In terrazzo floors use Watts CO-200-US-1-34 epoxy coated cast iron floor cleanout with square adjustable nickel bronze access cover and frame, with recess for terrazzo and secondary closure plug.

2.3.9 In pool deck and pool mechanical room, use Watts CO-1100-C-R-60-34 round PVC body floor cleanout with anchor flange, reversible membrane clamp, adjustable round scoriated Type 304 cast stainless steel removable access cover and secondary closure plug.

2.3.10 In floors with membranes use Watts CO-100 series epoxy coated cast iron floor cleanouts with membrane clamps.

2.3.11 In floors with surface membranes, use Watts CO-100-C-RFC-7-1-34 epoxy coated cast iron cleanout with anchor flange, cast iron reversible membrane clamp, and RFC satin nickel bronze cleanout top with surface membrane clamp.

2.3.12 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Enpoco
Jay R. Smith
Mifab
Zurn

2.4 VALVES

2.4.1 Use valves of same manufacturer except where approved otherwise by the Consultant.

2.4.2 Unless otherwise specified, use valves designed for minimum 1380 kPa (200 psig) CWP (Cold Working Pressure).

2.4.3 Use flanged, screwed or solder ends to suit pipe lines, and non-heating malleable iron handles. Use rising stems where space permits. Use valves with extended valve stems where piping is to be insulated.

2.4.4 Use only industrial class valves meeting ANSI, ASTM, ASME and applicable MSS standards.

2.4.5 All valves supplied for this project shall have a current and valid Canadian Registration Number (CRN) for the Province of Ontario. Upon request, suppliers shall provide a copy of statutory declaration for valves, stamped, signed and dated by TSSA as validation of the CRN registration.

2.4.6 All valves are to comply NSF/ANSI 372 with lead content below 0.25%.

2.4.7 For gear operated valves located within mechanical rooms or service spaces, where valves are installed more than 3 m (10 ft) above finished floor, or are difficult to access from a ladder, provide chain drives in lieu of handwheels.

2.4.8 Domestic Water Systems up to 1380 kPa (200 psi)

2.4.8.1 **Ball Valves 50 mm (2") and under:** 4140 kPa (600 WOG/psig) water oil or gas rating : Use Kitz model 868AMLL/869AMLL, lead free forged brass body, two piece full port, PTFE seats, double Viton "O" ring stem seals, Stainless Steel vented solid ball, blowout proof Stainless Steel stem, and Locking lever handle.

2.4.8.2 **Hose Bibbs/Drain Hose Connections c/w Cap & Chain:** For sizes 15 mm (1/2") and 20 mm (3/4"), use Kitz Model 868C/869C ball valves with cap and chain, 4140 kPa (600 psig) water oil or gas pressure rating, lead free cast brass body, full port, PTFE seats and packing, nickel plated lead free forged brass vented solid ball, blowout proof stem, lever handle.

2.4.8.3

2.4.9 **Equivalent Manufacturers**

- 2.4.9.1 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Ball Valves

Apollo	(Industrial Class)
Kitz	(Industrial Class)
Mueller	(Industrial Class)
Nibco	(Industrial Class)
Toyo	(Industrial Class)

2.5 **ESCUTCHEON PLATES**

- 2.5.1 Provide one piece brushed aluminum escutcheon plates at all points where pipes pass into finished areas through walls, floors, or ceilings.

3 **Execution**

3.1 **SANITARY PIPING**

- 3.1.1 Where pipe sizes are not shown on the Drawings and are not specified, size in accordance with the requirements of the Ontario Building Code.

- 3.1.2 Install piping and connect to, or rough-in for, all fixtures as shown or as specified. Conceal piping in walls or ceilings in finished areas. Where sewers pass under footings, backfill with lean concrete.

- 3.1.3 Combustible pipe and fittings shall not be installed in vertical shafts (vertical service spaces). Piping and fittings with a Smoke Developed Classification of greater than 50 shall not be installed in return air plenums, or High Buildings, per OBC.

- 3.1.4 Use the following minimum slopes on horizontal drains:

Fixture waste or drains	2%
Drains up to and including 75 mm (3")	2%
Drains 100 mm (4") and up to 150 mm (6")	1%
Drains over 150 mm (6")	0.5%

3.2 **WATER PIPING**

- 3.2.1 Use only lead free solder and fluxes.

- 3.2.2 Connect required service to plumbing fixtures, hose bibbs, etc., as shown or as specified.

- 3.2.3 After installation, thoroughly flush complete system to remove all scale, sediment, etc.

- 3.2.4 Where press-connect fittings, joints and valves are specifically permitted in Part 2 Clause "Pipe and Fittings", all press-connect fittings and joints are to be installed and tested in strict accordance with manufacturer's instructions, including two step process for pressure testing.

3.2.5 Piping below grade will only be accepted where shown below grade on the Drawings.

3.2.6 Arrange with local municipal service provided for supply and installation of domestic water meter. Provide all necessary valves and piping needed to comply with municipal service provider's requirements.

3.3 **ROUGHING-IN**

3.3.1 Where shown on Drawings, rough-in hot and cold water systems, drain and vent.

3.3.2 Cap off all piping and provide shutoff valves on hot and cold water piping.

3.3.3 Obtain roughing-in details for future equipment from Owner before starting work. Rough-in according to details received.

3.4 **VENTING**

3.4.1 Vent all fixtures in accordance with local and provincial regulations. Run vents as directly as possible and grade properly to drain back to the fixture connection. Connect the bottom of all vent stacks into soil or waste stacks for drainage. Conceal vents in walls and ceilings in finished areas. Carry vent stacks through roof where shown or where required and project at least 610 mm (24") above roof deck.

3.4.2 For Health Care Facilities, locate vents minimum distance away from air intakes and other building openings in accordance with CSA Z317.1.

3.5 **FLASHING**

3.5.1 Carry vent, waste, and soil stacks through roof where shown on Drawings or where required. Supply all flashing materials. Use materials as specified in Section 21 05 01, "Common Work Results for Mechanical".

3.6 **CLEANOUTS**

3.6.1 Install cleanouts behind walls so that the bolted cover on the cleanout will be within 25 mm (1") of the finished wall. Wall cleanout access doors to be installed minimum 200 mm (8") above finished floor.

3.6.2 Conceal cleanouts in finished walls with access doors. See Section 21 05 01 "Common Work Results for Mechanical".

3.6.3 Place cleanouts where shown, at end of all drainage lines, at all changes of direction greater than 45°, and at the base of all stacks.

3.6.4 Bring cleanouts up to floor level in all buried pipe and in all horizontal runs above grade where specifically shown. For all other cleanouts in horizontal runs above grade, leave with access from ceiling space. Bring cleanouts in concealed vertical pipes to a wall surface.

3.6.5 Locate floor cleanouts clear of fixed furniture and equipment. In corridors, locate cleanouts near walls but clear of base.

3.7 **VALVES**

- 3.7.1 Install a valve at takeoff point in each main branch which takes off from main and in all locations shown.
- 3.7.2 Install drain valves with hose connections at all low points and at all branch valves for upfeed risers.
- 3.7.3 Use line sized valves unless noted otherwise. Use ball valves on sizes up to 65 mm (2-1/2") size and butterfly valves on larger size pipe. Use ball valves or gate valves either side of water meter.
- 3.7.4 Mount interior hose bibbs with centre at a point 760 mm (30") above finished floor unless noted otherwise.
- 3.7.5 Install check valves on pump discharge a minimum of 8 pipe diameters downstream of pump.

3.8 **EXISTING SYSTEMS**

- 3.8.1 Maintain systems in operation throughout construction, using temporary systems where shown. Disconnect existing systems only when temporary or permanent replacement systems are operational.
- 3.8.2 Construct the temporary systems to the same standards of material and installation as the permanent systems.

3.9 **STERILIZATION OF POTABLE WATER SYSTEMS**

- 3.9.1 All chlorination and sampling must be completed and tested by a person holding a Water Distribution Licence Class 1 thru 4 and sampling submitted to an accredited laboratory. Provide certified reports.
- 3.9.2 Thoroughly flush the domestic hot and cold water piping systems using clean potable water to remove dirt and other contaminants. Remove all faucet screens prior to flushing and reinstall after completion of flushing.
- 3.9.3 Disinfect domestic hot and cold water piping systems using a liquid chlorine solution. Introduce the liquid chlorine to ensure the chlorine is distributed throughout the sections being tested. Apply chlorine to achieve a minimum chlorine concentration of 10 mg/L throughout the sections being tested. Leave the 10 mg/L chlorine solution in place for 24 hours.
- 3.9.4 Test the chlorine residual after 24 hours. If tests show a minimum chlorine residual of 5 mg/L, flush the disinfected sections and recharge with potable water. If the chlorine residual is found to be less than 5 mg/L, repeat the disinfecting procedure until satisfactory results are obtained.

- 3.9.5 After the systems have been flushed and recharged with potable water, arrange and pay for bacteriological tests to be conducted by an independent testing agency. Provide certified reports. If there is evidence of contamination, repeat the disinfecting procedure until satisfactory results are obtained. Obtain the Building Inspector's permission before placing the systems in normal operation.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 21 05 01, "Common Work Results for Mechanical".

1.2 **SHOP DRAWINGS**

1.2.1 Submit Shop Drawings in accordance with Section 21 05 01, "Common Work Results for Mechanical" Clause "Shop Drawings".

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 21 05 01, "Common Work Results for Mechanical" Clause "Material and Equipment".

2.2 **PLUMBING FIXTURES**

2.2.1 **General**

2.2.1.1 Provide white fixtures unless specified otherwise. Use only first quality fixtures. Warped or distorted fixtures will not be accepted. Use fixtures of a single manufacturer only, wherever possible. Likewise use a single manufacturer for faucets, supplies and drains.

2.2.1.2 All plumbing fixtures, faucets and supplies to meet NSF 372, with lead content below 0.25%.

2.2.1.3 Provide rigid spouts for all faucets except for sinks in kitchens, kitchenettes, scullery sinks, etc.

2.2.1.4 Use only new plumbing fixtures certified by CAN/CSA-B45.0, and closet seats, fittings, and trim certified by CAN/CSA B125, free from cracks, scratches, wrench marks, or imperfections of any kind. Replace any permanently stained, chipped, or marred fixtures or connections.

2.2.1.5 Use factory chrome plated items for all visible parts of the fixture trim including faucets, escutcheons, waste, strainers, traps, supplies, stops, etc.

2.2.1.6 Unless specified otherwise, the following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

- Plumbing Brass - Chicago Faucet, Delta Commercial, Moen Commercial, Kohler, T&S Brass
- Stainless Steel Sinks - Franke Kindred Commercial, Novanni
- Drains - McGuire, Zurn
- Supplies - McGuire, Zurn

2.2.2 Single Compartment Sink (Drawing Reference SS1) (Clinical Handwash Undercounter Sink)

2.2.2.1 Sink: Franke Kindred Steel Queen QSUA 1922-8, 551 mm x 476 mm x 203 mm (21-11/16" x 18-3/4" x 8") 20 gauge, Type 302 stainless steel single bowl undermount sink, with backledge drilled for 200 mm (8") centre faucet set. Sink complete with 90 mm (3-1/2") crumb cup strainer and 40 mm (1-1/2") tailpiece.

2.2.2.2 Faucet: Delta Commercial 26C3944 deck mounted faucet, chrome plated, 200 mm (8") centres, solid cast brass lead-free body, 1/4 turn ceramic disc valve cartridges, 250 mm (10") cast brass rigid gooseneck spout with 6 lpm (1.5 gpm) vandal resistant flow aerator outlet and cast brass 100 mm (4") blade handles. Provide stops on supply piping and wall escutcheons.

2.2.2.3 Waste: Cast brass P trap, 40 mm (1-1/2"), with unions, cleanout, and escutcheon.

3 Execution

3.1 PLUMBING FIXTURES

3.1.1 Provide shutoff ball valves at each fixture in addition to the faucets on each fixture.

3.1.2 Where fixture connections pass into walls, floors, or ceilings, provide proper escutcheons.

3.1.3 Where electronic faucets are provided, if the electronic solenoid valve is not integral to the faucet, locate solenoid enclosure in block wall behind surface mounted stainless steel access door.

3.1.4 When installing accessories, take great care to avoid marring chrome plating. Wrench or other tool marks on the plating will be sufficient cause for rejection.

3.1.5 Unless shown otherwise, use the following sizes of hot and cold water and waste connections to fixtures:

<u>Fixture</u>	<u>Hot Water</u>	<u>Cold Water</u>	<u>Waste</u>
mm (in)	mm (in)	mm (in)	mm (in)
Sink	15 (1/2)	15 (1/2)	40 (1-1/2)

3.1.6 Caulk all around bases of water closets, lavatories, wash fountains and other built-in equipment. Caulk all edges which abut walls and floors.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 21 05 01, "Common Work Results for Mechanical".

1.2 **SHOP DRAWINGS**

1.2.1 Submit Shop Drawings in accordance with Section 21 05 01, Clause "Shop Drawings", for the following equipment and materials:

- Laboratory Gas Piping and Fittings
- Valves

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 21 05 01, "Common Work Results for Mechanical", Clause "Material and Equipment".

2.2 **PIPE AND FITTINGS**

2.2.1 Select the most economical use of the materials named below. Unless specified or shown otherwise, either material may be used or a combination of materials, whichever provides the greatest economy.

2.2.2 **Laboratory Compressed Air and Laboratory Vacuum**

2.2.2.1 Install and pressure test these systems in strict accordance with the following Codes and Standards:

- | | | |
|--------------|---|---|
| – ASTM B88 | – | Seamless copper water tube |
| – CSA Z305.1 | – | Standard for Non-Flammable Medical Gas Piping Systems |
| – CSA Z305.2 | – | Low Pressure Connecting Assemblies for Medical Gas Piping Systems |
| – CSA Z305.3 | – | Pressure Regulators, Gauges, and Flow-Metering Devices for Medical Gases |
| – CSA Z305.4 | – | Qualifications Requirements for Agencies Testing Non-Flammable Medical Gas Piping Systems |
| – CGA G4.1 | – | Cleaning Equipment for Oxygen Service. |

2.2.2.2 **Materials**

2.2.2.2.1 **Pipes:** Use Type "K" or "L" washed and degreased, ASTM B88, seamless copper tubing, shipped with protective caps at both ends. Use hard tempered tubing for exposed locations and soft tempered tubing for concealed locations. Use copper tubing which is intended specifically for use with Medical Gas Systems.

2.2.2.2.2 **Fittings:** Use wrought copper or bronze solder type fittings specifically manufactured for silver brazing.

2.2.2.2.3 **Brazing:** All piping system joints to be made with silver brazing alloy conforming to AWS Classification BCuP-3 or BCuP-5, in conformance with AWS A5.8/A5.8M. Meet all requirements of CSA Z7396.1.

2.2.2.3 **Alternatively for sizes 15 mm (1/2") and Smaller**

2.2.2.3.1 **Pipes:** Stainless steel tubing, Type 304, fully annealed suitable for bending. Maximum hardness: Rockwell B80 conforming to ASTM A269. All tubing and fittings must be cleaned for oxygen service.

2.2.2.3.2 **Fittings and Valves:** Use Swagelok stainless steel fittings and valves.

2.2.3 **Laboratory Vacuum Discharge Lines and Vent Lines:** Use Type L copper tubing with soldered fittings or Schedule 10 304 stainless steel piping with TIG welded fittings and joints.

2.3 VALVES

2.3.1 Use valves of same manufacturer except where approved otherwise by the Consultant.

2.3.2 **Laboratory Compressed Air, Laboratory Vacuum:**

2.3.2.1 Use full port, ball type in-line isolation valves. Valves to be three piece construction, full flow, quarter-turn, cleaned for oxygen service, factory pressure tested, in-line serviceable and rated for 4140 kPa (600 psi). Valves to be complete with bronze body, lever handle, stainless steel ball, teflon seals and seats. Provide integral 250 mm (10") Type K copper tubing extensions, factory capped and packaged for cleanliness.

2.3.2.2 Provide colour coded identification labels with each valve for the specific gas service in which it is used.

2.3.2.3 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Class I
Amico
Apollo
Jamesbury

3 Execution

3.1 LABORATORY COMPRESSED AIR AND LABORATORY VACUUM PIPING

3.1.1 Use only people holding a current TSSA brazing certificate to do brazing work. Contractor must use a TSSA registered brazing procedure for medical gas piping.

3.1.2 Make copper to copper joints using Sil-Fos silver brazing alloy or equal to A.W.S. Standard BCUP-5. Use no flux.

3.1.3 Make copper to brass using Aircosil flux or dry borax and water. Do not use borax and alcohol mixture or resins and similar paste fluxes.

3.1.4 During the brazing of pipe connections, purge the interior of the pipe continuously with nitrogen except when making final connections.

3.2 **VALVES**

3.2.1 Use line sized valves unless noted otherwise.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 21 05 01, "Common Work Results for Mechanical".

1.1.2 The work to be performed under this Section includes the performance testing and balancing of all heating, ventilating, air conditioning and liquid system equipment installed or modified under this project, including all labour, materials and equipment required to carry out this work. Cooperate and collaborate with the Mechanical Contractor, who will operate the systems and, upon request from the Testing and Balancing Contractor, will make any required adjustments to the systems required in order to achieve the specified and intended performance.

1.1.3 The principal items of work are as follows:

- Performance testing and balancing of all equipment installed or modified under this project, including existing equipment serving renovated areas
- Provision of new sheaves and belts for existing fans as required to achieve specified air quantities
- Survey the installed automatic controls and verify their functional performance
- Test performance of all vibration isolation equipment
- Commissioning in accordance with Division 01 specifications

2 Products

2.1 **GENERAL**

2.1.1 Furnish all test equipment. All equipment will remain the property of the testing and balancing company. Use recently calibrated instruments. Provide verification of calibration to the Consultant when requested.

2.1.2 Approved testing and balancing companies for this project are:

Accu-Air Balance Co, Windsor
Air Audit, Cambridge
C. J. Zettler & Associates, London
Caltab Air Balance, Tecumseh
Design Test and Balance, Mississauga

2.2 **MATERIALS**

2.2.1 Use materials specified herein or approved equal as defined in Section 21 05 01, "Common Work Results for Mechanical", Clause "Material and Equipment".

2.3 **DUCT ACCESS HOLE PLUGS**

2.3.1 Use Duro Dyne Type IP 4 duct access hole plugs.

3 Execution

3.1 **GENERAL**

- 3.1.1 Include all labour, engineering, and test equipment required to test, adjust, and balance all equipment and systems installed or modified under this project.

3.2 **JOB CONDITIONS**

- 3.2.1 Prior to the start of work on the site, review with the Mechanical Contractor the location of balancing devices, test connections and access openings and configurations shown on the Drawings. Identify any issues which could compromise system performance. Submit to the Mechanical Contractor and the Consultant written guidelines concerning locations and configurations of equipment and devices involved in the Testing and Balancing work. The Mechanical Contractor is to obtain the approval of the Testing and Balancing Contractor before relocating any of these devices due to field conditions. During testing, ensure that all testing, balancing, and metering devices are installed properly and in the agreed locations. Report any errors, concerns, or issues to the Consultant.

- 3.2.2 Schedule the Testing and Balancing work in cooperation with other trades involved. Testing and Balancing Contractor is to cooperate with the Mechanical Contractor and provide adequate prior notification of all requests for services of tradesmen, and is to coordinate their efforts so that items requiring replacement or are subject to delivery delays (sheaves, motors, etc.) are tested as early as possible.

- 3.2.3 Do not begin testing and balancing until the systems have been completely installed, tested, and put in running order. Correct operation of equipment and system components and cleanliness of piping and ductwork is the responsibility of the appropriate trade.

3.3 **CO-OPERATION WITH OTHER TRADES**

- 3.3.1 The mechanical and electrical and other related trades are to cooperate with the Testing and Balancing Contractor and provide the following assistance and services:
- Schedule sufficient time so that the testing and balancing work can be completed in a timely manner, well in advance of Owner's use or occupancy
 - Inform the Testing and Balancing Contractor of any significant changes made during construction. Provide them with a set of up-to-date Drawings, and approved Shop Drawings
 - Provide and install balancing devices, test connections, access openings, balancing probe inlets and plugs as required for Testing and Balancing
 - Clean, start and pre-run all equipment, filters, etc. and place all HVAC systems into full operation, and continue same, during each working day of testing and balancing
 - Provide immediate labour from pertinent trades, and tools, equipment, and materials to make equipment and system alterations and adjustments, as required, including control adjustments
 - Make available all equipment data (shop drawing performance data and operating instructions) to the Testing and Balancing Contractor

- 3.3.2 As part of the coordination process, the Mechanical Contractor is to be fully responsible for construction and adjustment of the equipment and systems to achieve optimum performance. Any readjustments or re-testing required, as the result of spot checks by the Owner or Consultant, are to be performed promptly, at no additional cost to the Owner.

3.4 SUBMITTALS

- 3.4.1 Submit site visit reports, review and recommendation reports as the work progresses. Refer to Division 01 specifications and/or Drawings for work sequence and phasing. Provide a Testing and Balancing Report for each phase of work, at its completion.
- 3.4.2 Record all test data and submit reports in PDF format to the Consultant. A copy of the reviewed final report is to be included in the Operation and Maintenance Manual.
- 3.4.3 Use data sheets which are approved by the Consultant to record measurements. Include schematic diagrams of all systems identifying branches, inlets, outlets, and equipment. Submit sample sheets for review using same procedure as for Shop Drawings.
- 3.4.4 Provide a Deficiency List to the Contractor for all materials and installation methods which are found not to be complying with the Specifications and, where specified, quantities could not be achieved within the required tolerances. Submit copy of Deficiency List to the Consultant at the same time it is issued to the Contractor.
- 3.4.5 Reports are to be prepared and presented in either SI or IP units, as required to match the units presented on the Drawings. Reports that include both SI and IP units will also be accepted.

3.5 PROCEDURES

- 3.5.1 Review all pertinent plans, specifications, shop drawings, interference drawings and other documentation to become fully familiar with the systems and their specified and intended performance.
- 3.5.2 Check rotation of all fans and pumps. Advise appropriate trade if any corrections are needed. Ensure corrections are made before starting any testing or balancing.
- 3.5.3 Ensure that all control valves, devices, and equipment interlocks are operating in the manner required for the correct performance of the systems.
- 3.5.4 Report any objectionable noise or vibration and be prepared to locate cause by instrumentation and analysis.
- 3.5.5 Operate, test, and balance all systems over their entire design range of operation. Fully simulate both heating and cooling conditions. Record sufficient data to verify compliance with design requirements. Include minimum and maximum outside air, return air and supply air conditions.
- 3.5.6 Generally, balance pipework systems after the air systems are balanced. Balance systems to within the following tolerances:
- 3.5.6.1 For air flow rates lower than 70 L/s (150 cfm), adjust to $\pm 10\%$ of flow.

- 3.5.6.2 For air flow rates higher than 70 L/s (150 cfm), adjust to $\pm 5\%$ of flow.
- 3.5.6.3 For water flow rates, adjust to $\pm 5\%$ of flow.
- 3.5.7 Carry out testing and balancing under both extreme summer and extreme winter conditions. If you wish to simulate these conditions, obtain approval from the Consultant before beginning work.
- 3.6 **AIR SYSTEMS**
 - 3.6.1 For each air handling unit which serves new or renovated areas, adjust fan speeds by changing drives to maintain existing air flow quantity to areas to remain. Measure total air quantities and fan performance both before and after the renovation work, so that original air quantities supplied and returned from non-renovated areas can be restored at the completion of the work.
 - 3.6.2 Test and adjust fan speeds and dampers to deliver the required air quantities. For belt driven fans, determine size of sheaves required to properly balance systems and operate systems at minimum static pressures. Install selected sheaves. For new fans, sheaves and belts will be supplied by fan supplier. For existing fans, sheaves and belts are to be supplied and installed by the Testing and Balancing contractor.
 - 3.6.3 For each indoor and rooftop air handling unit installed or modified in the project, and for each indoor and rooftop air handling unit which serves new or renovated areas, provide a static pressure profile, including pressure drop across each individual unit component (i.e. coils, filter banks, fans, energy recovery wheels, etc) as well as static pressure in intake plenums, discharge supply ducts and return air ducts. Include return fan pressure differential whether return fan is located within air handling unit or not.
 - 3.6.4 For belt driven fans, variable frequency drives are not to be used for air balancing purposes.
 - 3.6.5 Test and adjust each diffuser, grille, register, air terminal unit, fan coil unit, heat pump, etc to specified flow rate tolerances, and also adjust so as to minimize drafts in all areas.
 - 3.6.6 **Constant Volume Systems:** Make pitot tube traverse of main supply and return air ducts to measure total air quantities.
 - 3.6.7 **Variable Volume Systems:** Make pitot tube traverse of main supply and return air ducts to measure total air quantities. Do this for both maximum and minimum air flow rate conditions. Assist controls trade in setting static pressure setpoint at minimum required pressure. Assist controls trade in calibration of flow measuring stations. Record calibration results and static pressure settings. For each volume box or air terminal unit, measure minimum and maximum air flows, and inlet static pressure at each air flow measurement. Set minimum and maximum air flows as shown on the Drawings.
 - 3.6.8 Seal duct access holes with plugs. Do not use duct tape to seal access holes.
 - 3.6.9 Record data as specified in Clause "Balancing Data".

3.7 **WATER SYSTEMS**

- 3.7.1 Prior to testing and balancing of these systems, verify that all new and existing strainers are clean. Check new and existing expansion tanks and ensure that the systems are not air bound and are completely filled with water or glycol solution as required. Check air vents at coils and high points of the systems to verify that all are installed and operating freely. Position all automatic valves, hand valves, and balancing valves for full flow through coils, heat exchangers, chillers, individual reheat coils, individual room heating elements, etc.
- 3.7.2 Measure and adjust circulating water pump flow capacities to design quantities. For variable speed pumping systems, assist controls trade in setting static pressure controls at minimum required pressure. Record static pressure setting and coordinate with Controls Trade.
- 3.7.3 Balance all main branches and terminal equipment where balancing devices are installed. See Piping Schematics for locations. This includes hot water reheat coils, fan coil units, force flow units, wall fin convectors, etc.
- 3.7.4 Mark and record flow readings of balancing devices. Where flow measuring devices are not installed, balance using design temperature differences.
- 3.7.5 Record data as specified in Clause "Balancing Data".

3.8 **BALANCING DATA**

- 3.8.1 Include the following information in the test report:

3.8.1.1 **Motors:**

Manufacturer
Model and/or Serial Number
Rated and measured voltage
Rated and measured amperage
Corrected full load amperage
Rated and measured rpm
Rated and calculated power
Sheave size, type, and manufacturer

3.8.1.2 **Fans:**

Manufacturer
Model and/or Serial number
Rated and measured airflow rate
Rated and measured rpm
Rated and measured pressure rise
Pulley size, type, and manufacturer
Belt size and quantity
Performance curve by manufacturer
Flow Measuring Station Calibration Results (VAV Systems)

3.8.1.3 Air Systems (including inlets and outlets):

Volume Boxes (minimum flow and maximum flow)
Grille, register or diffuser reference number and manufacturer
Grille, register or diffuser location
Design air quantity
Effective area factor and size
Measured air quantity
Static Pressure Setpoint (VAV Systems)

3.8.1.4 Heat Transfer Elements (Coils, Convertors etc.):

Manufacturer and type
Measured flow rate (air and water side)
Design and measured inlet and outlet temperatures (air and water side)
Design and measured pressure drop (air and water side)

3.8.1.5 Testing and Balancing Instruments:

Types
Serial Numbers
Dates of calibration

3.9 FINAL INSPECTION AND ACCEPTANCE

3.9.1 After submission of balancing report, arrange a final inspection with the Consultant.

3.9.2 At final inspection recheck points or areas selected by the Consultant.

3.9.3 For each system, if more than 10% of the measurements at the selected recheck stations deviate by 10% or more from those in the Report, then the Report for that system will be rejected as unacceptable.

3.9.4 If Report is rejected, rebalance systems deemed to be unacceptable, submit new Reports, and make reinspection at no extra cost to the Owner.

3.9.5 Permanently mark settings of dampers and other adjustment devices so that adjustment can be restored if disturbed. Type of marking and method of application to be approved by the Consultant.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 21 05 01, "Common Work Results for Mechanical".

1.1.2 All products used must have a flame spread rating less than 25 and a smoke developed classification not more than 50 when tested in accordance with CAN/ULC-S102.

1.1.3 **Environmental Requirements:** Maintain ambient temperature and conditions required by manufacturers of adhesives, mastics, and insulation cements.

1.1.4 **Quality Assurance:** Insulation materials must be manufactured at facilities certified and registered to ISO 9000 Quality Standard.

1.1.5 **Storage of Materials:** Protect materials from dirt, water, chemical and mechanical damage before, during and after installation. Provide and install waterproof sheeting to protect insulation in unfinished areas as required. Remove damaged materials from the site immediately and discard. Remove and replace at no additional cost any installed materials which are damaged.

1.1.6 **Delivery:** Deliver insulation, coverings, cements, adhesive coatings, etc., to the site in Manufacturer's original containers with the manufacturer's stamp or label affixed showing flame and smoke ratings of the products, name of manufacturer and brand.

1.1.7 **Insulating Contractor Qualifications:** Insulating contractors and thermal insulation installers for the work of this project must be members of the Thermal Insulation Association of Canada (TIAC).

1.2 **DEFINITIONS**

1.2.1 In this Specification, "exposed to view" means all surfaces of all services within Equipment Rooms, Service Corridors, plus all other areas of the building where the services are not enclosed within ceilings or shafts.

1.3 **SHOP DRAWINGS**

1.3.1 Provide shop drawings which include product description, list of materials and thickness for each service and manufacturers' installation instructions.

1.3.2 Submit Shop Drawings in accordance with the Clause "Shop Drawings" in Section 21 05 01 for the following equipment and materials:

- Duct, Piping, and Equipment Insulation Types (note application for each product)
- Finishing Cement
- Lagging Adhesive
- Pipe and Duct Insulation Coverings
- Piping Insulation Inserts
- Vapour Barrier Mastic

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 21 05 01, "Common Work Results for Mechanical", Clause "Material and Equipment".

2.2 **PIPING INSULATION INSERTS**

2.2.1 Use Johns Manville Thermo-12 Gold calcium silicate rigid piping insulation inserts. Inserts to be equal in thickness to the adjoining insulation and to extend up to pipe centreline on both sides. Quarter diameter size inserts will be accepted for copper piping only. Use the following insert lengths:

Nominal Pipe Size		Insert Length	
mm	(inches)	mm	(inches)
40 - 65	(1-1/2 - 2-1/2)	250	(10)
75 - 150	(3 - 6)	300	(12)
200 - 250	(8 - 10)	400	(16)
300 and over	(12 and over)	550	(22)

2.3 **PIPING INSULATION INSERT SHIELDS**

2.3.1 Use minimum 18 gauge galvanized metal shields. Form shields to fit insulation and extend up to the pipe centre line. Shield length to be 100 mm (4") less than length of associated insert. Shield colour is to match pipe finish colour when exposed to view.

2.3.2 Use steel pipe covering protection saddles at roller hangers and pipe roll supports.

2.4 **PIPE INSULATION**

2.4.1 **All Piping Systems Except Refrigeration**

2.4.1.1 **Piping:** Use formaldehyde-free Knauf Earthwool 1000° glass fibre pipe insulation with factory applied ASJ+ all-service jacket. Insulation conductivity and thickness in accordance with Pipe Insulation Schedule. Jacket to consist of aluminum foil vapour barrier reinforced with glass scrim and laminated to a fire resistant kraft facing.

2.4.1.2 **Valves and Fittings:** Insulate valves and fittings with formaldehyde-free factory precut Johns Manville Zeston Hi-Lo Temp insulation inserts or Knauf Earthwool 1000° formaldehyde-free glass fibre pipe insulation 16 kg/m³ (1 lb/ft³) density glass fibre insulation.

2.4.1.3 The following manufacturers of the above equipment will be considered as equal, provided products are formaldehyde free, subject to requirements of Clause "Material and Equipment":

CertainTeed
Johns Manville
Knauf
Manson

2.4.2 Pipe, Valve and Fitting Insulation Covering for Piping Exposed to View (Including Refrigeration Piping)

2.4.2.1 Use Proto LoSmoke or Johns Manville, Knauf or Walton Plastics equivalent, minimum 0.51 mm (20 mil) thickness PVC jacketing and fitting coverings. Use manufacturer's solvent welding adhesive to permanently seal all PVC joints. Use white jackets unless specified otherwise in Execution Section below.

2.5 PIPING INSULATION THICKNESS SCHEDULE

Fluid Design Operating Temperature Range °C (°F)	Insulation Conductivity		Nominal Diameter mm (in)				
	Conductivity Range W/m°C (Btu-in/hr-ft²-°F)	Mean Rating Temperature °C (°F)	less than 25 (1)	25 (1) and 32 (1-1/4)	40 (1-1/2) to 75 (3)	100 (4) to 150 (6)	200 (8) and up
Heating Systems (Hot Water)							
Above 177 (Above 350)	0.046 - 0.049 (0.32 - 0.34)	121 (250)	115 (4.5)	125 (5.0)	125 (5.0)	125 (5.0)	125 (5.0)
122 - 177 (251 - 350)	0.042 - 0.045 (0.29 - 0.31)	93 (200)	75 (3.0)	100 (4.0)	115 (4.5)	115 (4.5)	115 (4.5)
94 - 121 (201 - 250)	0.039 - 0.043 (0.27 - 0.30)	66 (150)	65 (2.5)	65 (2.5)	65 (2.5)	75 (3.0)	75 (3.0)
61 - 93 (141 - 200)	0.036 - 0.042 (0.25 - 0.29)	52 (125)	40 (1.5)	40 (1.5)	50 (2.0)	50 (2.0)	50 (2.0)
40 - 60 (105 - 140)	0.032 - 0.040 (0.22 - 0.28)	38 (100)	25 (1.0)	25 (1.0)	40 (1.5)	40 (1.5)	40 (1.5)

2.6 AIR DUCTS

2.6.1 Ductwork External Insulation

2.6.1.1 On all round ducts, and on rectangular ducts not exposed to view with both dimensions 600 mm (24") and smaller, use Knauf Atmosphere formaldehyde-free flexible blanket fiberglass insulation with FSK aluminum foil-scrim-kraft paper facing. Product must meet the requirements of ASTM C1290. Maximum thermal conductivity 0.042 W/m°C (0.29 Btu-in/hr-ft²-°F). Use 40 mm (1-1/2") thickness.

2.6.1.2 On rectangular ducts exposed to view, and on rectangular ducts not exposed to view with one dimension 650 mm (26") or larger, use Knauf Atmosphere formaldehyde-free rigid fiberglass insulation board, 48 kg/m³ (3 lb/ft³) density, with FSK aluminum foil-scrim-kraft paper facing. Product must meet the requirements of ASTM C1136. Maximum thermal conductivity 0.033 W/m°C (0.23 Btu-in/hr-ft²-°F) at 24 °C (75 °F) mean temperature. Use 40 mm (1-1/2") thickness.

- 2.6.1.3 The following manufacturers of the above equipment will be considered as equal, provided the products are formaldehyde-free, subject to requirements of Clause "Material and Equipment":

CertainTeed
Johns Manville
Knauf
Manson

2.6.2 **Ductwork Insulation Covering for Ductwork Exposed to View**

- 2.6.2.1 **Canvas Covering:** Use UL listed fabric 220 g/m² (6.5 oz/yd²) fire retardant canvas covering.

- 2.6.2.2 **Laminate Cladding:** Use Venture Tape Model 1577CWWME zero permeability, 0.20 mm (8 mil) thick, self-adhesive multi-ply embossed white laminate cladding, or Victoryclad equivalent.

2.7 **VAPOUR BARRIER MASTIC**

- 2.7.1 Use white Foster 30-33 or Childers CP-33 water based vapour barrier mastic. Permeance shall be 0.07 perms or less as tested by ASTM F 1249. Reinforcing mesh shall be Foster Mast a Fab or Childers Chil Glas #10.

2.8 **FINISHING CEMENT**

- 2.8.1 Use Ryder hydraulic setting finishing cement.

2.9 **LAGGING ADHESIVE**

- 2.9.1 Use white Childers CP-50AMV1 or Fosters 81-42/30-36 water based fire retardant lagging adhesive.

3 Execution

3.1 **GENERAL**

- 3.1.1 Install all insulation in strict accordance with manufacturer's published recommendations.
- 3.1.2 Install all insulation continuous through walls and sleeves. Insulate all components of insulated systems unless specifically excluded. Extend all surface finishes to protect all surfaces, ends, and raw edges of insulation.
- 3.1.3 Do not apply insulation until piping has been tested and approved.
- 3.1.4 Do not insulate unions or flanges at connections to equipment. In these locations, and in all other locations where insulation ends, finish with vapour resistant mastic.
- 3.1.5 Patch and make good any existing insulation and covering which is damaged during the work of this Contract. Use material of the same quality as existing.

3.2 PIPING SYSTEMS

3.2.1 General Requirements

3.2.1.1 Other Piping Systems

3.2.1.1.1 Insulate the following piping systems in their entirety:

- Hot Water Heating and Reheat

3.2.1.1.2 Use the following Mean Rating Temperatures when selecting insulation thicknesses for Heating Systems:

Hot Water Heating	: 52 °C (125 °F)
Hot Water Reheat	: 52 °C (125 °F)

3.2.2 Insulation Application

3.2.2.1 **General:** Seal all joints in accordance with manufacturer's recommendations.

3.2.2.2 **Firestopping:** Where an insulated pipe passes through a fire separation, use only ULC labelled piping insulation in accordance with ULC Listed firestop system being used. See Section 21 05 01, Clause "Firestopping". Extend ULC labelled pipe insulation through fire separation and 50 mm (2") beyond fire separation on both sides. Tightly butt joints and wrap with approved joint tape.

3.2.2.3 **Hanger Points:** Provide an insulation insert and shield at each hanger point on all piping 40 mm (1-1/2") and larger on all systems. On cold lines, vapour seal butt joints on each side of insert with vapour barrier mastic.

3.2.2.4 **Pipe:** Apply insulation over clean dry pipe. Butt all joints firmly together. Seal all jackets neatly in place. Wrap butt joints with a minimum 75 mm (3") wide strip of the jacketing material. Use a vapour barrier adhesive on all "cold" lines and dual temperature systems.

3.2.2.5 Fittings and Valves

3.2.2.5.1 For pipe sizes 40 mm (1-1/2") and smaller, insulate with fibreglass blanket wrapped firmly under compression (minimum 2:1) to a thickness matching adjoining insulation. Insulation ends may be mitred at elbows and sealed with tape.

3.2.2.5.2 For pipe sizes 50 mm (2") and larger, insulate with factory precut insulation inserts or with fibreglass blanket wrapped firmly under compression (minimum 2:1) to a thickness matching adjoining insulation. Insulation ends may be mitred at elbows and sealed with tape.

3.2.2.5.3 On components which require service, fabricate easily removable and reusable insulation sections e.g. suction guides for circulating pumps and pump casings. Test ports on balancing valves to be accessible outside of insulation.

3.2.3 **Pipe Insulation Finishes Exposed to View**

- 3.2.3.1 In all locations where the insulation will be exposed to view, including for refrigeration piping, finish with pipe insulation coverings. Follow strictly manufacturer's installation procedures for cold and hot systems.
- 3.2.3.2 Provide coloured PVC jackets in accordance with Owner's colour schedule. Obtain latest colour schedule from Consultant prior to ordering jacketing.

3.3 **AIR DUCTS**

3.3.1 **General**

- 3.3.1.1 Seal all vapour retardant jacket seams and penetrations with UL Listed tape and adhesive. Coat all taped seams with 100 mm (4") wide coating of vapour barrier mastic to prevent moisture ingress on cold systems.
- 3.3.1.2 Externally insulate all plenums not fabricated from insulated panels as well as all plenums specifically identified on the Drawings.
- 3.3.1.3 Externally insulate fire damper sleeve assemblies where duct system is internally lined.
- 3.3.1.4 Externally insulate all ductwork exposed to the weather or installed outside of the building insulated envelope.
- 3.3.1.5 Refer to Section 23 30 00, "Air Distribution", for ductwork internal lining materials and methods.

3.3.2 **System Specific Requirements**

3.3.2.1 **Supply Air Ductwork**

- 3.3.2.1.1 Externally insulate all supply air ductwork, including all supply air ductwork located in mechanical or electrical rooms, all supply air ductwork located in return air ceiling plenums, and all internally lined supply air ductwork.
- 3.3.2.1.2 Decorative low pressure ductwork exposed to view and located within the room it serves need not be externally insulated.
- 3.3.2.1.3 **Outside Air Intake Ductwork:** Externally insulate all outside air intake, combustion air intake, and all ductwork connected to outside air louvres or plenums.

- 3.3.2.2 **Return and Exhaust Air Ductwork:** Externally insulate all return and exhaust duct sections specifically identified on the Drawings. Insulate the first 1.5 m (5') of exhaust air ductwork located adjacent to outside walls or roof.

3.3.3 **Insulation Application**

- 3.3.3.1 On round and oval ducts, adhere insulation to ducts with a flame resistant, quick tacking adhesive. Apply adhesive in 100 mm (4") wide strips at 200 mm (8") centres. Butt all circumferential joints and overlap all longitudinal joints a minimum 50 mm (2"). Staple all

joints on 150 mm (6") centres. Tape all joints with minimum 75 mm (3") wide reinforced vapour barrier tape as recommended by insulation manufacturer.

- 3.3.3.2 On rectangular ducts, use adhesive and impale insulation over mechanical fasteners. Provide 100% coverage of adhesive on sheet metal, all exposed insulation edges, and all transverse joints. Provide mechanical fasteners per manufacturer's published recommendations. Insulate behind duct balancing damper operators.

3.3.4 **Insulation Finish for Ductwork Exposed to View**

- 3.3.4.1 In locations where the insulation will be exposed to view, finish with canvas. Provide 25 mm x 25 mm (1" x 1") galvanized steel sheet metal angle corner bead over duct insulation along all duct corners. Securely paste canvas on with a two coat application of lagging adhesive over the entire surface. Apply canvas between coats of adhesive, while first coat is still wet. Stretch canvas tight and smooth with overlapping seams located where least visible. Apply second coat of adhesive immediately following application of canvas. Do not use metal bands.
- 3.3.4.2 Seal canvas with off-white sizing to leave a smooth non-porous surface ready to receive paint application.
- 3.3.4.3 Self-adhesive aluminum covering will be acceptable in lieu of canvas for exposed to view ductwork within the building envelope only. Follow manufacturer's installation recommendations.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 21 05 01, "Common Work Results for Mechanical".

1.2 **SHOP DRAWINGS**

1.2.1 Submit Shop Drawings in accordance with Section 21 05 01, Clause "Shop Drawings", for the following equipment and materials:

- Valves

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 21 05 01, "Common Work Results for Mechanical" Clause "Material and Equipment".

2.2 **PIPING AND FITTINGS**

2.2.1 **General**

2.2.1.1 Use the following materials for all piping systems provided by this Section.

2.2.1.2 Use long radius elbows. Where the mains are 100 mm (4") diameter or greater and where branches are smaller by two pipe sizes or more, cut-ins will be permitted. For all other branch connections, use manufactured tees.

2.2.1.3 For all flanged connections use stainless steel spiral wound graphite gaskets in systems operating above 82 °C (180 °F). Use inorganic fiber gaskets with nitrile binder gaskets for all low temperature systems. Use minimum Grade 5, high tensile strength bolts, nuts, and washers. Use welding neck and raised face flanges as per ANSI/ASME B16.5.

2.2.2 **Design Conditions**

2.2.3 **Water and Glycol Piping for Sizes 50 mm (2") and Smaller:** Use either copper or steel pipe as follows:

2.2.3.1 **Copper**

Pipe - Type L hard drawn copper

Joints - Solder

Fittings - Wrought copper or cast bronze

Unions - 1030 kPa (150 psig) octagon end, bronze

2.2.3.2 **Steel**

Pipe - Black steel, Schedule 40, ASTM A-53

Joints - Threaded

Fittings - 1030 kPa (150 psig) malleable iron to ASME B16.3

Unions - 1030 kPa (150 psig) malleable iron, brass to iron ground joint seat to ASME B16.39

2.2.4 **Water and Glycol Piping for Sizes 65 mm (2-1/2") and Larger:**

2.2.4.1 **Pipe** - Black steel, Schedule 40, ASTM A-53B for pipe sizes 250 mm (10") and smaller. For larger sizes use 9.53 mm (3/8") wall thickness, ASTM A-53B, continuous electric resistance welded pipe.

Joints - Welded and flanged

Fittings - 1030 kPa (150 psig) Schedule 40, steel

Unions - 1030 kPa (150 psig) slip-on.

2.3 **VALVES**

2.3.1 **General**

2.3.1.1 Use the following valves for all piping systems provided by this Section, unless specified otherwise.

2.3.1.2 Use flanged, screwed or solder ends to suit pipe lines, and non-heating malleable iron handles. Use valves with extended valve stems where piping is to be insulated.

2.3.1.3 Use only industrial class valves meeting ANSI, ASTM, ASME and applicable MSS standards.

2.3.1.4 For gear operated valves located within mechanical rooms or service spaces, where valves are installed more than 3 m (10 ft) above finished floor, or are difficult to access from a ladder, provide chain drives in lieu of handwheels.

2.3.2 **Ball Valves**

2.3.2.1 **Water**

2.3.2.1.1 **Ball Valves 50 mm (2") and under:** 4140 kPa (600 WOG/psig) water oil or gas rating : Use Kitz model 68AMLL/68AMLL or 868AMLL/869AMLL, two-piece full port brass body, PTFE seats, double Viton "O" ring stem seals, Stainless Steel vented solid ball, blowout proof Stainless Steel stem, and locking lever handle. Use valves with extension stems when installed in insulated piping.

2.3.2.1.2 **Drain Hose Connections:** Use Kitz 68AC ball valves complete with No. 658 cap and chain.

- 2.3.2.2 The following manufacturers of the above items of equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Apollo
Kitz
MAS
Nibco
Toyo

2.3.3 **Butterfly Valves**

2.3.3.1 **Water:**

- 2.3.3.1.1 **Sizes 75 mm (3") and 100 mm (4"):** Use Kitz model 6123E ductile iron body valves with 50 mm (2") extended neck to allow for insulation, lug type having bi-directional pressure rating of 1720 kPa (250 psi). Stem to be stainless steel with positive retention mechanism. Valve to have aluminum bronze disc and moulded or bonded style EPDM seat. Valve to be capable of providing bi-directional "Dead End Service" at full rated pressure with the downstream flange removed. Valve is suitable for both chilled water and hot water operation. Crane, MAS, and Nibco will be considered equal, subject to requirements of Clause "Material and Equipment".

2.3.4 **Combination Balancing and Shutoff Valves**

- 2.3.4.1 Use Tour & Andersson Inc. STA-D and STA-F style balancing valves, or Victaulic or Oventrop equivalent, with digital handwheels.
- 2.3.4.2 Balancing valves will all be designed for flow measurement, flow balancing and positive shutoff. Size valves in accordance with manufacturer's published guidelines. Provide extended differential ports to enable access without removing insulation.
- 2.3.4.3 Valves to be calibrated globe style with differential ports providing flow measurement, balancing and positive shutoff. Do not exceed 9 kPa (3 ft W.C.) head at fully open position.

3 **Execution**

3.1 **PIPING**

3.1.1 **General**

- 3.1.1.1 Use flanges or unions on all piping connections to equipment.
- 3.1.1.2 Use unions on both sides of expansion compensators.
- 3.1.1.3 Support all piping connected to isolated equipment with spring hanger supports for at least the first three support points. If grooved pipe couplings are used, provide a minimum of three flexible type couplings on each side of isolated equipment.
- 3.1.1.4 Install all control valves, fittings, water temperature sensors and flow switches supplied by Section 25 00 00 "Controls".
- 3.1.1.5 See Section 21 05 01 "Common Work Results for Mechanical" Clause "Piping".

- 3.1.1.6 Where connections to existing water systems are required, include cost of draining and refilling systems in Bid Price.
- 3.1.1.7 Provide drain valves with hose connections at base of all risers, at all low points in piping distribution, and at low points on all equipment connections.
- 3.1.1.8 For upfeed take off top of pipe. For downfeed take off bottom of pipe.
- 3.1.1.9 Where press-connect fittings, joints and valves are specifically permitted in Part 2 Clause "Piping and Fittings", all press-connect fittings and joints are to be installed and tested in strict accordance with manufacturer's instructions, including two step process for pressure testing.
- 3.2 **ACCESS DOORS**
- 3.2.1 Provide access doors with quick fastening latches for access to all dampers, coils, thermostats, valves, and any other concealed devices which require servicing. Use access doors as specified in Section 21 05 01 "Common Work Results for Mechanical."
- 3.3 **VALVES**
- 3.3.1 Unless specifically noted, shown, or specified otherwise, shutoff valves may be either butterfly valves or ball valves. Do not use butterfly valves for sizes smaller than 65 mm (2-1/2"). Ball valves will be acceptable in lieu of gauge cocks.
- 3.3.2 Use line sized valves unless shown or specified otherwise.
- 3.4 **COMBINATION SHUTOFF AND BALANCING VALVES**
- 3.4.1 Provide water flow balancing valves and flow meters in all locations shown. Install in accordance with manufacturer's recommendations.
- 3.4.2 Valves with differential ports for measuring the flow to be installed with the ports above the centerline of the pipe to make sure there is no sediment settling in the ports.
- 3.5 **AIR AND WATER SYSTEM TESTING AND BALANCING**
- 3.5.1 Cooperate with and assist the air and water testing and balancing company. See Section 23 05 93 "Testing, Adjusting and Balancing for HVAC". Make any changes deemed necessary by the Testing and Balancing trade to permit proper testing and balancing of the systems.
- 3.5.2 Be responsible for the initial alignment and tension of all fan pulleys and belts.
- 3.5.3 Provide any changes to fan drives, pulleys and belts as required to allow a proper air balance as recommended by the Testing and Balancing Company for equipment supplied under this Contract.

3.6 WATER TREATMENT SYSTEMS

- 3.6.1 Install all water treatment equipment as shown and in accordance with manufacturer's recommendations. Provide all necessary piping and accessories. See Section 23 25 00 "HVAC Water Treatment".
- 3.6.2 Mechanical Contractor to flush, drain, clean and refill heating system as directed by Water Treatment Contractor. See Section 23 25 00 "HVAC Water Treatment".

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 21 05 01, "Common Work Results for Mechanical".

1.2 **SHOP DRAWINGS**

1.2.1 Submit Shop Drawings in accordance with Section 21 05 01, Clause "Shop Drawings" for the following equipment and materials:

- all chemicals including MSDS (include in operations and maintenance manuals)

2 Products

2.1 **WATER TREATMENT VENDOR**

2.1.1 Engage the Owner's existing vendor for the work of this Section, as follows:

2.1.1.1 For Western University projects, use Dubois Chemicals. Contact Don Hutchinson Donald.hutchinson@duboischchemicals.com; 519-671-1482. Refer to Division 01 Specification Section "Allowances".

2.2 **GENERAL**

2.2.1 Establish a comprehensive chemical treatment program using molybdate-based closed loop corrosion inhibitors, oxygen scavengers and scale inhibitors. Provide start-up quantity of all required chemicals to ensure that all closed water loops have a molybdate level of at least 90 ppm. All chemicals be shipped along with system equipment for startup purposes and commissioning.

2.2.2 Commission the system and provide two engineering service visits for the first two months of operation followed by monthly visits (or as required) thereafter. Provide a written copy of the Technical Service Report. Report to be reviewed with the Program Administrator and the Consultant. Provide a minimum two hour training session for all operating staff.

2.2.3 Provide project specific operating manuals for all equipment and systems.

2.3 **PRE-OPERATIONAL CLEANING**

2.3.1 Use a neutral pH cleaner and rust removal. Use a chemical cleaner formulated not to attack carbon steel, copper, stainless steel, bronze, brass, aluminum, plastics, or rubbers.

2.3.2 Provide an adequate quantity of cleaning solutions to thoroughly clean all new piping and associated equipment by removing sludge, oil, dirt, and debris. Cleaning products to be used for cleaning and flushing of all new piping systems (excluding domestic water and drains). Cleaning and flushing procedure to be as per manufacturer's instructions and must be performed under the supervision of a manufacturer's representative. Once cleaning is complete, provide a letter certifying that systems have been properly cleaned.

2.3.3 Ensure mechanical contractor provides temporary piping connections, bypasses and strainers as required for introduction of cleaning chemicals and removal of debris. Isolate boilers from cleaning chemicals.

2.4 **CLOSED WATER SYSTEMS**

- 2.4.1 Provide a sufficient quantity of corrosion inhibitor chemical to perform all initial system treatment, as well as all required chemicals for the first year after takeover.

3 Execution

3.1 **GENERAL**

- 3.1.1 Provide supervision and assistance during the installation, cleaning, and startup procedures, and develop an appropriate water conditioning program to control corrosion, scale, algae, and suspended solids. Instruct the Owner's operating personnel for a period of not less than one day duration in water treatment testing and operating procedures. Provide four copies of written operating instructions outlining the treatment dosages, control charts and test procedures. Submit operating instructions in PDF format.

- 3.1.2 Include a monthly (or bimonthly) visit by the treatment supplier for the first year's operation, to check operation. Conduct tests of all pertinent water treatment systems and submit a written report on same.

- 3.1.3 **Treatment Supplies:** Supply all chemicals required for initial cleaning and startup of the systems, as well as a year's supply of inhibitor chemicals required for normal system operation.

3.2 **FLUSHING AND STERILIZATION**

- 3.2.1 Flush all new or modified water and glycol system piping shown on the Drawings, including all hydronic heating and cooling systems.

- 3.2.2 Flush water piping with water flowing at a velocity of not less than 1.8 m/sec (6 ft/sec) for a period of 15 minutes or longer as required to remove all dirt, scale, and cuttings from the entire length of the piping.

- 3.2.3 Thoroughly clean sections of new piping which cannot be isolated for flushing purposes, prior to fabrication, and also where possible after welding of joints, by swabbing the interior of the pipe with swabs soaked with a caustic solution to remove all loose scale, oil, and dirt from the entire length of the piping.

- 3.2.4 Allow for all labour and chemicals for pipe flushing for each phase of construction. Coordinate all work with Piping Contractor.

3.3 **PRE-OPERATIONAL CLEANING**

- 3.3.1 Flush all new or modified water and glycol system piping shown on the Drawings, including all hydronic heating and cooling systems.

- 3.3.2 Prior to chemical cleaning, inspect the systems to ensure removal of heavy debris and excessive oil or dirt. Install temporary strainers on the suction of each circulating pump. Where necessary, make provision for temporary connections between supply and return mains in the distribution system to permit circulation of the cleaning solution. Provide a 25 mm (1") pipe connection on the suction side of the circulating pumps of each system for the admission of the cleaning solution.

- 3.3.3 Flush systems to remove loose dirt and hydrostatically test to detect excessive water losses. Check rotation of all circulating pumps.
- 3.3.4 Fill systems with water and cleaner at a 1% concentration, or as specifically recommended by the manufacturer. Circulate for 72 hours at a temperature between 21 °C - 60 °C (70 °F - 140 °F).
- 3.3.5 Drain systems, refill with fresh water, and circulate for a minimum of four hours, to flush out remaining chemical solution.
- 3.3.6 Following flushing, drain and refill systems with fresh, clean water and, where specified, inhibited glycol solution. Adjust inhibitor and glycol levels to required concentrations.
- 3.3.7 Allow for all labour and chemicals required for pipe cleaning for each phase of construction, and for final cleaning and fill. Coordinate all work with Piping Contractor.
- 3.3.8 Submit a PDF format report to Consultant, to certify that the systems are clean.
- 3.4 **CLOSED WATER SYSTEMS**
 - 3.4.1 Treat systems with corrosion inhibitor immediately after completion of pre-operational cleaning. Install cartridges in the filters.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 21 05 01, "Common Work Results for Mechanical".

1.2 **SHOP DRAWINGS**

1.2.1 Submit Shop Drawings in accordance with Section 21 05 01, Clause "Shop Drawings" for the following equipment and materials:

- balancing dampers
- duct access doors
- duct sealer
- ductwork gauges, material, and methods of support for each pressure type, shape (i.e. round, rectangular), and size range.
- fans
- flexible connectors
- flexible ductwork
- grilles, registers, and diffusers
- internal duct lining
- louvres
- turning vanes and rails

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 21 05 01, "Common Work Results for Mechanical", Clause "Material and Equipment".

2.2 **DUCTWORK**

2.2.1 **Standards:** Construct all ductwork in accordance with the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Manual "HVAC Duct Construction Standards - Metal and Flexible".

2.2.2 **Materials:** Unless specified otherwise, fabricate all ductwork from galvanized steel. Use SMACNA recommended thicknesses except where specified otherwise.

2.2.3 **Rectangular - Low Pressure:** Use SMACNA 0.5 kPa (2" W.G.) pressure class. Use SMACNA recommended sheet metal thicknesses. For all round take-offs from rectangular ducts use bevelled rectangular to round take-offs, tapered in the direction of air flow. For rectangular take-offs serving only one terminal outlet use bevelled rectangular take-offs. For rectangular take-offs serving multiple terminal outlets use full radius wye fittings.

2.2.4 **Rectangular - Medium Pressure:** Fabricate according to current SMACNA standards for static pressures in duct up to 1.5 kPa (6" W.G.). For all rectangular branch connections use full radius wye fittings. For all round branch connections use tapered or conical takeoffs.

2.2.5 **Round and Flat Oval - Medium Pressure:** Fabricate according to current SMACNA standards for static pressures in duct up to 1.5 kPa (6" W.G.). Use Alpha, McGill, Plascad or Rozell spiral round or flat oval ducts. Use machine formed fittings. Use conical type takeoffs. Where round or flat oval ductwork is shown internally lined, use Alpha, McGill, Plascad or Rozell acoustic thermal duct consisting of free-flow spiral round or oval duct lined with 25 mm (1") fibreglass insulation and 28 gauge steel perforated interior liner.

2.2.5.1 For sizes up to and including 200 mm (8") diameter, use machine formed fittings. In larger sizes, use machine formed or shop fabricated fittings. For shop fabricated fittings, make sample fittings and get approval of the Consultant before proceeding with fabrication of job fittings. For all round branch connections use tapered or conical type takeoffs.

2.2.5.2 Where round or flat oval ductwork is exposed to view, a decorative grade installation with a satin coat finish, degreased and suitable for field painting, is required. Arrange for special handling and shipping to avoid dents and minimize scratches.

2.2.6 **Flexible Type Round Ducts**

2.2.6.1 Flexible ductwork will not be permitted where exposed to view.

2.2.6.2 In other areas, where not exposed to view, use Thermaflex Type M-KC insulated flexible duct with a woven fibreglass fabric core with a flame resistant coating permanently bonded to a coated wire helix. Minimum positive pressure rating of 4 kPa (16" W.G.) for sizes 100 mm to 250 mm (4" to 10") and 2.5 kPa (10" W.G.) for sizes 300 mm to 400 mm (12" to 16"). Insulate duct with minimum 40 mm (1-1/2") thickness of 12 kg/m³ (0.75 lb/ft³) density fibreglass and bidirectional reinforced metallized film outer vapour barrier.

2.2.6.3 Flexible duct must bear ULC approval labels and conform to flame spread and smoke developed ratings as required by the Ontario Building Code.

2.2.6.4 The following manufacturers will be considered equal, subject to the requirements of Clause "Material and Equipment":

FlexMaster

2.3 **DUCT SEALER**

2.3.1 Use Duro Dyne DWN water based high pressure duct sealer.

2.3.2 The following manufacturers of the above material will be considered as equal, subject to requirements of Clause "Material and Equipment":

Childers
Multi-Purpose
3M Canada Inc.
United McGill
Hardcast

2.4 **BIRDSSCREENS**

2.4.1 Use 12 mm x 12 mm (1/2" x 1/2") galvanized steel wire mesh mounted in reinforced steel frame.

2.5 **TURNING VANES AND RAILS**

- 2.5.1 Use Duro Dyne turning vanes and rails in all square elbows. Use 26 gauge galvanized steel 50 mm (2") turning vanes and rails in standard ductwork. In stainless steel or aluminum ductwork, vane and rail material to match duct construction. Bolt or screw rail to duct and seal. Vane and rail to be manufactured in accordance with latest version of SMACNA guidelines.

2.6 **FLEXIBLE DUCT CONNECTORS**

- 2.6.1 Use Duro Dyne "Durolon" pre-assembled flexible duct connectors with 150 mm (6") fabric width, Hypalon coating.
- 2.6.2 The following manufacturer of the above equipment will be considered as equal, subject to requirements of Clause "Material and Equipment":

Carlisle
Thorburn
VentFabrics

2.7 **DUCT ACCESS DOORS**

- 2.7.1 Use Nailor Industries Inc. 0800 Series duct access doors. Minimum size for access to fire damper, smoke damper or combination smoke and fire damper is 300 mm x 300 mm (12" x 12"). For other locations, for duct dimension up to 300 mm (12") use 250 mm x 150 mm (10" x 6") door and for duct dimension up to 600 mm (24"), use 380 mm x 250 mm (15" x 10") door. For all larger ducts, use 660 mm x 510 mm (26" x 20") door. For round ducts, use Nailor 0895 access door.
- 2.7.2 For insulated ducts, use doors factory insulated with 25 mm (1") thick fibreglass insulation.
- 2.7.3 For grease ducts, use ULC listed Acudor model GDD bolted grease duct access doors with flange and gasket, or Ductmate equivalent. For insulated ducts, use 3M fire barrier grease duct access doors. Follow NFPA 96 requirements for access door sizes.
- 2.7.4 For access door with viewport, use Duro Dyne model DADVP hinged access door with frame and with plexiglass vision panel.
- 2.7.5 The following manufacturer of the above equipment will be considered as equal, subject to requirements of Clause "Material and Equipment":

Acudor
AMI
Ductmate
Nailor
Ruskin

2.8 **BALANCING DAMPERS**

- 2.8.1 For ducts 930 cm² (144 in²) and less in cross sectional area, use single blade dampers with locking quadrant and pin on far side. For larger ducts use, multi-blade, opposed blade

dampers with external operator and locking quadrant. Provide spacers to maintain clearance between duct and damper blades.

2.9 **BACKDRAFT DAMPERS**

2.9.1 Use Ruskin Model CBD-6 heavy duty, extruded aluminum backdraft dampers with counter balance. Use 3.2 mm (1/8") aluminum frame, 1.8 mm (0.070") aluminum blades with vinyl edge seals and nylon bushings.

2.9.2 The following manufacturer of the above equipment will be considered as equal, subject to requirements of Clause "Material and Equipment":

Alumavent
Arrow United Industries
EH Price
Greenheck
Nailor
National Controlled Air
Ruskin
United Enertech

2.10 **INTERNAL DUCT LINING**

2.10.1 Use Knauf Performance Plus formaldehyde free fibreglass duct liner with air stream surface protected with airstream surface mat facing treated with EPA registered anti-microbial agent so as not to support growth of fungus or bacteria as determined by ASTM G21 and G22. Flame spread rating less than 25 and Smoke Developed Classification less than 50 when tested in accordance with CAN/ULC S102. Use 24 kg/m³ (1.5 pcf) density insulation with a minimum Noise Reduction Coefficient of 0.70 and a maximum thermal conductivity of 1.42 W/m² °C). Equivalent Manson formaldehyde free duct liner product will also be acceptable.

2.11 **LOUVRES**

2.11.1 Use Price Model DE635, 150 mm (6") deep, 35° drainable blade type louvres with vertical jamb gutters, sizes as noted on the Drawings. Use 2.1 mm (0.081") louvre blades and 2.1 mm (0.081") frames, fabricated from extruded aluminium with all joints welded. Provide 13 mm (1/2") square mesh aluminum birdscreen on interior face of louvre. Provide 40 mm (1.5") wide perimeter flange to cover rough openings. Finish with factory-applied baked enamel. Colour to be selected by the Architect.

2.11.2 Louvres to be AMCA certified with minimum free area of 0.831 m² (8.95 ft²) for a 1220 mm x 1220 mm (4' x 4') panel.

2.11.3 Louvres to have a minimum free area velocity of 6.1 m/s (1,200 fpm) at the beginning point of water penetration as determined in accordance with AMCA Standard 511.

- 2.11.4 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Ventex
Nailor
Ruskin

2.12 **GRILLES, REGISTERS, AND DIFFUSERS**

- 2.12.1 Use Price Limited grilles, registers, and diffusers where noted in schedule on drawings. Provide types, accessories and finishes as noted in the Equipment Schedules. See Drawings for sizes.

- 2.12.2 The following manufacturers of the above equipment will be considered as equal, subject to requirements of Clause "Material and Equipment":

Kreuger
MetalAire
Nailor
Titus
Tuttle & Bailey

2.13 **HIGH INDUCTION GRILLES, REGISTERS, AND DIFFUSERS**

- 2.13.1 Use NAD Klima diffusers where noted in schedule on drawings. Provide types, accessories and finishes as noted in the Equipment Schedules. See Drawings for sizes.

- 2.13.2 The following manufacturers of the above equipment will be considered as equal, subject to requirements of Clause "Material and Equipment".

Effective HVAC
Kampmann
Klimaoprema
NAD Klima
Price
Trox

2.14 **AIR TERMINAL UNITS**

- 2.14.1 Refer to Section 23 80 00, "Decentralized HVAC Equipment".

2.15 **FANS**

2.15.1 **General**

- 2.15.1.1 See Equipment Schedules on Drawings for types, details, and capacities. Use arrangement and motor location to suit fan location. All motor mounting locations must maintain accessibility for maintenance staff. Fans to be listed in accordance with UL 705 and bear cUL label.

- 2.15.1.2 Use fan classification in accordance with A.M.C.A. Pressure Limitations. Use a minimum of Class I construction on all fans unless specified otherwise. Ensure all selections will

accommodate at least 10% speed increase before class change is required. Upgrade to higher construction class if this condition is not met. Submit certified Fan Performance Curves and fan sound level ratings based on A.M.C.A. Standards to the Consultant with Shop Drawings.

- 2.15.1.3 Provide felt edged backdraft dampers on all systems which are not provided with automatic control dampers.
- 2.15.1.4 Size V-belt drives for 150% of motor nominal horsepower. Use fixed drive pulleys on fans greater than 0.75 kW (1 hp). Use adjustable drive pulleys on fans 0.75 kW (1 hp) or less.
- 2.15.1.5 Provide lifting lugs with all fans within service rooms.
- 2.15.1.6 All steel fan components to be coated with electrostatically applied, baked polyester powder coating. Each component to be coated with minimum 0.05 mm (2 mil) thick baked powder finish. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.
- 2.15.1.7 Use bearings of ball bearing type, grease lubricated Use heavy duty ball bearings, grease lubricated, regreasable, designed specifically for HVAC applications. L10-200,000 hours minimum at maximum catalogued operating speed, unless specified otherwise. Provide extended grease fitting where required for easy access.
- 2.15.1.8 **Motors:** Motors must meet requirements of Section 21 05 01, "Common Work Results for Mechanical".
- 2.15.1.9 Where 2-speed or multi-speed motors are specified in the Equipment Schedule, provide motors which will be compatible with starters. Coordinate with Division 26 requirements.
- 2.15.2 **Square In-Line Fans:** Use square in-line direct drive centrifugal fans with optional all aluminum construction including enclosure and fan wheel. Unit housings to be heavy gauge with square inlet and outlet collars and powder coat finish. Continuously weld fan blades to backplate and inlet shroud. Statically and dynamically balance fan wheels. Use ECM motors with onboard adjustable speed controller.
- 2.15.3 The following manufacturers of the above equipment will be considered as an equal, subject to requirements of Clause "Material and Equipment":

Square In-Line Fans:	Aerovent
	Carnes
	Cook
	Greenheck
	PennBarry
	Twin City

3 Execution

3.1 DUCTWORK

3.1.1 Indoor Air Quality Requirements

- 3.1.1.1 Seal all openings in HVAC systems with plastic. While duct installation is proceeding, seal all openings that are not under immediate work.

3.1.2 General

- 3.1.2.1 Construct all ductwork located inside Mechanical Equipment Rooms and all supply air ducts on systems with variable air volume boxes between the fan outlets and the volume box inlets to Medium Pressure duct standards. Construct all ducts designated on Drawings as round or oval to Medium Pressure duct standards. Unless specified otherwise, construct all other ductwork to Low Pressure duct standards.
- 3.1.2.2 Fabricate and install ductwork in accordance with the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Manual "HVAC Duct Construction Standards - Metal and Flexible".
- 3.1.2.3 Pay particular attention to Section 21 05 01 "Common Work Results for Mechanical", Clause "Cutting and Patching". This will be strictly enforced on this project. Coordinate work with trades responsible for floor and wall construction to reduce difficulty of making tight seals.
- 3.1.2.4 Fabricate all ductwork to the clear inside dimensions shown on the Drawings. Where internal lining is specified, dimensions shown are inside insulation.
- 3.1.2.5 Do not suspend ducts from metal roof deck.
- 3.1.2.6 Make duct connections to fans, air handling units and connections between air handling units and plenums and any other rotating piece of equipment, with flexible duct connectors.
- 3.1.2.7 Install access doors for easy access to each damper, thermostat, coil, valve, or other concealed device which requires servicing. Use at least 1 m (36") of removable duct on inlet and outlet of inline return air fans.
- 3.1.2.8 Provide backdraft dampers where shown or specified.
- 3.1.2.9 Install dampers, air flow measuring stations and duct sensors as supplied by Section 25 00 00 "Controls". Exact locations to be determined by Section 25 00 00.
- 3.1.2.10 Where ductwork has to be altered from dimensions shown due to construction conditions, use the same effective cross sectional areas, without exceeding a 4 to 1 aspect ratio. Carry out such changes at no additional cost to the Owner.
- 3.1.2.11 Install ductwork to maximize clear floor to ceiling heights.
- 3.1.2.12 Transitions are described in the direction of air flow. For converging transitions, use a maximum slope of 1 in 4 and, for diverging transitions, use a maximum slope of 1 in 6.
- 3.1.2.13 Paint interior of ductwork for at least 610 mm (24") behind supply, return and exhaust grilles and registers with matte black paint so as to render ductwork invisible from occupied space. Do not paint ductwork which is internally lined.
- 3.1.2.14 Apply one coat zinc chromate primer over all welded surfaces.
- 3.1.2.15 If there is a conflict between the duct sizes shown on the floor plans and the duct sizes shown on sections, elevations or details, the floor plans will govern.

- 3.1.2.16 Seal all transverse joints, longitudinal seams, and duct wall penetrations to SMACNA Seal Class A standards.

3.1.3 **Low Pressure - Rectangular Ductwork**

- 3.1.3.1 Fabricate and install according to current SMACNA standards. Use 0.5 kPa (2" W.G.) pressure class. Use SMACNA recommended sheet metal thicknesses. Fabricate with all flat surfaces wider than 450 mm (18") either cross broken or transverse beaded, regardless of whether the duct is insulated, lined or bare.
- 3.1.3.2 Use elbows in the following order of preference:
 - 3.1.3.2.1 Full radius elbows with inside radius equal to duct width.
 - 3.1.3.2.2 Square elbows with turning vanes.
- 3.1.3.3 For duct takeoff to a single register, diffuser, grille, or branch, use balancing damper located at the branch takeoff. Do not use splitter dampers.

3.1.4 **Medium Pressure Ductwork**

- 3.1.4.1 Fabricate and install according to current SMACNA standards for 1.5 kPa (6" W.G.) pressure class.
- 3.1.4.2 Provide increasers on inlets to variable air volume boxes to match duct sizes shown.

3.1.4.3 **Round and Flat Oval Ductwork**

- 3.1.4.3.1 Provide a decorative grade installation where ductwork is exposed to view, outside of Mechanical Rooms. Use satin coat finish, degreased and suitable for field painting without etching duct surfaces.
- 3.1.4.3.2 Make all joints in ductwork exposed to view using "Spiralmate" round duct connector system or equivalent.
- 3.1.4.3.3 Rotate spiral seams on duct-to-duct joints so that the seam provides a continuous helical pattern across the joint.
- 3.1.4.3.4 Fasten diffuser collars to duct using pop rivets. Provide a finishing filet of elastomer seal at the collar-duct junction.
- 3.1.4.3.5 Space hangers at equal intervals. Fasten hangers to duct system using ring collars as shown on the Drawings.

3.2 **FLEXIBLE DUCTS**

- 3.2.1 In lieu of the solid duct connections shown, flexible ducts may be used to connect air terminal units to medium pressure duct system and to connect linear supply diffusers to supply duct plenums. Flexible ducts may also be used to connect diffusers to duct runouts.

3.2.2 Length of flexible duct must not exceed 600 mm (24") and only maximum 70° offsets (no elbows) will be permitted. Use hangers and supports to ensure this condition is maintained.

3.2.3 For diffuser runouts, the length of flexible duct must not exceed 1.8 m (6') and maximum one 90° elbow will be permitted. Use hangers and supports to ensure duct does not sag.

3.2.4 Make all duct connections using high pressure fibreglass tape, sheet metal screws, and high pressure duct sealer. Installation to be UL Listed treatment as published by the manufacturer.

3.3 **FLEXIBLE DUCT CONNECTORS**

3.3.1 Make all duct connections to fans, fan cabinets and heat pump units with preassembled duct connectors. On all return air fans, fabricate an acoustic seal over flexible connectors.

3.4 **INTERNAL DUCT LINING**

3.4.1 Install lining in accordance with liner manufacturer's published recommendations and SMACNA "HVAC Duct Construction Standards - Metal and Flexible". Use both adhesive and mechanical fasteners. Select pin lengths to limit insulation compression to 3 mm (1/8"). Butter butt joints with a fire-resistant coating and extend 50 mm (2") on either side of joint to stop air from lifting insulation. Repair liner surface penetrations with adhesive meeting ASTM C916. Pins must be welded to duct.

3.4.2 Internally line ducts where shown on Drawings. Use 25 mm (1") thickness, unless designated otherwise.

3.4.3 Where plenums are not specified, internally line outside air intake ducts with 40 mm (1-1/2") thickness. Finish with two 3 mm (1/8") thick coats of asphalt or vinyl mastic. Apply glass reinforcing fabric between coats. Lap joints by 100 mm (4").

3.5 **GRILLES, REGISTERS AND DIFFUSERS**

3.5.1 Cooperate on the job with other trades so that grilles, registers, and diffusers do not conflict with lights, etc. Bring any conflict between grilles, registers, and diffusers, and the work of other trades, to the attention of the Consultant before any ductwork is installed. See Architect's reflected ceiling plan for location of grilles, registers, and diffusers.

3.5.2 Install frame for each grille, register and diffuser to suit the type of building construction.

3.5.3 For high induction units, provide adequate chain hanger supports for all units installed in suspended ceilings

3.6 **TESTING AND BALANCING**

3.6.1 Cooperate with the Testing and Balancing trade. See Section 23 05 93, "HVAC Testing and Balancing". Make any changes deemed necessary by the Testing and Balancing trade to permit proper testing and balancing of the systems.

3.6.2 Provide additional balancing dampers where required by the Testing and Balancing Company.

- 3.6.3 Be responsible for the initial alignment and tension of all fan pulleys and belts.
- 3.6.4 Provide any changes to fan drives, pulleys and belts as required to allow a proper air balance as recommended by the Testing and Balancing Company for equipment supplied under this Contract.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Division 21 05 01 "Common Work Results for Mechanical".

1.2 **SHOP DRAWINGS**

1.2.1 Submit Shop Drawings in accordance with Section 21 05 01, "Common Work Results for Mechanical", Clause "Shop Drawings", for the following equipment and materials:

- Air Terminal Units

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Section 21 05 01, "Common Work Results for Mechanical", Clause "Material and Equipment".

2.2 **AIR TERMINAL UNITS**

2.2.1 Use Price Model SDV single duct air terminal units. See Equipment Schedule for sizes and capacities. Include optional removable flow measuring sensor so that sensor can be removed and cleaned.

2.2.2 Construct units of minimum 22 gauge galvanized steel. Line boxes with 25 mm (1") thick, fibre free foam.

2.2.3 Use assemblies which are pressure independent and capable of being easily reset to any airflow between 0 and maximum. With inlet velocity of 10 m/s (2000 fpm), the basic box differential static pressure must not exceed 37 Pa (0.15" W.G.). With an attenuator, the static pressure across the assembly with an inlet velocity of 10 m/s (2000 fpm) must not exceed 112 Pa (0.45" W.G.). Use dampers with gasket stops and leakage less than 2% of rated air flow at 750 Pa (3" W.G.) inlet static pressure.

2.2.4 Where shown or designated on the Drawings, provide hot water reheat coil mounted in enclosure. Provide coil access door with quarter turn latches. Size coil enclosure to match terminal unit outlet. Use coils with capacities as detailed in Equipment Schedule.

2.2.5 Provide 910 mm (3 ft) long discharge sound attenuator, sized to match terminal unit outlet, with each unit. Construction to match terminal unit.

2.2.6 The terminal unit controllers and damper actuators will be supplied by Section 25 00 00 "Controls" and shipped to the Air Terminal Unit manufacturer's factory for factory installation. Carry all costs associated with factory installation.

2.2.7 Provide Price standard NEMA 1 controls enclosure/shroud with removable cover, factory mounted to the side of each terminal unit, hanging as shown on the Drawings. Enclosure to be minimum 460 mm x 240 mm x 120 mm (18" x 9.5" x 5") size. Install the controller and damper actuator within the enclosure.

2.2.8 Submit unit discharge sound power level data and casing radiation sound power level data for each size unit to Consultant when submitting Shop Drawings.

- 2.2.9 The following manufacturers of the above equipment will be considered equal, subject to requirements of Clause "Material and Equipment":

Anemostat
Kreuger
Nailor
Titus
Tuttle and Bailey

- 3 Execution

3.1 **AIR TERMINAL UNITS**

- 3.1.1 Make connections to reheat coils with brass seated unions. Install a shutoff valve on each supply and a balancing valve on each return. Install an air vent and drain valve for each coil.

END OF SECTION

1 General

1.1 **CASH ALLOWANCE**

1.1.1 The work of this section is included in a Cash Allowance. See Section 21 05 01 "Common Work Results for Mechanical" for details.

1.1.2 The existing Building Automation System was provided by Durell Controls. For the work of this Section, use only Durell Controls. Contact Gary Vieira at 519-685-5432.

1.1.3 The work of this project is to be performed only by skilled factory-trained technicians under the direction of experienced engineers, all of whom shall be properly trained and qualified for this work and who are employed directly by the firms listed above.

1.2 **GENERAL REQUIREMENTS**

1.2.1 Conform to the requirements of Division 21 05 01 "Common Work Results for Mechanical".

1.2.2 Division 25 is to extend the existing Delta electronic/direct digital control (DDC) system to make the mechanical systems controls totally operational.

1.3 **SCOPE OF WORK**

1.3.1 Extend the existing electric/direct digital control (DDC) system to make the new mechanical systems and equipment controls completely operational.

1.3.2 This Section of the Contract includes the execution of all Mechanical Systems Controls called for or implied by the Drawings and Specifications, together with all necessary incidentals whether referred to or not, as required to complete the work to the full intent and meaning of the Drawings and Specifications. This includes the supply and installation of complete digital and electric controls systems as indicated.

1.3.3 Installation of temperature and pressure sensor wells, damper actuators, and control valves shall be completed by the Mechanical Contractor responsible for the installation of each respective system. Mechanical contractor is to make provision for all sensor, valve etc. installation requirements and include price in Base Bid.

1.3.4 Coordinate with WES staff and Owner's Representative for all system components and requirements for installation. Sequences of operation and integration of new graphics into existing Delta controls will be completed by this Contractor.

1.3.5 Wire components of control system in accordance with the requirements of Division 26. Include wiring between control components and electrical circuits of fans, pumps, and any other equipment or apparatus as indicated in this section or required for the proper functioning of controls as described in this section. Provide necessary transformers, relays, etc. to accomplish specified control function. All controls provided by this Section to be wired by this Section.

1.4 **SHOP DRAWINGS, MAINTENANCE DATA AND DOCUMENTATION**

1.4.1 Submit complete detailed Shop Drawings for Consultant's review before starting any other work. Ensure that identifying numbers on the Shop Drawings correspond to equipment identification, as specified elsewhere in the Specifications. Indicate spring ranges of controlled devices. Identify locations of all equipment.

- 1.4.2 Upon completion of the work, provide the complete Shop Drawings to the Mechanical Contractor for inclusion in the maintenance manuals, and affix one plastic coated set near or at the appropriate control panel. These Drawings to reflect Record conditions of the complete installation. Maintenance manual also to include Electrical Safety Authority Final Inspection Certificate.

1.5 **WIRING IDENTIFICATION**

- 1.5.1 The two extremities of all wiring will include the point description, device ID and I/O number. (Example is labelling for Heating Coil Valve on system 101 with Device ID 320110 and analog output 1204).

- 1.5.1.1 Field end tag will be labelled according to Device ID and I/O number (eg. tag will be "320110.AO1204")

- 1.5.1.2 Control panel end tag will be labelled according to point description (eg. AHU 101 HCV").

- 1.5.2 The terminal strips to be numbered. All drawings to show wire identification codes and terminal numbers. Flex type terminal blocks are acceptable.

- 1.5.3 Use self-adhesive strip or clip on style plastic markers for wire tags.

- 1.5.4 All labels will be black lettering on white background.

1.6 **NAMEPLATES & CONTROL DEVICE IDENTIFICATION**

- 1.6.1 Identify each I/O device and panel with nameplate identifying the point descriptor using the approved naming convention approved by the Owner. All equipment identification shall be clear and match the identification on the control drawings.

- 1.6.2 For thermostats and room temperature sensors, equipment identification label should include the room number and device ID.

- 1.6.3 All building control panels, control transformers, duct static pressure sensors, and piping differential pressure sensor locations shall be identified in the building using a label on the nearest ceiling grid, or access panel where concealed.

- 1.6.4 Provide plastic coated points list inside all DDC panels.

2 **Products**

2.1 **GENERAL**

- 2.1.1 All controls programming to be completed using entiliWEB.

- 2.1.2 All controls graphics are to be developed by entiliVIZ, using Western's Standard deployment and approved by the owner.

- 2.1.3 Any third party sub systems and BACnet gateways are to be approved by the Owner's WES Group.

2.2 **WIRING, CONDUIT AND CABINetry**

- 2.2.1 All of the installation requirements, be they temporary or permanent, shall comply with the Ontario Electrical Safety Code and all local and Provincial codes.
- 2.2.2 All wiring runs shall be direct from control to equipment.
- 2.2.3 For future expansion purposes, the Contractor shall ensure that wires are available in all conduits to accommodate the addition of possible future points to maximum capability of panel.
- 2.2.4 Supply, install and connect all wiring between the different components related to the Control System. Circuits shall be identified inside each control panel and on Shop Drawings using the same Code. Provide circuit breaker lock-offs and clearly mark breaker(s) with "BAS".
- 2.2.5 Coordinate electrical requirements with Electrical trade.
- 2.2.6 Provide all control transformers including the transformers for the room controls.
- 2.2.7 Division 26 will provide power wiring for all panels.
- 2.2.8 **Temperature Control Wiring:** All low voltage wiring, less than 50 volts, shall be a minimum of #22 gauge copper stranded. All wiring to be shielded.
- 2.2.9 **RS485 (MS-TP) Communications Wiring:** For the local field panels, wiring shall be two conductor, #24 awg low capacitance shielded twisted pairs, with ground drain wire. All drain wires shall be grounded at the panel end. The other end shall be protected from grounding with a dielectric material/electrical tape. All wiring to be shielded.
- 2.2.10 If wiring picks up unwanted noise, correct problem by replacing or rerouting wire at no additional expense to the Owner.
- 2.2.11 Wiremold and/or Raceway may not be used unless specifically approved by the Consultant.
- 2.2.12 FT6 wiring shall be acceptable in all rooms except Mechanical and Electrical Rooms and exposed areas (refer to reflected ceiling plans). All wiring within mechanical and electrical rooms and exposed areas shall be installed in conduit. Wiring shall be installed parallel to building lines or approved by the Engineer and tie-wrapped a minimum of every 1.2m (4").
- 2.2.13 Conduit to be thin-walled Electrical Metallic Tubing (EMT) conduit, complete with watertight steel connectors at all entrances to enclosures. Steel set screw connectors and couplings will be used in all other parts of the installation. Maximum of 60% conduit fill will be allowed.
- 2.2.14 Flexible conduit to be used only in areas where vibrations and/or expansion joints are present. The length of any run of flexible conduit shall not exceed 2m (6").
- 2.2.15 All conduit to be supported at least every 1.5m and as per Ontario Electrical Safety Code. Supports shall also be located at all connectors along the length of the conduit.

- 2.2.16 In damp or weather exposed areas, such as above the building roof, use rigid conduit with liquid tight connectors.
- 2.2.17 All conductors to be continuous from device to panel.
- 2.2.18 High and low voltage wire shall not be run in the same conduit.
- 2.2.19 Sensor, power and control wiring shall be run in separate conduit.
- 2.2.20 Where wiring penetrates fire separation, use fire stop sealant to maintain fire wall ratings.

2.3 **PULL BOXES AND JUNCTION BOXES**

- 2.3.1 All boxes to comply with the Ontario Electrical Safety Code in reference to size, capacity, etc.
- 2.3.2 All boxes to be fabricated of galvanized metal, unless otherwise warranted.
- 2.3.3 A pull box to be located every 30 m. The Contractor is responsible for the location and for obtaining any required approvals from the Consultant.
- 2.3.4 In suspended ceilings, all boxes to be installed on the structure.
- 2.3.5 All boxes to be clearly marked with "BAS" as part of the energy management system.

2.4 **SENSING DEVICES**

2.4.1 **Space Temperature Sensors**

- 2.4.1.1 In General, use eZNS T100 with Overlay 047 smart room sensor in all occupied spaces. Where RH and CO2 are required, use eZNS-T100H and eZNS-T100C, respectively. See drawings for sensor locations.
- 2.4.1.2 Space temperature sensors in classrooms, offices, labs and other regularly occupied rooms to be equipped with LCD display, limited setpoint adjustment and pushbutton for occupancy override.
- 2.4.1.3 In rooms fed by multiple terminal units (VAVs, FCUs, etc..), there should only be one thermostat capable of setpoint adjustment.
- 2.4.1.4 In change rooms, washrooms, corridors, vestibules, exam rooms, mechanical rooms and other regularly unoccupied rooms, use only Greystone blank stainless steel coverplate style sensors. In Breakout Rooms, use only Greystone blank stainless steel coverplate style sensors.
- 2.4.1.5 All space sensors are to be located away from any direct influence from air diffusers or areas affected by drafts.
- 2.4.1.6 Sensors that are installed on walls with high drafts in them, shall include insulating bases.
- 2.4.1.7 Sensors are never to be installed on exterior walls.

2.4.2 **Temperature Sensors, Thermostats, Freezestats and Firestats**

- 2.4.2.1 Sensors to be 10k ohm thermistors, type 3, with suitable range to match the application. RTD sensors may not be used. Accuracy to be $\pm 0.2^{\circ}\text{C}$ minimum. All temperature sensors shall be mounted in an enclosure suitable for the application. All sensor supplied as part of this work shall have fixed ranges to suit the requirements.
- 2.4.2.2 Use Greystone TE200C7B2A immersion temperature sensor and Greystone TE200B7XX for mechanical rooms and exposed ceiling duct sensors (XX is based on an appropriate length). Within the building in concealed areas, Greystone TE200BB7XX (XX is based on an appropriate length).
- 2.4.2.3 Sensor averaging elements are to be mounted in straight sections of duct, in serpentine fashion, equally spaced to provide adequate coverage of duct cross section to prevent stratification. Furthermore, sensor installation must not present a safety hazard nor impede access to fan compartments. Use only flex type. Copper or aluminum sheaths are not allowed. Use Greystone TE200FD7X (X is based on appropriate length).
- 2.4.2.4 All liquid temperature sensors to be mounted in wells, use Greystone T1 series or equivalent.
- 2.4.2.5 Provide the required well for the selected sensor and deliver to the mechanical contractor for installation. Advise the mechanical contractor as to the correct location of all wells.
- 2.4.2.6 The outdoor enthalpy sensor is to be mounted in a watertight enclosure complete with sun shield. It shall be thermally isolated from all indoor conditions and be mounted with a northern exposure. In general use Greystone RH300A03B.
- 2.4.2.7 All mixed air temperatures to be sensed with averaging sensors having a minimum active length of at least three duct cross sector.
- 2.4.2.8 **Carbon Dioxide Sensor and Transmitter:** Single detector, using solid-state infrared sensor, suitable for predicted installation temperature exposure range, 0-10VDC output, wall or duct mounted. Use Greystone CDD5 CO2 sensors.
- 2.4.2.9 Differential Pressure Sensors: Use Setra Model MRG.
- 2.4.2.10 **Air Flow Sensors and Switches:** Acceptable flow sensors use Ebtron GTC116 series for averaging in ducts and plenums, Ebtron EF-X2000-T series for single point. Acceptable flow switches are Cleveland Controls AFS-222.
- 2.4.2.11 **Occupancy Sensors:** Acceptable occupancy sensors are Hubbell OMNIDT series sensors.
- 2.4.2.12 **Freezestats:** Freeze stat to be low limit thermostat to be normally closed DPDT, manual reset. Switch to break on temperature fail. Provide 6.1m (20') capillary sensing element. Provide on all air handling and wire to shut down fans as indicated in the control sequences. Acceptable devices are Johnson Controls model A70HA or White Rogers Controls Series 1687, where self-resetting has been approved by the consultant.

2.5 **RELAYS AND CONTACTORS**

- 2.5.1 All interfacing/control relays and contactors to be sized to match the application. Low voltage coils to be used wherever possible, except where it is financially beneficial to use

high voltage coils. For all non horsepower rated applications use mechanical 0-10 VDC coil type Feme relays or approved equal.

2.5.2 Relay Enclosures: Mount interfacing relays in NEMA 1 control cabinets. The panel door must clear all obstacles and open fully to access relays. Mount the enclosure adjacent to the MCC at a maximum height of 1.9 m (6 2") from finished floor. Do not locate relays within electrical starter enclosure unless approved by Consultant. If necessary, use a separate enclosure to house interface relays. All control cabinets will come with a removable backplate. Label all relays using the Brother P Touch labelling system or approved equal. Use the "WES" hardware address and point descriptor. If relays are switching the load to fractional horse power motors they must be horse power rated.

2.5.3 Contactors to be equipped with auxiliary contacts wherever such status indication or hard wired interlock is required. Coordinate with Electrical trades. All contactors are to be mounted in a NEMA 1 cabinet, enclosing contactor, transformer, protection, etc.

2.6 CURRENT SENSING RELAYS

2.6.1 Unless otherwise noted, all motor non-fractional horse power driven equipment status monitoring to be accomplished though the use of a current-sensing relay. This device should output analog status signal proportional to current draw. These relays will provide a proportional 0-5 vdc output signal and do not require an external source of power, spec CS350. Program cut-off point when the equipment operating current falls below an adjustable level for each individual piece of equipment. Program the adjustable maximum operating current level to be utilized for high level alarm generation. Wire to the WES. Use analog output only. Digital type are acceptable for fractional horse power motors. Use Greystone CS-650.

2.7 CONTROL VALVES

2.7.1 Contractor is responsible for the section of control valves whose entire characteristics are suitable for the required application, including sizing, pressure rating, flow co- efficient, flow characteristics, close-off rating, fail position and allowable leakage factor.

Table 1

Zone Terminal Valves					
Type	Service	Normal Position	Fail Position	Control	Power
Pressure Dependent					
Belimo B2 series CCV pressure dependent characterized control valves	Heating and cooling water or glycol mixtures	Normally closed (NC)	Fail-in-place (FIP)	2-10 VDC fully modulating	24 VAC

Pressure Independent					
Belimo P2 and PICCV (larger sizes) series pressure independent characterized control valves	Heating and cooling water or glycol mixtures	Normally closed (NC)	Fail-in-place (FIP)	2-10 VDC fully modulating	24 VAC

2.7.2 Use Belimo valves and actuators with minimum Cv of 1.9. Modulating valves to have 24 VAC power supply and 2 to 10 VDC control. Actuators with motors that have brushes are not acceptable. Therefore Belimo TR actuators are not acceptable.

2.7.3 Belimo Energy Valves shall be installed on all Air Handling Unit Chilled Water systems. Energy valves shall be set to "Position Control", with Delta-T manager enabled. Delta-T shall be set to the coil design delta-T. BACnet over IP interface to control system to show feedback should be installed where practical, to show valve position feedback, temperatures and flow.

2.7.4 Freezestat controls shall be hard wired to de-energize 24 VAC power to valve actuator so that valve returns to fail position.

2.7.5 Use Belimo proportional action actuators with 0 to 10 volt or 2 to 10 volt signal, 24 VAC actuator. Size actuators to control valves against maximum pump pressure or dynamic closing pressure, whichever is greater. Provide spring returns to that the valves so that the valves "fail safe" in normally open or closed position as dictated by freeze or other temperature protection. Fail in place vales without spring return will be acceptable as outlined in Table able.

2.7.6 Use actuators with a NEMA 2 or greater rating when located in service space like Mechanical Room, etc.

2.8 **MOTOR CONTROL**

2.8.1 All non-fractional horsepower motors will have starters with HAND/OFF/AUTO position supplied by Mechanical and Electrical trades. In the event that the existing starter is not equipped with such, this functionally shall be implemented externally or by installing a retrofit kit to the existing starter. All starters and manual override switches shall be within eyesight of the motor being controlled. Supply and return fan will be assigned separate control outputs and will not be interlocked via hard wiring.

2.8.2 Fractional horsepower motors are to be controlled through a suitable size horsepower rated relay or contactor.

2.9 OTHER DEVICES

2.9.1 Other acceptable devices are listed in the Table 4:

Manufacturer	Device	Function
Greystone Device	PS1002	Power Supply (DC)
RIB	PSH/200/300/500AB10-LVC	power supply (AC)
RIB	TR100VA002/120-24	transformer c/w resettable breaker (AC)
Omron	G7L-1A-BUBJ-CB AC100/120	Relay (AC 120V Coil)
Omron	G7L-1A-BUBJ-CB AC24	Relay (AC 24V Coil)
Schrack	RT174012	Relay (DC 12V)
Finder Device	95.03/05	Relay Bases
Finder Device	40.51/52	Relays (AC)

3 Execution

3.1 GENERAL

- 3.1.1 Unless noted otherwise, mount all room sensors and thermostats at 1200 mm (47") above floor.
- 3.1.2 All controls to be connected to emergency power system.
- 3.1.3 All conduit and wiring is to comply with requirements of Electrical trades and General Conditions.
- 3.1.4 Upon completion of the system, the Testing and Balancing Contractor shall coordinate with the Owner's forces for final commissioning. A complete operational system as specified must be delivered to the Owner for final acceptance. Also conform to the requirements of Section 21 05 01 "Common Work Results for Mechanical".
- 3.1.5 All control components to be arranged such that on power failure all controls fail to the position that existed when failure occurred. Air handling unit dampers must fail as follows: Outside air inlet and exhaust air dampers closed. Control valves on air handling unit heating coils to fail open.
- 3.1.6 DDC controller to be mounted in same room as equipment being controlled. Where this is not practical, provide a communication interface at equipment location for communication to DDC panel.
- 3.1.7 Provide points list on inside of DDC panels.
- 3.1.8 Nomenclature in DDC programming to match Control Shop Drawing nomenclature. DDC panels to be labelled as per Shop Drawings.

- 3.1.9 Install labels at all duct-mounted devices including transmitters, controllers, gauges, etc. Similarly label manual switches, unless they are delivered with standard nameplates. Similarly label all devices installed on local panels. Use Brother P Touch label system or approved equal.
- 3.1.10 Provide all wiring from power supplies to valves, dampers, thermostats, sensors, etc., and all necessary control transformers and relays required for the control system. Fuse a minimum of one leg of the secondary side of all Class 2 transformers. Fuse maximum of 125% of transformer rating.
- 3.1.11 Do not use marrette type wire connectors for terminations to valves, damper actuators, etc. Use flex type terminal blocks for all terminations.
- 3.1.12 DDC controllers not to be loaded higher than 80%.
- 3.1.13 All MSTP networks shall be limited to 33 subnet devices.
- 3.1.14 All DDC trend logs to be archived in to a Copper Cube. Coordinate with Owner.
- 3.1.15 Follow Owner's latest standardized meter configurations, request most recent standards from Owner.
- 3.1.16 Use Owner's latest programming logic and controls standards where applicable, request most recent standards from Owner.
- 3.1.17 Coordinate with Owner for activates requiring Owner review and approval.
- 3.1.18 Graphics for systems that are heavily dependent are to be shown on the graphic page. (Example is shared fresh air between systems or hydronics systems with heat injection / rejection).
- 3.2 **ELECTRICAL WORK**
 - 3.2.1 Provide an installation which follows horizontal and perpendicular lines to fit into the layout of the area. Properly support and install in a neat and workmanlike manner throughout.
 - 3.2.2 All conduit and wiring is to comply with requirements of Division 26 and General Conditions.
 - 3.2.3 Coordinate Electrical requirements with the Electrical trade.
- 3.3 **AIR TERMINAL UNITS**
 - 3.3.1 **Control Devices**
 - 3.3.1.1 Provide a unitary controller for each air terminal unit.
 - 3.3.1.2 Provide a space temperature sensor, supply air temperature sensor, reheat control valve and modulating electric damper actuator for each terminal unit. Field install the actuators and controllers to the air terminal unit (volume box).
 - 3.3.1.3 Provide space carbon dioxide sensor adjacent to temperature sensor where shown on the Drawings.

3.3.2 **Control Sequence**

- 3.3.2.1 Provide limited setpoint adjustment at space temperature sensors. Provide occupied heating and cooling space temperature setpoints. Maintain a minimum 1.5°C (3°F) differential between space heating and space cooling temperature setpoints.
- 3.3.2.2 On a call for cooling, modulate open damper from damper minimum position to damper maximum position, as required to maintain space temperature setpoint.
- 3.3.2.3 On a call for heating, modulate damper closed until minimum position is reached. Once damper is at minimum position, modulate open reheat coil control valve to maintain space temperature setpoint. On a further call for heat, gradually open air terminal unit damper to increase airflow as required to maintain space temperature setpoint.
- 3.3.2.4 In rooms with CO2 detectors, override the terminal unit air damper minimum position as required to maintain space carbon dioxide sensor setpoint of 900 ppm (adjustable). Program an annual maintenance alarm for the carbon dioxide sensor.

3.3.3 **Miscellaneous Controls**

- 3.3.3.1 Work with Testing and Balancing Contractor to field set terminal unit minimum and maximum airflow positions. Minimum and maximum airflow rates are shown on the Drawings. Indicate design minimum and maximum airflows on graphic for each terminal unit. Minimum and maximum positions to be easily adjustable from graphic.
- 3.3.3.2 Where a single room is served by two air terminal units with two sets of space temperature sensors and carbon dioxide sensors, control both terminal units to satisfy average of two space temperature sensors and carbon dioxide sensors.
- 3.3.4 **Graphic Display:** Provide graphic display of air terminal unit and equipment internal components such as space temperature and setpoint, damper position, flow measuring sensor, reheat coil control valve, perimeter heater control valve, supply air temperature sensor, etc. Display must include all monitored and controlled functions, sensors, etc. Include a pull down tab with a unit specific summary of how the unit is controlled.

3.4 **EXHAUST FANS**

- 3.4.1 For all fans, provide exhaust air damper and actuator, current sensor and relay. Provide start/stop and status. Provide occupied/unoccupied schedule through the BAS.

3.5 **TREND LOGS**

- 3.5.1 Set up trend logs to continuously monitor critical parameters for each system. Consultant will assist in determining critical parameters.

END OF SECTION

1 General

1.1 **GENERAL PROVISIONS**

1.1.1 This Section and Division 1 - General Requirements apply to and govern the work of all Sections of Divisions 26, 27 and 28.

1.2 **VISITING SITE**

1.2.1 Visit the site and be familiar with working conditions and work involved before submitting Bids. **NO EXTRAS WILL BE GRANTED DUE TO LACK OF A THOROUGH PRELIMINARY INVESTIGATION.**

1.2.2 Remove and replace existing ceiling tiles to inspect ceiling for existing mechanical, electrical and structural obstructions. Include cost of all necessary changes in Bid Price. No extras will be granted due to lack of a thorough preliminary investigation of accessible ceiling spaces.

1.3 **CONTRACT DRAWINGS**

1.3.1 Electrical Drawings show Electrical work only and are not intended to show Structural details, Mechanical details or Architectural features. Take building dimensions and details from Architectural or Structural Drawings or from job measurements only.

1.3.2 Electrical Drawings indicate only the general locations of equipment and outlets. Wiring requirements are shown diagrammatically. Responsibility for the detailed layout of equipment, outlets, raceways and wiring is part of the work of this Division. Specific outlet locations are detailed on elevations.

1.3.3 If shown, only the general location and route of conduit, cable trays and communication hooks are shown. Install all services neatly to conserve headroom. All conduit, cable trays and communication hooks are to be accessible after work by other trades is complete. Install all services parallel to building lines unless shown otherwise.

1.3.4 The Consultant reserves the right to revise the locations of equipment and outlets within any given room without altering the Contract Price provided Notice of Change is given prior to roughing-in.

1.3.5 In case of conflict between work of other trades and work of this Division, clarify the location of these items with the Consultant before roughing-in.

1.3.6 In the event of any discrepancies or ambiguity of any symbol, note, abbreviation, etc., used in this Specification or on the Contract Drawings, obtain clarification, in writing, from the Consultant prior to submitting Bid. No allowance will be made for additional costs arising from failure to obtain proper clarification of conflicting information before Bid.

- 1.3.7 All dimensions and sizes are in SI units. Generally, units are in millimetres. All exceptions to this are noted.

CONDUIT SIZES

Imperial (Inches)	½	¾	1	1-¼	1-½	2	2-½	3	3-½	4	4-½	5	6
S.I. (metric) (mm)	16	21	27	35	41	53	63	78	91	103	116	129	155

1.4 SHOP DRAWINGS

- 1.4.1 Submit Manufacturers' shop drawings, electrical wiring diagrams and control system drawings to the Consultant. Provide title sheet for shop drawing submitted. Include project name, shop drawing item (including Specification paragraph reference) and approval stamps. The Consultant reserves the right to have samples submitted of any specified products.
- 1.4.2 Before submitting shop drawings, provide a complete list of shop drawings to be submitted in Microsoft Excel format. List all shop drawings and approximate date of submission.
- 1.4.3 Submit all shop drawings electronically in PDF format. File attachments to an email must total no more than 5 MB and must be submitted unzipped. If multiple items are submitted in single PDF file, each individual piece of equipment must be "book marked" using equipment labels as per Design Drawings. All shop drawings submitted electronically must be checked and stamped by Contractor as specified below.
- 1.4.4 All shop drawings submitted electronically must be checked and stamped by Contractor as specified below.
- 1.4.5 Catalogues, manuals or price lists will not be accepted as shop drawings. Before submission, check shop drawings, make necessary corrections, apply stamp "Checked and Certified Correct", sign and date.
- 1.4.6 Submit one reviewed set of shop drawings with each set of Maintenance and Operating Instructions.
- 1.4.7 The review of shop drawings by Chorley + Bisset Ltd. is for the sole purpose of ascertaining conformance with the general design concept. This review does not mean that Chorley + Bisset Ltd. approves the detail design inherent in the shop drawings, responsibility for which remains with the Contractor. Such review does not relieve the Contractor of their responsibility for errors or omissions in the shop drawings or of their responsibility for meeting all requirements of the Construction and Contract Documents. The Contractor is responsible for dimensions to be confirmed and correlated at the job site, for information that pertains solely to fabrication processes or to techniques of construction and installation, and for coordination of the work of all subtrades.

- 1.4.8 The Contractor is to review each shop drawing and document the differences between the shop drawing submission and the description listed in the specification. If there are no differences listed, the Contractor implicitly declares the shop drawing meets all requirements of the Specification.
- 1.4.9 Ensure at least one copy of each reviewed shop drawing is kept on site at all times for reference.
- 1.4.10 Prepare all Drawings in SI units.
- 1.4.11 Shop Drawings to include the following:
 - 1.4.11.1 Indicate details of construction, dimensions, capacities, weight and electrical performance characteristics of equipment or material.
 - 1.4.11.2 Where applicable, include wiring, single line and schematic diagram including interconnect with work of other sections.
 - 1.4.11.3 Include manufacturer's special installation instructions where applicable.
- 1.5 **FIELD DRAWINGS**
 - 1.5.1 Submit, to the General Contractor, Drawings accurately showing all openings for busducts, conduits, etc. Drawings must include the size of openings and their locations by dimensions, including the location of the structural members framing these openings. Each trade will be responsible for detail layout of their own work.
 - 1.5.2 Assume full responsibility for the detailed coordination of all Electrical work. Prepare Field Drawings to determine the exact location of each service. On these drawings, include all mechanical and electrical services, architectural features, and structural details. If a conflict becomes apparent after the installation of services, pay all costs associated with removing and reinstalling these services.
 - 1.5.3 If the General Contractor separates the Communication, Security or similar work from the other work of Division 26, the General Contractor assumes full responsibility for this coordination work including the preparation of the Field Drawings.
- 1.6 **AS-BUILT DRAWINGS**
 - 1.6.1 The Contractor will be provided with Mechanical and Electrical Files used to produce the contract documents. The following digital formats were used and are to be maintained: AutoCAD, Revit, and PDF. The Contractor is to print Drawings from the PDF files provided.
 - 1.6.2 Revise and maintain the prints as work progresses. Show all revisions, relocations and changes, to scale. Use colour markings. At the end of the project, provide a complete PDF red mark-up set of as-built drawings to the Consultant for record purposes. Printed hard copies will not be accepted.
 - 1.6.3 Contractor shall take as-built measurements, prior to backfill, of all buried duct bank(s) and conduits under floor slab. Show routing, depths and dimensions from fixed points on as-built drawings.

- 1.6.4 Transfer information from the marked prints to AutoCAD files and Revit model on a monthly basis. Match the software version that the original files were created in. Have the marked prints and updated CAD/Revit prints on site for review by the Consultant at all times. Monthly draws will not be approved unless all changes have been shown.
- 1.6.5 Prior to testing, balancing and final commissioning, complete the transfer of marked prints to the AutoCAD files and Revit model. Fill in the Owner's equipment numbering system in the Schedules on the Drawings and on the plans where blank placeholder tags have been shown.
- 1.6.5.1 AutoCAD format files are to match exactly the layering system and symbology of the Consultant. Bind all external references.
- 1.6.5.2 Revit model will be completed as per the project Revit/BIM deliverable. If no deliverable is defined, minimally the "Sheets" included under the "02-Construction" subset in the model, should properly display the as-built condition. Bind/Insert all linked files in the Revit model.
- 1.6.5.3 **Revit/BIM Deliverable**
- 1.6.5.3.1 Model will not include engineering, analytics or systems symmetry functionality (i.e. defined or totally connected systems).
- 1.6.5.3.2 All engineering and manufacturer information contained in the model will only be considered correct for identification with regard to the corresponding specification and scheduling purposes.
- 1.6.5.3.3 MEP components should be modeled by the Contractor to be as close as possible to as-built conditions but must still produce an acceptable printed as-built document.
- 1.6.5.3.4 The "Sheets" included under the "02-Construction" subset in the model, should properly display the as-built condition.
- 1.6.5.3.5 MEP components (i.e. piping, conduit) may not be modelled the proper size but identified correctly.
- 1.6.5.3.6 MEP components will be represented properly on floor plans (i.e. symbology) but not necessarily in elevations.
- 1.6.5.3.7 MEP equipment and other items that are generally required for coordination among disciplines (i.e. ceiling components) will be included in the model (approximate size shown). Many services will be shown in schematic fashion (i.e. not necessarily at correct elevation or in exact position required).
- 1.6.5.3.8 Due to the schematic nature of many portions of the model, services are likely to conflict and clash with various other services and structure. In some cases, this is intentional so that services display properly on sheets. The Consultant will not be responsible for providing to the Contractor a detailed, accurate or clash-free model without compensation, as the Owner has not required or paid for this work to be done by the Consultant. In turn, the Consultant will not require the Contractor to provide a more detailed, accurate or clash free model for the project as-built documentation than was originally provided to the

Contractor. Responsibility for creation of accurate Field Drawings and resolving minor interferences remains with the Contractor.

- 1.6.6 Mark Drawings "As-Built Drawings" and insert name and logo of Contractor. Submit one set of printed "As-Built Drawings" for review by the Consultant. Remove Engineers Stamp. Include Contractor's name and logo.
- 1.6.7 Submit completed As-Built Drawings on disks in same digital data software program, and version as original contract documents. Also provide one set of printed Drawings with the Operating and Maintenance Manuals.
- 1.6.8 For the purposes of Contract payments, As-Built Drawings will be assumed to have a value of \$2,500.00. This will not be released until the As-Built Drawings have been accepted as complete and acceptable by the Consultant. This amount is in addition to the normal 10% holdback required by the Construction Lien Act, 2018.

1.7 **SIMULTANEOUS PROJECTS**

- 1.7.1 Other projects may be under construction simultaneously on this site during the course of this construction project. The Owner will not be the "constructor" as defined by The Ontario Health & Safety Act & Regulations. This Contractor is to maintain a separation between this project and all other Contractors, by time or space, as defined by The Ontario Health & Safety Act & Regulations.

1.8 **CONFLICTS AND PRECEDENCE**

- 1.8.1 Immediately upon discovery of any conflict, ambiguity, error or omission in the Contract Documents, request clarification in writing from Consultant prior to starting the work in question.
- 1.8.2 Failure to give such written notice will constitute an irrevocable waiver and release of any claim for additional compensation or delays incurred.
- 1.8.3 Where work fails to conform to Contract Documents, as clarified by Consultant, promptly remove and replace such work as directed, without adjustment to Contract price.

1.9 **FIRESTOPPING**

- 1.9.1 Before starting any work on site, submit detailed shop drawings to the Consultant for review and comments. Include:
 - 1.9.1.1 Manufacturer's technical product data and installation instructions for each specific type and location of penetration.
 - 1.9.1.2 Certification that proposed firestopping materials and assemblies comply with the latest edition of CAN/ULC-S115 "Standard Method of Fire Test for Firestop Systems".
 - 1.9.1.3 For each specific type and location of penetration, provide installation instructions from a recognized independent testing agency.

- 1.9.2 Mark penetration and system number types and locations on set of white prints and submit with shop drawings. At completion of project, transfer this information to As-Built Drawings.
- 1.9.3 Comply with all requirements of Ontario Building Code Clause 3.1.9, "Building Services in Fire Separations and Fire Rated Assemblies".
- 1.10 **MAINTENANCE AND OPERATING INSTRUCTIONS – WESTERN UNIVERSITY**
- 1.10.1 For the Electrical Division 26 work only, assemble equipment literature (cuts), operating instructions, maintenance instructions, voltage test results, certificate, other pertinent data and Letter of Warranty. Submit to Consultant for approval.
- 1.10.2 Make changes or submit additional information as required to obtain approval. Final Certificate of Completion will not be issued until the Consultant an approved set. Include copies of reviewed shop drawings and name and address of Spare Parts' Suppliers with manuals.
- 1.10.3 Provide an electronic copy of the maintenance and operating manual in PDF format on a USB drive and submit with the final version of manuals. Provide separate files in accordance with the sections of the hard copy manuals. Divide the maintenance manuals into sections which correspond with Specification Sections.
- 1.10.4 Divide the manuals into the following sections:
- Section 1 – General
 - Section 2 – Lighting
 - Section 3 – Fire Alarm
 - Section 5 – Distribution
 - Section 7 – Communications
 - Section 8 – Certificates
- 1.10.5 The following information is to be contained within the Sections:
- 1.10.5.1 **Section 1:** A list of names, addresses, and telephone numbers of the Consultants, General Contractor and Electrical Contractor. Written warranty of the Electrical systems.
- 1.10.5.2 Sections 2 through 7
- 1.10.5.2.1 A list of names, addresses, and telephone numbers of all suppliers. A copy of all reviewed shop drawings.
- 1.10.5.2.2 A complete and comprehensive maintenance and operating instructions details D (daily), W (weekly), M (monthly), SA (semi-annually), A (annually) for maintenance.
- 1.10.5.2.3 Copies of warranties.
- 1.10.5.2.4 Complete control diagrams, wiring diagrams and description of applicable control systems and the functioning of the system.
- 1.10.5.3 **Section 8:** Electrical Safety Authority Inspection Permit, Fire Alarm Verification Report and Certificate, Emergency Lighting Verification Letter.

1.11 REGULATIONS AND PERMITS

- 1.11.1 Carry out the work in accordance with the latest editions of relevant codes, local bylaws, and requirements of local Authority Having Jurisdiction. Apply for and obtain permits and pay all fees. Consultant will submit Drawings to Electrical Safety Authority as required.
- 1.11.2 Enforce all prevailing Provincial and local safety regulations at all times. Abide by all Owner's safety and security policies and procedures and conform to all regulations of the current Occupational Health & Safety Act.
- 1.11.3 After completion of the work, furnish to Consultant a Certificate of Unconditional Approval from Inspecting Authorities.

1.12 MATERIAL AND EQUIPMENT

- 1.12.1 Where an item of material or any equipment is specifically identified by a manufacturer's trade name and/or catalogue number, make no substitution except as provided for in paragraphs 3, 4 and 5 below.
- 1.12.2 In the case of some items of equipment, one or more additional names of acceptable equal manufacturers are listed in the Clause describing an item or a group of items. The design, layout, space allocation, connection details, etc., are based on the products named first in the description of each item. The products named first in the description of each item establish the quality of manufacture and design standards for all other manufacturers of that item. The general approval indicated by listing the names of other manufacturers is subject to final review of shop drawings, performance data, test reports, production samples (if required) by Consultant, and equipment shipped to site. Ensure that the products used meet the requirements specified and as shown on the Contract Drawings.
- 1.12.3 Suppliers wishing to submit other items of equipment for approval as an equal to those specified must apply to the Consultant at least 8 working days before Bid closing date. Requests must be accompanied by complete description and technical data on the items proposed. Approval for substitution of equipment will only be given on the understanding that all details, accessories, features and performance meet the Specifications unless otherwise stated. Deviations from the Specifications must be stated in writing at time of application for approval.
- 1.12.4 Include in the Bid, the equipment named in the Specifications or approved as an equal as in paragraph 3 above. This will form the Base Bid. Any number of alternative bids, as defined below, may be included in addition to the Base Bid.
- 1.12.5 Items of equipment by Manufacturers not named in the Specifications may be offered as alternatives to the manufacturers named in the Specifications. The alternative proposals must be accompanied by full descriptive and technical data, together with the statement of amount of addition or deduction from the Base Bid, if the alternative is accepted. Prior approval by the Consultant is not required on items submitted as alternative bids.
- 1.12.6 After execution of the Contract, substitution of equipment will be considered only if equipment accepted cannot be delivered in time to complete the work in proper sequence, or if the manufacturer has stopped production of the accepted item. In such cases, requests for substitution must be accompanied by proof of equality and difference in price

and delivery, in the form of Certified Quotations from Suppliers of both specified and proposed equipment. Credit any decrease in price involved in substitution to the Owner by reduction of the Contract Price. The Contractor will not be reimbursed for any such increase in price.

- 1.12.7 Where equipment other than the equipment used as a basis for design, layout and space allocation is used, produce and submit revised layouts of equipment, pipes, ducts, etc., in the areas affected. Submit these Drawings with the shop drawings. Failure to produce these Drawings is indication by the Contractor that they are not required and that the original space allocations are adequate for the substituted equipment.

- 1.12.8 Name the Subcontractors and Manufacturers in the Bid as indicated in Clause "List of Electrical Subcontractors and Manufacturers".

1.13 **INTERPRETATION OF CONTRACT DOCUMENTS**

- 1.13.1 The decision as to which trade provides required labour or materials rests solely with the Contractor. Extra payments will not be considered based on a difference in interpretation of the Contract Documents as to which trade involved provides materials or labour for specific items of work. The Consultant will not enter into such discussions.

1.14 **SITE VISITS**

- 1.14.1 The Electrical Contractor shall have an office representative (not site personnel) at each site meeting and deficiency review. Attendance at these meetings is mandatory.

1.15 **PROGRESS DRAWS**

- 1.15.1 Electrical Contractor shall review all supplier and subcontractor draws submitted to their office to ensure they are fair and reasonable for the amount of work completed on site to date prior to submitting to the General Contractor. Electrical Contractor will be responsible for the validity of supplier and subcontractor draw claims.

1.16 **WARRANTY**

- 1.16.1 Warranty all workmanship, material and equipment supplied by Divisions 26, 27 and 28 for one year after Ready for Takeover except where specifically specified otherwise. Make good damage caused due to defects and workmanship.

- 1.16.2 Where equipment specified in Sections of Divisions 26, 27 and 28 to have an extended warranty period, e.g. five years, the first year of the warranty period will be governed by the terms and conditions of the warranty in the Contract Documents, and the remaining years of the warranty will be direct from the manufacturer and/or supplier to the Owner. Submit signed and dated copies of the extended warranties to the Consultant before applying for a Certificate of Substantial Performance of the Work.

1.17 **DIMENSIONS AND QUANTITIES**

- 1.17.1 If shown on Drawings, dimensions are approximate. Verify dimensions by reference to shop drawings and field measurement.

- 1.17.2 Verify equipment access and coordinate with equipment supplier to ensure equipment can be physically transported to installation location. Under no circumstances will any claim be allowed for extra cost to disassemble and/or assemble equipment at the final location which will be considered as part of equipment installation.
- 1.17.3 Quantities or lengths indicated in any of the Contract Documents are approximate only and will not be held to gauge or limit the work. No adjustment to the Contract Price will be allowed to complete the work.
- 1.17.4 Provide labour, products and services specified, but not shown on Drawings and vice versa, and all other labour, products and services necessary for completion of the work.
- 1.17.5 Make any necessary changes or additions to routing of conduit, cables, cable trays, and the like to accommodate structural, mechanical and architectural conditions, without adjustment to Contract price.
- 1.17.6 Provide work in accordance with the approved Schedule to meet completion date and specified interim Schedules.
- 1.18 **COOPERATION BETWEEN TRADES**
- 1.18.1 Cooperate and coordinate with other trades as required for satisfactory and expeditious completion of work. Take field dimensions relative to work. Fabricate and erect work to suit field dimensions and field conditions. Pay cost of extra work caused by and make up time lost as result of failure to provide necessary cooperation information or items to be fixed to or built-in, in adequate time.
- 1.19 **COOPERATE WITH OWNER'S STAFF**
- 1.19.1 Maintain close cooperation with Owner's staff. The Owner will determine the times during which work may be carried out in certain areas. If the work cannot be completed in the allowed time, the Contractor may be required to clean up the area and finish the work at some future time.
- 1.19.2 Shutdowns will be scheduled during unoccupied times. Include any overtime wages due to conditions stipulated above in the Bid Price.
- 1.19.3 Provide seven day's minimum notice, in writing, prior to any interruptions of service or restriction of use of any service.
- 1.19.4 Provide all phase testing, as required, prior to disconnecting existing and connecting new to avoid damage to equipment.
- 1.19.5 The Owner's operations must take precedence over Contractors' operations at all times. Interruptions due to noise, drilling, etc., will not be allowed without Owner's prior approval.
- 1.19.6 Include any overtime wages due to conditions stipulated above in the Bid Price.
- 1.20 **EXAMINATION OF DAMAGED DEVICES**
- 1.20.1 Report all damaged, defective and non-functioning devices and equipment shown for reinstallation or relocation to the Consultant prior to removal and storage. All devices and

equipment will be assumed to be fully functional unless reported otherwise prior to removal.

- 1.20.2 Devices and equipment damaged during removal, storage or reinstallation will be replaced at no cost to the Owner.

2 Products

2.1 **MATERIALS**

- 2.1.1 Use materials specified herein or approved equal as defined in Clause "Material and Equipment".

2.2 **SLEEVES**

- 2.2.1 In general, sleeves are not required through walls or floors except in service room floors and foundation walls.

- 2.2.2 Use Schedule 40 steel pipe sleeves through concrete structural members, walls and floor slabs. Extend sleeves minimum 25 mm (1") past finished surface and seal pipe to sleeve.

- 2.2.3 For all conduits passing through foundation walls, use Link-Seal pre-engineered mechanical seals between sleeves and pipes.

- 2.2.4 For rated separation requiring a FT firestopping rating, use materials in conformance with manufacturer's recommendations.

2.3 **FIRESTOPPING**

- 2.3.1 Use only service penetration firestop components and assemblies tested in accordance with the latest edition of CAN/ULC-S115 "Standard Method of Fire Tests for Firestop Systems" and listed in most recent ULC "List of Equipment and Materials" or by another recognized independent testing and certification agency acceptable to the Consultant.

- 2.3.2 All pipe insulation passing through the fire separation to be approved with the listing of the firestop system.

- 2.3.3 Fire stopping installers must be trained by the fire stopping manufacturer and be able to provide proof of training by providing Fit Level 1 certificate when requested, while working on site.

- 2.3.4 Pipe sleeves through fire separations requiring a rating are to be installed as per firestopping manufacturer's recommendations, as some firestopping manufacturers do not allow pipe sleeves within their approved system. Confirm pipe sleeve compatibility prior to starting work on site.

- 2.3.5 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

STI

2.4 ACCESS DOORS

2.4.1 Access doors to be flush to edge of frame, concealed continuous hinge with screwdriver operated cam latch. Non-fire-rated door construction to be minimum 14 gauge, with 16 gauge frame. Fire-rated door construction to be a minimum 20 gauge insulated door with 16 gauge frame. Insulation thickness to provide required rating.

2.4.2 Size doors to allow adequate operating/maintenance clearance for devices. Doors to be a minimum 600 mm x 600 mm (24" x 24") for body entry, and 300 mm x 300 mm (12" x 12") for hand entry, unless noted otherwise. Use the following access doors:

Masonry Walls	Acudor UF-5000
Drywall Walls	Acudor DW-5040
Drywall Ceilings	Acudor BP58, match ceiling thickness
Fire-Rated	Acudor FW-5050/FB-5060 to match fire separation
Wet Areas,	Acudor UF-5000 (stainless)

2.4.3 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Adam
Ancon LeHage
E. H. Price

2.5 SPRINKLER PROOF EQUIPMENT

2.5.1 This building will be fully sprinklered. Use sprinkler proof electrical equipment to prevent the sprinkler system water from entering electrical equipment for all surface mounted equipment.

2.6 IDENTIFICATION NAME LABELS

2.6.1 Provide white lamacoid identification labels with black uppercase lettering, minimum 14 pt Arial or Helvetica typeface, for identification of all MCCs, switchboards, distribution panels, panelboards, transformers and transfer switches.

2.6.2 Submit a complete list of nameplate wording for review by Consultant prior to installation.

2.6.3 Warning plates are to be red with white letters, minimum 14 pt Arial or Helvetica typeface, as indicated on drawings.

2.6.4 For all pieces of equipment served by multiple sources of power, provide a lamacoid warning label to read: "CAUTION – EQUIPMENT FED FROM MULTIPLE SOURCES. DISCONNECT ALL SOURCES OF POWER PRIOR TO SERVICING EQUIPMENT". This label is to match the lamacoid warning plate specification noted above.

2.7 FLASHING

2.7.1 For locations with roof penetrations serving a piece of equipment, such as for roof mounted split system condensing units, receptacles, etc, use Portals Plus, Inc. Alumi-Flash system consisting of 330 mm (13") high, one piece spun aluminium base with deck

flange and EPDM rubber cap. Use caps suitable for required number and diameter of service penetrations. Flashing is for Divisions 23, 25, 26, 27 and 28 use only. Coordinate with Division 25 to minimize the number of flashings required.

- 2.7.2 The following manufacturers of the above equipment will be considered equal subject to requirements of Clause "Material and Equipment":

Portals Plus

- 3 Execution

3.1 **GENERAL**

- 3.1.1 Instruct and supervise other Sections doing related work.

- 3.1.2 Supply the measurements of equipment to other Sections to allow for necessary openings to be left in the work of other Sections.

- 3.1.3 Install conduit, which is to be concealed, neatly and close to building structure so that the necessary furring can be kept as small as possible.

- 3.1.4 Carry out all work in accordance with the latest regulations of the Ontario Electrical Safety Code and all applicable Municipal, Provincial and Federal Codes and Regulations. In no instance, however, is the standard established by the Drawings and Specifications, to be reduced by any of the Codes referred to above.

- 3.1.5 Install all ceiling components in direct accordance with reflected ceiling plans.

- 3.1.6 Electrical Drawings show approximate locations for wall-mounted devices. Clarify exact location and mounting height with Consultant prior to roughing-in.

- 3.1.7 All serviceable equipment installed on the roof (including receptacles) to be installed minimum 3 m (10') from roof edge unless otherwise noted on Drawings.

- 3.1.8 Pack all roof penetration flashings with mineral wool insulation after service installation is complete, to prevent condensation.

3.2 **STORAGE OF MATERIALS**

- 3.2.1 Provide proper weatherproof storage for the protection of materials and equipment on site. Blank off openings in all equipment until required for use. Consultant may require materials which are not properly stored to be discarded and removed from the site.

3.3 **SUPPORTS AND BASES**

- 3.3.1 Provide structural work required for installation of equipment provided under this Division.

- 3.3.2 Set all floor-mounted equipment on concrete bases at least 100 mm (4") high. Size concrete equipment bases to suit the equipment actually supplied and in accordance with the shop drawings of such equipment. Do not start concrete work until anchor bolts and other embedded parts required for the complete installation, as well as shop drawings, are available at the site.

- 3.3.3 Extend existing concrete bases as required for replacement or new equipment. Match existing height.
- 3.3.4 For new concrete bases or pads on existing floors, first scrape and remove existing floor finish. Scarify existing floor so that new concrete adheres to it. Dowel new pads to new and existing floors.
- 3.3.5 Provide all brackets and supports required in steel stud walls. All conduits and equipment must be supported on brackets or supports attached to steel studs. Do not support materials or equipment from wall sheathing.
- 3.3.6 Provide independent support; brackets and unistrut structures where required to install electrical equipment; disconnect switches, splitters, panels, etc:
- in areas where the equipment is located on walls/columns that are not suitable for direct installation;
 - when installation away from structural building elements is called for; or
 - when it is necessary to elevate the electrical equipment to ensure code compliance or ergonomical operator access.
- 3.3.7 For all supports of suspended or wall hung electrical equipment, provide structural drawings stamped and signed by a structural engineer holding a P.Eng. designation and registered in the Province of Ontario. This engineer is to submit proof of professional liability insurance. These drawings are to be provided complete with all engineering calculations, including but not limited to sizes of members and lateral bracing, connections to building structure, and sizes of all bolts and welds etc. For existing structures, structural engineer is to provide a statement on the drawings that the existing structure has been reviewed and was found to be satisfactory to support the new equipment load when using present day floor and/or roof loads from current OBC or provide drawings showing required reinforcement for the existing structure to support the new equipment. Equipment to be supported from the bottom.
- 3.3.8 Do not suspend luminaires greater than 11.3 kg (25 lb), cable tray, conduit racks, etc from metal roof deck. Provide supports as required to suspend from roof joists.
- 3.3.9 Provide lintels for double-width and adjacent tubs and multiple conduits running in parallel, where located in block and poured walls.
- 3.4 **CONCRETE INSERTS**
- 3.4.1 **General**
- 3.4.1.1 Anchors for the support of conduits and equipment from the underside of suspended structural concrete systems may be by cast-in-place inserts placed prior to the pouring of concrete or by the use of inserts placed in holes drilled after the forms are stripped.
- 3.4.1.2 The safe load capacity of concrete anchors is affected by a number of variables such as specific anchor type, embedment, spacing between individual anchors, edge distances, direction of loading, concrete strength and "prying action". Refer to the manufacturer's recommendations for each specific insert proposed, including any dynamic or vibratory loads.

- 3.4.1.3 Be responsible for the proper selection and installation of inserts, including number, type, spacing and accurate placement to provide the necessary safe load capacity and satisfactory long term performance.

3.4.2 **Installation of Inserts in Hardened Concrete**

- 3.4.2.1 Use inserts placed in pre-drilled holes. Do not use powder driven inserts or self-drilling inserts. Before drilling holes, accurately locate all reinforcing bars in the affected areas using an electro-magnetic locator.
- 3.4.2.2 Do not drill through or otherwise damage reinforcing bars. If reinforcing is encountered, the inserts must be relocated. Ensure that hole diameter, depth of penetration, spacing, etc., are in strict accordance with the insert manufacturer's recommendations for the specific insert type and load condition.
- 3.4.2.3 Due to the relatively close spacing of reinforcing bars in the bottom of many of the beams and girders, the preferred location of drilled-in-place anchors in beams and girders is into the sides of these members, rather than upwards into the bottom.
- 3.4.2.4 Inserts to be zinc plated female concrete anchors. Nylon or plastic anchors are not acceptable.
- 3.4.3 Concrete screws without anchors are not acceptable.

3.5 **SLEEVES**

- 3.5.1 **Sleeves Embedded in Concrete:** Except as approved otherwise by the Consultant, install sleeves embedded in concrete in accordance with the following general guidelines:
 - 3.5.1.1 Centre to centre spacing to be not less than 3 diameters of the maximum size adjacent sleeve.
 - 3.5.1.2 Provide additional reinforcing at points of congestion as directed by the Consultant.
 - 3.5.1.3 Sleeves through beams will be permitted only as directed by the Consultant.
 - 3.5.1.4 The reinforcing in beams, slabs and columns must not be displaced from its intended position under any circumstances unless prior written approval is obtained from the Consultant.
- 3.5.2 Provide sleeves for all conduits which pass through service room floors and foundation walls. Sleeves to extend minimum 25 mm (1") past finished surface.

3.6 **FIRESTOPPING**

- 3.6.1 Provide a listed firestop system in accordance with the Ontario Building Code to seal around all piping, tubing, ducts, conduits, electrical wires and cables, and other similar mechanical services which penetrate part of a building assembly required to have a fire resistance rating or a fire separation. Refer to Architectural Drawings and Specifications Section "Firestopping and Smoke Seals" for building assembly and fire separation types and locations.

- 3.6.2 For all penetrations through fire separations required to have a fire resistance rating, use firestop systems with an F rating not less than the fire resistance rating for the fire separation. This includes the sealing of any sleeves provided for future uses. Provide an FT rating where required by the Ontario Building Code. For all penetrations through a service room floor, provide a minimum W rating - Class 1 in addition to the fire resistance rating.
- 3.6.3 At each fire stopping penetrating location, provide a fire stopping identification label indicating the system number installed, products used, date installed and installer's name. Locate label on penetrating service at the penetration location.
- 3.6.4 All firestopping must be reviewed by the Consultant on site before any firestopping is concealed. Complete 3 destructive tests to confirm compliance with ULC listing, minimum one floor test and one wall test, third test to be Contractor's choice. Contractor to replace fire stopping system after destructive test has been completed. Submit a copy of the report to the Consultant. Report to include as a minimum, confirmation fire stopping shop drawings were used during review, locations where destructive testing was completed, confirmation all fire stopping locations were reviewed and installed systems meet the manufacturer requirements.
- 3.7 **CUTTING AND PATCHING**
- 3.7.1 Flash holes through walls and roof to make weatherproof.
- 3.7.2 Do not cut or drill holes through floors, roof or structural members without obtaining permission from the Consultant. Accurately locate and note sizes for each required hole prior to cutting or drilling.
- 3.7.3 For penetrations through walls not required to have a fire rating, seal all spaces between pipe or pipe and surrounding wall construction with a fire-rated foam sealant. Use 3M Fire Barrier, Metacaulk, or Dow Fire Stop UL Classified fire rated foam sealants. Do this as the work progresses to avoid leaving inaccessible holes at completion of the job. For penetrations through parts of the building assembly required to have a fire resistance rating or acting as a fire separation, see Clause "Firestopping" in this Section.
- 3.7.4 Where conduits are required to pass through existing walls, floors, and roof, cut and patch the necessary openings.
- 3.7.5 Where recessed electrical equipment is removed or replaced with equipment of a smaller size, patch openings to match existing wall material.
- 3.7.6 Where wiring devices (switches, receptacles, etc) are removed from drywall walls, remove device box and patch opening to match existing wall.
- 3.7.7 Where wiring devices (switches, receptacles, etc) are removed from poured concrete or block walls, remove device and provide blank coverplate.
- 3.7.8 Include the cost of all cutting and patching in the Lump Sum Contract Price for the work of Divisions 26, 27 and 28.
- 3.7.9 Remove and replace ceiling where necessary to complete the work of this Division unless this work is specifically included in another Division.

3.7.10 All cutting and patching to be done by the trade specializing in the materials to be cut.

3.8 **PAINTING**

3.8.1 Touch up minor damage to finish on equipment supplied with factory applied baked enamel finish. Completely refinish items suffering damage which, in the opinion of the Consultant, is too extensive to be remedied by touch-up.

3.8.2 Where walls and/or ceilings are cut and patched for electrical work including the removal of existing devices, paint walls and ceilings to match existing. For walls and ceilings less than 9.3 m² (100 ft²), paint entire wall. For walls and ceilings larger than 9.3 m² (100 ft²), paint area of patch. Painting to be completed by painting contractor.

3.8.3 Include the cost of all painting in the Lump Sum Contract Price for the work of Divisions 26, 27 and 28.

3.9 **ACCESS DOORS**

3.9.1 Supply access doors wherever equipment, junction boxes, life safety devices, etc., are concealed behind walls or inaccessible ceilings. All devices installed requiring periodic maintenance to be made accessible. Doors will be installed by the trade specializing in the materials receiving access doors.

3.10 **IDENTIFICATION**

3.10.1 Colour code control wiring consistently throughout the installation and generally match colour coding of internal wiring of pre-wired components. Match existing colour coding in use on site. Verify with Owner prior to installation.

3.10.2 All branch circuits shall be:

Phase A red
Phase B black
Phase C blue

3.10.3 Identify all disconnects, starters, and other control equipment with lamacoid nameplates indicating the equipment controlled and all panels, transformers, etc identifying equipment name.

3.10.4 Lamacoid labels to be mechanically attached with self-tapping screws or rivets. Lamacoid labels attached using adhesive methods are not acceptable.

3.10.5 Identify the panel and circuit number for each wiring device with self-adhesive label on the coverplate. Use clear tape with black 14 pt Arial or Helvetica typeface. Locate labels for receptacles on front of coverplate and labels for switches on rear of coverplate.

3.10.6 Identify all pull boxes, junction boxes or octagon boxes located in the ceiling cavity with the exact use of the box, including circuits contained within. Felt pen is acceptable.

3.10.7 Where equipment is concealed above accessible ceilings, indicate location using coloured-coded marking devices, approved by Consultant, fastened to the ceiling components.

3.11 LOCKS AND KEYS

- 3.11.1 Where locked panelboards, control panels, terminal cabinets, etc., are specified, use a separate key pattern for each system with all locks in each system common to one key. Provide seven keys of each pattern to the Owner on a 25 mm (1") key ring. Submit one set of keys with manuals.

3.12 TESTING

- 3.12.1 All systems must be thoroughly tested before arrangements are made for the final demonstration in the presence of the Owner's staff. Systems to be tested are:

- Emergency Lighting
- Lighting Control Systems
- Security and Access Control Systems
- CCTV

- 3.12.2 For the following systems, the manufacturer's Testing Representative must be present for the test period and submit a Certificate of Operation to the Consultant:

- Fire Alarm

- 3.12.3 At the completion of the work, demonstrate operation of all systems to the Owner's representative and the Consultant. Promptly rectify any malfunction found.

3.13 TEMPORARY ELECTRICAL FACILITIES FOR CONSTRUCTION

- 3.13.1 Temporary electrical power is available at the site. Cooperate with owner for use of this power.

- 3.13.2 Tie in at one location only, as directed. Distribute temporary power from this location.

- 3.13.3 Arrange and pay for the cost of inspection of the temporary service.

- 3.13.4 Notify the monitoring company and Owner each and every time a part of the fire alarm system is shut down and reactivated.

- 3.13.5 Completely remove all temporary facilities when they are no longer required.

- 3.13.6 Provide fixed temporary lighting for open areas, stairwells and each enclosed room. In open areas and enclosed rooms use 150W A21 lamps, or equivalent, at spacings not exceeding 7.5 m (25'). In stairwells, use one 100W A21 lamp, or equivalent, at each landing. Lighting to be on dedicated circuits.

- 3.13.7 Temporary lighting stipulated in this Section, do not include provisions for higher intensity lighting required for a specific operation (concrete finishing, plastering, etc.). This will be the responsibility of the specific trade requiring the higher intensity.

- 3.13.8 Provide minimum two 120V 20A GFCI receptacles, on dedicated circuits, per 150 m² (1600 ft²) construction area.

- 3.13.9 Temporary power requirements stipulated in this Section, do not include provisions for electric space heating, electric welders, or any other item of equipment which requires either a 3 phase supply or connection to a single phase circuit rated in excess of 20A. Any trade using equipment which falls into above categories is to be responsible for providing additional facilities required for such equipment, including any increased sizing. This Division is responsible to see the connection to the temporary system is safe.
- 3.13.10 Use non-metallic sheathed cable, Type NMW-10, #12 AWG, manufactured in accordance with CSA C22.2 No. 38 "Thermoset-insulated wires and cables" for all temporary lighting branch circuit wiring.
- 3.13.11 **Temporary Fire Alarm Devices**
- 3.13.11.1 Notify the local Fire Department and Owner each and every time a part of the fire alarm system is shut down and reactivated.
- 3.13.11.2 Provide new temporary hard wired fire alarm detectors, pull stations and notification appliances within the construction area.
- 3.13.11.2.1 Provide one 135°F rate-of-rise heat detector for every 465 m² (5000 ft²) of floor area.
- 3.13.11.2.2 Provide smoke detectors in all temporary corridors spaced maximum 10 m (30').
- 3.13.11.2.3 Provide a manual pull station at every exit/entrance to the construction area.
- 3.13.11.2.4 Provide one surface mounted bell for every 560 m² (6000 ft²) of floor area.
- 3.13.11.3 Use #14 AWG, AC-90 cable for temporary wiring to devices.
- 3.13.11.4 Connect devices to dedicated fire alarm zones, grouped on a floor-by-floor basis. Provide zone cards as required to suit existing fire alarm panel.
- 3.13.11.5 Completely verify temporary fire alarm devices any time temporary devices are added, removed or relocated.
- 3.13.11.6 Once the permanent fire alarm system is operational completely remove all temporary devices and wiring. Turn devices over to the Owner.
- 3.14 **EQUIPMENT SCHEDULE**
- 3.14.1 Equipment Schedules are as shown on Drawings.
- 3.14.2 In general, the motor or item numbers shown in the Equipment Schedules coincide with those numbers shown for Mechanical Trades.
- 3.15 **GROUNDING**
- 3.15.1 Ground all components of the Electrical system in accordance with the requirements of Section 10 of the Ontario Electrical Safety Code latest edition and the Inspection Authority.
- 3.15.2 Provide a separate green ground conductor in all raceways.

- 3.15.3 Ground secondary neutrals of transformers to building ground conductor.
- 3.15.4 Where attached to equipment, conduits, cabinets, etc., use suitable approved solderless lugs, compression connectors. No soldered or split bolt type connections are to be used on grounding circuits at any point.
- 3.15.5 All compression connectors, lugs, etc., used in grounding circuits in any location are to have bolts, nuts, etc., of silicone bronze alloy equal to "Everdur" metal.
- 3.15.6 Clean all surfaces to which bus or cable are to be bolted, of all paint, rust, etc., and work to a bright, flat surface.
- 3.15.7 Conduit expansion joints and telescoping sections or metal raceways not thoroughly bonded otherwise, are to be provided with approved bonding jumpers or not less than #8 AWG stranded bare copper.
- 3.15.8 Provide a separate #14 green ground wire for all isolated ground receptacles.
- 3.16 **START-UP SERVICES**
- 3.16.1 Provide the services of a qualified person to be on call and available to the site within one hour for 2 weeks after the Work of this Contract is taken over by the Owner. Assist Owner's staff to become familiar with the system operation.
- 3.17 **MAINTENANCE OF EXISTING SERVICES**
- 3.17.1 Take every precaution to locate and protect existing services so that no interruption occurs. If any existing service is damaged due to the work of this Division, arrange and pay for repair. Bear any costs due to interruption of existing services.
- 3.17.2 Be responsible for maintaining continuity of existing services, and for programming work so that the Owners can carry out their normal business uninterrupted, with the exception of scheduled shutdowns for connection to or rerouting of existing services, at a time agreed to by the Owners, on weekdays, over weekends or after normal working hours.
- 3.17.3 Permission from the Owner is required before making any connections to or rerouting of existing services. Give seven days prior notice to the Consultant and Owner.
- 3.18 **PROTECTING AND MAKING GOOD**
- 3.18.1 Be responsible for protection of Owner's property, as well as finished and unfinished work, from damage due to execution of work under this Contract. Repair damage resulting from failure to provide such protection to the satisfaction of the Consultant, at no expense to the Owner.
- 3.18.2 Attach and fasten fixture and fittings in place in safe, sturdy, secure manner so that they cannot work loose or fall or shift out of position during occupancy of building, as the result of vibrating or other causes in normal use of building.
- 3.18.3 Coordinate and cooperate with other trades, taking into account existing installations, to assure best arrangement of equipment in available space. For critical locations, prepare

interference and installation drawing showing work of various sections as well as existing installations, for approval before commencing work.

- 3.18.4 All new equipment shall be delivered to site wrapped in plastic and removed only after room is thoroughly cleaned and painted, if applicable. Where existing or new equipment must be operational throughout construction in adjacent spaces, ensure door sweeps are installed and mechanical ventilation systems are fully operational. Provide filters with minimum filtration rate of 10 micron (MERV 5) on all make-up air and supply ducts. Ensure filters are regularly changed to maintain adequate airflow.

3.19 **REMOVAL OF EXISTING MATERIAL AND EQUIPMENT**

- 3.19.1 Remove existing material and equipment where shown or specified. Equipment such as Fire Alarm devices, and any other special devices are to be turned over to the Owner. Relocate these items to a designated storage site as directed by Owner. Other material and equipment which is removed becomes the property of the Contractor and must be immediately removed from the site.

3.20 **REBATES AND INCENTIVES**

- 3.20.1 Provide all invoices and proof of purchase documentation to Owner as requested for application by Owner for rebates and incentives. All incentives will be paid to the Owner.

3.21 **PHASING**

- 3.21.1 The work on this project is to be phased to enable continuous operation of the Owners facilities. See the Architectural Drawings and Specifications regarding the proposed phasing of the work. Provide for temporary services, connections, bypasses, etc. to enable the phasing as described. Carry all associated costs in the Bid.

3.22 **DEFICIENCY REVIEW**

- 3.22.1 The Electrical Contractor shall confirm in writing that the work is complete and ready for inspection. The Consultant will schedule a site visit to review the work and provide a written deficiency list. Once deficiencies have been corrected, the Electrical Contractor shall confirm in writing to the Consultant that all deficiencies have been corrected. The Consultant will schedule a second site visit to review the correction of noted deficiencies. Should any noted deficiencies be found to be still outstanding, the Electrical Contractor shall correct them and again notify the Consultant in writing. Charges to the Electrical Contractor may result from repeat visits after the second visit.
- 3.22.2 The Electrical Contractor is required to complete all work above ceilings and allow time for deficiency reviews and correction of noted deficiencies in a timely manner in order to accommodate the current Construction Schedule. This includes time for reinspection as required prior to concealing (drywall enclosures, drywall ceilings and acoustic tile ceilings) of any service. The Electrical Contractor will be responsible for uncovering any concealed services for inspection.

3.23 **HOURLY LABOUR RATE**

- 3.23.1 Hourly labour rate shall be the actual rate paid to the worker as posted by the local Union Agreement plus a burden mark-up of 100% to compensate for contributions,

assessments, employment insurance, health insurance, pension plans, WSIB, taxes, vacation pay, travel, parking, welfare, union package and membership dues, supervision, material handling, training, rest periods, down time, breaks, personal hygiene, small tools, clean up time, profit, other benefits paid to the worker and all other costs incurred by the Company including meetings, office time. Travel time to and from the site shall be at no charge to the Owner. For the purpose of electrical work, the journeyman electrician union rate will be used for all trades completing any electrical work.

3.24 LIST OF ELECTRICAL SUBCONTRACTORS AND MANUFACTURERS

3.24.1 In the Bid documents, name the Subcontractors and Manufacturers for the items listed below. Use only one name for each item. See Clause "Material and Equipment". Where the name of a manufacturer is not entered on the Bid Form, the Contractor will be required to use the base specified manufacturer.

3.24.2 Subcontractors

Fire Alarm System

3.24.3 Manufacturers

Cable Tray
Disconnect Switches
Exit Signs
Fire Alarm Devices
Lighting Control System
Luminaires (by Type)
Panelboards
Structured Wiring
Wiring Devices

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 26 05 00, "Common Work Results for Electrical".

1.2 **DESCRIPTION OF SYSTEM**

1.2.1 Provide all new wiring and raceways. Where possible, conceal all wiring and raceways above ceilings, in walls and partitions. See Section 26 05 00, "Common Work Results for Electrical".

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal as defined in Clause "Material and Equipment".

2.1.2 All outlet boxes, wiring devices, equipment and accessories must be C.S.A. approved and be designed for the application intended.

2.2 **RACEWAYS**

2.2.1 Use E.M.T. in concealed locations in concrete block walls, drywall partitions and for main and branch circuit wiring above ceiling spaces.

2.2.2 Use minimum 1/2" (16 mm) conduit for power wiring and 3/4" (21 mm) conduit for motor circuits.

2.2.3 Raceways for motors and equipment are to be dedicated home runs back to source and shall not be grouped with adjacent motors and equipment.

2.2.4 Refer to Section 27 05 28 for communication raceways.

2.2.5 Use set screw steel couplings and connectors. Use raintight steel couplings and connectors complete with "O" rings, in sprinklered buildings.

2.2.6 Use red conduit for Fire Alarm wiring concealed above ceilings, in concrete walls and in mechanical and electrical rooms.

2.2.7 For new devices on existing block or poured concrete walls exposed in finished areas, provide metallic single compartment raceway and appropriate bases.

2.2.8 Use conduit expansion coupling for expansion joint crossing.

2.2.9 Use flexible metal conduit for all final connections to motors and other equipment subject to vibration or which has adjustable mountings. Minimum size 1/2" (16 mm).

- 2.2.10 Use rigid PVC underground and in concrete floors, unless otherwise noted. Provide marking tape for underground installations in accordance with Ontario Electrical Safety Code.
- 2.2.11 For exterior above grade installations, use rigid aluminum conduits and fittings. All boxes and conduit bodies shall be die-cast, copper-free aluminum with aluminum covers and neoprene gaskets.
- 2.2.12 Fasten all raceways with approved supports. Use clamps and all mounting hardware of the same material as the conduit or compatible material to prevent galvanic corrosion.

2.3 CONDUCTORS

- 2.3.1 Aluminum conductors are NOT permitted on this project.
- 2.3.2 Use minimum copper #12 AWG RW-90XLPE **stranded** for branch circuiting and receptacle wiring.
- 2.3.3 Use RWU-90XLPE wire in all below grade locations.
- 2.3.4 Use minimum size of #14 AWG RW-90XLPE for control wiring.
- 2.3.5 Type AC-90 cable may be used for final drops (maximum 2 m [6.5']) to lighting fixtures and devices in accessible ceiling spaces. **DO NOT USE AS MAIN BRANCH WIRING FROM PANELBOARDS OR FOR BRANCH CIRCUIT WIRING (i.e. RECEPTACLES, ETC.).**
- 2.3.6 For wiring to heating equipment, recessed lighting fixtures or where body of fluorescent fixture is used as raceway, use conductors with high temperature insulation of type approved by Electrical Safety Authority.
- 2.3.7 Use all wire and cable insulation rated 600 volts minimum unless specified otherwise.

2.4 OUTLET BOXES

- 2.4.1 Use only masonry approved boxes in concrete and masonry construction.
- 2.4.2 Use 100 mm (4") square or utility type boxes for surface-mounted boxes and 100 mm (4") octagonal boxes for ceiling outlet boxes. Use multi-gang boxes for grouped devices. Use wrap-around covers for utility boxes. Use cast aluminium FS type boxes where surface mounted in finished areas.
- 2.4.3 Use flush-mounted boxes complete with adjustable ears, extension rings and plate rings as required. Do not use shallow or narrow boxes.
- 2.4.4 Provide FS type boxes c/w rain tight fittings where surface mounted in service rooms or for any surface boxes in sprinklered buildings not located above ceilings.

2.5 WIRING DEVICES

- 2.5.1 Use specification grade wiring devices, types and ratings shown on the Drawings.

- 2.5.2 Use red devices for receptacles/switches fed from emergency circuits.
- 2.5.3 Confirm colour of wiring devices and plates with Consultant prior to ordering.
- 2.5.4 **Receptacles**
 - 2.5.4.1 125 volt 20 amp white U-ground Duplex Receptacle (CSA 5-20R)
Hubbell Catalogue No. HBL-5352-W
 - 2.5.4.2 125 volt 20 amp white self-testing GFCI Duplex Receptacle (CSA 5-20R)
Hubbell Catalogue No. GFST20W
- 2.5.5 **Cover Plates**
 - 2.5.5.1 In general, use Hubbell "indestructible" smooth nylon plates for all flush-mounted devices and die-cast face plates for all surface-mounted devices.
 - 2.5.5.2 All receptacles exposed to weather to have die-cast aluminum duplex gasketed spring door in-use covers.
- 2.5.6 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":
 - Arrow Hart
 - Hubbell
 - Leviton
 - Pass & Seymour
- 2.5.7 **Wall Box Dimmers**
 - 2.5.7.1 All devices are to be CSA certified and UL listed, specifically for the required loads (i.e. incandescent, fluorescent, low voltage, electronic low voltage). Universal dimmers are not acceptable.
 - 2.5.7.2 All dimmers and switches are to provide power failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption. Restoration to some other default level is not acceptable.
 - 2.5.7.3 Dimmers are to meet ANSI/IEEE Standard C62.41-1980, tested to withstand voltage surges of up to 6000 volts and current surges of up to 200 amps without damage, and UL 20 limited short circuit test.
 - 2.5.7.4 Dimmer control is to be a linear slide beside an air gap rocker switch. The dimmer switch will provide a smooth and continuous Square Law dimming curve for 0-10V dimming loads.
 - 2.5.7.5 Dimmer switches are to be voltage regulated so that +10% variation line voltage will not cause more than a +5% variation in load voltage when dimmer is operating at 40 volt (5% light output).
 - 2.5.7.6 Dimmers will utilize an LC filtering network to minimize interference with properly installed radio, audio, and video equipment.

- 2.5.7.7 Faceplate is to snap onto the device with no visible means of attachment bright chrome finish. Heat fins are not to be visible on front of device.
- 2.5.7.8 Dimmer switches for line voltage incandescent loads will be minimum 1000 watt rated, Lutron Diva Preset Series when decora type single pole switches are specified and Lutron Ariadni Preset Series when toggle type single pole switches are specified. For loads over 1000W, provide suitable power packs.
- 2.5.7.9 Dimmer switches for 0-10V loads with switched-off, Lutron Diva Preset Series. Provide power packs when load exceeds rating of standard dimmer.
- 2.5.7.10 Provide single pole 3 way dimmer switches as indicated on Drawings. All dimmer switches are to be compatible.
- 2.5.7.11 At locations with multiple dimmer devices, provide one seamless, multi gang faceplate Lutron Claro CW series. Do not gang dimmer switches with other devices.

2.6 **DISCONNECT SWITCHES**

- 2.6.1 Unless specified otherwise, fused or unfused disconnect switches to be conditionally hp rated, heavy duty type with visible break industrial safety switches in general purpose or weatherproof enclosures as required. NEMA 3R enclosures with large exposed factory mounting holes must be plugged with stainless steel washer, nut, bolt and plug.
- 2.6.2 For 120V mechanical equipment, provide Hubbell Cat. #HBL1372D disconnect switch with aluminum housing and lockable switch.
- 2.6.3 For equipment above ceilings such as fans and heat pumps single phase and three phase 30A and below: Hubbell Cat # HBL1379D disconnect switch with aluminum housing or equivalent to be approved by Consultant..
- 2.6.4 For exterior roof mounted equipment single phase and three phase 30A and below: Hubbell Cat # HBL13R series NEMA 3R disconnect switch with aluminum housing. Or equivalent to be approved by Consultant.
- 2.6.5 The door to be mechanically interlocked with the operating handle to prevent it from being opened when the switch is in the "ON" position. The handle is to be capable of being padlocked in the "OFF" or "ON" position.
- 2.6.6 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":

Eaton
Schneider
Siemens

2.7 **FLUSH FLOOR BOXES**

- 2.7.1 Provide 2 gang non-metallic floor box or through-floor fitting for all slab-on-grade and suspended slab locations where data outlets or other communication outlets are provided.

- 2.7.2 Refer to floor box legend for details provide all fittings and hardware, blank plates to suit communications and power.
- 2.7.3 Boxes to have hinged lid for flush trimless recessing in tile or carpet floor with brushed aluminum finish.
- 2.7.4 Units to be CSA approved and meet UL scrub water exclusion requirements.
- 2.7.5 To be Wiremold RFBA Series.
- 2.7.6 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":
 - Hubbell
 - Wiremold
- 3 Execution
- 3.1 **GENERAL**
- 3.1.1 Unless shown otherwise, the minimum size of all raceways and conductors to be in accordance with the Ontario Electrical Safety Code.
- 3.2 **CONDUIT INSTALLATION**
- 3.2.1 Conceal all conduits except in equipment rooms, unfinished area, and where specifically noted. Flush mount all devices, starters, etc., in finished areas. Install all exposed conduits parallel to building walls and partitions.
- 3.2.2 All conduit supports and fastening accessories installed outside are to be stainless steel or aluminum. Galvanized will not be accepted.
- 3.2.3 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
- 3.2.4 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- 3.2.5 Run parallel or perpendicular to building lines.
- 3.2.6 Run conduits in flanged portion of structural steel. Do not pass conduits through structural members except as indicated.
- 3.2.7 Group conduits wherever possible on suspended surface channels.
- 3.2.8 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers. Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- 3.2.9 Do not run conduit through unconditioned (heated or cooled) spaces without approval from the consultant.

- 3.2.10 Horizontal runs of conduit will not be permitted in walls unless noted otherwise.
- 3.2.11 Vertical conduits must be supported at each floor slab and at the top and bottom of each riser.
- 3.2.12 Conduits must be supported from building structure. Provide independent unistrut under obstructions such as ductwork for support as required. Support unistrut from structural members. Do not secure to underside of metal pan roof deck.
- 3.2.13 Conduit placement should follow the following priority:
 - Below grade
 - In walls or partitions
 - In ceiling cavity
 - Exposed
- 3.2.14 Maintain continuity of ground through all connection points. Use sealer lubricant on all threaded connections embedded in concrete, buried in ground or exposed outdoors.
- 3.2.15 Leave all conduit systems finished complete with outlet boxes, coverplates, bushings, caps, nylon fish wire, etc. Provide bushings for all sleeves.
- 3.2.16 Except as approved otherwise by the Structural Engineer, install conduits and sleeves embedded in concrete in accordance with the following general guidelines:
 - 3.2.16.1 Centre to centre spacing to be not less than 3 diameters of the maximum size adjacent conduit or sleeves.
 - 3.2.16.2 Centre line spacing between parallel conduit and adjacent reinforcing bar to be 3 diameters of the larger conduit or sleeve.
 - 3.2.16.3 Provide additional reinforcing at points of congestion as directed by the Structural Engineer.
 - 3.2.16.4 For conduits in the plane of slabs or walls:
 - 3.2.16.4.1 Locate at approximately mid depth of the slab between top and bottom layers of reinforcing.
 - 3.2.16.4.2 Maximum size of conduit in one layer not to exceed 1/3 the concrete thickness of the slab.
 - 3.2.16.4.3 Maximum size of each conduit in two layers crossing to be not more than 1/4 the concrete thickness of the slab.
 - 3.2.16.4.4 Three layers crossing will not be permitted.
 - 3.2.16.5 For columns, the maximum size of conduit or other fittings not to exceed 3% of the column area located centrally in the column. Embedded piping will not be allowed without the expressed permission of the Structural Engineer and the Electrical Consultant.
 - 3.2.16.6 For beams, the maximum size of conduit is not to exceed 3% of the beam area. Install sleeves and embedded conduit through the beam as directed by the Structural Engineer.

3.2.16.7 The reinforcing in beams, slabs and columns must not be displaced from its intended position under any circumstances, unless prior written approval is obtained from the Structural Engineer.

3.2.16.8 Provide accurate, detailed, dimensioned Drawings of all embedded conduits.

3.3 **CONDUCTORS**

3.3.1 Join #8 AWG and larger conductors with compression connectors properly sized. On #10 AWG and smaller, relaxed wing-nut type connectors may be used. Ideal Industries 451, 452 or 453.

3.3.2 Size conductors for a maximum of 2% voltage drop from the supplying panel to the furthest outlet in the circuit. In calculating voltage drop, use 80% of overcurrent rating or design load where known, whichever is less.

3.3.3 For all equipment feeders (panels, transformers, and directly connected electrical loads) over 50m of total installed length, provide voltage drop calculations to consultant for review. Submit calculations prior to installation of any cabling, conduit, and raceways.

3.3.4 Draw wiring into raceways only after all other work that may cause injury to the wire is completed. Use only wiring lubricants that do not shorten insulation life. Use continuous lengths for feeders to panels and large equipment. Do not splice without permission from Consultant.

3.4 **GROUNDING**

3.4.1 Ground all components of the Electrical system in accordance with the requirements of Section 10 of the Electrical Safety Code latest edition and the Inspection Authority.

3.4.2 Provide a separate ground conductor in all raceways.

3.4.3 Where attached to equipment, conduits, cabinets, etc., use suitable approved solderless lugs, compression connectors. No soldered or split bolt type connections are to be used on grounding circuits at any point.

3.4.4 All compression connectors, lugs, etc., used in grounding circuits in any location are to have bolts, nuts, etc., of silicone bronze alloy equal to "Everdur" metal.

3.4.5 Clean all surfaces to which bus or cable are to be bolted, of all paint, rust, etc., and work to a bright, flat surface.

3.4.6 Conduit expansion joints and telescoping sections or metal raceways not thoroughly bonded otherwise, are to be provided with approved bonding jumpers or not less than #8 AWG stranded bare copper.

3.4.7 Provide a separate #14 green ground wire for all outlets connected to a GFCI circuit breaker.

3.5 **NEUTRALS**

3.5.1 Provide a separate neutral conductor to each receptacle located adjacent to a data outlet.

3.6 **OUTLET BOXES**

- 3.6.1 Support all boxes independently of the conduits running to them. Use flush boxes in areas where concealed conduit is used.
- 3.6.2 Check the Drawings to ensure that no outlets are roughed-in at inaccessible locations, where built-in furniture, counters, etc., are to be installed. In such locations, install the outlets above and clear of the trim by approximately 100 mm (4") unless shown otherwise on the Drawings.
- 3.6.3 **DO NOT INSTALL OUTLET BOXES OF ANY SYSTEM BACK TO BACK.** Offset as necessary to prevent sound transmission between areas.

3.7 **WIRING DEVICES**

- 3.7.1 Install light switches on lock jamb side of the door as finally hung. Check door swing before roughing-in. Install switches with the "ON" position up. Locate switch as close as practical to door jamb but not closer than 1". Coordinate location with built-in and Owner supplied equipment and furnishings.
- 3.7.2 When two or more devices are grouped together, mount under a common coverplate unless shown otherwise.
- 3.7.3 Mount light switches at height as indicated on Drawings.
- 3.7.4 Mount duplex receptacles 25 mm (1") above a countertop backsplash to bottom of device coverplate.

3.8 **CABLE TRAY**

- 3.8.1 Install cable trays as indicated: Installation shall be in accordance with equipment manufacturer's instructions, and with recognized industry practices to ensure that cable tray equipment comply with requirements of applicable codes. Reference NEMA VE-2 for general cable tray installation guidelines.
- 3.8.2 Coordinate cable tray with other electrical work as necessary to properly integrate installation of cable tray work with other work.
- 3.8.3 Provide sufficient space encompassing cable trays to permit access for installing and maintaining cables.
- 3.8.4 Cable tray fitting supports shall be located such that they meet the strength requirements of straight sections. Install fitting supports per NEMA VE-2 guidelines, or in accordance with manufacturer's instructions.
- 3.8.5 Indoor Tray from Ceiling: Cable tray to be supported on 3 m (10') centres with centre rod hangers as manufactured by tray manufacturer. Trapeze/centre rod hangers to be hung with 6.35 mm x 9.53 mm (1/4" x 3/8") threaded rod. Supports may include pedestal to floor as required. Contractor to work with manufacturer to size tray and supports adequately to provide minimum 1.5 times support.

- 3.8.6 Exterior Tray on Roof: Cable tray to be supported by pads with channel on roof as specified. Spacing not to exceed 1.5 m (5') to limit load on roof. Contractor to work with manufacturer to size tray and supports adequately to provide minimum 1.5 times support.
- 3.8.7 All connections to be checked to make sure they are correctly tightened and to ensure that all tray sections and fittings are electrically continuous and bonded with adjacent systems in accordance with the Ontario Electrical Safety Code for proper grounding.
- 3.8.8 All systems to be installed complete. Work to include fastening all trays to adjacent wiring systems to install a complete system as indicated on the electrical and/or communication drawings and in the applicable specifications.
- 3.9 **DIMMERS**
- 3.9.1 Dimmer switches are to be flush mounted in single or ganged backboxes. Provide sufficient backboxes to ensure that the dimmer switch is installed without the removal of any cooling fins. Do not gang dimmer switches with other electrical devices other than other dimmers.
- 3.9.2 Provide a dedicated neutral conductor from the lighting panel to each dimmer switch.
- 3.9.3 For ganged dimmer switches, provide P touch labelling system 1/4" high black lettering on a clear field nameplate identifying the dimmer load.
- 3.9.4 Provide manufacturer recommended flush backboxes.

END OF SECTION

- 1 General
 - 1.1 **GENERAL REQUIREMENTS**
 - 1.1.1 Conform to the requirements of Section 26 05 00, "Common Work Results for Electrical" and Section 26 05 33, "Basic Materials and Methods".
 - 1.2 **DESCRIPTION OF SYSTEMS**
 - 1.2.1 **Digital Lighting Controls**
 - 1.2.1.1 Provide Digital Lighting Control devices as shown on plans and specified herein.
 - 1.3 **SUBMITTALS**
 - 1.3.1 Submit a lighting control sequence of operation schedule with shop drawings outlining control sequence for each type of room. Group rooms with identical sequence of operation and indicate room numbers.
 - 1.3.2 Schedule to identify number of lighting zones, zone type (switching or dimming), auto-on operation (to preset lighting level if applicable), auto-off operation, daylight harvesting, work plane height and illumination as specified herein.
- 2 Products
 - 2.1 **GENERAL**
 - 2.1.1 Use materials specified herein or approved equal.
 - 2.1.2 In general, switches and automatic wall switches to match wiring device colour. Faceplates for low-voltage switches to match wiring device faceplates. Refer to Section 26 05 33.
 - 2.2 **DIGITAL LIGHTING CONTROLS**
 - 2.2.1 Provide a 100% digital lighting control system as shown on the drawings to meet space control requirements of AHSRAE/IESNA 90.1-2013. Provide occupancy/vacancy modes of operation. In general, provide two control circuits per lighting zone with one circuit configured in occupancy mode and other in vacancy mode.
 - 2.2.2 Provide automatic shut-off of receptacles as shown on the drawings. Receptacles to be powered whenever spaces are occupied, regardless of overhead lighting.
 - 2.2.3 System to be capable of adjustment, including programming and photosensors and occupancy sensor parameters, using software residing on a PC. Use of a handheld configuration tool may not be substituted for this programming ability. Room controllers to operate independent of programming PC.
 - 2.2.4 All components to be self-configuring, digitally addressable, capable of ladderless configuration and will not have dip switches or potentiometers.
 - 2.2.5 Provide contact closure to BAS for occupancy status.

2.2.6 **Digital Room Controllers**

- 2.2.6.1 Provide digitally addressable two relay controllers. Controllers to be self-configuring, automatically binding the room loads to the connected control devices without commissioning or the use of any tools.
- 2.2.6.2 Housing to be plenum rated and complete with nipple to mount to standard junction box.
- 2.2.6.3 Room controllers to have two integral on/off zero-crossing relays rated for 20A at 120V and three connections for digital lighting network connection.
- 2.2.6.4 Dimming room controllers to have three integral on/off zero-crossing relays rated for 20A at 120V with three 0-10V dimming outputs and three connections for digital lighting network connection.
- 2.2.6.5 Provide receptacle controllers for circuits as shown on the drawings.
- 2.2.6.6 WattStopper LMRC-102, LMPL-101 or LMRC-210 (dimming).




2.2.7 **Digital Switches**

- 2.2.7.1 Low voltage momentary pushbutton switches to be in 2 equal-sized button configuration, white and compatible with standard decorator wall plates. Buttons to be field replaceable without removing switch from wall. WattStopper LMSW-102.
- 2.2.7.2 Low voltage switches shown connected to dimming room controllers to be momentary pushbutton switches with one button configuration and LED bar graph showing relative light level of controlled load, white and compatible with standard decorator wall plates. WattStopper LMDM-101.
- 2.2.7.3 Buttons to be field replaceable without removing switch from wall.
- 2.2.7.4 Switches to have two connection ports for digital network through-wiring.

2.2.8 **Digital Occupancy Sensors**

- 2.2.8.1 Digital occupancy sensors to provide automatic switching for specified load connected to a room controller. Sensors shall be interchangeable without the need for rewiring.
- 2.2.8.2 Sensors to have two connection ports for digital lighting network.
- 2.2.8.3 Sensors to use dual technology (passive infrared and ultrasonic or microphonic) for occupancy detection. Sensors must be initially triggered by both detection technologies.
- 2.2.8.4 Digital occupancy sensors shall provide digital calibration for sensitivity (0-100%), time delay (1-30 minutes) and test mode.
- 2.2.8.5 Multiple occupancy sensors shall be able to be added to the digital lighting network without additional configuration.

2.2.8.6 Unless otherwise indicated, provide the following models according to the symbol type:

Type	Symbol	Wattstopper Cat. No.	Mounting
1		LMDX-100	wall at ceiling
2		LMDC-100	ceiling
3		LMDW-102-W	wall at switch height

2.2.9 Isolated Relay Interface

2.2.9.1 Provide Wattstopper LMRL-100 isolated relay interface to provide contact closure.

2.2.10 Other manufacturers must meet all of the above requirements and must submit shop drawings to Consultant for review minimum six working days prior to close for compliance review. Equal manufacturers will be added via addendum.

2.2.11 The following manufacturers will be considered as equal, subject to the requirements of Clause "Material and Equipment":

Acuity nLight Series
Wattstopper DLM Series

2.3 DIGITAL LIGHTING CONTROLS

2.3.1.1 Provide a 100% digital lighting control system as shown on the drawings to meet space control requirements of AHSRAE/IESNA 90.1-2013. Provide occupancy/vacancy modes of operation. In general, provide two control circuits per lighting zone with one circuit configured in occupancy mode and other in vacancy mode.

2.3.1.2 Provide automatic shut-off of receptacles as shown on the drawings. Receptacles to be powered whenever spaces are occupied, regardless of overhead lighting.

2.3.1.3 System to be capable of adjustment, including programming and photosensors and occupancy sensor parameters, using software residing on a PC. Room controllers to operate independent of programming PC.

2.3.1.4 All components to be self-configuring, digitally addressable, capable of ladderless configuration and will not have dip switches or potentiometers.

2.3.1.5 Provide contact closure to BAS for occupancy status. To be Acuity Brands nLight nAR40.

2.3.2 Digital Room Controllers

2.3.2.1 Provide digitally addressable relay controllers. Controllers to be self-configuring, automatically binding the room loads to the connected control devices without commissioning or the use of any tools.

2.3.2.2 Housing to be plenum rated and complete with nipple to mount to standard junction box.

2.3.2.3 Room controllers to have integral on/off zero-crossing relays rated for 16A at 120V and three connections for digital lighting network connection.

2.3.2.4 Each room controller to have 0-10V dimming output.

Acuity Brands, nLight nPP16 EFP.

2.3.2.5 Provide receptacle controllers for circuits as shown on the drawings.

Acuity Brands, nLight nPP20 PL.

2.3.3 Digital Switches

2.3.3.1 Low voltage momentary pushbutton switches to be three button configuration, white and compatible with standard decorator wall plates. Buttons to be field replaceable without removing switch from wall. Acuity Brands nLight nPODMA-DX-WH. Provide nPODMA-WH for non-dimming loads.

2.3.3.2 Buttons to be field replaceable without removing switch from wall.

2.3.3.3 Switches to have two connection ports for digital network through-wiring.

2.3.4 Digital Occupancy Sensors

2.3.4.1 Digital occupancy sensors to provide automatic switching for specified load connected to a room controller. Sensors shall be interchangeable without the need for rewiring.




2.3.4.2 Sensors to have two connection ports for digital lighting network.

2.3.4.3 Sensors to use dual technology (passive infrared and ultrasonic or microphonic) for occupancy detection. Sensors must be initially triggered by both detection technologies.

2.3.4.4 Digital occupancy sensors shall provide digital calibration for sensitivity (0-100%), time delay (1-30 minutes) and test mode.

2.3.4.5 Multiple occupancy sensors shall be able to be added to the digital lighting network without additional configuration.

2.3.4.6 Unless otherwise indicated, provide the following models according to the symbol type:

Type	Symbol	nLight Cat. No.	Mounting
1		nWV PDT 16-KIT	wall at ceiling
2		nCM PDT-10-RJB	ceiling
3		nWSX PDT LV-DX-WH	wall at switch height

2.3.5 Isolated Relay Interface

2.3.5.1 Provide Acuity Brands nLight nIO-1S, isolated relay interface to provide contact closure.

- 2.3.6 The following manufacturers will be considered as equal, subject to the requirements of Clause "Material and Equipment":

Acuity nLight Series
Wattstopper DLM Series

2.4 **ADDITIONAL SYSTEM COMPONENTS**

- 2.4.1 Provide auxiliary relays and other items as shown on the drawings:

2.4.2 **Emergency Shunt Relay**

- 2.4.2.1 Provide emergency shunt relay to provide control for emergency lighting and force on during a power outage.
- 2.4.2.2 Shunt relay to shunt ON emergency lighting circuit during a power outage and be enclosed in a self-contained NEMA 1 plenum rated enclosure mountable through a panel knockout or remotely on flat surface.
- 2.4.2.3 Relay to have indicator LED which illuminates whenever relay is activated.
- 2.4.2.4 Relay to be continuous duty type with expected relay life of 10,000,000 cycles minimum and an operating time of 18 ms.
- 2.4.2.5 Relay to be UL-924 listed and cUL listed.
- 2.4.2.6 RIB Lighting Controls ESR2401B or equal.

3 Execution

3.1 **ADDITIONAL SYSTEM COMPONENTS**

- 3.1.1 Demonstrate to consultant correct operation of shunt relays.

3.2 **DIGITAL LIGHTING CONTROLS**

- 3.2.1 Provide CMP rated Category 5e with RJ-45 connectors for all control wiring. Wiring in accessible ceiling space may be free run, supported by conduit for other systems. Do not attach cable to ceiling grid supports. In inaccessible ceilings and all walls, provide conduit and back boxes.
- 3.2.2 Digital lighting network cabling to be green throughout building. Contractor to ensure cabling colour is unique from other low voltage cabling (data, voice, BAS controls, etc).
- 3.2.3 Program all rooms for 50% automatic ON operation and 100% automatic OFF operation of all circuits. Programming to be in accordance with ASHRAE 90.1.
- 3.2.4 Adjust time delay so that controlled area remains lit for 5 minutes after occupant leaves area.
- 3.2.5 Provide assistance to BAS contractor as required to integrate, at minimum, occupancy status with BAS.

3.2.6 Upon completion of the installation, the system shall be commissioned by the manufacturer's factory authorized representative who will verify a fully functioning system. Provide Consultant and Owner ten working days written notice of system startup and adjustment date.

3.2.7 Adjust high trim level for luminaires to obtain the following maximum lighting levels at the work plane. Provide high trim percentage and measured illuminance at work plane for each room in maintenance manual.

Space	Work Plane Height	Illuminance
Classrooms	760 mm	30 fc
Offices	760 mm	35 fc

3.2.8 Provide room-by-room documentation on the commissioning of the system including sensor parameters, time delays, sensitivities, daylighting setpoints, sequence of operation, (e.g. manual ON, Auto OFF. etc.) and load parameters (e.g. blink warning, etc.).

3.2.9 Resubmit updated sequence of operation schedule to include high trim setting for each lighting zone and measured illumination at work plane.

3.2.10 Upon completion of commissioning, the factory-authorized technician shall provide the proper training to the owner's personnel on the adjustment and maintenance of the system.

3.2.11 Thirty days from occupancy re-calibrate all sensor time delays and sensitivities to meet the Owner's specific requirements. Provide a detailed report to the Consultant of re-commissioning activity.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 26 05 00, "Common Work Results for Electrical" and Section 26 05 33, "Basic Materials and Methods".

1.2 **DESCRIPTION OF WORK**

1.2.1 Provide breakers in existing panelboards.

1.3 **SPRINKLER SHIELDS**

1.3.1 This building will be fully sprinklered. All surface mounted panels and enclosures will include sprinkler shields. Ensure all conduit and fittings in sprinklered areas meet the requirements outlined in 26 05 00 clause "Sprinkler Proof Equipment".

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal.

2.2 **DISTRIBUTION EQUIPMENT**

2.2.1 **Distribution and Panelboard Circuit Breakers**

2.2.1.1 Unless noted otherwise on Drawings or panel schedules, circuit breakers are to be moulded case as rated below. Series rated breakers are not acceptable unless stated otherwise on the Drawings (ground fault breakers excluded).

2.2.1.2 Breakers are to be suitable for the panelboards provided. All breakers are to be bolted in place. Plug-in only type are not acceptable.

2.2.1.3 For 250V panelboards, main and branch breakers to be rated minimum 22,000 amperes RMS symmetrical at 208 or 240 volt.

2.2.1.4 For 600V panelboards, main and branch breakers to be rated minimum 22,000 amperes RMS symmetrical at 600 volt.

2.2.1.5 All circuit breakers smaller than 400A to be moulded case thermal-magnetic type providing inverse time-current tripping curves. Multi-pole breakers to have common-trip device with single handle.

2.2.1.6 Shunt trip breakers to be 120V AC solenoid type. Electrically held shunt trip breakers are not acceptable.

2.2.1.7 Provide ground fault circuit interrupters breakers as indicated on Panel Schedules. Provide separate neutral conductors for each circuit. Unless noted otherwise, ground fault circuit interrupter breakers are Class A, Group 5mA.

- 2.2.1.8 Provide positive locking devices on the handles of breakers serving loads below. Trip units to remain free to function while locked in the ON position.
- exit signs
 - door hardware
 - smoke fire dampers
- 2.2.1.9 Provide quantity of spare breakers as called for on the Panel Schedules or Drawings
- 2.2.2 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Material and Equipment":
- Eaton
Schneider
Siemens
- 3 Execution
- 3.1 **PANELBOARDS**
- 3.1.1 Provide new typewritten directories for all existing panelboards affected by work.
- 3.1.2 Contractor to provide updated schedules complete with room numbers. Trace out existing circuits as required.
- 3.1.3 Include room number and description of load for each breaker. For circuits serving mechanical equipment, indicate room number mechanical equipment serves. Coordinate on site with Mechanical Divisions.

END OF SECTION

SECTION 26 20 00

A P P E N D I X

Panel Schedules

PROJ. NAME: WU LHSB RENOVATION

PROJ. NO : 10500.2

PANEL ID: GB
MAINS: 225A
VOLTAGE: 208/120V, 3Ø, 4W
MOUNTING: FLUSH
NO OF CKT: 60

LOCATION: SEE FLOOR PLANS
FED FROM: DP1
COMMENTS: EXISTING BREAKERS ARE SHADED
LOADS REMOVED TO BE MARKED AS SPARE

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	20	14 LTG		2	20	14 LTG	
3	20	14 REC		4	20	14 REC	
5	20	14 MOTORIZED SHADES		6	20	14 MOTORIZED SHADES	
7	20	14 PROJECTOR		8	20	14 PROJECTOR SCREENS	
9	20	14 WORKSTATION/TV REC		10	20	14 WORKSTATION/TV REC	
11	20	14 WORKSTATION/TV REC		12	20	14 WORKSTATION/TV REC	
13	20	14 WORKSTATION/TV REC		14	20	14 WORKSTATION/TV REC	
15	20	14 WORKSTATION/TV REC		16	20	14 WORKSTATION/TV REC	
17	20	14 WORKSTATION/TV REC		18	20	14 WORKSTATION/TV REC	
19	15	14 CHARGING STATION		20	15	14 CHARGING STATION	
21	15	14 CHARGING STATION		22	15	14 CHARGING STATION	
23	15	14 COUNT DOWN CLOCK		24	15	14 COUNT DOWN CLOCK	
25	15	14 CAMERA ARM REC		26	20	14 AV CABINET	
27	15	14 REC		28	15	SPARE	
29	15	SPARE		30	15	SPARE	
31	15	SPARE		32	15	SPARE	
33	15	SPARE		34	15	SPARE	
35	15	SPARE		36	15	SPARE	
37	15	SPARE		38	15	SPARE	
39	15	SPARE		40	15	SPARE	
41	15	SPARE		42	15	SPARE	
43	15	SPARE		44	15	SPARE	
45	15	SPARE		46	15	SPARE	
47	15	SPARE		48	15	SPARE	
49	15	SPARE		50	15	SPARE	
51	15	SPARE		52	15	SPARE	
53	15	SPARE		54	15	SPARE	
55	15	SPARE		56	15	SPARE	
57	15	SPARE		58	15	SPARE	
59	15	SPARE		60	15	SPARE	

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PROJ. NAME: WU LHSB RENOVATION

PROJ. NO : 10500.2

PANEL ID: GC
MAINS: 225A
VOLTAGE: 208/120V, 3Ø, 4W
MOUNTING: FLUSH
NO OF CKT: 42

LOCATION: SEE FLOOR PLANS
FED FROM: DP1
COMMENTS: EXISTING BREAKERS ARE SHADED
LOADS REMOVED TO BE MARKED AS SPARE

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	20	13 LTG		2	20	13 AV CABINET	
3	20	13 REC		4	20	13 TV REC	
5	20	13 BIKE REC		6	20	13 MOTORIZED SHADES	
7	20	13 ROWING REC		8	20	13 MOTORIZED SHADE	
9	20	13 TREADMILL REC		10	15	13 DIGITAL CLOCK	
11	15	13 EF-1		12	15	13 COUNT DOWN CLOCK	
13	15	SPARE		14	15	SPARE	
15	15	SPARE		16	15	SPARE	
17	15	SPARE		18	15	SPARE	
19	15	SPARE		20	15	SPARE	
21	15	SPARE		22	15	SPARE	
23	15	SPARE		24	15	SPARE	
25	15	SPARE		26	15	SPARE	
27	15	SPARE		28	15	SPARE	
29	15	SPARE		30	15	SPARE	
31	15	SPARE		32	15	SPARE	
33	15	SPARE		34	15	SPARE	
35	15	SPARE		36	15	SPARE	
37	15	SPARE		38	15	SPARE	
39	15	SPARE		40	15	SPARE	
41	15	SPARE		42	15	SPARE	

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PROJ. NAME: WU LHSB RENOVATION

PROJ. NO : 10500.2

PANEL ID: GD

MAINS: 225A

VOLTAGE: 208/120V, 3Ø, 4W

MOUNTING: FLUSH

NO OF CKT: 42

LOCATION: SEE FLOOR PLANS

FED FROM: DP1

COMMENTS: EXISTING BREAKERS ARE SHADED
LOADS REMOVED TO BE MARKED AS SPARE

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	15	SPARE		2	15	SPARE	
3	15	SPARE		4	15	SPARE	
5	15	SPARE		6	15	SPARE	
7	15	SPARE		8	15	SPARE	
9	15	SPARE		10	15	SPARE	
11	15	SPARE		12	15	SPARE	
13	15	SPARE		14	15	SPARE	
15	15	SPARE		16	15	SPARE	
17	15	SPARE		18	15	SPARE	
19	15	SPARE		20	15	SPARE	
21	15	SPARE		22	15	SPARE	
23	15	SPARE		24	15	SPARE	
25	20	9/9A LTG		26	15	SPARE	
27	20	9B/C/D LTG		28	20	9 REC WORKSTATION	
29	20	9 REC		30	20	9 REC WORKSTATION	
31	20	9A REC		32	20	9C REC	
33	20	9B REC		34	20	9D REC	
35		space		36		space	
37		space		38		space	
39		space		40		space	
41		space		42		space	

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PROJ. NAME: WU LHSB RENOVATION

PROJ. NO : 10500.2

PANEL ID: EGB

MAINS: 225A

VOLTAGE: 208/120V, 3Ø, 4W

MOUNTING: FLUSH

NO OF CKT: 42

LOCATION: SEE FLOOR PLANS

FED FROM: EDP1

COMMENTS: EXISTING BREAKERS ARE SHADED
LOADS REMOVED TO BE MARKED AS SPARE

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	15	EXISTING LOAD		2	15	EXISTING LOAD	
3	15	EXISTING LOAD		4	15	EXISTING LOAD	
5	15	EXISTING LOAD		6	15	EXISTING LOAD	
7	15	EXISTING LOAD		8	15	EXISTING LOAD	
9	15	EXISTING LOAD		10	15	EXISTING LOAD	
11	20	9,13,14 LTG		12	20	DOOR OPERATORS	
13		space		14		space	
15		space		16		space	
17		space		18		space	
19		space		20		space	
21		space		22		space	
23		space		24		space	
25		space		26		space	
27		space		28		space	
29		space		30		space	
31		space		32		space	
33		space		34		space	
35		space		36		space	
37		space		38		space	
39		space		40		space	
41		space		42		space	

PROJ. NAME: WU LHSB RENOVATION

PROJ. NO : 10500.2

PANEL ID: 3B
MAINS: 225A
VOLTAGE: 208/120V, 3Ø, 4W
MOUNTING: FLUSH
NO OF CKT: 42

LOCATION: SEE FLOOR PLANS
FED FROM: DP2
COMMENTS: EXISTING BREAKERS ARE SHADED
LOADS REMOVED TO BE MARKED AS SPARE

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	20	311A/B LTG		2	20	311A AV CABINET	
3	20	311A PROJECTOR		4	20	311A REC	
5	20	311B PROJECTOR		6	20	311B REC	
7	20	312A REC		8	20	312A/B,312 REC	
9	20	312A REC		10	15	SPARE	
11	15	SPARE		12	15	SPARE	
13	15	SPARE		14	15	SPARE	
15	15	SPARE		16	15	SPARE	
17	15	SPARE		18	15	SPARE	
19	15	SPARE		20		space	
21	15	SPARE		22	15	SPARE	
23	15	SPARE		24	2P		
25	15	SPARE		26	20	312 HEADWALL REC	
27	15	SPARE		28	20	312 HEADWALL REC	
29	15	SPARE		30	20	312 HEADWALL REC	
31	15	SPARE		32	20	312 BEDSIDE REC	
33	15	SPARE		34	20	312 HEADWALL REC	
35	15	SPARE		36	20	312 HEADWALL REC	
37		space		38	20	312 HEADWALL REC	
39		space		40	20	312 BEDSIDE REC	
41		space		42		space	

PROJ. NAME: WU LHSB RENOVATION

PROJ. NO : 10500.2

PANEL ID: 3C
MAINS: 225A
VOLTAGE: 208/120V, 3Ø, 4W
MOUNTING: FLUSH
NO OF CKT: 42

LOCATION: SEE FLOOR PLANS
FED FROM: DP2
COMMENTS: EXISTING BREAKERS ARE SHADED
LOADS REMOVED TO BE MARKED AS SPARE

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	20	312 LTG		2	20	EXISTING LOAD	
3	20	SPARE		4	20	SPARE	
5	20	SPARE		6	20	312A/B,312 LTG	
7	20	SPARE		8	20	312 HEADWALL REC	
9	20	312 HEADWALL REC		10	20	312 HEADWALL REC	
11	20	312 HEADWALL REC		12	20	312 HEADWALL REC	
13	20	312 HEADWALL REC		14	20	312 BEDSIDE REC	
15	20	312 BEDSIDE REC		16	20	312 BEDSIDE REC	
17	20	312 HEADWALL REC		18	20	312 HEADWALL REC	
19	20	312 HEADWALL REC		20	20	312 HEADWALL REC	
21	20	312 HEADWALL REC		22	20	312 HEADWALL REC	
23	20 GFCI	312 REC		24	20	312 BEDSIDE REC	
25	20	312 BEDSIDE REC		26	20	312 BEDSIDE REC	
27	20	312 HEADWALL REC		28	20	312 HEADWALL REC	
29	20	312 HEADWALL REC		30	20	312 HEADWALL REC	
31	20	312 HEADWALL REC		32	20	312 HEADWALL REC	
33	20	EXISTING LOAD		34	20	312/313 REC	
35	15	EXISTING LOAD		36	20	EXISTING LOAD	
37	15	EXISTING LOAD		38	15	EXISTING LOAD	
39		space		40		space	
41		space		42		space	

PROJ. NAME: WU LHSB RENOVATION

PROJ. NO : 10500.2

PANEL ID: 3E
MAINS: 225A
VOLTAGE: 208/120V, 3Ø, 4W
MOUNTING: FLUSH
NO OF CKT: 42

LOCATION: SEE FLOOR PLANS
FED FROM: DP2
COMMENTS: EXISTING BREAKERS ARE SHADED
LOADS REMOVED TO BE MARKED AS SPARE

CKT	BRKR	DESCRIPTION	WATTS	CKT	BRKR	DESCRIPTION	WATTS
1	20	313 LTG		2	20	313 HEADWALL REC	
3	20	313 BEDSIDE REC		4	20	313 HEADWALL REC	
5	20	313 BEDSIDE REC		6	20	313 HEADWALL REC	
7	20	313 BEDSIDE REC		8	20	313 HEADWALL REC	
9	20 GFCI	313 REC		10	20	313 HEADWALL REC	
11	20	313,314 LTG		12	20	313 HEADWALL REC	
13	20	314 REC		14	20	313 HEADWALL REC	
15	20	314 REC		16	20	313 HEADWALL REC	
17	20	313 REC		18	20	313 HEADWALL REC	
19		space		20	20	313 BEDSIDE REC	
21	20	313 BEDSIDE REC		22	20	313 BEDSIDE REC	
23	20	313 BEDSIDE REC		24	20	313 BEDSIDE REC	
25	20	313 HEADWALL REC		26	20	313 HEADWALL REC	
27	20	313 HEADWALL REC		28	20	313 HEADWALL REC	
29	20	313 HEADWALL REC		30	20	313 HEADWALL REC	
31	20	313 HEADWALL REC		32	20	313 HEADWALL REC	
33	20	313 HEADWALL REC		34	20	313 HEADWALL REC	
35	20	313 HEADWALL REC		36	20	313 HEADWALL REC	
37		space		38	20	313 HEADWALL REC	
39		space		40	20	313 HEADWALL REC	
41		space		42	20	313 HEADWALL REC	

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PROJ. NAME:

WU LHSB RENOVATION

PROJ. NO :

10500.2

PANEL ID:

E3A

MAINS:

225A

VOLTAGE:

208/120V, 3Ø, 4W

MOUNTING:

SURFACE

NO OF CKT:

42

LOCATION:

SEE FLOOR PLANS

FED FROM:

EDP1

COMMENTS:

EXISTING BREAKERS ARE SHADED
LOADS REMOVED TO BE MARKED AS SPARE

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 26 05 00, "Common Work Results for Electrical" and Section 26 05 33, "Basic Materials and Methods".

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 Lighting Systems

1.2.1.1 Nominal 120 volt A.C.

1.2.1.2 Branch circuit wiring from 120/208 volt, 3 phase, 4 wire panelboards.

2 Products

2.1 **GENERAL**

2.1.1 Use materials specified herein or approved equal.

2.1.2 Use the product of only one manufacturer for each type of luminaire.

2.1.3 Refer to Luminaire Schedule on Drawings.

2.2 **LED LUMINAIRES**

2.2.1 All LED luminaires must bear an approved certification mark as per Ontario Electrical Safety Code Bulletin 2-7-29. A UL certification mark without the 'c' is not an approved certification mark.

2.2.2 **Luminaires designed for LED lamps with integral driver** as specified below shall adhere to LED lamp manufacturer guidelines, certification programs, and test procedures for thermal management to guarantee the minimum lamp life and lumen maintenance as specified below.

2.2.3 **Luminaires designed with integrated custom LED's.** shall be as specified on drawings or approved equal meeting the following requirements:

2.2.3.1 Only products from manufacturers that have been in the lighting manufacturing business for minimum of 10 years will be considered.

2.2.3.2 Modularity, shall be designed to allow for replacement of; driver, LED's, without specialised tools and without removing luminaire from the ceiling.

2.2.3.3 Performance - LED luminaire with custom lamps must exceed LED lamp parameters specified below for efficacy and lumen maintenance by minimum 15%.

2.2.3.4 Lumen Maintenance - at least 70% of initial lumens for at least 60,000 hours.

2.2.3.5 Minimum luminous efficacy 50 lumens per watt (lm/W)

- 2.2.3.6 0-10V dimming standard to 10% unless noted otherwise in luminaire schedule
- 2.2.3.7 Warranty - Written warranty covering repair or replacement for a minimum of five (5) years from the date of purchase. Warranty must be included with maintenance manuals and have a toll-free (e.g., "800") number, or mailing address, or web site address for consumer complaint resolution and future LED replacement upgrade.
- 2.3 **LED LAMPS (FOR STANDARD LAMP TYPE OR FORM WITH INTEGRATED LED DRIVER)**
 - 2.3.1 All LED lamps must bear an approved certification mark as per Ontario Electrical Safety Code Bulletin 2-7-29. A UL certification mark without the 'c' is not an approved certification mark.
 - 2.3.2 Use LED lamps, as specified in schedule or approved equals. The following parameters are considered minimum:
 - 2.3.2.1 Colour Rendering Index (CRI) - minimum 80
 - 2.3.2.2 Lumen Maintenance - at least 70% of initial lumens for at least 60,000 hours.
 - 2.3.2.3 Warranty - Written warranty covering repair or replacement for a minimum of three (3) years from the date of purchase. must be included with maintenance manuals and have a toll-free (e.g., "800") number, or mailing address, or web site address for consumer complaint resolution.
 - 2.3.2.4 Colour Temperature as specified in schedule +/- 175K - The variation of chromaticity in different directions shall be within 0.004 from the weighted average point on the CIE 1976 (u',v') diagram.
 - 2.3.2.5 Colour Maintenance - The change of chromaticity over the lifetime of the product shall be within 0.007 on the CIE 1976 (u',v') diagram.
 - 2.3.2.6 Power Factor. ≥ 0.90
 - 2.3.2.7 Output Operating Frequency. 120 Hz
 - 2.3.2.8 Transient Protection Power supply shall comply with IEEE C.62.41-1991, Class A operation.
 - 2.3.2.9 Operating voltage - nominal as specified +/- 15%
 - 2.3.2.10 Lamp manufacturer to be Philips, Osram, or GE.
 - 2.3.3 **Omnidirectional Lamp Requirements** For LED lamps intended to replace the following ANSI standard lamp types (ANSI C79.1-2002): A, G, P, PS, S
 - 2.3.3.1 Maximum lamp dimensions and base shall be equal to target lamp.
 - 2.3.3.2 Minimum luminous efficacy 50 lumens per watt (lm/W)

2.3.3.3 Luminous intensity distribution. Lamp shall have an even distribution of luminous intensity within the 0° to 150° zone (axially symmetrical). Luminous intensity at any angle within this zone shall not differ from the mean luminous intensity for the entire 0° to 150° zone by more than 10%.

2.3.4 **Directional Lamp Requirements** For LED lamps intended to replace the following ANSI standard lamp types (ANSI C79.1-2002): BR, ER, K, MR, PAR, R, MR and PAR lamps.

2.3.4.1 Maximum lamp dimensions and base shall be equal to target lamp.

2.3.4.2 Minimum luminous efficacy 40 lumens per watt (lm/W)

2.3.4.3 Minimum beam requirements. Directional lamps shall be designed to ensure integral LED replacement lamps will perform similarly to the incandescent or halogen lamps they are intended to replace (i.e., the target lamp).

2.4 **EXIT SIGNS**

2.4.1 Signs to be suitable for wall and/or ceiling mounting and be provided with diffusers on the underside for down lighting and directional arrows in the face as indicated on the Drawings.

2.4.2 Signs to be green pictograms, Meeting CSA22.2 No. 141-10 with directional pictograms and faces as shown on the drawings.

2.4.3 Provide an LED (light emitting diode) type light source, maximum 3 watts, 120/347 volt power supply.

2.4.4 Signs to meet CSA-C860-01 "Performance of Internally Lighted Exit Signs".

2.4.5 Provide suitable clear acrylic guards as indicated on the Drawings.

2.4.6 Signs to be constructed from extruded, one-piece aluminum painted white, suitable for wall and/or ceiling mounting. To be Lumacell LA-3-W-U00.

2.4.7 The following manufacturers will be considered as equal subject to the requirements of Clause "Material and Equipment":

AimLite
Beghelli
Emergi-lite
Hubbell
Lithonia
Lumacell
Stanpro

2.5 **LUMINAIRE NOISE**

2.5.1 All ballasted luminaires are to be manufactured to reduce noise below room ambient noise level.

2.5.2 Any luminaire or group of luminaires which can be heard above ambient noise are to be quietened or replaced at no additional cost to the Contract.

3 Execution

3.1 **INDOOR LIGHTING**

3.1.1 Install luminaires complete with the necessary accessories, conduit supports, ball aligners, hangers, mounting yokes, etc.

3.1.2 Check the type of ceilings before placing an order for luminaires.

3.1.3 Provide independent supports from slabs or steel above hung ceilings. Luminaires are not to be supported solely by the hung ceiling. Nylon inserts are not on approved fastening method for poured concrete. Do not secure to underside of metal pan roof deck.

3.1.4 Obtain revised locations from the Consultant when pipes or ductwork interfere with the proper mounting location of recessed luminaires before roughing-in conduit.

3.1.5 Take all necessary precautions to ensure that all luminaires, diffusers and lamps are left clean at the completion of the job.

3.1.6 Ensure that all luminaires including ballasts and lamps are in good working order at the completion of the job. Replace at no extra cost any defective or burned-out lamps.

3.2 **LUMINAIRES IN SUSPENDED CEILINGS**

3.2.1 Provide adequate additional chain hanger supports for all luminaires in suspended ceiling systems to approval of the Consultant, and in accordance with Ontario Electrical Safety Code Bulletin No. 30-4-12.2016.

3.2.2 All existing luminaires to be removed and reinstalled are to have new chain hangers provided.

3.2.3 Coordinate with the Architect and Ceiling Contractor to determine which ceilings have been designed and constructed to carry the weight of the luminaires, so the support chains can be eliminated.

3.2.4 Ensure all luminaires are mechanically secured to the ceiling system with manufacturer approved clips.

3.3 **LUMINAIRE SCHEDULE**

3.3.1 Refer to Drawings for luminaire type and description.

3.4 **REPLACEMENT LUMINAIRES**

3.4.1 Prior to ordering new luminaires to replace existing, Contractor to verify voltage of existing luminaires.

3.5 REPLACEMENT LED LAMPS

- 3.5.1 Prior to ordering new LED lamps to replace existing incandescent lamps, particularly when replacing halogen MR16s in existing low voltage systems with electronic transformers verify compatibility. LED may fail to meet minimum load requirements.

3.6 EXIT SIGNS

- 3.6.1 Locate exit signs as required to prevent obstruction from view. Mount on walls where possible.
- 3.6.2 Mount exit signs as required to prevent plumbing, structural supports, etc from obstructing view of exit sign. Provide pendant mounts as required for ceiling mounted signs.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 The requirements of the Instructions to Bidders, the Contract Forms, the General Conditions as amended, and the Supplementary General Conditions as hereinbefore written will form a part of the following Specifications and the Contractor will consult them in detail for instructions governing the work.

1.1.2 Conform to the requirements of Section 26 05 00, "Common Work Results for Electrical".

1.2 **REFERENCES**

ANSI/EIA/TIA-569B - Commercial Building Standard for Telecommunications Pathways and Spaces

1.3 **DESCRIPTION OF SYSTEMS**

1.3.1 **Data Communication System:** Provide a system of empty conduits and boxes, outlets and wiring, as indicated on Drawings. All conduits are to be complete with nylon fishwire.

1.3.2 **Security System:** Provide a system of empty conduits and boxes, outlets and wiring, as indicated on Drawings. All conduits are to be complete with nylon fishwire.

1.3.3 **Audio and Video Systems:** Provide a system of empty conduits and boxes, outlets and wiring, as indicated on Drawings. All conduits are to be complete with nylon fishwire. Refer to attached AV drawings at the end of this section.

1.3.4 **Door Hardware Elevations:** Provide a system of empty conduits and boxes, outlets and wiring, as indicated on the Door Hardware Elevations attached at the end of this section. All conduits are to be complete with nylon fishwire.

2 Products

2.1 **MATERIALS**

2.1.1 Use materials specified herein or approved equal.

2.2 **WIRE BASKET CABLE TRAY**

2.2.1 The tray is to be constructed of high strength electro plated zinc galvanized steel rods.

2.2.2 Cable tray is to be constructed of wire configured in a 51 mm x 102 mm (2" x 4") grid pattern wires welded at the intersection points. The ends of the wire mesh pattern shall be bent up to form the sides of the wire basket tray. The tray will have dimensions 100mm high x 300mm wide (4" x 12").

2.2.3 Straight sections of wire basket tray to be provided in 3 m (10 ft) standard lengths.

2.2.4 A complement of fittings for the cable tray to be available including, but not limited to, sweeping bends and tees, couplings for joining sections of the tray, hangers, a field installed divider and all other components necessary to make the system workable.

Additional fittings can be constructed in the field from straight sections and couplings. The fittings and accessories shall be of compatible material.

2.2.5 Hangers: Provide FAS PCH centre hung hangers.

2.2.6 Where specifically indicated on the drawings, provide powder coated cable tray in all areas exposed to view. Cable tray not exposed to view may be standard finish. Powder coat colour from standard colours (minimum black, grey and white) to be selected at shop drawing stage.

2.2.7 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment".

B Line
Cablofil

2.3 COMMUNICATION/SECURITY/ACCESS CONTROL SYSTEM CONDUIT

2.3.1 Cables shall generally be installed in communication trays or conduit. All new conduit shall be thin wall EMT, sized for the cables required plus an additional 50% for future cables. Minimum conduit size shall be 3/4".

2.3.2 In general, the following table shall be used for communication conduit fill:

Conduit Size	3/4" 21mm	1" 27mm	1-1/4" 35mm	1-1/2" 41mm	2" 53mm	2-1/2" 63mm	3" 78mm
Max UTP	2	3	6	7	14	17	20
Max Coax	2	4	6	9	17	26	38

2.3.3 Cables shall NOT be attached to pipe or conduit or ductwork, etc.

2.3.4 Conduit ends shall be provided with non-metallic bushings to provide a round edge, which will not abrade the cable jacket.

2.3.5 **Telephone/Data:** Provide single gang device wall boxes, complete with 21 mm (3/4") conduit up to the cable tray or J hook system. Provide pull boxes and splice boxes as indicated, for every 30 m (100') of conduit, and more than two 90 bends or equivalent.

2.3.5.1 Stainless Steel faceplates specified in Section 27 10 00 do not fit in all device boxes. Confirm compatibility with Data contractor prior to rough-in.

2.3.6 **Security/Access Control System:** Provide single gang device wall boxes, complete with 16 mm (3/4") conduit up to the cable tray or J hook system. Provide pull boxes and splice boxes as indicated, for every 30 m (100') of conduit, and more than two 90 bends or equivalent. All conduits to have pull strings from device wall boxes to cable tray.

2.3.7 **Door Hardware Elevations:** Provide single gang device wall boxes, complete with 16 mm (3/4") conduit as indicated on Door Hardware Elevations attached. Provide pull boxes and splice boxes as indicated, for every 30 m (100') of conduit, and more than two 90 bends or equivalent. All conduits to have pull strings.

2.3.8 PVC conduit is not allowed inside and will be removed at the contractor's expense.

3 Execution

3.1 WIRE BASKET CABLE TRAY

3.1.1 Wire basket to be installed in accordance with all appropriate NEMA VE-2 2000, Ontario Electrical Safety Code, and NFPA standards

3.1.1.1 Wire basket tray to be supported on 3m (10') centres with centre rod hangers as manufactured by tray manufacturer. Trapeze/centre rod hangers to be hung with 1/4" x 3/8" (6.35 mm or 9.53 mm) threaded rod.

3.1.1.2 All connections to be checked to make sure they are correctly tightened and to ensure that all tray sections and fittings are electrically continuous and bonded with adjacent systems in accordance with the Ontario Electrical Safety Code for proper grounding.

3.1.1.3 All systems to be installed complete. Work to include fastening all trays to adjacent wiring systems to install a complete system as indicated on the electrical and/or communication drawings and in the applicable specifications.

3.2 COMMUNICATION/SECURITY/ACCESS CONTROL SYSTEM CONDUIT

3.2.1 Provide 20 mm (3/4") conduit except as noted, from each wall outlet to accessible ceiling space. **Ensure end of conduit is fully accessible for cabling installers.**

3.2.2 Provide all conduits, outlet boxes and wiring for a complete system. Minimum size conduit to be 21 mm (3/4"), except where noted.

3.2.3 Where possible, run all conduit in the ceiling space and conceal all conduit within ceiling spaces, walls or partitions. Mount outlets at the same elevation above finished floor level as duplex receptacles or as noted on the floor plans.

3.2.4 Rigidly install all conduits, adequately supported and properly reamed at both ends. Join sections of conduits by approved couplings and conduit terminations at boxes, pull boxes, etc. using approved fittings.

3.2.5 The inside radius of bends not to be less than: Six times the internal diameter of conduits 50mm (2") and smaller.

3.2.6 Install conduits and boxes as per TIA/EIA-569-A.

3.2.7 Minimum size of pull boxes and splice boxes to be sized as per conduits and Tables 5, 2-2 and 5, 2-3 in TIA/EIA-569-A.

3.2.8 Conduits shall be grounded minimum at one end.

3.2.9 Conduit fill capacity shall not exceed 35%.

3.2.10 Cables and raceway shall maintain minimum 150mm (6") separation from sources of heat such as steam or hot water pipes, vessels and fittings, which are insulated, and minimum 610mm (24") from the same, which are uninsulated.

3.2.11 Pull wires must be provided in all conduits.

END OF SECTION

1 General

1.1 **GENERAL REQUIREMENTS**

1.1.1 Conform to the requirements of Section 26 05 00, "Common Work Results for Electrical".

1.2 **DESCRIPTION OF SYSTEMS**

1.2.1 **Fire Alarm System**

1.2.1.1 Supply and install all equipment and accessories to extend the existing electrically supervised, coded, zoned fire alarm system by Edwards as described herein and as shown on plans. Fire alarm devices are to be in accordance with the Ontario Building Code and associated standards.

2 Products

2.1 **FIRE ALARM CONTROL PANEL**

2.1.1 Existing Fire Alarm Control Panel is Edwards EST3.

2.1.2 Consult with fire alarm manufacturer to determine accessories and wiring diagrams required to extend the existing fire alarm system. Extras will not be granted for failure to consult with fire alarm manufacturer.

2.1.3

2.2 **ADDRESSABLE DEVICES**

2.2.1 Provide suitable wire guards for all devices where indicated on the drawings.

2.2.2 **Manual Pull Stations:** Manual single action break-glass addressable pull stations to be Edwards SIGA-270. Provide flush box for all new installations. Provide auxiliary contacts as required for release of magnetic locks where noted on the drawings.

2.2.3 **Photoelectric Smoke Detectors:** Addressable photoelectric smoke detectors to be Edwards SIGA-OSD. Provide SIGA-SB standard sensor base, SIGA-RB sensor base with addressable supervised relay driver, or SIGA-AB4G audible base as indicated on the drawings.

2.2.4 **Automatic Heat Detectors:** Addressable fixed temperature/rate-of-rise sensing automatic heat detectors to be Edwards SIGA-HRD or SIGA-HFS with standard sensor base.

2.2.5 **Addressable Monitor Module:** For monitoring valves, flow switches, and conventional devices, Edwards SIGA-UM. Monitor modules shall be capable of powering 2-wire smoke detectors.

2.2.6 **Addressable Control Module:** Provide control relays to allow for various addressable control functions, Edwards SIGA-CR. Relays shall be rated for 0.5A at 120VAC. Relay to change to open state upon loss of communication.

2.2.7 **Zone Isolation Modules:** Provide isolator at zone separations, fire separations and where required by the manufacturer. Alternately provide SIGA-IM isolator bases.

2.3 NOTIFICATION APPLIANCES

- 2.3.1 Provide suitable wire guards for all devices where indicated on the drawings.
- 2.3.2 **Horn:** Wall mounted horn devices are to have red housing with white "FIRE" lettering. Edwards G4ARF.
- 2.3.3 **Horn-strobes (Wall Mounted):** Wall mounted horn-strobe devices are to have red housing with white "FIRE" lettering with field selectable 15, 30, 75 or 110 candela, 1 Hz synchronized LED high output strobe. Edwards G4AVRF.
- 2.3.4 **Horn-strobes (Ceiling Mounted):** Ceiling horn-strobe devices are to have white housing with red "FIRE" lettering with field selectable 15, 30, 75 or 110 candela, 1 Hz synchronized LED high output strobe. Edwards GCAVWF.
- 2.3.5 Provide red adapter skirt for surface mounted devices on walls.
- 2.3.6 Provide tile bridge for all devices mounted in acoustic ceiling tile ceilings.
- 2.3.7 Provide wire guard with mounting plate where indicated on the drawings.

2.4 ANCILLARY DEVICES

- 2.4.1 **Electromagnetic Door Holders:** Provide electromagnetic door holders, flush mounted, Edwards 1504-AQN5 or 1505-AQN5 as required. Confirm voltage prior to installation.

2.5 WIRING

- 2.5.1 Provide new wiring to conform with requirements of Ontario Electrical Safety Code Section 32, and applicable Codes and Standards. Size wiring in accordance with Class 2 requirements, but protected from mechanical injury or other injurious conditions such as moisture, excessive heat or corrosive action in accordance with Class 1 requirements.
- 2.5.2 General wiring with a floor area, conductors to be solid copper Securix II, Type 105 C PVC, 300 volt. Minimum size of any conductor: for alarm receiving circuits and remote annunciators, #16 AWG solid. Wire resistance in these circuits not to exceed 50 ohms. For audible signal circuits minimum #16 AWG solid. Voltage drop to any signal not to exceed 10%.
- 2.5.3 Conductors in multi-conductor cables to have allowable temperature rating of at least 105 C (200°F).
- 2.5.4 All conductors to be as per Ontario Electrical Safety Code and installed in metallic raceway.
- 2.5.5 Install conductors entirely independent of all other wiring and do not enter fixture, raceway, box or enclosure occupied by other wiring.
- 2.5.6 Splices will not be permitted unless otherwise indicated on the Drawings or specified. Where splices are necessary and approved by the Consultant, use approval metal contact electrical crimp type connectors.

2.5.7 All wiring must be clear of shorts, open and grounds on completion of work.

2.6 **MANUFACTURER**

2.6.1 The following manufacturers of the above equipment will be considered as equal subject to requirements of Clause "Materials and Equipment":

Edwards

3 Execution

3.1 **FIRE ALARM SYSTEM INSTALLATION**

3.1.1 Fire alarm system installation to be in accordance with the latest edition of CAN/ULC S-524 "Standard for the Installation of Fire Alarm Systems".

3.1.2 **Wiring**

3.1.2.1 Riser diagrams on drawings show general design intent. Obtain complete wiring diagrams from Fire Alarm manufacturer prior to rough-in.

3.1.2.2 Provide all wiring in conduit and in accordance with Fire Alarm equipment manufacturer's requirements.

3.1.2.3 Identify signal circuit, initiating circuit, auxiliary circuit and all other wiring at Fire Alarm control panel, annunciator, terminal boxes or elsewhere on completion of work with appropriate marking labels.

3.1.2.4 All conventional initiating wiring to be Class B.

3.1.2.5 Provide quantity of addressable loops as indicated on the drawings and schematics. All addressable wiring to be Data Communications Link Style A (DCLA). Provide line isolation devices at every circuit/zone change and every fire separation crossing, per CAN/ULC-S524:2019 which automatically opens circuit when line voltage drops to protect the rest of the loops on either side.

3.1.2.6 Addressable loops must have at least 30% spare capacity for addition of future devices. Do not exceed 140 devices total on any addressable loop.

3.1.2.7 All initiating and D.C. signal circuits extending from the fire alarm control to be current limited and protected, in accordance with Ontario Electrical Safety Code requirements.

3.1.2.8 The extended circuit wiring to each alarm receiving circuit or signal circuit is to be individually supervised with no common wiring.

3.1.2.9 Install all wiring in EMT metal conduit above ceilings, and surface in mechanical spaces, and in maintenance/storage spaces with exposed ceilings.

3.1.3 **Control Panels, Transponders and Annunciators**

- 3.1.3.1 In finished areas, recess control panel and annunciator in walls. Where not feasible, confirm with consultant prior to rough-in. In this case, provide enclosure without knockouts suitable for surface mounting.
- 3.1.3.2 Passive graphic, annunciator and field device identification tags provided by Fire Suppression Contractor must be displayed and labelled verbatim.
- 3.1.3.3 Review zone identification with Fire Inspection Department prior to programming, labelling and manufacturing passive graphics.

3.1.4 **Devices**

- 3.1.4.1 Install detectors in accordance with CAN/ULC Standard CAN/ULC-S524:2019 latest edition "Installation of Fire Alarm Systems".
- 3.1.4.2 Location of devices shown on Drawings are approximate and must be adjusted to site conditions. If location of existing device to be replaced is not properly centred in individual rooms, adjust to suit.
- 3.1.5 Mount detectors on ceiling as per CAN/ULC Standard CAN/ULC-S524:2019 standard unless otherwise specified herein, with the minimum and maximum distances as required for the respective type of detector, at the highest point where variations in ceiling height exist. Do not mount detectors on sides, on undersides, or less than 600 mm (20") from walls, beams, joints, ducts, open web steel joists, bulkheads or any structure projecting below actual ceiling height and less than 450 mm (18") from air handling or heating outlets.
- 3.1.6 Should interference from obstruction, lamp positions, air outlet or heat radiating surfaces be encountered in locating any detector where shown, locate the detector as near as possible to the indicated position, clear of obstacles, to the satisfaction of the Consultant, but maintain a clear space of 600 mm (24") on the ceiling, below and around.
 - 3.1.6.1 Duct detectors to be mounted in supply air ducts unless otherwise indicated on the Drawings.
 - 3.1.6.2 Mount end of line resistors beside last device. Document location of end of line resistors and place inside fire alarm control panel and in maintenance manuals. Provide PTouch labels on end of line faceplates indicating circuits contained within.
- 3.1.7 Locate all addressable monitor modules adjacent to equipment being monitored.
- 3.1.8 Locate all addressable control modules for motors adjacent to starters/motor control centres or building automation control panels as site directed.
- 3.1.9 Locate all addressable control modules not controlling motors within 3' of device being controlled, where practicable.
- 3.1.10 **Ancillary Devices**
 - 3.1.10.1 Provide independent addressable control modules for each ancillary device shutdown.

- 3.1.10.2 Verify operating voltage of door hold open devices and magnetic locks supplied by door hardware contractor for tie into new system. Provide necessary transformation or relays.
- 3.1.10.3 Unless specified otherwise, power door hold-open devices from nearest unswitched lighting circuit.
- 3.1.10.4 Shutdown of fans to occur at starter separate from building automation controls. Where single point connections are provided to mechanical equipment, connect to fire alarm shutdown contact on mechanical equipment control panel.
- 3.1.10.5 Door hold open devices and latch retraction hardware to be installed in accordance with Ontario Building Code clause 3.1.8.12.
- 3.1.10.6 Magnetic locks to be installed in accordance with Ontario Building Code clause 3.4.6.16(4).

3.2 VERIFICATION AND CERTIFICATION OF FIRE ALARM EQUIPMENT

- 3.2.1 The Contractor is to provide a full set of Electrical Drawings and Specifications to the fire alarm system representative prior to starting the verification of the fire alarm system. Failure to do so may require the entire fire alarm system to be reverified. Fire alarm system representative to review drawings and provide comments to Consultant prior to commencing verification.
- 3.2.2 All construction work must be complete before verification of fire alarm system is started. Any modifications to the fire alarm installation after the verification has been commenced will require the entire system to be reverified. Where partial occupancies occur, the fire alarm system for the area to be occupied (including control units) shall meet the requirements of this Standard. Upon system completion, those parts of the fire alarm system tested to this Standard shall be retested in accordance with the requirements of CAN/ULC-S536, Standard for the Inspection and Testing of Fire Alarm Systems, prior to the release of the Verification Report.
- 3.2.3 Fire alarm technician to review existing building prior to date of verification and review any existing conditions requiring repair. Submit report minimum one week before commencing verification. Consultant will review and issue appropriate instruction.
- 3.2.4 Where a field device is replaced, the device shall be verified in accordance with CAN/ULC-S537:2019.
- 3.2.5 Testing of all flow switches is to be with actual water flow activation. Supervised valve switches and other supervisory zones to be tested by closing valves or replicating the abnormal condition.
- 3.2.6 The Contractor is to engage the services of the Fire Alarm manufacturer's representative to verify the fire alarm system in accordance with CAN/ULC-S537:2019.
- 3.2.7 Test all voice communication systems throughout building. Adjust speaker taps as required to provide a minimum common intelligibility scale (CIS) score of 0.70. Evaluate each acoustically isolated space separately. Provide appropriate reports for review by Consultant. Reports to include room name and number, speaker tap wattage, SPL and CIS at no less than 2 locations per room.

- 3.2.8 During the period of inspection by the manufacturer's representative, make available to the manufacturer's representative as many electricians as designated by the manufacturer's representative to complete the verification within the specified time frame.
- 3.2.9 Contractor is to supply Consultant with a list of deficiencies indicating areas where installation deviates from ULC Standards or Ontario Building Code. This list will be reviewed and authorized or rejected by Consultant prior to acceptance of certificate.
- 3.2.10 **Inspection Certification:** On completion of the inspection and when all the above conditions have been complied with, the Contractor is to provide to the Consultant:
- 3.2.10.1 A verification report identical to Appendix C of CAN/ULC-S537:2019 completed by the fire alarm manufacturer's technician. Document C1 from CAN/ULC-S537:2019 must be signed and dated by the technician upon completion of the verification.
- 3.2.10.2 A certificate of verification confirming that the inspection has been completed showing the conditions upon which such inspection and certification have been rendered. Certificate must be free of conditions noted. No additional exceptions or conditions are acceptable.
- 3.2.10.3 Proof of liability insurance for the inspection.
- 3.2.10.4 A letter separate from the Verification Report stating "All door hold open devices, including latch retraction/release have been tested by the fire alarm verifier and are installed and working, in accordance with Ontario Building Code 3.1.8.12".
- 3.2.10.5 Provide ESA Inspection Certificate.
- 3.2.11 **Description of Fire Alarm System**
- 3.2.11.1 Upon completion of the project, provide to the Owner a copy of CAN/ULC-S536-13 Appendix E "Description of Fire Alarm System for Inspection and Test Procedures". Provide type written copy of this form and provide soft copy with maintenance manuals.
- 3.3 **FIRE WATCH - ALTERNATIVE MEASURES FOR OCCUPANT FIRE SAFETY**
- 3.3.1 In the event of any shutdown of fire protection equipment or part thereof, the Fire Department and building occupants/owner should be notified. Instructions should be posted as to alternate provisions or actions to be taken in case of an emergency. These provisions and actions should be acceptable to the Chief Fire Official and be in accordance with the accepted Fire Safety Plan.
- 3.3.2 An attempt to minimize the impact of inoperative equipment should be made (i.e. where portions of a sprinkler, fire alarm system and standpipe system are taken out of service, the remaining portions will be maintained). Assistance and direction for specific situations should be sought from the Fire Department and be in accordance with the accepted Fire Safety Plan.

- 3.3.3 Procedures to be followed in the event of shutdown of any part of a fire protection system are as follows:
 - 3.3.3.1 Notify the Fire Department and the monitoring station. Give your name, address and a description of the work and when you expect it to be corrected. The Fire Department should be notified in writing of shutdowns longer than 24 h;
 - 3.3.3.2 Post notices on all floors by elevators and at entrances, stating the work and when it is expected to be completed;
 - 3.3.3.3 Unless noted otherwise in the Fire Safety Plan, have staff or other reliable person(s) patrol the affected area(s) at least once every hour; and
 - 3.3.3.4 Notify the Fire Department, the fire signal receiving centre, and building occupants/owner when work has been completed and systems are operational.
- 3.4 **ANCILLARY DEVICE OPERATION**
 - 3.4.1 All door hardware connected to fire alarm are to release upon general alarm.
 - 3.4.2 Outputs to building automation system and lighting control systems to activate upon general alarm.
 - 3.4.3 Connect fire alarm panel to ULC remote monitoring station. Coordinate with Owner.
 - 3.4.4 Outputs to shutdown air handling equipment to activate on general alarm.
- 3.5 **INSPECTION COSTS**
 - 3.5.1 Include all costs involved with this inspection in the total Bid Price.
- 3.6 **TESTING**
 - 3.6.1 Tests of the complete system in the presence of the Owner and the Consultant are to include:
 - 3.6.1.1 Spot check of devices to ensure proper connections and supervision.
 - 3.6.1.2 Operation of an alarm initiating device on each detection circuit is to verify the required operation of alarm devices, annunciators, etc.
 - 3.6.1.3 Operation of all other alarm initiating devices in a convenient, silent method (buzzer, light, meter, etc.) are to ensure connection to the proper circuit and function of the device.
 - 3.6.1.4 Live smoke or open flame are not to be used for testing.
 - 3.6.1.5 Test each area in stages to match the Work Schedule.
 - 3.6.1.6 Demonstrate to Consultant and Owner the operation of ancillary functions (ie maglock and door hardware release, elevator recall, etc).

- 3.6.2 Provide assistance to the Fire Inspection Department for testing a minimum of 25% of the installed field devices and up to 100% of sprinkler/ standpipe devices (supervised valves, flow switches, etc). Correct deficiencies and retest any devices or zones operating incorrectly as directed by the Fire Inspection Department.

3.7 **TRAINING**

- 3.7.1 The Contractor shall provide 2 hours training for the complete operation of fire alarm system.

3.8 **SPARE PARTS**

- 3.8.1 Provide spare fire alarm system parts, including programming and verification, as follows (minimum of 2):

Automatic Initiation Devices	:	10% of each type installed
Manual Pull Stations	:	5% of units installed
Signal Appliances	:	5% of each type installed
Monitor Modules	:	10
Control Modules	:	10
Duct Detector Housing	:	2

- 3.8.2 Turn spare parts over to Owner at end of construction. Provide signed letter from Owner listing items and quantities of accessories confirming receipt, and include in electrical manuals.

END OF SECTION