

TECHNICAL SPECIFICATIONS FOR :

PROJECT: COSMOTOLOGY & CULINARY
ARTS CLASSROOM RENOVATION
NOTRE DAME CATHOLIC
SECONDARY SCHOOL

CLIENT: HALTON CATHOLIC DISTRICT SCHOOL BOARD

PROJECT No.: 24140B

DATE: FEBRUARY 2026

BINDER: ARCHITECTURAL, KITCHEN &
MECHANICAL



CONSULTANTS:



105-1939 IRON OAK WAY
OAKVILLE, ONTARIO L6H 3V8
Tel (905) 815-8284



PROJECT NAME

**Notre Dame Catholic Secondary School
Cosmotology & Culinary Interior Renovation**
2333 Headon Forest Dr
Burlington, ON L7M 3X6

PROJECT OWNER

HALTON CATHOLIC DISTRICT SCHOOL BOARD
802 Drury Lane
Burlington, ON L7R 2Y2
Tel: (905) 632-6300

CONSULTANTS

ARCHITECT
HOSSACK ARCHITECTURE
105-1939 Ironoak Way
Oakville, ON L6H 3V8
Tel.: (905) 815-8284

KITCHEN CONSULTANT
Van Vekzen & Radchenko Design Associates Ltd.
99, 1262 Don Mills Road,
North York, Ontario M3B 2W7
T: 416 447.6483

ELECTRICAL ENGINEER
RDZ Engineers Ltd.
30 Pennsylvania Ave #17A
Concord, ON L4K 4A5
Cell: 647.674.9656

MECHANICAL ENGINEER
RDZ Engineers Ltd.
30 Pennsylvania Ave #17A
Concord, ON L4K 4A5
Cell: 647.674.9656

STRUCTURAL ENGINEER
Kalos Engineers Inc.
300 York Boulevard
Hamilton, ON L8R 3K6
Cell: 905.333.9119

ROOF & ENVELOPE CONSULTANTS
Tri-Tech Pinnacle Group
Unit 3, 73 Industrial Parkway North
Auroa, ON L4G 4C4
Cell: 605.503.1300

END OF SECTION

No. of Pages

SPECIFICATIONS

INTRODUCTORY INFORMATION

000005	Consultants	1
000010	Table of Contents	4

THE BID DOCUMENTS

00 21 10	Stipulated Price Bid Form	6
00 22 00	Supplementary Information Form	2
00 22 10	Supplemental General Conditions to CCDC-2	

DIVISION 1- General Requirements

01 11 00	General Instructions and Summary of Work	24
01 22 00	Meetings and Progress Reports	6
01 33 00	Submittal Procedures	4
01 35 23	Site Safety Protocol for Occupied Buildings	8
01 35 30	Health and Safety Requirements	7
01 35 43	Environmental Procedures	2
01 45 00	Quality Control	4
01 51 00	Temporary Utilities	3
01 52 00	Construction Facilities	3
01 56 00	Temporary Barriers and Enclosures	3
01 73 03	Execution Requirements	4
01 74 11	Cleaning	2
01 77 00	Closeout Procedures	2
01 78 00	Closeout Submittals	7
017810	Sample Guarantee/Warranty form	2

DIVISION 2- Existing Conditions

02 10 00	Existing Site Photos	6
02 41 15	Selective Demolition & Removals	4

DIVISION 3 - Concrete

03 10 01	Concrete Forming and Accessories	3
03 20 00	Concrete Reinforcing	
03 30 00	Cast in Place Concrete	3
03 35 05	Concrete Floor Hardeners	3

DIVISION 4- Masonry

04 05 12	Mortar and Grout	3
04 22 00	Concrete Masonry Unit	4

DIVISION 5- Metals

05 50 00	Metal Fabrications	8

DIVISION 6- Wood, Plastics and Composites

06 10 11	Rough Carpentry	4

	<u>No. of Pages</u>
<u>DIVISION 7- Thermal and Moisture Protection</u>	
07 52 15 Summary of Work (Roofing)	2
07 52 16 SBS Mod. Bit Membrane Roofing	9
07 62 00 Sheet Metal Flashing & Trim	7
07 92 00 Joint Sealants (Roofing)	5
Roofing Detail	1
07 92 10 Joint Sealants	3
07 95 00 Applied Fireproofing	3
07 96 00 Firestopping	3
<u>DIVISION 8- Openings</u>	
08 11 14 Metal Doors and Frames	15
08 11 15 Door Schedule	1
08 80 50 Glazing	7
<u>DIVISION 9-Finishes</u>	
09 30 13 Ceramic Tiling	8
09 51 13 Acoustical Panel Ceiling	5
09 65 17 Resilient Safety Flooring	3
09 91 22 Painting	3
09 91 27 Finishes and Colour Notes	1
09 91 30 Room Finish Schedule	1
<u>DIVISION 10- Specialties</u>	
10 11 25 Manufactured Specialties	6
<u>DIVISION 11, 12, 13 & 14 - Equipment, Furnishings, Special Construction & Conveying Systems</u>	
11 40 40 Kitchen Equipment	
<u>DIVISION 20, 21, 22, 23, 25 Mechanical</u>	
20 05 01 Form of Supplementary Mechanical Tender	
20 05 05 Mechanical Work General Instructions	
20 05 10 Basic Mechanical Materials and Methods	
20 05 20 Mechanical Vibration Control	
20 05 25 Mechanical Insulation	
20 05 35 Mechanical Demolition and Revision Work	
20 05 50 Testing, Adjusting and Balancing	
20 05 55 Firestopping and Smoke Seal System	
21 13 00 Fire Protection Sprinkler system	
21 20 05 Fire Extinguishers	
22 11 00 Domestic Water Piping and Specialties	
22 13 00 Drainage and Vent Piping and Special ties	
22 30 00 Plumbing Equipment	
22 42 00 Plumbing Fixtures and Fittings	
22 66 00 Acid and Corrosive Resistant Drain and Vent Piping Systems	
23 11 23 Natural Gas Piping system	

	<u>No. of Pages</u>
23 21 00 Hydronic Piping Special Specialties and Pumps	
23 30 00 HVAC Air Distribution	
23 34 00 HVAC Fans	
23 70 00 Gas fired Make Up Air Unit	
25 05 01 Form of Supplementary Controls Tender	
25 05 05 Automatic Controls and Instrumentation	
<u>DIVISION 26 - Electrical</u>	57
Refer to Drawings for Specifications	

DRAWING SET

Drawing No.	Title	30" x 42" format

ARCHITECTURE

- A01 FIRE SEPARATION & OBC MATRIX
- A02 GROUND FLOOR DEMOLITION PLANS
- A03 GROUND FLOOR PROPOSED PLANS
- A04 GROUND FLOOR PROPOSED FINISH
- A05 PARTIAL SECOND FLOOR PLANS & DETAILS
- A06 INTERIOR ELEVATIONS
- A07 SCHEDULES

KITCHEN

- K1 FOOD SERVICE EQUIPMENT PLAN & SERVICE LIST
- K2 ELEVATIONS AND SECTIONS
- K3 ELEVATIONS AND SECTIONS

KITCHEN EXHAUST HOOD

- SAS1-B ITEM 12 REMOTE – HOOD PLAN AND SECTION
- SAS2-B ITEM 12 REMOTE – HOOD ELEVATION
- SAS3-B ITEM 12L – HOOD PLAN AND SECTION
- SAS4-B ITEM 12R – HOOD PLAN AND SECTION
- SAS5-B ITEM 12L&R – HOOD ELEVATION
- SAS6-B CONTROL DIAGRAM
- SAS7-B CONTROL SEQUENCES
- SAS8-B CONTROL PANELS

STRUCTURAL

- S01 GENERAL NOTES & TYPICAL DETAILS
- S02 FRAMING PLANS, DEMOLITION PLANS & SECTIONS

No. of Pages

MECHANICAL

M1.0	DRAWING LIST, SYMBOL LIST, NOTES, SCHEDULES, DETAILS
M2.0	GROUND FLOOR DEMOLITION – HVAC
M2.2	GROUND FLOOR DEMOLITION PLUMBING & FIRE PROTECTION
M3.1	GROUND FLOOR NEW WORK – PLUMBING
M3.3	GROUND FLOOR NEW WORK – FIRE PROTECTION
M3.4	PARTIAL MECHANICAL ROOM FLOOR PLANS & ROOF PLAN
M4.1	CONTROL DIAGRAMS
M5.1	EQUIPMENT SCHEDULES
M6.1	DETAILS 1
M6.2	DETAILS 2
M6.3	DETAILS 3

ELECTRICAL

E1.0	SYMBOL LIST AND DETAILS
E1.1	ELECTRICAL SPECIFICATION
E2.0	KEY PLAN
E2.1	DEMOLITION LAYOUT
E3.1	NEW LIGHTING LAYOUT
E3.2	NEW POWER LAYOUT
E3.3	PARTIAL MECHANICAL ROOM FLOOR PLANS & ROOF PLAN
E4.0	POWER RISER DIAGRAM

END OF TABLE OF CONTENTS

1. STIPULATED PRICE BID FORM

1.1. TENDER INFORMATION

NAME OF BIDDER: _____

DATE OF TENDER CLOSE: **4:00:00 P.M., TUESDAY MARCH 10, 2026**

All Stipulated Price Bid Forms are to be received by email at the Architect's office on or before the date noted above.

NAME OF PROJECT: Notre Dame Catholic Secondary School -
Cosmetology & Culinary Arts Interior Renovation
2333 Headon Forest Dr, Burlington, ON L7M 3X6

TO: HOSSACK ARCHITECTURE
Attention: Alexander Mayhew & Priscilla Ladouceur
amayhew@hossackarch.com & admin@hossackarch.com

1.2. EXAMINATION OF TENDER DOCUMENTS

Having carefully examined all of the drawings (architectural, kitchen, mechanical and electrical), and having carefully examined the Instructions to Bidders, General Instructions and all of the attached Specifications; **including Addenda numbered** as follows:

_____.
and

Having visited the site, investigated and examined all conditions affecting the Work.

1.3. TENDER AMOUNT

We, the undersigned, hereby offer to furnish all materials, labour, plant and equipment and to perform all duties and services called for by the ENTIRE WORK INCLUDING ALL TRADES for the project named above for the stipulated sum of:

(Insert amount in writing)

_____ \$ _____
(Insert numerical amount)

in lawful money of Canada, **excluding** H.S.T., but **including** all other applicable Federal and Provincial Taxes, Custom Duties, Insurances, Freight, Exchange and all other charges.

In the event that a discrepancy arises between the written stipulated price and the associated numerical sum, the stipulated price, to the advantage of the Owner, will be deemed to be correct. H.S.T. will be based on the stipulated sum deemed to be to the advantage of the Owner, irrespective of any discrepancy.

1.4. SUBCONTRACTORS

- 1.4.1 We enclose the following list of Major Subcontractors who the Contractor proposes to retain for the Work of this project.
- 1.4.2 We have confirmed and investigated each Subcontractor's reliability, bonding capabilities as required and ability and competence to execute the Work of this Contract.
- 1.4.3 No deviation from the attached list of major Subcontractors will be permitted prior to award of the Contract and or during the performance of the Contract without written permission of the Owner. In the event of any Subcontractor becoming bankrupt during or prior to execution of the Agreement, the Contractor shall provide satisfactory evidence of same prior to requesting Owner acceptance of substitution.
- 1.4.4 Any designation of "Own Forces" shall not be used unless the intent is to actually employ the General Contractor's own forces. Only one Subcontractors name may be listed for each discipline.

1.5. WORK DIVISION

- 1.5.1 We the Bidder confirm that the division of Work among all the subcontractors and suppliers/installers is our responsibility and we covenant that neither the Consultants nor the Board, will be requested to act as an arbiter to establish subcontract limits between Sections or Division of Work.

SUB-TRADE

NAME OF SUBCONTRACTOR

Mechanical Sub-Contractor

(to be selected from list provided in
Section 01 11 00 General Instructions and
Summary of Work item 1.5.)

Electrical Sub-Contractor

(to be selected from list provided in
Section 01 11 00 General Instructions and
Summary of Work item 1.6.)

1.6. TIME OF COMPLETION

- 1.6.1 If awarded the Contract for said Work, the entire Contract will commence and be completed within the time periods as stated below.

1.7. CONTINGENCY AND CASH ALLOWANCES

- 1.7.1 The Tender Amount INCLUDES a Contingency Allowance and Cash Allowance as identified in the *Section 01 00 50 – 'General Instructions and Summary of Work'*.

1.8. TENDER VALIDITY

- 1.8.1. We are submitting a valid tender and will enter into a formal contract if we are notified in writing of our tender acceptance by the Owner within **sixty (60) calendar days** from the closing of the tender. The undersigned agrees to assume all increases in labour rates and material prices, cost indexes, or any other rates that may develop for the duration of this Contract.
- 1.8.2. We hereby acknowledge that the lowest or any bid may not be accepted by the Owner.
- 1.8.3. We hereby acknowledge that the Owner reserves the right to accept any Bid deemed to be considered best for their own interests.

1.9. AGREEMENT TO BOND

- 1.9.1. We acknowledge and comply with bonding requirements outlined in Section 01 10 00 General Instructions and Summary of Work, Item 1.9.
- 1.9.2. We acknowledge and will comply with the terms and conditions of the ***Project Occupancy Requirements*** as outlined below.
- 1.9.3. We acknowledge and will comply with all the terms and conditions of the amendments as outlined in the ***Canadian Construction Document CCDC-2, 2020***.
- 1.9.4. We agree and acknowledge the Tender Deadline Times and submission requirements as set forth in ***Section 00 20 00 - Instructions to Bidders***. We agree to provide, as required, all submissions, duly signed and executed.

1.10. UNDERTAKING

- 1.10.1. We solemnly undertake, as an integral part of our proposal and tender to:
- 1.10.1.1. Have the project **Substantially Complete** (to meet the requirements of OAA/OGCA Document 100, Construction Lien Act: latest amendments) by:
Tuesday, August 25, 2026
- 1.10.1.2. Have the entire Contract **Totally Performed** by: **Friday, September 4, 2026**
- 1.10.2. We confirm that all appropriate costs and all overtime costs for all trades to meet the aforementioned schedule, have been included in our tender price to achieve these dates.

1.11. COMMENCEMENT OF WORK

- 1.11.1. We the Contractor, if notified of the acceptance of this Tender via a *Letter of Intent* issued by the Board, will sign, seal and deliver the Contract Documents and will proceed with the preparation

of shop drawings within two weeks of notification. We will complete all Work ready for full legal occupancy as described above.

1.12. FEES FOR CHANGES IN WORK

- 1.12.1 We agree to the terms and conditions outlined in the *Canadian Construction Document CCDC 2, 2020* as being applied to any work added or deleted subsequent to the award of the Contract not covered by Unit Prices and Labour Rates.

1.13. DESIGNATED SUBSTANCES

- 1.13.1 The term “designated substances” shall have the meaning as defined in the Occupational Health and Safety Act.

1.14. ALTERNATE, SEPARATE AND ITEMIZED PRICES

- 1.14.1 We the undersigned, have inserted in the attachment(s) prepared and requested by the Architects, all Alternate, Separate, and Itemized prices. We agree to the following:
- 1.14.2 All prices submitted take into consideration and allow for changes and adjustments in other Work as may be necessary, to provide a finished and functional result, unless specifically indicated otherwise.
- 1.14.3 Alternate and Separate Prices may, at the discretion of the Board, be used to determine the low bidder.
- 1.14.4 **Alternate Prices** are for Work that is not included in the Tender Price requested by the Architect and identified or submitted by the Tenderer below, but which may be substituted by the Board for Work which is included. (No price listed shall mean no change in the cost.)
- 1.14.5 **Separate Prices** are for Work that is not included in the Tender Price listed below, but which may be added by the Board for the price quoted on the attachment(s).
- 1.14.6 **Itemized Prices** are for Work that is included in the Tender Price to be supplied by the Tenderer as listed in the *Instruction to Bidders*.
- 1.14.7 **None of the prices listed below include HST.**

1.15. ALTERNATE PRICES

- 1.15.1 Not Applicable.

1.16. GENERAL CONTRACTOR’S PROPOSED ALTERNATES:

- 1.16.1 We, the General Contractor propose, for the Board’s consideration, possible alternates to specified materials or products by indicating the alternate and the sum to be added to, or deducted from, the Stipulated Price. We acknowledge that the Board is under no obligation to consider or

accept such proposed alternates.

Description of Alternate Product or Method of installation proposed as a deduction/addition to the Contract:

1.) _____

Add: _____ Deduct: _____

2.) _____

Add: _____ Deduct: _____

1.17. SEPARATE PRICES (Not included in the Tendered Amount, not incl. HST)

1.17.1 Not Applicable.

1.18. ITEMIZED PRICES

1.18.1 Not Applicable.

1.19. CONTRACTOR'S ACKNOWLEDGEMENT

1.19.1 We, confirm that I/We have been advised by the Owner of the presence, if any, of designated substances with which my workers may come in contact during the performance of the Work awarded under this Contract. The Notice to me from the Owner forms part of this Bid and Contract.

1.19.2 We, if awarded the Work under this Contract, agree that:

- i) I/We shall inform all persons working at the Place of the Work of the existence of designated substances of which I have been advised, if any;
- ii) I/We shall inform any Subcontractors I/We are required to retain of the existence of the designated substances of which I have been advised, if any;
- iii) I/We shall inform the Owner of the presence of any potentially hazardous materials or substances which I/We plan to bring to the Place of the Work, and I will provide all applicable MSDS sheets the Owner, if any;
- iv) I/We shall clean up and remove from the Place of the Work any potentially hazardous waste or material generated by the Work I/We perform. I shall not dispose of such materials on any property owned and or maintained and or leased by the Owner, and

- v) I/We shall comply with the requirements of the Occupational Health & Safety Act, the Environmental Protection Act, and all regulations under those Acts, and all other applicable statutes, and I/We shall cause my workers to comply.

1.20. DECLARATION OF NON-CONFLICT & ACCEPTANCE/REJECTION OF BIDS

1.20.1 We, the undersigned hereby declare that:

- i) this Tender submission is made in good faith and without any connection, knowledge, comparison of figures, or arrangement with any other company, firm, or person making a Tender for the same Work and is, in all respects, fair and without collusion with any other bidder for this contract, and without fraud.
- ii) That representations set forth in the Tender may be relied upon as true and accurate.
- iii) No employee of the Owner or Consultant has pecuniary interest, direct or indirect, in the Tender.

1.20.2 In submitting this Bid, the Bidder recognizes that changes and or alterations to the Form of Tender and or attachments and or enclosures from the Bidder, are unacceptable and may be rejected by the Owner.

1.20.3 In submitting this Bid, the Bidder recognizes and accepts the right of the Owner to accept any bid which may be deemed to be the most advantageous to the Owner, or any part thereof, at the stipulated price submitted, or to reject any or all bids. The bidder acknowledges that the Owner may rely upon criteria in which the Owner deems to be relevant even though such criteria may not have been disclosed to the bidder. 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, past performance and stipulated price. Unit Prices and or Separate Prices and or Alternate Prices and or Contractors Subcontractor selection may be considered in making final decisions relating to Contract award. These conditions will be made at the Owner's sole discretion.

1.20.4 By submitting this bid, the bidder acknowledges the Owner's sole right to utilize reductions and cost-savings in the Contract Price by the acceptance of a combination of Alternate Prices and Itemized Prices in order for the Owner to determine the lowest Contract Price. The lowest stipulated (base bid) price may not necessarily be accepted by the Board. The Board will determine the lowest stipulated price deemed to be the advantage of the Owner regardless of the stipulated (base bid) price identified.

1.21. SIGNING OF TENDER

We are submitting this Stipulated Sum Tender under a Corporate Seal as a Limited Company or witnessed as an individual, or Partnership.

PRINT COMPANY NAME: _____

PRINT NAME OF CONTACT PERSON REGARDING THIS TENDER: _____

PRINT NAME OF SIGNING OFFICER: _____

PRINT TITLE OF SIGNING OFFICER: _____

PRINT ADDRESS OF FIRM: _____

PRINT PHONE NUMBER OF FIRM: _____

SIGNATURE OF SIGNING OFFICER: _____

SIGNATURE OF WITNESS: _____

PRINT NAME OF WITNESS: _____

DATED AT _____ THIS _____ DAY OF _____ 2026

CORPORATE SEAL:

END OF STIPULATED PRICE BID FORM

1. SUPPLEMENTARY INFORMATION FORM

1.1. SUBMISSION REQUIREMENTS

Note that this **Supplementary Information Form** is to be submitted only by the LOWEST ACCEPTABLE BIDDER, to the offices of the Architect:

HOSSACK ARCHITECTURE

105-1939 IRONOAK WAY

OAKVILLE, ON L6H 3V8

PHONE: 905 815-8284

EMAIL: amayhew@hossackarch.com and admin@hossackarch.com

WITHIN TWENTY-FOUR (24) HOURS FOLLOWING ISSUANCE OF THIS FORM
(E-MAILING OF THIS FORM IS ACCEPTABLE)

1.2. TENDER BREAKDOWN

1.2.1. Cash Allowance

1.2.1.1 The value of the Cash Allowance included in the Tender Amount:

\$ 15,000.00 (excluding H.S.T.)

1.2.2. Contingency Allowance

1.2.2.1 The value of the Contingency Allowance included in the Tender Amount:

\$ 50,000.00 (excluding H.S.T.)

1.2.3. Mechanical Bid

1.2.3.1 The value of the Mechanical Bid included in the Tender Amount:

\$ _____ (excluding H.S.T.)

1.2.3.2 Name of Listed Mechanical Sub-Contractor: _____
(from list included in section 011100 - General Instructions and Summary of Work, item 1.5)

1.2.4. Electrical Bid

1.2.4.1 The value of the Electrical Bid included in the Tender Amount:

\$ _____ (excluding H.S.T.)

1.2.4.2 Name of Listed Electrical Sub-Contractor: _____
(from list included in section 011100 - General Instructions and Summary of Work, item 1.6)

1.2.5. Kitchen Equipment Bid

- 1.2.5.1 The value of the Kitchen Equipment Bid included in the Tender Amount
(not including the relocation of existing equipment to be re-used):

\$ _____ (*excluding H.S.T.*)

- 1.2.5.2 Name of Listed Kitchen Equipment Sub-Contractor: _____

1.2.6. Interior Renovation Amount – Remaining Amount (Tender Amount subtract allowances, mechanical, electrical and kitchen equipment amounts above).

1.2.6.1 \$ _____ (*excluding H.S.T.*)

The total of items 1.2.1.1, 1.2.2.1, 1.2.3.1, 1.2.4.1, 1.2.5.1 and 1.2.6.1 shall equal the Tender Amount listed on 00 21 10 Stipulated Price Bid Form).

1.3. SUPPLEMENTARY LIST OF SUB-CONTRACTORS

- 1.3.1. We, the Bidder, propose to have the following Subcontractors perform the Work on this project and these are an integral part of this Tender.
- 1.3.2. We confirm that we shall not substitute other Subcontractors for any of the Subcontractors listed below. Any such substitution shall be subject to the Consultants' and Board's approval.
- 1.3.3. Where we propose to do the Work ourselves, we so note by inserting the word, "*Contractor*".
- 1.3.4. We confirm that we have investigated their reliability, bonding abilities where required, and competence to carry out the Work as specified. We agree that no changes to this list will be made without the express written approval of the Board.
- 1.3.5. We confirm that if more than one name is given for a specific sub-trade, the Board has the right to select the preferred trade without any adjustment to the Contract Amount.

1.4. WORK DIVISION

- 1.4.1. We the Bidder confirm that the division of Work among all the subcontractors and suppliers/installers is our responsibility and we covenant that neither the Consultants nor the Board, will be requested to act as an arbiter to establish subcontract limits between Sections or Division of Work.

SPECIFICATION SECTION/SUB-TRADE	NAME OF SUBCONTRACTOR
04 21 13 Block Unit Masonry	
06 40 00 Architectural Millwork	
08 11 14 Metal Doors and Frames	
09 30 13 Porcelain Tile	
09 51 13 Acoustic Panel Ceilings	
09 65 17/19 Resilient Safety Flooring/Tile	
09 91 22 Painting	

1.5. SIGNATURE OF SUPPLEMENTARY INFORMATION FORM

We are submitting this *Supplementary Information Form* under a Corporate Seal as a Limited Company, or witnessed as an individual or partnership.

NAME OF BIDDER _____

PRINT NAME OF SIGNING OFFICER _____

PRINT TITLE OF SIGNING OFFICER _____

SIGNATURE OF AUTHORIZED SIGNING OFFICER _____

DATED AT _____ THIS _____ DAY OF _____ 2026

END OF SUPPLEMENTARY INFORMATION FORM

PART 1 GENERAL

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

The Standard Construction Document for Stipulated Price Contract, 2020 English version, consisting of the Agreement Between *Owner* and *Contractor*, Definitions, and General Conditions of the Stipulated Price Contract, Parts 1 to 12 inclusive, governing same is hereby made part of these *Contract Documents*, with the following amendments, additions and modifications. Where these amendments, additions, and modifications specifically reference a change to the Agreement, Definitions, or General Conditions, these amendments, additions and modifications shall govern.

1.1 ARTICLE A-5 – PAYMENT

- .1 Revise Paragraph 5.1 as follows:
 - .1 Revise format of the blank line and text following “subject to a Holdback of...” and insert: “Ten percent (10%) plus a **RESERVE FUND** of one percent (1%), the *Owner* shall...”
 - .2 NOTE: The Reserve Fund shall be held back on the full net value of each progress claim and shall be discharged separately from the Lien Holdback, if required, only upon the completion by the contractor of all contract deficiencies.

1.2 ARTICLE A-6 — RECEIPT AND ADDRESSES FOR NOTICES IN WRITING

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

1.3 DEFINITIONS

- .1 Add the following definition:

“19a. Submittals

Submittals are documents or items required by the *Contract Documents* to be provided by the *Contractor*, such as:

Shop Drawings, samples, models, mock-ups to indicate details or characteristics, before the portion of the *Work* that they represent can be incorporated into the *Work*; and As-built drawings and manuals to provide instructions to the operation and maintenance of the *Work*.

1.4 GC 1.1 CONTRACT DOCUMENTS

- .1 Add to the end of subparagraph 1.1.2.2:
"Except where the *Consultant* shall be indemnified as a third party beneficiary as provided in subparagraphs 9.2.7.4, 9.5.3.4 and in 12.1.3."
- .2 Add new subparagraph 1.1.7.5:
1.1.7.5 "In case of discrepancies, noted materials and annotations shall take precedence over graphic indications in the *Contract Documents*".
- .3 Add new subparagraph 1.1.7.6:
1.1.7.6 " And, in general, where discrepancies occur among various parts of the drawing or specifications, the Contractor shall provide the greatest amount of labour and/or materials to which it may refer."
- .4 Change 1.1.8 to read:
"The *Owner* shall provide the *Contractor*, without charge up to twenty (20) complete sets of the Contract Documents to perform the work. The *Contractor* may obtain additional sets of *Contract Documents* at the cost of printing, handling and shipping."

1.5 GC 2.2 ROLE OF THE CONSULTANT

- .1 Add at the end of paragraph 2.2.9. "The *Owner* and the *Contractor* shall waive any claims against the *Consultant* arising out of the making of such interpretations and findings made in accordance with paragraphs 2.2.7., 2.2.8. and 2.2.9".
- .2 Change Paragraph 2.2.14 to read:
"The *Consultant* will review and take appropriate action upon *Shop Drawings*, samples and other *Contractor's* submittals which are provided in accordance with the Contract Documents."
- .3 Add to paragraph 2.2.13:
"If in the opinion of the *Contractor* a *Supplemental Instruction* involves an adjustment in the Contract Price or Contract Time the Contractor shall within seven (7) working days of receipt of *Supplemental Instruction* advise the *Consultant* in writing accordingly. Failure to provide written notification within time stipulated shall imply acceptance of *Supplemental Instruction* by *Contractor*.

If it is the Contractor's opinion that a Supplemental Instruction, Change Order or Change Directive, as issued by the Consultant, will delay the project, the Contractor shall, within three (3) days after receipt of such Supplemental Instruction or Change Form, notify the Consultant in writing accordingly"

1.6 GC 2.3 REVIEW AND INSPECTION OF THE WORK

- .1 Add to end of paragraph 2.3.2:

"Should a designated test or inspection fail, the *Contractor* shall promptly correct and retest the work using the designated testing/inspection agency and be responsible for all costs associated with retesting."
- .2 Add to end of paragraph 2.3.3:

"In addition to the timely notice given to the Consultant of the Contractor's request for inspection, the Contractor shall notify the Owner of said inspections and the Owner shall have access for purposes of witnessing the testing and to the results thereof."
- .3 Add new paragraph 2.3.8:

2.3.8 "The *Consultant* will conduct periodic reviews of the Work in progress, to determine general conformance with the requirements of the *Contract Documents*. Such reviews, or lack thereof, shall not give rise to any claims by the *Contractor* in connection with construction means, methods, techniques, sequences and procedures, nor in connection with construction safety at the Place of the Work, responsibility for which belongs exclusively to the *Contractor*."

1.7 GC 2.4 DEFECTIVE WORK

- .1 Add new subparagraphs 2.4.1.1:

2.4.1.1 "The *Contractor* shall rectify, in a manner acceptable to the *Owner* and the *Consultant*, all defective work and deficiencies throughout the *Work*, whether or not they are specifically identified by the *Consultant*."

1.8 GC 3.1 CONTROL OF THE WORK

- .1 Add new paragraph 3.1.3:

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

1.9 GC 3.4 DOCUMENT REVIEW

- .1 Delete paragraph 3.4.1 in its entirety and substitute new paragraph 3.4.1:

3.4.1 "The *Contractor* shall review the *Contract Documents* and shall report promptly to the *Consultant* any error, inconsistency or omission the *Contractor* may discover. Such review by the *Contractor* shall comply with the standard of care described in paragraph 3.14.1 of the *Contract*. Except for its obligation to make such review and report the result, the *Contractor* does not assume any responsibility to the *Owner* or to the *Consultant* for the accuracy of the *Contract Documents*. The

Contractor shall not be liable for damage or costs resulting from such errors, inconsistencies, or omissions in the *Contract Documents*, which the *Contractor* could not reasonably have discovered. If the *Contractor* does discover any error, inconsistency or omission in the *Contract Documents*, the *Contractor* shall not proceed with the work affected until the *Contractor* has received corrected or missing information from the *Consultant*."

1.10 GC 3.5 CONSTRUCTION SCHEDULE

- .1 Add new sub-sentences .4 and .5 to paragraph 3.5.1:
 - .4 "commence Work immediately upon notification of award of the Contract, including mobilization on site within 2 weeks and provide sufficient labour for the steady progress of the Work including overtime work, if required to meet the scheduled date of completion.
 - .5 "carry out the Work to completion as rapidly as possible, or as otherwise agreed with *Owner* and *Consultant* consistent with good practice, safe working conditions and reasonable economy."

1.11 GC 3.6 SUPERVISION

- .1 Add to paragraph 3.6.1:

"and not without prior consultation with *Consultant* and *Owner*."
- .2 Add the following as Item 3.6. 3:
 - 3.6.3 "Complete qualifications of the Superintendent shall be submitted to the Consultant for approval, including references to past projects and project participants. The Consultant reserves the right to review the record of experience and credentials of the supervisory staff. This same Superintendent must remain on the project from the start of Work, through the lien period, and ***must remain on site until all deficiencies are completed and accepted***, unless otherwise approved by the Consultant and Owner's Representative."

1.12 GC 3.7 SUBCONTRACTORS AND SUPPLIERS

- .1 Refer to sentence 3.7.4: Delete entire sentence.
- .2 Add the following paragraph:
 - 3.7.7 "Should the *Contractor* inadvertently or by design, claim to include in his bid, a *Product* from a manufacturer other than a manufacturer named in the specifications, he shall provide the *Product* from a manufacturer named in the specifications at no cost to the *Owner*."

1.13 GC 3.8 LABOUR AND PRODUCTS

- .1 Change paragraph 3.8.3 to read:
 - 3.8.3 "The *Contractor* shall maintain good order and discipline among workers engaged on the Work and shall not employ or permit to be employed anyone not skilled in the tasks assigned."
- .2 Add new paragraph 3.8.4:

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

.4 Add new GC 3.8.5 to 3.8.10:

3.8.5 "*Products* which are specified by their proprietary names, or by parts or catalogue number, shall form the basis for the Specification and Contract. No substitutes for these may be used without the *Consultant's* approval in writing. Substitutes will be considered only when submitted in sufficient time to permit proper investigation by the *Consultant*. In applying for permission to use substitutes, the *Contractor* shall prove, to the *Consultant's* satisfaction, that the substitute is equal to or better than the specified product. Each application shall be accompanied by a list of properties of the specified product and the proposed substitute. No application to use substitutes will be considered unless made in this way."

3.8.6 "When requesting approval for the use of substitutes, the *Contractor* shall include in this submission any affect that the substitution may have on the *Contract Price* and/or *Contract Time*."

3.8.7 "The *Contractor* shall use all *products* in strict accordance with the manufacturer's directions except where specified otherwise. Whenever specific reference to manufacturer's directions or instructions is made in Specifications, submit copies of said instructions or directions, or both, for approval before commencing such work."

3.8.8 "Whenever more than one *product* is specified for one use, the *Contractor* may select for this use any of the *products* so specified unless the Specification or the Drawings indicate otherwise."

3.8.9 "*Products* are sometimes specified by reference to brand names, propriety names, trademarks or catalogue number or catalogue designation or symbols. In such cases, the name of a manufacturer, distributor, supplier or dealer is sometimes given to assist the *Contractor* to find a source of supply. The naming of a source of supply does not relieve the *Contractor* from his responsibly for finding his own source of supply even if the source named no longer supplies the products specified. If the *Contractor* is unable to obtain the specified product, he shall supply a substitute product equal to or better than the specified product, as approved by the *Consultant*, with no extra compensation. Should the *Contractor* be unable to obtain a substitute *product* equal or superior to the specified product and the *Owner* accepts an inferior product, the *Contract Price* shall be adjusted accordingly, as approved by the *Consultant*."

3.8.10 "The *Contractor* shall use Canadian made products where the price and quality thereof are comparable to corresponding foreign made products."

1.14 GC 3.10 SHOP DRAWINGS

.1 Add the words "AND OTHER SUBMITTALS" to the Title after SHOP DRAWINGS.

.2 Add "and *Submittals*" after the words "*Shop Drawings*" in paragraphs 3.10.1, 3.10.2, 3.10.4, 3.10.7, 3.10.8, 3.10.8.2, 3.10.9, 3.10.10, 3.10.11, and 3.10.12.

.3 Delete 3.10.3 in its entirety and substitute new paragraph 3.10.3:

- 3.10.3 "Prior to the first application for payment, the *Contractor* and the *Consultant* shall jointly prepare a schedule of the dates for submission and return of *Shop Drawings* and any *Submittals*."
- .4 Delete the words "with reasonable promptness so as to cause no delay in the performance of the Work" and replace with "within 10 working days or such longer period as may be reasonably required" in paragraph 3.10.12.
- .5 Add new paragraph 3.10.13:
- 3.10.13 "Reviewed *shop drawings* shall not authorize changes in *Contract Price* or *Contract Time*."

1.15 GC 3.11 USE OF THE WORK

- .1 add the following paragraph
- "3.11.3 "The *Owner* shall have the right to enter upon and take possession of the *Work* in whole or in part for purpose of placing fittings, furniture and equipment or other use before completion of the *Contract*, if such action does not prevent nor interfere with the *Contractor* in performing the completion of the *Contract* within the time specified. Such entry and taking possession shall not be considered as acceptance of the *Work* or parts of the *Work* or in any way relieve the *Contractor* of responsibility to complete the *Contract*. The *Contractor* shall cooperate and coordinate his work with that of the fittings, furniture and equipment installation."

1.16 GC 3.14 ADDITIONAL CONDITIONS

- .1 Add new General Condition 3.14.1
- 3.14.1 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*.
- .2 Add new General Condition 3.14.2
- 3.14.2 The *Contractor* further represents, covenants and warrants to the *Owner* that:
- .1 The personnel it assigns to the *Project* are appropriately experienced;
 - .2 It has a sufficient staff of qualified and competent personnel to replace its designated supervisor and project manager, subject to the *Owner's* approval, in the event of death, incapacity, removal or resignation.

1.17 GC 4.1 CASH ALLOWANCES

- .1 Delete paragraph 4.1.4 in its entirety and substitute new paragraph 4.1.4:
- 4.1.4 "Where costs under a cash allowance exceed the amount of the allowance, unexpended amounts from other cash allowances shall be reallocated at the *Consultant's* direction to cover the shortfall."
- .2 Delete paragraph 4.1.5 in its entirety and substitute new paragraph 4.1.5:

- 4.1.5 "The net amount of any unexpended cash allowances, after providing for any reallocations as contemplated in paragraph 4.1.4, shall be deducted from the Contract Price by Change Order."
- .3 Delete paragraph 4.1.7 in its entirety and substitute new paragraph 4.1.7:
- 4.1.7 "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 3.5, that items called for under cash allowances and items that are specified to be *Owner* purchased and *Contractor* installed or hooked up are required at the site to avoid delaying the progress of the Work."
- .4 Add new paragraph 4.1.8:
- 4.1.8 "The *Owner* reserves the right to call, or to have the *Contractor* call for competitive bids for portions of the *Work*, to be paid for from cash allowances."
- .5 Amend GC 4.1.2 to read:
- "Cash Allowances cover the net cost to the *Contractor* of services, labour, products, construction machinery and equipment, freight, unloading, handling, storage, installation, provincial sales taxes and other authorized expenses incurred in performing the work stipulated under the cash allowances, but do not include any Value Added Taxes (HST) payable by the *Owner* to the *Contractor*."
- .6 Paragraph 4.1.4: change first line to read:
- "Where the total costs expended under cash allowances exceed the aggregate amount of all cash allowances, the Contractor shall be"
- .7 Add new GC 4.1.8 and GC 4.1.9:
- 4.1.8 "Where a cash allowance covers a sub-contract, the *Owner* or the *Consultant* will call tenders for that part of the Work. Alternatively, the *Owner* of the *Consultant* may elect to have the *Contractor* call tenders and submit the results to the *Consultant*, with Contractor's recommendations, for the approval of the *Owner*. In either case, the invited bidders shall be mutually approved by the *Contractor* and the *Consultant*, and the *Contractor* shall then enter into a sub-contract with the bidder selected by the *Owner*."
- 4.1.9 "If requested by the *Consultant*, applications for payment from allowances shall be substantiated by, certified copies of all invoices and statement from suppliers or Sub-Contractors furnishing products, etc., purchased under a cash allowance."

1.18 GC 5.2 APPLICATION FOR PROGRESS PAYMENT

- .1 Paragraph 5.2.2, first line: change "dated the last day" to "dated as of the last day".
- .2 Change paragraph 5.2.7 to read:
- "Application for payment for *Products* manufactured but not yet delivered to the Place of the Work will not be considered. Applications for payment for *Products* delivered to the Place of the Work but not yet incorporated into the work, provided such *Products* are Project specific and cannot readily be used elsewhere, may be considered for payment on an individual basis and shall be supported by such evidence as the *Consultant* may reasonably require to establish the value of delivered *Products*."

- .3 Add new paragraph 5.2.8 and 5.2.9:

5.2.8 "A statutory declaration in the form CCDC Document 9A, and such additional supporting documents as the *Consultant* may reasonably require".

5.2.9 "Products delivered to the site significantly in advance of their being required for installation in the orderly process of construction will not be eligible for payment, unless approved in writing by the *Consultant* prior to delivery."

1.19 GC 5.5 PAYMENT OF HOLDBACK UPON SUBSTANTIAL PERFORMANCE OF THE WORK

- .1 Delete paragraph 5.5.3.

- .2 Delete paragraph 5.5.5.

1.20 GC 5.6 PROGRESSIVE RELEASE OF HOLDBACK

- .1 Paragraph 5.6.1, third line: change "*Owner* shall pay the *Contractor*" to read "*Owner* may pay the *Contractor*".

1.21 GC 5.8 WITHHOLDING OF PAYMENT

- .1 Add new paragraph 5.8.2:

"5.8.2 In addition to any rights the *Owner* has pursuant to the Construction Lien Act, if a lien is registered or an action commenced against the *Owner*, the *Owner* shall have the right to withhold, from any money otherwise due to the *Contractor*, the full amount claimed in the lien action plus an additional sum sufficient to satisfy all of the *Owner's* expenses relating to such lien actions, including legal and consulting costs. These funds held back, less expenses incurred, shall be released to the *Contractor* upon the full discharge of all liens and dismissal of all actions against the *Owner*."

1.22 GC 5.10 NO CLAIMS FOR ANTICIPATED PROFIT

- .1 Add new article GC 5.10 as follows:

"5.10.1 "If any change or deviation in, or omission from the Work is made by which the cost of Work to be done is decreased, or if the whole or any portion of the Work is dispensed with, or if the Contractor should stop Work or terminate the Contract in accordance with the provisions of GC 7.2, no compensation shall be claimable by the Contractor or Sub-Contractor for any loss of anticipated profits in respect thereof."

1.23 GC 6.2 CHANGE ORDER

- .1 Add new paragraph 6.2.3:

6.2.3 "The costs for the following items shall be considered to be included in the allowance for overhead and profit:

- .1 *Contractor's* head office expenses.
- .2 Wages of project managers, superintendents, assistants, watchpersons and administrative personnel.
- .3 Temporary site office expenses, including costs for telephone and facsimile machine.
- .4 Small tools.
- .5 Insurance and bonding premiums.
- .6 Record drawings.

- .7 Clean up and disposal of waste materials.
- .2 Add new paragraph 6.2.4:
6.2.4 "If the method of valuation, measurement, change in *Contract Price* and change in *Contract Time* cannot be promptly agreed upon and the change is required to be proceeded with then the *Consultant* in the first instance will determine the method of valuation, measurement, the change in *Contract Price* and *Contract Time* subject to final determination in the manner set out in Part 8 Dispute Resolution. In this case the *Consultant* will, with the consent of the *Owner*, issue a written authorization for the change setting out the method of valuation and if by lump sum his valuation of the change in *Contract Price* and *Contract Time*."
- .3 Add Items 6.2.5 through 6.2.7 as follows:
- 6.2.5 "Combined overhead and profit mark-up on Work performed by the General Contractor's own forces shall not exceed 15%. Overhead and profit shall not be charged on credits to the Contract. Where a change involves both credits and extras, overhead and profit shall apply only to a net extra."
- 6.2.6 "General Contractor's combined overhead and profit mark-up on sub-contract Work shall not exceed 10%.
- 6.2.7 "Combined overhead and profit mark-up charged by Sub-Contractor's on their own Work shall not exceed 15%.

1.24 GC 6.4 CONCEALED OR UNKNOWN CONDITIONS

- .1 Add new subparagraph 6.4.5:
6.4.5 "The *Contractor* confirms that, prior to bidding the *Project*, it carefully investigated the *Place of the Work* and applied to that investigation the degree of care and skill described in paragraph 3.14.1, 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 careful investigation undertaken prior to the submission of the bid."

1.25 GC 6.5 DELAYS

- .1 Delete the period at the end of paragraph 6.5.1, and substitute the following words:
", but excluding any consequential, indirect or special damages."
- .2 Paragraph 6.5.4, first line: after "*Consultant*" add:
"and simultaneously to the *Owner*".
- .3 Add new paragraph 6.5.6:
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, the cost of the *Consultant's* services during the period between the date of *Substantial Performance of the Work* stated in Article A-1 herein as the same may be extended through the provisions of these General Conditions and any later, actual date of *Substantial Performance of the Work* achieved by the *Contractor*.

- .4 Add new paragraph 6.5.7:

6.5.7 "The *Contractor* shall be responsible for the care, maintenance and protection of the Work, in the event of a suspension of delay in the performance of the Work."

1.26 GC 6.6 CLAIMS FOR A CHANGE IN CONTRACT PRICE

- .1 Add the words "*as noted in paragraph 6.6.3*" after the words "*of the claim*" in paragraph 6.6.5 and add the words "*and the consultant*", at the end of paragraph 6.6.5.

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

- .1 Paragraph 7.1.2, second line:
Delete the words "to a substantial degree..."

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

- .1 Add the following new paragraph 7.2.6:

7.2.6 "The provisions of this GC 7.2 shall not apply to the withholding of certificates and/or payments because of the Contractor's failure to pay all just claims promptly, or because of the registration of a lien against the place of Work."

1.29 GC 8.2 NEGOTIATION, MEDIATION, AND ARBITRATION

- .1 Add the following new paragraphs 8.2.9, 8.2.10, 8.2.11, 8.2.12., 8.2.13., 8.2.14. and 8.2.15.

8.2.9 Within five days of receipt of the notice of arbitration by the responding party under paragraph 8.2.6, the Owner and the Contractor shall give the Consultant a written notice containing:
a) a copy of the notice of arbitration
b) a copy of supplementary conditions 8.2.9 to 8.2.14 of this Contract, and;
c) any claims or issues which the Contractor or the Owner, as the case may be, wishes to raise in relation to the Consultant arising out of the issues in dispute in the arbitration

- 8.2.10 The Owner and the Contractor agree that the Consultant may elect, within ten days of receipt of the notice under paragraph 8.2.9, to become a full party to the arbitration under paragraph 8.2.6 if the Consultant:
- a) has a vested or contingent financial interest in the outcome of the arbitration;
 - b) gives the notice of election to the Owner and the Contractor before the arbitrator is appointed;
 - c) agrees to be a party to the arbitration within the meaning of the rules referred to in paragraph 8.2.6, and,
 - d) agrees to be bound by the arbitral award made in the arbitration.
- 8.2.11 If an election is made under paragraph 8.2.10, the Consultant may participate in the appointment of the arbitrator and, notwithstanding the rules referred to in paragraph 8.2.6, the time period for reaching agreement on the appointment of the arbitrator shall begin to run from the date the respondent receives a copy of the notice of arbitration.
- 8.2.12 The arbitrator in the arbitration in which the Consultant has elected under paragraph 8.2.10 to become a full party may:
- a) on application of the Owner or the Contractor, determine whether the Consultant has satisfied the requirements of paragraph 8.2.10, and;
 - b) make any procedural order considered necessary to facilitate the addition of the Consultant as a party to the arbitration.
- 8.2.13 The provisions of paragraph 8.2.9 shall apply mutatis mutandis to written notice to be given by the Consultant to any sub-consultant;
- 8.2.14 In the event of notice of arbitration given by the Consultant to a sub-consultant, the sub-consultant is not entitled to any election with respect to the proceeding as outlined in 8.2.10, and is deemed to be bound by the arbitration proceeding.
- 8.2.14 The cost of arbitration shall be apportioned against the parties hereto or against any one of them as the arbitrator may decide, as outlined in the latest edition of the Rules for Mediation of CCDC 2 Construction Disputes, except that these costs shall not include counsel fees for any of the parties to the arbitration. Counsel fees shall be paid by each party.

1.30 GC 9.1 PROTECTION OF WORK AND PROPERTY

- .1 Delete subparagraph 9.1.1.1 in its entirety and substitute new subparagraph 9.1.1.1:
- 9.1.1.1 errors in the *Contract Documents* which the *Contractor* could not have discovered applying the standard of care described in paragraph 3.14.1;
- .2 Delete paragraph 9.1.2 in its entirety and substitute the following new paragraph 9.1.2:
- 9.1.2 Before commencing any *Work*, the *Contractor* shall determine the locations of all underground utilities and structures indicated in the *Contract Documents*, or that are discoverable by applying to an Inspection of the *Place of the Work* exercising the degree of care and skill described in paragraph 3.14.1.

1.31 GC 9.4 CONSTRUCTION SAFETY

- .1 Add new paragraph 9.4.2:
9.4.2 "The Contractor shall assume the role of the "Constructor" as defined by applicable legislation."

1.32 GC 10.1 TAXES AND DUTIES

- .1 Add new paragraph 10.1.3:
10.1.3 "The *Contractor* shall, at the request of the *Owner*, assist, join in, or at *Owner's* expense, make application on behalf of the *Owner* for any exemption, recovery or refund. Provide the *Owner* with copies, or where required, originals of records, invoices, purchase orders or other documentation as may be necessary to support such application."

1.33 GC 10.2 LAWS, NOTICES, PERMITS, AND FEES:

- .1 Delete from the first line of paragraph 10.2.5 the first word, "The" and substitute the words:
"Subject to paragraph 3.14.1, the".

1.34 GC 10.4 WORKERS' COMPENSATION

- .1 Paragraph 10.4.1, change first line to read:
"Prior to commencing the Work, with each application for payment, again with the Contractor's application . . . "

1.35 GC 11.1 INSURANCE

- .1 Add new paragraph 11.1.9:
11.1.9 "Insurance shall not be terminated until the *Owner* has been notified in writing of this intention by the insured and agrees to such termination."
- .2 Delete paragraph 11.1.1.3, "Aircraft and watercraft liability insurance".
- .3 Add to paragraph 11.1.1.4, "Town of Oakville" to joint names.

1.36 GC 11.2 CONTRACT SECURITY

- .1 Add new paragraphs 11.2.3 through 11.2.7:
11.2.3 The *Contractor*, after receiving written notification from the *Owner* within forty-eight (48) hours of such notification, and prior to the signing of the Contract, shall provide a Performance Bond and a Labour and Materials Payment, Bond, each in the amount of 50% of the *Contract Price* issued by a duly incorporated and nationally recognized surety company approved by the *Owner*, guaranteeing the faithful performance of the *Contract* in accordance with the *Contract Documents* including the requirements for warranties provided for the GC 12.3 WARRANTY, and the payment of all obligations incurred in the event of the *Contractor's* default, including, but not limited to the following:
 - .1 The payment of all legal, accounting, architectural, engineering and other consultant's expenses incurred by the *Owner* in determining the extent of *Work* executed and any additional work required as a result of the interruption of the Work, and its completion.

- .2 The payment of additional expenses to the *Owner* in the form of security services, light, heat, power, and other related costs, payable over the period between the default of the *Contract* and commencement of the Work under the terms of this Article.
- 11.2.4 Without limiting the foregoing in any way, the bonds shall indemnify and hold harmless the *Owner* for and against any and all costs and expenses (including legal and Consultant services and court costs) arising out of or as a consequence of any default of the *Contractor* under this *Contract*.
- 11.2.5 The form of such bonds shall be in accordance with the latest edition of the CCDC approved bond forms, modified as may be necessary to incorporate the requirements stated herein.
- 11.2.6 The *Contractor* shall be responsible for notifying the surety company of any changes made to the *Contract* during the course of construction.
- 11.2.7 Should the *Owner* require additional bonds by the *Contractor* or any of his subcontractors, after the receipt of bids for the Work, the *Contract Price* shall be increased by all costs attributable to providing such bonds. The Contractor shall promptly provide the *Owner*, through the *Consultant* with any such bonds that may be required.

1.37 GC 12.1 INDEMNIFICATION

- .1 Add new paragraph to 12.1.7 as follows:
- 12.1.7. The Contractor shall indemnify and hold harmless the Consultant, its agents and employees from and against claims, demands, losses, costs, damages, actions, suits, or proceedings by third parties that arise out of, or are attributable to, the Contractor's performance of the Contract, provided such claims are attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property, and caused by negligent acts or omissions of the Contractor or anyone for whose acts the Contractor may be liable, and made in writing within a period of 6 years from the date of Substantial Performance of the Work as set out in the certificate of Substantial Performance of the Work, or within such shorter such period as may be prescribed by any limitation statute or the province or territory of the *Place of Work*.
- The indemnification, provided for in this paragraph shall specifically include, but shall not be limited to, all claims, demands, losses, costs, damages, actions, suits or proceedings directly or indirectly arising or alleged to arise as a result of or in connection with any scaffolding, structural Work or safe place law or any law with respect to the protection of adjacent landowners, but shall not include any claims arising solely from negligence of the party asking to be defended, indemnified or saved harmless.
- .2 Add new paragraph 12.1.8:
- 12.1.8 "If a construction lien is registered or a construction action is commenced against the *Owner* for any reason whatsoever, the *Contractor* shall satisfy all judgments and pay all costs resulting from such liens and actions and shall fully indemnify the *Owner* against any and all expenses resulting from such liens and actions, including legal costs on a solicitor and his own client basis."

1.38 GC 12.3 WARRANTY

- .1 Delete from the first line of paragraph 12.3.2 the word, "The" and substitute the words: "Subject to paragraph 3.14.1, the".
- .2 Add to paragraph 12.3.2:

"The *Contractor* warrants that the work is in compliance with the requirements of the *Contract Documents*."
- .3 Paragraph 12.3.5: change first sentence to read:

"The *Contractor* shall be responsible for obtaining Product Warranties from respective manufacturers where such warranties or extended warranties are required and/or offered by the manufacturer."
- .4 Add paragraphs 12.3.7 through 12.3.9 as follows:
 - 12.3.7 "The conditions of warranty cover all items of Work for at least 12 months and/or 1 year. Warranties are extended on all components specified in individual specification sections with specific extended warranties."
 - 12.3.8 "The Contractor shall obtain from Sub-Contractors and provide with the final documentation, forms of warranty for all items for which warranties extend beyond the one-year period as required by the specifications."
 - 12.3.9 "Upon acceptance of a deficiency correction, the warranty period shall be re-established for the period of time as originally specified."

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

Part 1 General

1.1 PRECEDENCE

- .1 This Section contains Articles prepared which represent the Owner standards and policies. In all cases this Section is intended to be read in conjunction with and to coordinate with all other Sections. In the case of discrepancy between this Section and other Sections to more stringent Articles of any applicable Section shall apply.

1.2 CONTRACT

- .1 Construct the Work under a single, lump sum, Stipulated Contract. The form of Contract for this project shall be the *CCDC-2, 2020*.
- .2 Contract includes the following Scope of Work, but is not limited to:
 - .1 Primary renovation to two (2) interior classrooms on the ground floor of the existing school and adjacent spaces as required to complete the scope of work, including the classroom above on the second floor.
 - .2 Two (2) new rooftop units and modifications to the roof structure to support the new conditions.
 - .3 Supervision and coordination of all trades to meet schedule requirements.
- .3 Project Occupancy Requirements
 - .1 Refer to completion and occupancy requirements in Section 00 21 10 – Stipulated Price Bid Form.
- .4 Cautionary Note
 - .1 Bidders, both General Contractors and Subcontractors, are cautioned that they should not submit bids or tenders if they are unsure of their ability to comply with the above stated construction/occupancy schedule and requirements, provide overtime work as necessary and/or are unwilling to be bound by the schedule and Provisions described in these documents.

1.3 RELATIONS OF TRADES

- .1 The Contract Specifications have been generally divided into trade sections for the purpose of ready reference.
- .2 The Contractor is responsible for coordinating all trades. He is solely responsible for determining the lines of demarcation between Contractor and/or trades. Neither the Consultant nor the Owner, assume any responsibility for any such determination or for any dispute arising concerning it. No extras will be considered due to any such dispute concerning either labour or materials.
- .3 Specifications and drawings form an integral part of the Contract Documents. Any subject or item omitted from one, but which is mentioned or reasonably implied in the other, shall be considered as properly and sufficiently specified and will be part of the Work.

1.4 INVITED BIDDERS

- .1 The following list of General Contractors are invited to tender this project:

1. Alies Contracting
2. Anacond Contracting Inc.
3. Design 4 General Contracting
4. Golden Gate Contracting Inc.
5. Gen-pro Construction
6. Kessab General Contracting
7. Starfleet Construction
8. TRP Construction

1.5 MECHANICAL SUBCONTRACTORS

- .1 The mechanical sub-trade is to be selected by the General Contractor from the following list for this project:

1. Anvi Services Ltd
2. Besseling Mechanical Inc.
3. CEC Mechanical Ltd.
4. Kirk Mechanical
5. L.J. Barton Mechanical Inc.
6. Mattina Mechanical Ltd.
7. Mekcon Ltd.

1.6 ELECTRICAL SUBCONTRACTORS

- .1 The electrical sub-trade is to be selected by the General Contractor from the following list for this project:

1. Best Electric Co.
2. Elite Electrical
3. Greymar Electrical Ltd.
4. Indcon Inc.
5. JMR Electric
6. LJ Barton
7. Multi Tech Corp.
8. North Star Electric
9. PHE Contractors

ADDITIONAL DRAWINGS

- .2 Consultant may furnish additional drawings to assist proper execution of the Work. These drawings will be issued for clarification only. Such drawings, however, shall have the same meaning and intent as if they were included with plans referred to in the Contract Documents.

1.6 EXAMINATION

- .1 Upon receipt of Bid Documents verify that documents are complete; notify Consultant should the documents be incomplete.
- .2 Immediately notify the Consultant upon finding discrepancies or omissions in the Bid Documents.

1.7 PRE-BID SITE EXAMINATION

- .1 Visit the Place of the Work prior to submitting a bid to understand the scope of the work.
- .2 A non-mandatory site visit has been arranged on the date and time noted in the tender invitation email.

1.8 QUERIES AND ADDENDA

- .1 Direct queries in writing by Email to:
Alexander Mayhew
Hossack Architecture
Email: amayhew@hossackarch.com and admin@hossackarch.com
- .2 Addenda may be issued during the bidding period. All addenda become part of the Contract Documents. Include costs in Bid Price.
- .3 Verbal answers are only binding when confirmed by written addenda.
- .4 Clarifications requested by bidders must be in writing not less than five Working Days before date set for receipt of bids. The reply will be in the form of an addendum, a copy of which will be forwarded to known bidders no later than two Working Days before receipt of bids.

1.9 BONDING REQUIREMENTS

- .1 Only bid submissions equal to or greater than \$300,000, must be submitted with a Bid Bond in the value of ten percent (10%) of the Total Cost and a Surety Consent in favour of the Halton Catholic District School Board. The Bid Security so submitted shall be irrevocable and valid for 30 days from closing date set for the submission of tender. The value of this contract is expected to be lower than the amount noted above, therefore, it is not expected that a bid bond is required.
- .2 The Surety Consent shall cover a Performance Bond and a Labour & Materials Payment bond, each in the amount of fifty percent (50%) of the contract price as a guarantee that the Bidder shall execute the contract upon award.
- .3 In order to be considered for award of a contract equal to or over \$300,000, the Bidder shall submit as part of their Submission, a Surety Consent (Agreement to Bond), completed by a Bonding Company.
- .4 Upon receipt of written notice from the Owner that it has been awarded the Contract, the successful Bidder shall provide, within five (5) working days of such notice, an original Performance Bond and a Labour and Material Payment Bond, each for the amount of fifty per cent (50%) of the total lump sum price, to guarantee the performance of all obligations of the Contract.

1.10 EXISTING SITE CONDITIONS

- .1 At the outset of the contract and before any other work begins, the contractor shall review all site conditions to confirm compliance with the contract documents. Failure to do so at

this initial stage shall eliminate the contractor's right to make claim regarding incorrect grades or site surface conditions at any later stage for the work.

- .2 Ascertaining the specific site and building conditions as they relate to the project is the responsibility of the contractor. Notwithstanding this overriding responsibility the consultant has made every effort to properly represent existing site conditions as they are evident at the time of tender.
- .3 Inspection of the site during the tender period is mandatory for all Contractors.

1.11 RENOVATION TO AN EXISTING OCCUPIED BUILDING

- .1 The commencement of work to this project is intended to begin while the school is occupied. Contractor is to be aware that the school is occupied and noise is to be kept at an acceptable level. Refer to specification section 01 35 23 Site Safety Protocols for Occupied Buildings for detail.
- .2 Absolutely no contracting personnel are allowed in the other parts of the school building during operating hours other than in the work areas designated within this Section under Construction Sequencing, or by express permission of the Owner and under the direct supervision of the Contractor's Site Superintendent.
- .3 *Refer also to Section 01 52 00- 'Construction Facilities' and Section 01 56 00- 'Temporary Barriers and Enclosures'*

1.12 CONSTRUCTION SEQUENCING

- .1 Basic Sequencing Outline
 - .1 Immediately upon contract award, prepare and issue a Shop Drawing list, indicating all timing and requirements for long lead items.
 - .2 Within 1 week of contract award, issue any long lead shop drawings for advance orders immediately.
 - .3 Develop and issue a Project Gantt Chart Schedule illustrating work sequence and all milestone dates to achieve completion dates submitted at Tender.
 - .4 Confirm with consultants any inconsistencies with contract documents found on site.
 - .5 Prepare and issue any remaining Shop Drawings immediately.
 - .6 Complete all renovation works such that the work is Substantially Performed by the required date for occupancy in the Contract.
 - .7 Following Substantial Performance complete deficiencies to renovations to the existing building such that project Total Completion is achieved by the required date.
 - .8 Anticipated schedule of events:

March 2026	Construction Start
August 25, 2026	Substantially Complete
Sept. 2, 2026	Totally Complete
- .2 Coordinate Schedule and Sequencing as indicated in Section 01 33 00 – Submittals and Section 01 22 00 – Meetings and Progress Reports
- .3 Coordinate sequencing with all trades and advise sub-trades of these sequencing requirements prior to the close of Tenders.

1.13 CONTRACTOR PARKING

- .1 Refer to section 01 52 00 - Construction Facilities.

1.14 BYLAWS, PERMITS AND APPROVALS

- .1 Nothing indicated on the Drawings or Specifications is intended to be in conflict with any law, by-law or regulation of Municipal, Provincial, or similar Authority Having Jurisdiction.
- .2 Work of this Contract must conform with such laws, by-laws and/or regulations. Any required variation to, or deviation from, the drawings and specifications, shall be performed in accordance with the Contract contained in these specifications.
- .3 Furnish inspection certificates and/or permits as may be applicable as evidence that the installed Work conforms with laws, by-laws and regulations of Authorities Having Jurisdiction.
- .4 Each subtrade shall obtain and pay for all permits and licenses required by Municipal, Provincial, or other authorities having Jurisdiction, particular to their trade.
- .5 It is the final responsibility of the General Contractor to obtain all the required approvals and permits and include in his Total Stipulated Price, the cost of such approvals, permits and fees. The only exception is the Building Permit, which has been applied for by the Consultant and paid for by the Owner.
- .6 Any revisions or deviations to Contract Documents required by any Authorities Having Jurisdiction must be reviewed by the Consultants before implementation.

1.15 ORGANIZATION

- .1 Organize the Work of each section as required for satisfactory and expeditious completion of the Work. Take field dimensions required for the Work. Fabricate and install work to suit field dimensions and conditions.
- .2 If applicable, take into account existing work to ensure best arrangements of components in available space. Contact the Consultant prior to commencing Work in critical locations and interface with other Contractors' Work.
- .3 Provide all forms, templates, anchors, sleeves, inserts and accessories required to be installed in the Work. Set in place, or instruct the applicable subtrade as to their location. Pay costs of extra work, if required, as a result of a failure to comply with these requirements at the proper time.
- .4 Before starting his work and from time to time as the work progresses, each Subcontractor shall examine the work and materials installed by the other Subcontractors insofar as it effects his own work, and the General Contractor shall promptly notify the Consultant IN WRITING, if any condition exists that will prevent any Subcontractor from giving a satisfactory result in his own work.
- .5 Should any Subcontractor start his own work without such notification, it shall be construed as an acceptance by him of all preceding work and as a waiver of all claims or questions as to its suitability for receiving his work.

1.16 CANADIAN PRODUCTS AND LOCAL LABOUR

- .1 To the extent that the same are available and consistent with the proper economy and expeditious completion of the Contract, Canadian equipment, materials, products and other such applicable items are preferred by the Owner to be used in the Work, wherever possible and practical.

1.17 MATERIALS AND WORKMANSHIP

- .1 All materials shall be new and the best of their respective kinds, where a specific grade or brand is not indicated. Pre-packaged materials shall be delivered and stored in unopened containers.
- .2 All work performed under this Contract shall be done by mechanics skilled in their respective trades. They shall make use of such templates, jigs or special tools as may be required for the operation involved.
- .3 The acceptance of any materials or workmanship shall not be a bar to their subsequent rejection, if found defective.
- .4 Adequate, dry storage facilities shall be provided and all stored materials shall be protected from damage and theft.
- .5 All Contractors will do Work in accordance with the best industry practice of the type of work specified, unless the Contract Documents stipulate more precise requirements, in which case, the more precise requirements shall govern.
- .6 Do Work in a neat, plumb & square manner. Ensure that various work components are properly installed, forming tight joints and appropriately aligned junctions, edges and surfaces, free of warps, twists, waves, or other such irregularities.
- .7 Wherever indicated on the drawings or specifications, or in the manufacturers' / suppliers' written instructions, arrange to have manufacturers' / installer's representatives inspect the Work which incorporates their materials, products or items.
- .8 Do not permit materials to come in contact with other materials such conditions may result in corrosion, staining, discolouration or deterioration of the completed Work. Provide compatible, durable separators where such contact is unavoidable.
- .9 The design of the Work is based on the full interaction of its component parts. No provisions have been made for conditions occurring during construction. Ensure that no part of the Work is subjected to a load which will endanger its safety or which might cause permanent deformation.
- .10 Conceal pipes, ducts, conduit, wiring and other such items requiring concealment preferably in, wall or ceiling construction of all finished areas. If in doubt as to method of concealment, or intent of the Contract Documents in this regard, request clarification from the Consultant before proceeding with the Work.
- .11 Lay out mechanical and electrical work well in advance of concrete placement and furring installation to allow for proper concealment. Test and inspect Work before applying pipe covering and before it is concealed.

- .12 Provide and maintain control lines and levels required for the Work. Lay out the Work in accordance with these lines and levels and dimensions indicated on the drawings.
- .13 Verify lines, levels and dimensions and report any errors or inconsistencies on the drawings to the Consultants.
- .14 Final responsibility of satisfactory completion of all the Work, however, lies with the General Contractor.

1.18 QUALITY CONTROL

- .1 Refer also to Section 01 45 00.
- .2 The Consultants and authorized Owner staff shall have access to all areas of the Work, including any off site construction facilities.
- .3 The General Contractor shall give timely notice requesting inspection if Work is designated for special tests, inspections, or approvals by the Consultants, or any other authorized Owner staff or testing and Inspection Company.
- .4 If the General Contract covers, or permits to be covered Work that has been designated as outlined above, he shall uncover such work, have the inspections and tests satisfactorily completed and make good such work at no additional cost to the Owner.
- .5 The Consultants or the authorized Owner Staff may order any part of the Work to be examined, if such Work is suspected not to be according to the Contract Documents. If, upon examination, such work is found not to be in accordance with the Contract Documents, then the General Contractor shall correct such Work and pay for cost of examinations and correction. If such Work is found to be in full accordance with the Contract Documents, the Owner shall pay for the cost of examination and making good.
- .6 If defects are revealed during inspection and/or testing, the appointed agency may request additional inspection and/or testing to ascertain the full degree of defects. The General Contractor shall correct the defects and irregularities as reported by the inspection and/or testing agency, at no additional cost to the Owner and the General Contractor shall pay all associated costs for retesting and re-inspection.
- .7 The General Contractor shall provide any tools, materials or equipment that may be required by the inspection and/or testing agencies in retesting the Work.
- .8 The employment of inspection and/or testing agencies does not, in any way, affect the General Contractor's responsibility to perform the Work in strict accordance with the Contract Documents.
- .9 The General Contractor shall remove all defective work, whether the result of poor workmanship by him or his subtrades, use of defective or damaged products, whether or not incorporated into the Work and any Work that has been rejected by the Consultants or authorized Owner Staff as failing to conform to the Contract Documents. Replacement and execution of the affected Work shall be done in full accordance with the Contract Documents, making good other trades' work damaged by such removals or replacements at no additional charge to the Owner.

- .10 If, in the opinion of the Consultant and/or the authorized Owner Staff, it is not expeditious to correct the defective Work, or Work not performed in accordance with the Contract Documents, the Owner, may, at its sole discretion, deduct from the Contract Price, the difference in value between the work performed and that required by the Contract Documents, the amounts of which shall be determined by the Consultant.

1.19 OVERTIME AND OVERTIME SCHEDULING

- .1 The General Contractor must include in his Total Stipulated Tender Price, all costs for overtime work which may be necessary to complete the various portions of the Work, in accordance with the Completion Dates specified in the *Tender Form*. The Owner shall not entertain requests for any payments in connection with overtime work that may be required by the General Contractor, or any of his subtrades, in order to comply with the above referenced dates.
- .2 Similarly, it is the Contractor's responsibility to ensure, prior to the close of tenders that all subtrades will meet the requirements for overtime, as required, with no additional costs to the owner, in order to meet the Completion Dates specified in the Form of Tender.
- .3 The contractor shall recognize the critical importance that the schedule for full occupancy must be met by the dates stated in the *Tender Form*. Note that local by-laws may be enforced restricting morning and evening and Sunday work hours.
- .4 Note that at no time will the Owner entertain additional charges or claims from the General Contractor or his subcontractors for premium, overtime or after-hours work.
- .5 Only claims for scope changes or conditions beyond the control of the Contractor may be submitted for review by the Consultants and must be submitted and accepted in advance of the work taking place and at the outset of the condition or scope change arising. No claims additional charges or delays will be accepted if not reviewed and formally accepted in advance.

1.20 PROTECTION OF OTHER WORK

- .1 Each trade shall avoid damage to other trades and shall take all measures necessary and provide all masking and materials necessary, to provide adequate protection.
- .2 Each Subcontractor shall be held responsible for all damage to work installed by others that is caused by this work or by anyone employed by him.
- .3 Patching and repairing of damaged work shall be done by the Contractor who installed the work, as directed by the Consultant, but the cost of same, shall be paid for by the Contractor who is responsible for the damage.

1.21 FASTENINGS

- .1 All fastenings must be permanent, of same metal, or compatible with any metals with which they are in contact, of adequate size and spacing, to ensure permanent anchorage against load or shear.

- .2 Exposed fastenings must be evenly spaced, neatly laid out and must not mar surfaces of prefinished materials.
- .3 No ram-setting or similar techniques will be permitted, without prior written approval of the Consultant.

1.22 SUPPLY AND INSTALL

- .1 Unless specifically noted, “*supply only*”, any reference to supply intends the **supply and installation** of material or item so noted.

1.23 OCCUPATION BEFORE COMPLETION

- .1 If the General Contractor, for any reason, does not have the Project completed by the specified completion date and the Owner, of necessity, is forced to occupy any part of the building before the whole of the Work is completed, the Contractor will not be entitled to any indemnity for interference with his operation.

1.24 GENERAL REQUIREMENTS

- .1 All Contractors shall examine carefully all drawings and specifications to inform themselves fully of all conditions and limitations pertaining to the work of the contract.
- .2 All Contractors shall co-operate and co-ordinate their work for the proper completion of the work, including co-ordination of delivery dates and commencement of subtrades work.
- .3 The responsibility and costs for all work, including temporary structures, shoring, shoring design (if applicable) and erection shall at all times rest with the General Contractor and his Subcontractors. The Consultant will review construction methods and shop drawings for general arrangements only. The method of obtaining the results contemplated by the Contract Documents shall be determined by the General Contractor.
- .4 The undertaking of period site review by the Consultant or Owner Representative shall not be construed as supervision of actual construction, nor make them responsible for providing a safe place for work, visit, use, access, travel, or occupancy of the Consultant’s or Owner’s employees or agents.
- .5 The General Contractor shall be fully responsible for coordinating and expediting the work of all Subcontractors and shall employ the necessary and qualified personnel to provide the required quality of labour and materials and to prevent delays in the progress of the project. Each trade shall be afforded all reasonable opportunities for the installation of its work and for the storage and handling of its materials.

1.25 COORDINATION

- .1 The General Contractor shall coordinate all work and preparation on which subsequent work depends to facilitate mutual progress, and to prevent any conflict.
- .2 The General Contractor shall ensure that each trade makes known, for the information of the General Contractor and other trades, the environmental and surface conditions

required for the execution of its work; and that each trade makes known the sequence of others' work required for installation of its work.

- .3 The General Contractor shall ensure that each trade, before commencing work, knows the requirements for subsequent work and that each trade is assisted in the execution of its preparatory work by trades whose work depends upon it.
- .4 The General Contractor shall ensure that shop and layout drawings, templates, and all information necessary for the location and installation of materials, openings, inserts, anchors, accessories, fastenings, connections and access panels are provided by each trade whose work requires cooperative location and installation by other trades and that such information is communicated to the applicable installer.
- .5 The General Contractor shall ensure that delivery of materials supplied by one trade to be installed by another is well before the installation begins.
- .6 The General Contractor shall inform all trades that giving installation information in error, or too late to incorporate in the work, shall be responsible for any extra work caused thereby, unless impractical and where required, cutting shall be done by each respective trade, and patching shall be done by the general contractor.

1.26 ACCESS TO THE PROJECT

- .1 The General Contractor for this Work shall, at all times allow the Consultants, the Owner, or any other Owner commissioned contractor or their employees, access into the building or around the premises, undisturbed, whether union or non-union, as may be required in the execution of other portions of the building work and installation of equipment, etc.
- .2 The General Contractor shall cooperate fully with any and all Owner commissioned Contractors.

1.27 SUBTRADE AWARDS

- .1 The Contractor shall, on notice of award of the contract, obtain the Consultants approval of a complete list of all persons or firms to which he proposes to sublet any part of the work, the trades or divisions of work which are to be sublet to each, and the amount of each trade. The General Contractor shall provide to the Consultant a financial breakdown showing all divisions of the work amounting to the full sum of the contract. Mechanical and Electrical trades shall be further broken down as specified in Divisions 26 and 33.

1.28 SAFETY DATA SHEETS

- .1 The General Contractor shall ensure that the following material and safety data sheets are submitted prior to commencing installation and application of at least the following:
 - .1 Lead-free solder
 - .2 Resilient flooring
 - .3 Painting and finishing
 - .4 Fertilizers
 - .5 Glues and adhesives

- .6 Pesticides
- .7 Herbicides
- .8 Any other product which may give off air borne particles after installation.
- .9 Sealants and caulking
- .2 The General Contractor and all of his Subcontractors must note that specifically, Asbestos and Asbestos containing materials solder for piping containing lead, and Painting & Coatings containing lead and/or mercury must be excluded from any part of the Work.
- .3 Contractor The General must submit Certificates of Compliance, prior to the application for Substantial performance, for each of the following items:
 - .1 An affidavit relative to the use of Lead-free solder for all domestic water lines, regardless of location.
 - .2 Products for which Material Safety Data Sheets have been submitted and accepted.
 - .3 Other Work/Products identified in the Contract Documents as requiring a Certificate of Compliance.
- .4 Each Certificate of Compliance must indicate names and addresses of the project, the Owner, the date of Issue, produce description including name, number, manufacturer, with a statement verifying that the Work/Product installed meets specified requirements and, if applicable, complies with the submitted and accepted Material Safety Data Sheets.
- .5 Each Certificate of Compliance must be issued on the trade's letterhead, properly executed, under whose work the respective Work/Product has been provided.
- .6 Each Certificate of Compliance must be endorsed by the General Contractor with his authorized stamp/signature.

1.29 REGULATING DOCUMENTS

- .1 The General Contractor and all of his Subcontractors, Suppliers/Installers etc., must conform to the latest editions in force at the time of tender of each and all of the following: Ontario Building Code, Canadian Electrical Code (CEC), The Occupational Health and Safety Act, Ontario, the National Fire Code, the local Municipal Fire Code, and all other applicable Codes and Building By-Laws. All must also conform to the requirements of the Authorities Having Jurisdiction, such as Public Utilities. Where required under the Occupational Health and Safety Act, engage a Professional Engineer to design hoarding, scaffolding and shoring, formwork and falsework for concrete.
- .2 Contract forms, codes, standards and manuals referred to in these specifications are the latest published editions at the date of close of tenders. The General Contractor and all of his Subcontractors, Suppliers/Installers must meet or exceed the requirements of specified standards.
- .3 Provide, on site, copies of documents referred to in the Specification for joint use of Contractor and Consultant.

1.30 SITE SUPERINTENDENTS AND PROJECT MANAGERS

- .1 It is the requirement under the work to this Contract that the Contractor provide on-site, full-time, *Site Superintendent* for the entire project duration through to the end of Deficiency completion. Superintendent shall have qualifications of previous experience with similar projects. Superintendent shall remain assigned full time to the project until completion of all deficiencies. This is a base bid requirement and the Contractor shall include this cost in the Tender Amount.

1.31 GENERAL CONTRACTOR'S RESPONSIBILITIES

- .1 The list of General Contractor's responsibilities identified below is by no means comprehensive, nor is it in any priority or critical order. It is here, merely to identify the most often forgotten or ignored responsibilities of the General Contractor and is reproduced only as a reminder. The Consultants and the Owner advise the General Contractor that it is he who is responsible for all aspects and facets of the Project, from start to completion, from compliance with Occupational Health and Safety regulations to compliance with all codes and statutes.
 - .1 The General Contractor 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.
 - .2 All equipment shall be in safe operating condition and appropriate to the task.
 - .3 Only competent personnel will be permitted on site. During the site introduction, *only the Consultant* will determine who is competent. The General Contractor will cause to remove from the site any persons not observing or complying with safety requirements.
 - .4 The General Contractor shall comply with, and shall ensure that all of his Subcontractors, Suppliers, Installers etc., comply with all Federal, Provincial and Municipal Safety Codes and Regulations and the Occupational Health and Safety Act.
 - .5 The General Contractor shall supply competent personnel to implement his safety program and ensure that all Subcontractors comply with the Owner's standards, and those of the Occupational Health and Safety Act.
 - .6 The Owner will provide periodic monitoring to ensure that safety requirements are met, and that safety records are properly kept and maintained. Continued disregard for safety standards can cause the Contract to be canceled and the General Contractor removed from the site.
 - .7 The Owner may hire Commissioners to perform inspections of building systems at the closing stages of the work of this contract. The General Contractor shall cooperate with and coordinate the work of the Owner's Commissioners on site.
 - .8 The General Contractor will report to the Owner and Jurisdictional Authorities any accident or incident involving personnel and/or property of the Contractor, Owner, or Public, arising from the General Contractor's or any of his Subcontractors' execution of the work.
 - .9 The General Contractor will include all provisions of this contract in any agreement with Subcontractors, and hold them equally responsible for safe work performance.
 - .10 If the General Contractor is responsible for a delay in the progress of the work due to an infraction of legislation or Owner Health and Safety requirements, the

Contractor will, without additional cost to the Owner, work such overtime, and acquire and use for the execution of the work such additional labour and equipment as to be necessary in the sole opinion of the Owner's Representative and Consultant, to avoid delay in the final completion of the work or any operations thereof.

1.32 MANUFACTURERS' INSTRUCTIONS

- .1 Unless otherwise specified, the General Contractor and all his Subcontractors shall comply with manufacturer's latest printed instructions for materials and installation methods.
- .2 The General Contractor shall notify the Consultant in writing of any conflict between the Specifications and Manufacturer's Instructions and have same clarified.

1.33 FIRE SAFETY

- .1 The General Contractor and all of his Subcontractors must comply with requirements of standard for Building Construction Operations FC No. 301-1982, issued by the Fire Commissioner of Canada.
- .2 The appropriate clauses of the Ontario Building Code relating to fire protection shall be strictly followed.
- .3 The General Contractor shall provide and maintain free access to temporary or permanent fire hydrants acceptable to local fire department.

1.34 CONSTRUCTION SAFETY

- .1 The General Contractor and all his trades must observe and enforce construction safety measures required by Canadian Construction Safety Code, Workplace Safety & Insurance Owner, and Municipal statutes. In particular, the Ontario Construction Safety Act, the regulations of the Ontario Department of Labour and Ontario Hydro Safety Requirements shall be strictly enforced. In event of conflict between any provisions of above authorities the most stringent provisions will apply.
- .2 The General Contractor is reminded, once again, that it is he who is responsible for Occupational Health and Safety on this Project. The items listed below are only guidelines of the Owner's expectations in this regard and not to be construed to be comprehensive or total in nature.
- .3 The Owner will take every reasonable precaution to prevent injury or illness to members, employees and the public, participating in Owner activities, or performing their duties. This shall be accomplished by providing and maintaining a safe, health working environment by providing the education necessary to perform these activities or duties safely.
- .4 The Owner is vitally interested in the health and safety of all Contractors and their workers performing work for the Owner. Cooperation and support of the General Contractor in the protection of workers from injury or occupational disease is a major, continuing object of the Owner. To achieve these goals, the Owner, in concert with the Contractors, will endeavor to make every effort to ensure that the Contractors provide a work site which is a safe and healthy work environment. The Owner insists that all

Contractors and their workers are dedicated to the continuing objective of reducing risk and injury.

- .5 The General Contractor covenants and agrees to comply with all statutory and other obligations, including, without limitation, the provisions of the Occupational Health and Safety Act (Ontario) and all Regulations thereto, and all amending and successor legislation, including without limitation, Bill 208 (the “Act”) in connection with all work performed by either the Contractor, Subcontractors, or any Other Contractor on, or in connection with, the Project.
- .6 Without limiting the foregoing, for the purposes of this Contract, the General Contractor agrees that **he** shall be the “constructor” of the Project within the meaning of the Act, and as such, shall assume all the obligations and responsibilities, and observe all construction safety requirements and procedures, and duties of inspection imposed by the Act on the “constructor”, as therein defined, for all work and services performed by the General Contractor, Subcontractors and Other Contractors on or in connection with the Project.
- .7 The General Contractor further covenants and agrees that the Owner and its existing and former officers, trustees, employees and agents, and their respective heirs, executors, administrators, successors and assigns (hereinafter collectively referred to as the “Owner”) shall be released from any obligations or liabilities otherwise imposed on the Owner, or on any of them, pursuant to the Act in connection with the Project, and that the General Contractor shall assume all liability and responsibility in connection with same.
- .8 The General Contractor agrees to save harmless and indemnify the Owner from any losses, damages, costs and expenses of any kind, or nature whatsoever, including all legal expenses, and all defense costs and related expert or consulting fees, incurred by the Owner, or any of them, arising in connection with the failure, default, or inability of the General Contractor of the Owner, or any of them, to comply with any of the aforementioned statutory, or other legal requirements, or arising in connection with any breach by the General Contractor of any of its covenants, agreements and obligations under this Contract.
- .9 The General Contractor shall inform and instruct Other Contractors that they, while performing work on this project, are under the authority of the Contractor. Other Contractors are to discuss and co-ordinate with, and follow instructions from, the General Contractor on all matters of site access, vehicles, deliveries, storage, temporary facilities, coordination with the work of other subcontractors, work methods, scheduling, labour conditions, construction safety, environmental protection, security and all other matters which relate to the safe and proper execution of construction work.
- .10 The General Contractor shall ensure that all supervisory personnel on job site are fully aware of the procedures and requirements outlined above and comply with all requirements specified.
- .11 All Contractors are responsible to ensure that all machinery and/or equipment are/is safe and that the workers perform their tasks in compliance with established safe work practices or procedures. Workers must receive adequate training in their specific work tasks to protect their health and safety.
- .12 The General Contractor shall be responsible for all persons and companies performing work, including Other Contractors, on this project, at all times, up to and including, the

date of Substantial Performance of the Work. Authority for coordination and instructions relating to all matters which relate to the safe and proper execution of construction work shall rest with the General Contractor. The Contract Price must include the General Contractor's fees for the coordination and supervision of the work of all Other Contractors.

- .13 In addition to the responsibility of all contractors as outlined above, Subcontractors will be held accountable for the health and safety of workers under their supervision.
- .14 Every worker must protect his/her own health and safety by working in compliance with the law and with safe work practices and procedures established by the authorities having jurisdiction.
- .15 All sections of the Occupational Health and Safety Act for Industrial Establishments, latest edition, and the Occupational Health and Safety Act for Construction projects, latest edition, shall be enforced, by the General Contractor, in their entirety, throughout the duration of the construction project.
- .16 The General Contractor shall provide the Consultant with the telephone number where the General Contractor or his representative can be reached at any time, day or night, for the duration of the contract.
- .17 Where an accident, explosion, or fire causes a person injury at the work place, and the worker is disabled from performing the usual task, the General Contractor shall prepare a written notice and shall forward same to the Ministry of Labour within four days of the occurrence with a copy to the Owner's Representative, who shall copy and inform the Owner's Supervisor of Health and Safety and/or the Owner's Joint Health and Safety Committee, containing such information and particulars as may be described.
- .18 Where a person is killed or critically injured from any cause at the work place, the General Contractor shall immediately call the Ministry of Labour. A written notice from the General Contractor shall be given to the Ministry of Labour within forty-eight hours after the occurrence, containing such information and particulars as may be prescribed, with copies to the Architect and the Owner's Representative.
- .19 The General Contractor is advised that the accident scene is under the jurisdiction of the Ministry of Labour and no wreckage, articles, etc., shall be interfered with, disturbed, destroyed, altered or carried away at the scene, or connected with the occurrence, until the Ministry of Labour has given permission.

1.35 INDEPENDENT TESTS AND INSPECTIONS

- .1 The Contractor shall appoint inspection firms as directed by the Consultant and make payments from the Cash Allowances specified in Division noted, except for the following, which shall be included in the contract:
 - .1 Inspection and testing required by laws, ordinances, rules, regulations or orders of public authorities.
 - .2 Inspection and testing performed exclusively for Contractor's convenience.
 - .3 Testing, adjustment and balancing of mechanical and electrical equipment and systems.

- .4 Mill tests and certificates of compliance.
- .5 Re-testing as already described in *Quality Control* of this Section.
- .2 The Consultant will authorize payment of inspection services from specified cash allowances.
- .3 The General Contractor shall furnish labour and facilities to:
 - .1 Provide access to work to be inspected and tested.
 - .2 Facilitate inspections and tests.
 - .3 Make good work disturbed by inspection and test.
 - .4 Pour concrete test cylinders and store as directed by Inspection Firm.
- .4 The General Contractor shall notify Inspection Firms sufficiently in advance of operations to allow for assignment of laboratory personnel and scheduling of test.
- .5 Where materials are specified to be tested, the General Contractor shall deliver representative samples in required quantity to testing laboratory.

1.36 PERIODIC CLEANING

- .1 Refer also to Section 01 74 11.
- .2 As part of the Tender, the General Contractor shall provide all necessary garbage bins through the duration of the project. The General Contractor shall ensure that the following is accomplished:
 - .1 Keep all areas of the Work clean and orderly, free from accumulation of dirt, debris, garbage, oily rags, excess material, or such other trash items. Remove such items for all areas of the Work on a daily basis.
 - .2 Vacuum and/or broom interior building areas when ready to receive painting and other finishes. Continue cleaning on an “as needed” basis until the building is ready for inspection and takeover.
 - .3 Schedule cleaning operations so that resulting dust and other contaminants do not affect wet, newly painted surfaces.
 - .4 In preparation for Substantial Performance and Occupancy, conduct inspections of all exposed interior and exterior surfaces.
 - .5 Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials from all exposed interior and exterior finishes, including glass and other polished surfaces.
 - .6 Remove all protective film from switch plates and hardware, particular kick plates.
 - .7 Clean lighting reflectors, lenses and other lighting surfaces.
 - .8 Broom clean paved surfaces and rake clean other disturbed surfaces in the area of the Work, to remove site debris caused by the Work of this Contract. Inspect for damages and make good.
 - .9 Remove debris and surplus materials from the roof areas and accessible concealed spaces.

- .10 Replace heating, ventilation and/or air conditioning filters through the entire building to the extent that they supply or return from the work areas, whether or not, the units were operated during construction operations.
- .11 Refer to “cleaning” sections of the specifications for additional specific periodic and final clean up requirements.

1.37 TEMPORARY PROTECTION

- .1 Properly protect the Work from any damage by the elements. In cold weather cover all exterior openings in the work areas likely to cause water damage.
- .2 During off hours and/or stages of suspended operations for whatever reasons, the General Contractor must assume all responsibility for protection against the elements, theft and/or vandalism. This applies to all work in progress and to any materials, products, tools, equipment, or other such items left at the work site.
- .3 Properly protect floors and roofs from any damage. Take special precautions when moving heavy loads or equipment over floors and roofs.
- .4 The General Contractor must keep floors free of oils, grease or other such materials likely to discolour them and/or affect bonding of applied surfaces.
- .5 The General Contractor must ensure that no part of the Work is loaded greater than it was designed for, when completed. Make any temporary support as strong as the permanent support. Place no load on concrete structure until it has sufficient strength to safely bear such load.
- .6 Protect glass and other finishes against heat, slab and weld splatters, using appropriate protective shields and covers.
- .7 The General Contractor must provide and maintain, in good working order, appropriately labeled ULC fire extinguishers, to the approval of Authorities Having Jurisdiction.
- .8 The General Contractor must provide a minimum of two safety helmets on site at all times for the use of the Consultant and any other Owner authorized visitors to the site. It is the General Contractor’s responsibility to make certain that any such visitors wear the protective headgear and any other safety gear which may be necessary at that particular time of construction.

1.38 COMPLETION

- .1 Upon completion of the Work, all protection erected shall be removed, all damage to the Work and adjoining Work due to the lack or failure of such protection shall be made good and all debris, surplus materials tools equipment shall be removed from the work areas and the site, and the Project shall be left clean and tidy to the full and complete satisfaction of the Consultant and Owner Staff. The General Contractor shall give written notice to the Consultant, requesting final inspection of the completed Project.
- .2 Refer to the pertinent sections of the Specifications for requirements with respect to submission of *Record Documents, Maintenance Materials, Special Tools and Spare Parts*.

1.39 CONTINGENCY ALLOWANCE

- .1 Include in the Contract Price, a Contingency Allowance in the amount of **fifty thousand dollars, (\$50,000.00) not including HST.**
- .2 Expend Contingency costs as directed by the Consultant, in writing, in accordance with the Contract
- .3 Contractor's charges for expenses and profit on Contingency cost expenditure shall not be included in Contract Price. Refer to the Contract for percentages of mark-ups.
- .4 Such charges shall be added to the net trade cost of each expenditure from the Contingency Allowance at the percentage rates noted in the Bid Documents.

1.40 CASH ALLOWANCES

- .1 Include in the Contract Price, a Cash Allowance in the amount of **fifteen thousand dollars, (\$15,000.00) not including HST.**
- .2 Cash Allowances, unless otherwise specified, cover the net cost to the General Contractor of services, products, construction, machinery and equipment, freight, handling, unloading, storage installation and other authorized expenses incurred in performing the Work.
- .3 The Contract Price, *and not the Cash Allowance*, includes the General Contractor's profit and coordination costs in connection with all Cash Allowance expenditures.
- .4 The Contract Price will be adjusted by written order by the Consultant to provide for an excess or deficit to each Cash Allowance. Any unused portions of these allowances shall be returned to the Owner on the conclusion of the Contract.
- .5 A schedule shall be prepared jointly by the Consultant and the General Contractor to show when items called for under Cash Allowances, so that the progress of the Work is not delayed.
- .6 Exclusive of Deposits, which are the contractor's sole responsibility to provide as required of Authorities Having Jurisdiction, the following is a summary of the scope Cash Allowances to be included in the contract:
- .7 Expend both Cash Allowances as directed by the Consultant in writing. Allowances will be adjusted to actual cost with no adjustment to Contractor's charges. Cash expenditure must identify the H.S.T. separately.
- .9 Cash Allowance Breakdown of Items
 - .1 Testing and Inspections
 - .2 Preparation of digital As-Built Drawings (by consultants)
 - .3 Finish Door Hardware
 - .4 Interior Signage
 - .5 Window coverings (roller shades)

1.41 ALLOWANCES CARRIED IN DIVISIONS 15 AND 16

- .1 Not Applicable

1.42 SCHEDULE OF ALLOWANCES

- .1 Material Allowances shall include the following:
 - .1 Net cost of Material
 - .2 Applicable taxes and duties
 - .3 Delivery to site
- .2 For Material Allowance, the contract shall include:
 - .1 Handling at site, including unloading, uncrating, storage and hoisting
 - .2 Protection from elements, from damage
 - .3 Labour, installation and finishing
 - .4 Other expenses required to do cash allowance work (i.e. contract co-ordination)
 - .5 Overhead and profit
- .3 Material and Installation Allowances shall include the following:
 - .1 Net cost of material
 - .2 Applicable taxes and duties
 - .3 Deliver to site
 - .4 Handling at site, including unloading, uncrating, storage and hoisting
 - .5 Labour, installation and finishing

1.43 POLYCHLORINATED BIPHENYL (PCB)

- .1 Conform to the Environmental Protection Act and Regulations, Ontario Regulation 11/82 as amended.

1.44 USE OF CONSULTANTS'S DIGITAL DRAWINGS

- .1 Where a contractor wishes to obtain a digital copy of consultant drawings for shop drawings or survey purposes, the consultant may elect to provide this drawing for a nominal fee. As this is the consultants' option, the contractor shall not anticipate provision of these digital drawings to meet the contract schedule.

1.45 BUILDING DIMENSIONS

- .1 Ensure that all necessary job dimensions are taken and all trades are co-coordinated for the proper execution of the work. Assume complete responsibility for the accuracy and completeness of such dimensions, and for co-ordination.
- .2 Verify that all work, as it proceeds, is executed in accordance with dimensions and positions indicated which maintain levels and clearances to adjacent work, as set out by requirements of the drawings, and ensure that work installed in error is rectified before construction resumes.
- .3 Check and verify all dimensions referring to the work and the interfacing of all services. Verify all dimensions, with the trade concerned when pertaining to the work of other

trades. Be responsible to see that Subcontractors for various trades co-operate for the proper performance of the Work.

- .4 Avoid scaling directly from the drawings. If there is ambiguity or lack of information, immediately inform the Consultant. Be responsible for any change through the disregarding of this clause.
- .5 All details and measurements of any work which is to fit or to conform with work installed shall be taken at the building.
- .6 Advise Consultant of discrepancies and if there are omissions on drawings, including layout of items which affect aesthetics, or which interfere with services, equipment or surfaces. DO NOT PROCEED without direction from the Consultant.
- .7 Prepare interference drawings AND SUBMIT AS SHOP DRAWINGS IN ADVANCE OF PRODUCTION to properly co-ordinate the work in all ceiling spaces and where necessary. Coordinate these drawings with all Divisions. Refer also to Section 01 33 00.

1.46 SETTING OF WORK AND REQUIRED SURVEYS

- .1 This article not applicable to this project.

1.47 LAYOUT OF WORK

- .1 Layout work with respect to the work of all trades. Arrange mechanical and electrical work such as piping, ducts, conduits, panels, equipment and the like to suit the architectural and structural details.
- .2 Alterations necessary due to conflict and interference between trades, to be executed at no cost to the Owner unless notification is given in writing before Tender Closing Date.

1.48 DOCUMENTS REQUIRED AT START, DURING & CLOSE-OUT OF CONSTRUCTION

- .1 At Commencement of Contract
 - .1 If so required, Supply Performance Bond and Labour and Material Bond, in accordance with Section 00 21 13, Instructions to Bidders.
 - .2 Supply Public Liability and Property Damage Insurance Certificates, also Builder's Risk and Boiler Insurance as required of the Contract.
 - .3 Supply Certificates of good standing from WSIB for the General Contractor and all Subcontractors.
 - .4 Supply a complete Contract Sum Breakdown of all subtrades or parts of work and general expense items for approval by all consultants. Include Mechanical and Electrical Breakdowns for review and acceptance by Consultants.
 - .5 Supply a competent detailed Construction Schedule that has been reviewed and approved by major subtrades. Identify critical milestone dates for Renovations.
 - .6 Supply Cash Flow schedule of monthly progress payments in coordination with the Construction Schedule and plot as 'S' curve chart.
 - .7 Supply Schedule of Shop Drawing Submissions and identify list of long-lead items.
 - .8 Apply for and post and supply a copy of Notice of Project.

- .9 Supply a copy of Health & Safety policy as well as post at the job site.
- .10 Supply Shoring Designs and Method Statements of any aspects requiring shoring or as required of the construction sequence or specifications Sections.
- .11 Supply interference drawings for all areas requested by the Architect, Mechanical Engineer or Electrical Engineer. Treat as Shop Drawings for approval.
- .2 During Construction
 - .1 Maintain as-built record drawings in clean condition.
 - .2 Organize regular Trade Coordination meetings.
 - .3 Provide at each bi-weekly site meeting a “Two-Week Look ahead” schedule that is updated for each meeting.
 - .4 Organize separate, regular Owner and Consultant Job Meetings in accordance with Section 01 22 00.
 - .5 Maintain a copy of up to date records on site including, but not limited to Permit Sets, Contract Documents updated with all addenda, all Changes issued by Consultants.
- .3 Monthly with Each Progress Payment Application
 - .1 Supply Monthly Progress Reports and Construction Schedule in accordance with Section 01 22 00.
 - .2 Adjust Allowances, as required.
 - .3 Current WSIB Form
 - .4 Confirm that payments are being made to subcontractors and suppliers by submission of original copies of the current versions of Statutory Declarations with the second and subsequent Progress Payment Application. Include both Statutory Declarations Form CCDC-9A for the General Contractor and CCDC-9B from subcontractors with each monthly Progress Payment Application. No payment will be made for unincorporated material on the site, unless Bill of Sale in proper format is provided.
- .4 Prior to Substantial Completion
 - .1 Provide detailed Completion Schedule a minimum of 21 days prior to Substantial Completion. Schedule to illustrate all trades and sequences required for completion and legal occupancy. Issue to Consultants and upon acceptance, to all trades.
 - .2 Coordinate Completion Schedule with commissioning period as directed by Consultant.
 - .3 Prior and as a requirement of owner acceptance of Substantial Completion of the work the following to be observed, executed and submitted:
 - .1 DEFICIENCIES ARE LISTED: prior to Substantial Completion, the contractor shall prepare a room by room deficiency list in electronic format on an MS Excel spreadsheet provided by the Consultant. Contractor shall print and review on site with consultants at a site meeting and post on each room or area. Contractor shall reissue back to Consultant, when updated, in Excel electronic format. This list will be acted upon by all trades and coordinated and updated weekly as a minimum by the General Contractor to ensure all deficiencies are addressed by the date required for Total Performance. Confirm in writing

- to the Architect when and on what dates each deficiency has been completed in a satisfactory manner. The Consultant's site review will be final approval.
- .2 Acceptable preliminary submissions of all Mechanical and Electrical Operations and Maintenance Manuals have been reviewed by Consultants.
 - .3 Acceptable preliminary submissions of all Warranty and Shop Drawing Records have been reviewed by Consultants.
 - .4 All final clean-up to have been executed, as specified in Section 01 74 11.
 - .5 Complete preliminary Balancing and provide preliminary Balancing Reports.
- .4 Failure to comply with these requirements shall have amounts withheld on Progress Payments and delay issuance of Certificate of Substantial Completion.
- .5 Note that Prior to the Release of Holdback, a similar Progress Claim is required, and must include current Statutory Declaration Forms CCDC-9A for the General Contractor and CCDC-9B from subcontractors updated to refer to the Previous Certificate of Payment.
- .5 Upon Completion (Refer also to 01 78 00 Close-Out Submittals)
- .1 Upon completion of work before the Final Certificate of Payment is issued, the following to be observed, executed and submitted:
 - .2 DEFICIENCIES ARE COMPLETE. Confirm in writing to the Architect when and on what dates each deficiency has been completed in a satisfactory manner. The Consultant's site review will be final approval.
 - .3 Finishing Hardware, Inspection and Verification. Note requirements for qualified installation and inspection in Section 08 71 10- Door Hardware.
 - .4 Organize a Final Inspection tour at which to be present: the Owner's authorized representative; the Architectural, Structural, Mechanical and Electrical Consultants, and their supervisory personnel, if any; the Contractor and his superintendent.
 - .5 Where the above procedure is impossible or where any deficiencies remain outstanding, the Owner's representative and the Consultant concerned, to inspect and accept the affected work and/or material upon notification by the Contractor, that all deficiencies involving this Consultant have been made good.
 - .6 A complete release of all liens arising out of this Contract, other than his own. If a subcontractor or supplier refuses to furnish a release of such a lien, furnish a bond satisfactory to the Owner to indemnify him against any claim under such a lien.
 - .7 Certificates of good standing from the WSIB, for the General Contractor and all Subcontractors.
 - .8 All reference records, as specified, under Section 01 78 00.
 - .9 Certificate of Inspection from Mechanical and Electrical Engineers.
 - .10 Copies of all Lists of Deficiencies with each Deficiency verified when complete by only this project's job Superintendent. The Final List of Deficiencies to be signed, completed by all concerned, if accepted.
 - .11 Statement of Completion from General Contractor.

- .12 Final adjustment of all Allowances.
- .13 Certificates required by Provincial, Municipal and other authorities having jurisdiction. Including signed Building Permit.
- .14 Provide 1 hard copy and one digital copy of as-built drawings and 1 hard copy and 1 digital copy of manuals, all as per timing, sequence and quantity noted in detail in Section 01 78 00

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 PROJECT MEETINGS FOR COORDINATION

- .1 In consultation with the Consultant not later than the second week of construction, arrange for site meetings weekly or every 2 weeks as appropriate to the stage of construction, for project coordination. Such meetings shall fall at the same time each week the meeting is scheduled.
- .2 Responsible representatives of the Contractor's and Subcontractor's office and field forces and suppliers shall be obliged to attend.
- .3 Inform the Owner, Consultant, and those others whose attendance is obligatory, of the date of each meeting, in sufficient time to ensure their attendance.
- .4 Provide physical space for meetings, prepare an agenda, chair and record the minutes of each meeting. Relevant information must be made available to all concerned, in order that problems to be discussed may be expeditiously resolved. Identify "action by: _____".
- .5 Within three days after each meeting, distribute two copies of the minutes to each invited person and regular distribution list to be issued by the consultant.

1.2 PRECONSTRUCTION MEETING

- .1 Within 5 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
- .2 Include in the agenda the following:
 - .1 Appointment of official representative of participants in the Work.
 - .2 Site Safety and Security
 - .3 Scheduling of Work. Schedule to include a detailed breakdown of mechanical and electrical works.
 - .4 Interference with ongoing business.
 - .5 Work by other Contractors.
 - .6 Schedule of submission of shop drawings and samples.
 - .7 Requirements for temporary facilities, site sign, offices, storage sheds utilities.
 - .8 Delivery schedule of specified equipment and identification of long-lead or other critical items.
 - .9 Site security.
 - .10 Procedures for Contemplated change notices, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
 - .11 Record drawings.
 - .12 Maintenance manuals.
 - .13 Take-over procedures, acceptance, warranties.
 - .14 Monthly progress claims, administrative procedures, photographs, holdbacks.
 - .15 Appointments of inspection and testing agencies or firms.

- .16 Insurances, transcript of policies.
- .17 Schedule for progress meetings.

1.3 PROJECT MEETINGS FOR PROGRESS OF WORK

- .1 Conduct progress meetings in accordance with the schedule and/or decisions made at Preconstruction meeting.
- .2 Inform the Owner, Consultant, project consultants, Subcontractors and suppliers and those whose attendance is obligatory, of the date of the meeting, in sufficient time to ensure their attendance.
- .3 Include in the agenda the following:
 - .1 Site Safety and security record or incidents.
 - .2 Review, approval of minutes of previous meeting.
 - .3 Review of Work progress since previous meeting.
 - .4 Field observations, problems, conflicts.
 - .5 Problems which impede construction schedule.
 - .6 Review of off-site fabrication delivery schedules.
 - .7 Corrective measures and procedures to regain projected schedule.
 - .8 Revisions to construction schedule.
 - .9 Progress during succeeding work period as a “two-week look ahead”.
 - .10 Review submittal schedules: expedite as required.
 - .11 Maintenance of quality standards.
 - .12 Pending changes and substitutions.
 - .13 Review proposed changes for effect on construction schedule and on completion date.
 - .14 Other business.

1.4 PROGRESS RECORDS

- .1 Maintain a permanent written record on the site of the progress of the work using standard OGCA form. This record shall be available to the Consultant at the site, and a copy shall be furnished to same on request. The record shall contain:
 - .1 Daily weather conditions including maximum and minimum temperatures.
 - .2 Dates of the commencement and completion of stage or portion of the work of each trade in each area of the project.
 - .3 Conditions encountered during excavation.
 - .4 Dates of erection and removal of formwork, in each area of the project.
 - .5 Dates of pouring the concrete in each area of the project, with quantity and Particulars of the concrete.
 - .6 Work force on project daily per trade and active hours.
 - .7 Visits to site by personnel of Consultant, Jurisdictional Authorities and testing companies.

1.5 PROGRESS REPORTS

- .1 Submit to the Consultant, Monthly Progress Reports consisting of a concise narrative and a marked-up summary schedule showing physical percentage complete by item and in total. These progress calculations must agree with the Progress Payment Claims. Include with this submission the digital schedule referenced below

1.6 DIGITAL PROJECT SCHEDULES

- .1 At the outset of the project, General Contractor to provide and maintain a digital project schedule including Milestone Dates and listing all trades.
- .2 Update and issue to Consultant in hard copy and electronic copy not less than monthly and at each Progress Draw. To be issued in format compatible with Microsoft Project program.
- .3 At 70% completion, develop a detailed Completion Schedule outlining final coordination and sequences to completion.

1.7 DOCUMENTS REQUIRED AT PROJECT START, DURING CONSTRUCTION AND CLOSE OUT

- .1 Refer to Section 01 11 00 – Summary of Work, article 1.46.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Shop drawings and product data.
- .2 Samples and mock ups.

1.2 SHOP DRAWINGS

- .1 Submit to Architect, for review, shop drawings, product data and samples specified.
- .2 Until submission is reviewed, work involving relevant product must not proceed.

1.3 SHOP DRAWINGS AND PRODUCT DATA

- .1 The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
- .2 Drawings to be originals prepared by Contractor, Subcontractor, Supplier or Distributor, which illustrate appropriate portion of work; showing fabrication, layout, setting or erection details as specified in appropriate Sections.
- .3 Identify details by reference to sheet and detail numbers shown on Contract Drawings.
- .4 Maximum sheet size 606 x 909 mm.
- .5 Reproductions for submissions: opaque diazo prints.

1.4 PROJECT DATA

- .1 Certain specification Sections specify that manufacturer's standard schematic drawings, catalogue sheets, diagrams schedules, performance charts, illustrations and other standard descriptive data will be accepted in lieu of shop drawings.
- .2 Above will only be accepted if they conform to following:
 - .1 Delete information which is not applicable to project.
 - .2 Supplement standard information to provide additional information applicable to project.
 - .3 Show dimensions and clearances required.
 - .4 Show performance characteristics and capacities.
 - .5 Show wiring diagrams (when requested) and controls.

1.5 COORDINATION OF SUBMISSIONS

- .1 Review shop drawings, product data and samples prior to submission.
- .2 Verify:
 - .1 Field measurements.
 - .2 Field construction criteria.

- .3 Catalogue numbers and similar data.
- .3 Co-ordinate each submission with requirement of work and Contract documents. Individual shop drawings will not be reviewed until all related drawings are available.
- .4 Contractor's responsibility for errors and omissions in submission is not relieved by Architect's review of submittals.
- .5 Contractor's responsibility for deviations in submission from requirements of Contract documents is not relieved by Architect's review of submission, unless Architect gives written acceptance of specified deviations.
- .6 Notify Architect, in writing at time of submission, of deviations from requirements of Contract documents.
- .7 After Architect's review, distribute copies.

1.6 SUBMISSION REQUIREMENTS

- .1 Schedule submissions at least fourteen (14) days before dates that reviewed submissions will be required to be returned.
- .2 Submit one reproducible transparency, plus six (6) opaque diazo copies of shop drawings, product data to Architect for review.
- .3 Accompany submissions with transmittal letter, in duplicate, containing:
 - .1 Date.
 - .2 Project title and number.
 - .3 Contractor's name and address.
 - .4 Number of each shop drawing, product data and sample submitted.
 - .5 Other pertinent data.
- .4 Submissions must include:
 - .1 Date and revision dates.
 - .2 Project title and number.
 - .3 Name of:
 - .1 Contractor.
 - .2 Subcontractor.
 - .3 Supplier.
 - .4 Manufacturer.
 - .5 Separate detailer when pertinent.
- .5 Identification of product or material:
 - .1 Relation to adjacent structure or materials.
 - .2 Field dimensions, clearly identified as such.
 - .3 Specification Section number.
 - .4 Applicable standards, such as CSA or CGSB numbers.

- .5 Contractor's stamp, initialed or signed, certifying review of submission, verification of field measurements and compliance with Contract documents

1.7 INTERFERENCE DRAWINGS

- .1 Prepare interference drawings for all work in confined space: all typical ceiling space conditions and atypical conditions. Coordinate with all trades.
- .2 Submit as shop drawings in advance of fabrication or installation of components. Site conditions requiring corrections, due to failure to provide interference drawings as required will be corrected at no additional cost to the owner.
- .3 Ceiling heights and bulkheads will not be revised during construction due to failure to prepare interference drawings.

1.8 SHORING DESIGN DRAWINGS

- .1 If required as part of this project, or due to construction sequence, it is the contractor's responsibility to provide in advance of any work requiring shoring, detailed Shoring design drawings bearing the seal of a Professional engineer registered in the Province of Ontario and also a Method Statement describing the work sequence.
- .2 Submit to the Consultants as shop drawings in advance of the work.

1.9 LIST OF SAMPLE OR MOCK-UP SUBMITALS

- .1 At the outset of the project the contractor shall prepare a comprehensive list of all shop drawings, sample submissions and mock ups required.
- .2 For assistance only, the following samples and mock up items to be provided are included but not limited to the list following (note this is not exclusive of data sheets and shop drawings):
- | | | | |
|----|----------|---------------------------|---------------------|
| .1 | 06 47 00 | Plastic Laminates | samples, mock-up |
| .2 | 09 30 13 | Ceramic Tiling | samples |
| .3 | 09 51 13 | Acoustical Panel Ceilings | samples (300 x 300) |
| .4 | 09 65 16 | Resilient Flooring | samples |
| .5 | 09 91 22 | Painting | draw downs, mock-up |

1.10 SUBMISSIONS TO INSPECTION AGENCIES

- .1 Note that Paint formulations specified are to be submitted to the OPCA or MPI with set up documentation upon award of Contract.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

- Part 3** **Execution**
- 3.1** **NOT USED**
- .1 Not Used.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 This Section outlines the mandatory minimum Health and Safety protocols for all renovation, addition and new school construction Projects where all or a portion of the existing school building remains occupied and in use.
- .2 These Health and Safety protocols are mandatory minimum requirements, procedures and standards that the School Board insists are fully complied with by all parties involved with renovation projects.

1.2 RELATED SECTIONS

- .1 These specifications apply to all Divisions of this Project specification. It is the responsibility of the Contractor to apply these provisions wherever practical within specification limits to all products and services used on this Project.
- .2 The requirements of this Section supersede those of all other specification Sections and Drawings. Where conflicts exist in procedures, methods or materials, they shall immediately be brought to the attention of the Consultant and Board Project Manager. Where clarification is not immediately available, the Contractor shall assume the specifications contained in this Section are a minimum standard and the more stringent specification shall apply.
- .3 The Contractor must receive approval from Board Project Manager for any deviations from this specification Section.
- .4 The General Contractor shall recognize that it is *he* who is the Constructor of the Project. The General Contractor shall also recognize that he is solely responsible for site safety at the Place of the Work and compliance with the requirements of this Section does not limit or remove his total responsibility for site safety as Constructor of the Project.

1.3 REFERENCES

- .1 Applicable related regulations, standards and laws related to safety include but are not limited to:
 - .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
 - .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
 - .3 Province of Ontario
 1. Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. 1990 June 2002.

1.4 COMPLIANCE SPECIFICATION

- .1 Notwithstanding the requirements of this Section, the Contractor must comply with all applicable health, safety and environmental regulations and statutes.

1.5 BEYOND COMPLIANCE SPECIFICATION

- .1 These specifications apply in addition to all applicable health, safety and environmental compliance regulations. They are incorporated here to reflect the Board's intention to develop a specification which provides the safest practical procedures and policies for construction project sites that are occupied and in use by staff, students and visitors during the execution of the Construction Contract.
- .2 Beyond compliance specifications recognize that performance well beyond the minimum regulatory standard is often desirable, possible and affordable, often with no cost or low cost options. It also recognizes that application methods or protocols may be as important as the material specified. Therefore, these specifications cover both material and methods.
- .3 These provisions apply to both indoor and outdoor applications equally.

Part 2 Products

2.1 NOT USED

Part 3 Execution and Compliance Requirements

3.1 APPLICATION OF COMPLIANCE REQUIREMENTS

- .1 The articles setout herein are to be applied together as a set of related policies and procedures to achieve a comprehensive Health and Safety working protocol.
- .2 The Contractor shall execute all of the procedures and meet all of the requirements set out herein and apply these protocols from the outset of the Construction Phase.
- .3 These procedures or requirements are to be maintained for the duration of the Construction Phase. The Contractor shall not discontinue any of the individual procedures or requirements without the prior approval of the Board Project Manager.

3.2 SITE SUPERVISOR (SITE SUPERINTENDENT)

- .1 A full-time Site Supervisor (Site Superintendent) is required on site, regardless of the number of active workers on site.
- .2 Site Superintendent shall have as a minimum:
 - .1 Recent, previous experience with renovation or addition projects involving occupied buildings including (but not limited to) school construction, sites with students, tenants, employees, retail customers, pedestrian and vehicular traffic.

- .2 Successful completion of a multi-session Supervisor's training course conducted by a recognised Construction Association in Ontario.
- .3 Site Superintendent must carry a cell phone at all times during construction with the ability to be reached directly during all work hours and the ability to have voicemail recorded and accessed during all non-work hours including weekends and holidays.
- .4 Site Superintendent must have means of live phone or walkie-talkie communication with the site Flagman during all work hours.
- .5 Site Superintendent shall not be changed throughout project unless confirmed and approved by the Board Project Manager.

3.3 ONTARIO OCCUPATIONAL HEALTH & SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS

- .1 General Contractor to comply with the Ontario Occupational Health & Safety Act and Regulations for Construction Projects, latest edition– including all amendments.
- .2 Beyond compliance in item .1 above, regardless of the number of labourers active on the Project, the General Contractor shall form a contractors' Health & Safety Committee at the outset of construction. This Committee shall then follow the standard requirements for such a Committee as set out in the *Occupational Health & Safety Act and Regulations for Construction Projects*.

3.4 ON-SITE COMMUNICATIONS

- .1 At the outset of the project the General Contractor shall provide to the Board Project Manager all relevant contact information for the Site Superintendent, GC Project Manager and key sub-contractors including names and cell phone numbers.
- .2 The General Contractor shall provide at least one "emergency contact" telephone number at which the Contractor's representative can be reached directly during all work hours and have the ability to have voicemail recorded during all non-work hours including weekends and holidays. As outlined below, this may be designated to the Site Superintendent's cell phone number.
- .3 Regardless of compliance method for the emergency contact telephone number stated above, the Site Superintendent must carry a cell phone at all times during construction with the ability to be reached directly during all work hours and the ability to have voicemail recorded during all non-work hours including weekends and holidays.
- .4 Site Superintendent must have means of live phone or walkie-talkie communication with the site Flagman during all work hours.
- .5 The Contractor is to ensure that the Board Project Manager is immediately apprised of any safety issues as each arises and the related request and/or resolution. The Board Project Manager is responsible for any decisions that have an effect on the contract execution.

- .6 Notwithstanding the reporting to the Project Manager noted above the Site Superintendent shall liaise with school principal or designate on all safety related matters as required on a daily basis.
- .7 In the event of a safety issue requiring contractual clarification or action (i.e. Change Notice, etc.), the contractor shall ensure that, where applicable, the action is followed up with appropriate documentation.

3.5 FULL-TIME ON-SITE FLAGMEN

- .1 A full-time, designated Flagman is required at all vehicular construction entrances. Refer to drawings for the scope and locations.
- .2 In the event there is more than one entrance to the hoarded/fenced construction area, there must be a separate Flagman for each entrance.
- .3 Flagman may not be same person as Site Superintendent or other construction worker.
- .4 Flagman shall not be changed throughout the Project unless confirmed and approved by the Board Project Manager.
- .5 Flagman must have means of phone communication with Site Superintendent (phone or walkie-talkie).
- .6 The Flagman shall not be designated for any other duties than to act as a Flagman for safety purposes as described herein.
- .7 The Flagman shall meet and escort any construction traffic from the site entrance into and out of the hoarded/fenced construction area (including through open site areas until entrances to hoarding).
- .8 The Flagman shall only open hoarded areas when construction traffic moves through and immediately re-close gates.
- .9 The Flagman shall control construction parking at the school site (including vehicles parking or traveling in unauthorized areas).
- .10 The location of the Flagman shall be set to ensure the safe guarding of staff, student, and pedestrian traffic.
- .11 If not designated on the Contract Documents, the location of the Flagman shall be confirmed with the Board Project Manager and Consultant at the outset of the project and before the placement of hoarding and fencing.
- .12 Where the Contractor deems it necessary, in order for the Flagman to carry out the required full-time duties, the cost of a temporary shelter shall be included in the Tender Price.

- .13 The Flagman shall be properly attired to carry out his duties, including the use of safety equipment (e.g. wear reflective vest, have appropriate traffic hand-held “Stop” sign and have a visible identification tag).

3.6 SITE SAFETY SIGNAGE

- .1 Standardised Safety Signage is required at all construction entrances.
- .2 If not designated on the Contract Documents, the location of the Safety Signage shall be confirmed with the Board Project Manager and Consultant at the outset of the Project and before the placement of hoarding and fencing.
- .3 Safety Signage is to be posted at all street entrances to school site and at each entrance to hoarded/fenced construction area.
- .4 Total surface area of signage is to avoid exceeding municipal standards that would require a separate signage permit.
- .5 Access signage text shall include cell phone contact number for Site Superintendent.
- .6 Signage posted at gates shall state restrictions on hours of entry and egress as described in the Contract Documents and under no circumstances shall construction traffic be allowed within 30 minutes prior to school start, during recess, lunch break, and 30 minutes after dismissal periods.

3.7 ACCESS/EGRESS CONTROLS

- .1 At the outset of the Contract, the General Contractor shall advise all suppliers and subcontractors of the protocols listed herein and of the requirement to contact the Site Superintendent by Cell phone prior to entering the site.
- .2 The drivers of all construction vehicles entering the site, including delivery vehicle drivers, are to contact site Superintendent by cell phone prior to entering site; the Site Superintendent shall, in turn, give notice to the Flagman to be aware of the traffic and authorize the Flagman to allow entry of that vehicle.
- .3 Vehicular Gates are only for entry and exit of for construction purposes such as construction personnel, Authorities performing inspections, Board representative, delivery personnel, and disposal pickup and ONLY under escort by the Flagman. As such vehicular gates must remain closed and locked at all times and only opened for access/egress under escort by the Flagman, then closed and locked again.
- .4 Gates are to be lockable swing gates for vehicles and man gates at all access points to the hoarded/fenced construction area.

3.8 CONTRACTOR PARKING

- .1 Contractor parking shall be restricted to hoarded areas or designated parking areas only where pre-approved by Board Project Manager and Principal.
- .2 Contractor parking is restricted from all off-site street areas that interfere with site specific parent drop-off and parking areas.

3.9 REQUIRED PRE-CONSTRUCTION MEETINGS

- .1 Meeting 1: Contractor shall receive approval from the Architect and the Board Project Manager for parking, vehicular movement, access/egress strategies at a Pre-construction meeting taking place in advance of mobilizing on site.
- .2 Meeting 2: Once hoarding and fencing is erected BEFORE site construction is fully active and vehicles or equipment is mobilized on site, an initial site meeting shall take place at which time the layout of trailers and staging, deliveries, storage of materials, parking areas and vehicular movement to be reviewed and approved by the Board Project Manager.
- .3 See article 3.12- 'Site Meetings' following.

3.10 CONSTRUCTION FENCING AND HOARDING

- .1 Construction hoarding requirements shall be a site based decision to be determined by the Architect and the Board Project Manager at the design stage and shown on Contract Documents.
- .2 No fencing or hoarding shall be less than a continuous 1800 mm high.
- .3 In portions of the site where chain link is approved, it shall be continuous 1800 mm high chain link fencing, wire-tied to staked iron 'tees' at 1800 mm on centre - OR - leased, modular 'quick fencing' if staked down and wire tied together.
- .4 All fenced and hoarded areas to be gated with lockable vehicular and man gates-minimum construction to be steel rail and chain link construction.
- .5 Plastic snow fencing is NOT permitted.
- .6 All hoarding and fencing shall be maintained in a stable condition, for duration of construction period as part of the base contract price and to include Superintendent's inspection at the beginning and end of each work day.
- .7 All Fire Routes to be outside all fenced and hoarded areas and maintained clear at all times.
- .8 'Covered way' protection shall be provided when accesses or pathways are in proximity to construction, in accordance with Ministry of Labour *Occupational Health & Safety Act* Regulations.

3.11 HEALTH, WELLNESS & SAFETY DEPARTMENT REPRESENTATIVE

- .1 A representative of the Board's Health, Wellness & Safety Dept. ('Environment, Health and Safety Officer') may visit site at any anytime throughout the duration of the Contract to review the site, as it relates to the safety of the occupied areas of the site. Such site review shall neither constitute an inspection or approval for the Contractor.
- .2 Concerns or issues identified by the representative from the Board's Health, Wellness & Safety Dept. shall be communicated through the Board Project Manager and the school Principal for corrective action.
- .3 Contractor shall ensure full access to all site areas, at all times, for the Board's Health, Wellness & Safety Department Representative.

3.12 SITE MEETINGS

- .1 Coordinate the requirements of this Section with *Section 01 22 00 – 'Meetings and Progress Reports'*.
- .2 Initial site meeting to take place after erecting fencing and hoarding but prior to the mobilisation of any vehicles, equipment or start of Work.
- .3 Contractor shall ensure that the Board Project Manager, School Principal and a representative of the Board's Health, Wellness & Safety Department and the School Principal attend the initial site meeting.
- .4 The initial meeting shall review and approve a standardised agenda for all site meetings and a thorough review of the Site Safety Protocol.
- .5 The standardised agenda shall include a Checklist and Report of Health and Safety items at the beginning of the agenda. This Checklist shall be included and each item reviewed at all site meetings for the duration of the project.
- .6 The Checklist of Site Safety items shall include but not be limited to:
 - .1 Contractor's report of site safety record and report of recent site activities, precautions or actions.
 - .2 Review any visits to the site and actions required by Ministry of Labour or Board Health, Wellness & Safety representatives or other Authorities Having Jurisdiction.
 - .3 Contractor's Health & Safety policy manual posted in site trailer.
 - .4 Copy of Ministry of Labour *Occupational Health & Safety Act and Regulations for Construction Projects* in site trailer.
 - .5 Name of General Contractor H&S representative.
 - .6 Continuing compliance with Safety Signage.
 - .7 Hoarding & fencing layout and condition.
 - .8 Access and egress measures and any breaches of requirements.
 - .9 Confirmation of communications link between Site Superintendent & Flagman.

- .10 Work that may produce any noxious odours and the containment measures, (*i.e.*: schedule, type, approvals required therefore).
- .11 Copies of Material Safety Data sheets in site trailer.
- .12 Complete meeting minutes including details of Safety Checklist shall be copied to Architect, Board Project Manager and Principal.
- .7 Contractor to produce record of written Memorandum to all subtrades and suppliers detailing but not limited to: hours of delivery; site access procedures and restrictions; use of existing facilities.
- .8 Contractor to prepare detailed and accurate written record of all meetings to be kept and issued to all parties.

3.13 CONTRACTOR'S HEALTH AND SAFETY COMMITTEE MEETINGS

- .1 As required in item 3.1.2, the Contractor shall form a Health and Safety Committee, hold meetings and record minutes of meetings for the duration of the Contract.
- .2 Contractor to maintain a copy of Health & Safety Committee minutes on site for review by Ministry of Labour or Board representative(s).

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Health and safety considerations required to ensure due diligence towards health and safety on construction sites, and meets the requirements laid out Occupational Health and Safety - Construction.

1.2 RELATED SECTIONS

- .1 These specifications apply to all divisions of this project specification. It is the responsibility of the Contractor to apply these provisions wherever practical within specification limits to all products and services used on this project.
- .2 Recognized that currently specified materials and methods may conflict with the basic intention of this section. Where reasonable alternate materials and methods exist that are not specified here, and that do not compromise quality or create additional cost for the Owner, notify the Consultant of such alternate materials or methods. Do not proceed to use alternate materials or methods to those specified without the express approval of the Consultant.
- .3 Elsewhere, apply the provisions of this section to all work. Exceptions can only be made when signed off by the Consultant. Suitability of all products used is the responsibility of the Contractor.

1.3 REFERENCES

- .1 Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .3 Province of Ontario
 - .1 Occupational Health and Safety Act and Regulations for Construction Projects, R.S.O. [1990 June 2002].

1.4 COMPLIANCE SPECIFICATION

- .1 The Contractor must comply with all applicable health, safety and environmental regulations.

1.5 BEYOND COMPLIANCE SPECIFICATION

- .1 These specifications apply in addition to all applicable health, safety and environmental compliance regulations. They are incorporated here to reflect the Owner's intention to develop a specification which maximizes environmentally "friendly" materials and methods wherever possible within current technical and budget limitations.
- .2 Beyond compliance specifications recognize that performance well beyond the minimum regulatory standard is often desirable, possible and affordable, often with no cost or low cost options. It also recognizes that application methods or protocols may be as important

as the material specified. Therefore these specifications cover both material and methods.

- .3 The primary goal of beyond compliance specification is to reduce the use of products or methods which have negative health and environmental impacts both during and after construction. These considerations may include full life cycle impacts, associated with raw materials, manufacturing, transport, deconstruction and their eventual fate.
- .4 These specifications will specifically address primary categories of readily identifiable products, ingredients and methods.
- .5 These provisions apply to both indoor and outdoor applications equally.

1.6 EXCEPTIONS

- .1 These specifications recognize that not all substitutes are equal and therefore exceptions can be made based on substantive evidence of necessary and superior performance. Special considerations may be given to restricted substances when secondary provisions are made such as sealed in place (contained) applications. All such exceptions must be approved in writing by the Consultant.

1.7 PRODUCTS OR SUBSTANCES TO BE AVOIDED OR LIMITED IN USE

- .1 No product containing the following substances may be used on this project when an equivalent product without or with a lower concentration of this substance is suitable and available. All products containing substances which are known to cause health effects including but not limited to cancer, mutagenic, neurological, or behavioral effects should be avoided if suitable substitutes not containing or containing lower concentrations are available. This provision shall be limited to information contained on Material Safety Data Sheets, therefore MSDS sheets must be reviewed for all products for which such sheets are required. Applications for exceptions must be accompanied by related MSDS and product application and performance sheets, clearly showing a need for the exception.

1.8 VOLATILE ORGANIC COMPOUNDS

- .1 No product containing volatile organic compounds (in over simplified terms volatile petro chemical or similar plant derived solvents) may be used on this project when a suitable non VOC or failing that a low VOC substitute is available. Manufacturers may refer to the U.S. EPA definition of VOC's for guidance or alternatively use the low molecular weight organic compound descriptor.
 - .1 Example: Paints, Coatings, Primer, Adhesives, Chalks, Firestops, etc.
- .2 Waterborne equivalents are available for most of the solvent borne products used in construction and in most cases would be the preferred alternative. Waterborne products may in some instances have high VOC contents; therefore the fact that a product is waterborne does not automatically make it acceptable.

1.9 CHLORINATED SUBSTANCES

- .1 Poly Vinyl Chloride (vinyl) and other chlorinated products should be avoided if suitable substitutes are available.

1.10 PLASTICIZERS

- .1 Plasticizers which off-gas (low molecular weight) should be avoided.

1.11 MAN MADE MINERAL FIBRES

- .1 Products containing mineral fibres which can be emitted or abraded should be avoided.
 - .1 Examples: duct liner, mineral fibre ceiling tiles, etc.

1.12 RADIATION

- .1 Products or methods which result in the lowest emission of Electro Magnetic Fields are preferred.

1.13 BIOCIDES

- .1 Products containing biocides (pesticides, miticides, mildewicides, fungicides, rodenticides, etc.) are not to be used if suitable alternatives are available. Highly stable, low human toxicity biocides such as Portcept may be acceptable substitutes. Biocide formulas which break down, emit powders or offgass should be avoided.

1.14 HEAVY METALS

- .1 Heavy metals such as lead, cadmium, mercury etc. should be avoided.

1.15 ALUMINUM

- .1 Raw aluminum should be avoided, anodized or factory painted aluminum is acceptable. This is particularly applicable to surfaces which people can touch.

1.16 OZONE DEPLETING SUBSTANCES

- .1 Products which contain or which use Ozone Depleting Substances such as Bromide, Chlorofluorocarbons (CFC) or Hydrofluorocarbons (HFC) etc. should be avoided if suitable substitutes are available.

1.17 GREENHOUSE GASES

- .1 Products which contain, use or generate Greenhouse gasses such as CO₂ should be avoided if suitable substitutes are available.

1.18 BITUMINOUS (Tar) PRODUCTS

- .1 Products containing tar compounds should not be used if suitable substitutes are available.

1.19 CHEMICAL COMPOUNDS

- .1 Products containing the following chemical compounds should not be used if suitable substitutes are available: Neoprene, Latex, Butyl, ABS, and Formaldehyde.

1.20 ADHESIVES

- .1 Adhesives containing solvents or other non preferred ingredients should be avoided if suitable substitutes are available, including systems designs which do not need adhesives or can use mechanical etc. fastening alternatives

1.21 COMPOSITE PRODUCTS

- .1 Some composite products contain adhesives such as formaldehyde which are not preferred, and some composites such as Fibre Reinforced Plastics are not practical for recycling. These products should be avoided if suitable substitutes are available.

1.22 CLEANERS AND SOLVENTS

- .1 Products, equipment, and methods which require the use of cleaners and solvents are not preferred if suitable substitutes are available. Examples of preferred products would include No Wax floors, or primerless caulks and adhesives, or products not requiring caulks and adhesives.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 FIRES

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

1.2 DISPOSAL OF WASTES

- .1 Do not bury rubbish and waste materials on site.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.3 DRAINAGE

- .1 Refer also to Section 31 23 10.
- .2 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .3 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .4 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.4 SITE CLEARING AND PLANT PROTECTION

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Restrict tree removal to areas indicated or designated by Engineer.

1.5 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under previous contract and to be provided new under this contract and as requested by local Municipal and Regional Authorities.
- .2 Install, maintain, restore, replace sediment control fence as required by Municipal and Regional authorities. The fence shall be in accordance with Municipal standards.
- .3 Install, maintain, restore, replace roadside catchbasin sediment protection at all street catch basin in accordance with Municipal standards.
- .3 Install, maintain, restore, replace catchbasin sediment barrier immediately after installation of catch basins on the property in accordance with Municipal Standards.

- .4 If shown on drawings, install and maintain a temporary mud mat as part of the base contract price. Maintain in good condition to avoid contaminating public streets and sewers. Remove and reinstate surfaces as part of the contract.
- .5 Control emissions from equipment and plant to local authorities emission requirements.
- .6 Prevent sandblasting, concrete block cutting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .7 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Inspection and testing, administrative and enforcement requirements.
- .2 Tests and mix designs.
- .3 Mock-ups.
- .4 Mill tests.
- .5 Equipment and system adjust and balance.

1.2 RELATED SECTIONS

- .1 Section 1 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 01 11 00, article 1.14 – Quality Control

1.3 REFERENCES

- .1 Stipulated Price Contract.

1.4 INSPECTION

- .1 General: Materials and workmanship shall be subject to inspection at any time. Cooperate in permitting access for inspection to all places where work is being done or stock is being stored.
- .2 Owner's quality control inspection and testing is specified in the technical sections and will be paid from Cash Allowance except as otherwise specified. Contractor to be responsible to pay for inspections and retesting to verify acceptability of work requiring correction.
- .3 Allow Consultant access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.
- .4 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by Consultant instructions, or law of Place of Work.
- .5 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.
- .6 Consultant may order any part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

1.5 ACCESS TO WORK

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

1.6 PROCEDURES

- .1 Notify appropriate agency Consultant in advance of requirement for tests, in order that attendance arrangements can be made.
- .2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in an orderly sequence so as not to cause delay in Work.
- .3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by Consultant as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.

1.8 TESTS AND MIX DESIGNS

- .1 Furnish test results and mix designs as may be requested.
- .2 The cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work shall be appraised by Consultant and may be authorized as recoverable.
- .3 Allow sufficient time for testing, evaluation, alterations and retesting so as not to interrupt the Progress Schedule for the Project.
- .4 The Consultant may require testing of connections and special prefabricated inserts, as part of the work of this Section.

1.9 MOCK-UPS

- .1 Refer to partial list of mock ups in Section 01 33 00 - Submittal Procedures
- .2 Prepare mock-ups for Work specifically requested in specifications. Include for Work of all Sections required to provide mock-ups.
- .3 Construct in all locations acceptable to Consultant.

- .4 Prepare mock-ups for Consultant's review with reasonable promptness and in an orderly sequence, so as not to cause any delay in Work.
- .5 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 If requested, Consultant will assist in preparing a schedule fixing dates for preparation.
- .7 Remove mock-up at conclusion of Work or when acceptable to Consultant.
- .8 Mock-ups may remain as part of Work only if previously agreed to by consultant and accepted as acceptable quality upon completion..
- .9 Specification section identifies whether mock-up may remain as part of Work or if it is to be removed and when.

1.10 MILL TESTS

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

1.11 EQUIPMENT AND SYSTEMS

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

1.12 SEALANTS

- .1 Refer also to Section 07 92 10.
- .2 Sealants used for the various building envelope assemblies shall be selected from those specified in the respective assembly Section, and shall be coordinated with the sealant being provided under other building envelope Sections. Preferably, one sealant by the same manufacturer shall be used throughout. If different sealants are selected, from those specified, it is the responsibility of the respective Section to ensure compatibility between selected sealant, substrates, and sealants of other Sections which come in contact with the selected sealant.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Temporary utilities.

1.2 RELATED SECTIONS

- .1 Section 01 52 00 - Construction Facilities.
- .2 Section 01 56 00 – Temporary Barriers and Enclosures.

1.3 INSTALLATION AND REMOVAL

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

1.4 DEWATERING

- .1 Refer also to Sections 31 23 10 and 01 35 43.
- .2 Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.

1.5 WATER SUPPLY

- .1 Use of the school water supply may be acceptable providing it does not disrupt school services. Water usage from existing services is at the discretion of the school project manager. Otherwise, arrange, pay for and maintain temporary water supply in accordance with governing regulations and ordinances. Provide for water as require whether available in the vicinity of the site or not.

1.6 TEMPORARY HEATING AND VENTILATION

- .1 Pay for cost of temporary heat and ventilation used during construction, including costs of installation, fuel, operation, maintenance and removal of equipment. Use of direct-fired heaters discharging waste products into work areas will not be permitted unless prior approvals given by the Architect.
- .2 Furnish and install temporary heat and ventilation in enclosed areas, as required to:
 - .1 Facilitate progress of work.
 - .2 Protect work and products against dampness and cold.
 - .3 Prevent moisture condensation on surfaces.
 - .4 Provide ambient temperatures and humidity for storage, installation, curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for safe working environment.
- .3 Maintain minimum temperature of 10 degrees C or higher where specified as soon as finishing work is commenced and maintained until acceptance of structure by Engineer.

- .4 Ventilating:
 - .1 Prevent hazardous accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
 - .2 Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
 - .3 Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
 - .4 Ventilate storage spaces containing hazardous or volatile materials.
 - .5 Ventilate temporary sanitary facilities.
 - .6 Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful elements.
- .5 Maintain strict supervision of operation of temporary heating and ventilating equipment to:
 - .1 Conform with applicable codes and standards.
 - .2 Enforce safe practices.
 - .3 Prevent abuse of services.
 - .4 Prevent damage to finishes.
 - .5 Vent direct -fired combustion units to outside.
- .6 The Architect may permit the use of permanent system providing agreement can be reached on:
 - .1 Conditions of use, special equipment, protection and maintenance.
 - .2 Guarantees will not be affected.
 - .3 Approval of the Owner.
- 7. Refer to Section 011100, item 1.30. 'Periodic Cleaning' for replacement of filters at time of final acceptance of work.

1.7 TEMPORARY COMMUNICATION FACILITIES

- .1 For duration of contract, it is expected that the Site Superintendent and General Contractor Project Manager, use and pay for cell phone services and equipment necessary for own use and communication with Owner and Consultants.

1.8 FIRE PROTECTION

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by [insurance companies having jurisdiction] [and] governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

1.9 POWER

- .1 Temporary power is available at the site subject to the approval of the Board Project Manager and the following:

- .1 power connections can be made without interruption to the school's power supply during the period of school occupancy.
- .2 the contractor can isolate power usage or itemized based on previous power usage records, such that costs for power usage by the contractor shall be tracked and paid for by the contractor.
- .2 Contractors may bid this project on the assumption that temporary power is available at the site on the basis as described above.
- .3 ~~During the tender period, determine if power will be available in the vicinity of the project site. If no power is deemed available, include costs for generation of power required to carry out the work for the duration required to complete the Project. Provide written clarification at the time of Tender of estimated costs included in the Tender Price. The Board will not consider payment of generated power unless this written clarification is provided at the time of Tender.~~
- .4 Arrange, pay for and maintain temporary electrical power supply in accordance with governing regulations and ordinances.
- .5 Install temporary facilities for power such as pole lines and underground cables to approval of local power supply authority.
- .6 Electrical power and lighting systems installed under this Contract may be used for construction requirements with prior approval of Architect, provided that guarantees are not affected. Make good damage. Replace lamps which have been used over period of three (3) months.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

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

1.2 RELATED SECTIONS

- .1 Section 01 51 00 - Temporary Utilities.
- .2 Section 01 56 00 - Temporary Barriers and Enclosures.

1.3 REFERENCES

- .1 CCDC 2 – 2020 Stipulated Price Contract.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 1-GP-189M-84, Primer, Alkyd, Wood, Exterior.
 - .2 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
- .3 Canadian Standards Association (CSA International)
 - .1 CAN3-A23.1-/A23.2-94, Concrete Materials and Methods for Concrete Construction/Method of Test for Concrete.
 - .2 CSA-0121-M1978, Douglas Fir Plywood.
 - .3 CAN/CSA-Z321-96, Signs and Symbols for the Occupational Environment.

1.4 INSTALLATION AND REMOVAL

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

1.5 SCAFFOLDING

- .1 All necessary scaffolding shall be provided and constructed according to all by-laws and safety regulations. It shall be removed promptly and completely when no longer required.
- .2 As required by Ministry or Labour, design of scaffolding or hoarding shall be by a Professional Engineer.

1.6 ACCESS

- .1 Provide and maintain adequate access to project site.
- .2 The General Contractor for this Work shall, at all times allow the Consultants, the Board, or any other Board commissioned contractor or their employees, access into the building or around the premises, undisturbed, whether union or non-union, as may be required in the execution of other portions of the building work and installation of equipment, etc.

- .3 The General Contractor shall cooperate fully with any and all Board commissioned Contractors.

1.7 HOISTING

- .1 Provide, operate and maintain hoists & cranes required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for use thereof.
- .2 Hoists & cranes shall be operated by qualified operator.

1.8 ELEVATORS

- .1 Permanent elevators may not be used by construction personnel for transporting of materials unless coordinated with the Architect or Structural Engineer.
- .2 Provide protective coverings for finish surfaces of cars and entrances.

1.9 SITE STORAGE/LOADING

- .1 Provide adequate weather tight sheds with raised floors, for storage of materials, tools and equipment which are subject to damage by weather.

1.10 CONSTRUCTION PARKING

- .1 Provide, on site, sufficient temporary parking.

1.11 OFFICES

- .1 Provide office heated to 22 degrees Celsius, lighted 750 Lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing lay down table, telephone, and facsimile machine. Pay telephone not acceptable.
- .2 Maintain in clean condition.
- .3 Provide and maintain in clean condition: two separate plans layout tables, minimum 1200 x 1800 mm each. One table shall be used by the General Contractor and subcontractors at their discretion. The second shall be provided for use by subcontractors and by the consultant or Inspection and Testing Companies during site visits or project meetings.

1.12 EQUIPMENT, TOOL AND MATERIALS STORAGE

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

1.13 SANITARY FACILITIES

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

- .2 Post notices and take such precautions, as required, by local health authorities. Keep area and premises in sanitary condition.
- .3 When the school is not occupied, at the discretion of the Board Project Manager, a school washroom may be designated for contractor's use, provided it is maintained in a clean condition at all times. Otherwise, when permanent water and drain connections are completed, provide temporary water closets and urinals complete with temporary enclosures, inside building. Permanent facilities may be used on approval of Board Project Manager or Architect.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Barriers.
- .2 Traffic Controls.
- .3 Fire Routes.

1.2 RELATED SECTIONS

- .1 Section 01 51 00 - Temporary Utilities.
- .2 Section 01 52 00 - Construction Facilities.
- .3 Section 01 11 00 - Summary of Work.

1.3 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.189M- [84], Primer, Alkyd, Wood, Exterior.
 - .2 CGSB 1.59- [97], Alkyd Exterior Gloss Enamel.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121- [M1978], Douglas Fir Plywood.

1.4 INSTALLATION AND REMOVAL

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

1.5 SITE ENCLOSURES

- .1 Refer to Section 01 11 00- Summary of Work, article 1.8 'Construction Fencing' for clarification of existing fence on site.' Maintain fences in good repair.

1.6 WEATHER ENCLOSURES

- .1 Provide temporary weathertight enclosures protection for exterior openings until permanently enclosed.
- .2 Erect enclosures to allow access for installation of materials and working inside enclosure.
- .3 Design enclosures to withstand wind pressure.
- .4 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.

1.7 DUST TIGHT SCREENS

- .1 Provide dust tight screens, insulated and fire rated temporary partitions as required to separate work areas and localize dust generating activities, and for protection of workers, equipment and finished areas of work and the public.
- .2 Maintain and relocate protection until such work is complete.

1.8 ACCESS TO SITE

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

1.9 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.10 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.11 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.12 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with Consultant locations and installation schedule 5 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 EXECUTION

3.1 NOT USED

.1 Not Used

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Requirements and limitations for cutting and patching the Work.
- .2 The responsibilities of this section includes but is not limited to the following item(s), including all related labour and materials necessary to successfully complete the installation of same as detailed on the Drawings.
- .3 The cutting, removal and disposal and patching of masonry wall sections in locations of all new electrical panels and for all mechanical ducts passing through masonry walls or walls of any other construction not automatically accommodated in new work by the mason.
- .4 The cutting, removal and patching of all penetrations required for mechanical and electrical services through floors, ceilings and walls.
- .5 The supply and installation of a Portland cement based leveling skim coat as required to provide an acceptable surface for the installation of new VCT tile to any rooms as described on drawings to receive such flooring.
- .6 All other work not listed in other Sections, but detailed on the Drawings.

1.2 RELATED SECTIONS

- .1 Section 01 11 00 - Summary of Work.
- .2 Section 04 21 13- Brick Masonry
- .3 Section 01 33 00 - Submittal Procedures.
- .4 Section 08 11 14- Metal Doors and Frames
- .5 Section 08 71 15 – Finish Hardware
- .6 Section 09 91 22- Painting
- .7 Section 09 21 16- Gypsum Board Assemblies
- .8 Section 09 51 13- Acoustic Panel Ceilings
- .9 Section 10 11 25- Manufactured Specialties
- .10 Mechanical and Electrical Sections.
- .11 Individual product Sections: cutting and patching incidental to work of section. Advance notification to other sections required.

1.3 SUBMITTALS

- .1 Submit written request in advance of cutting or alteration which affects:
 - .1 Structural integrity of any element of Project.
 - .2 Integrity of weather-exposed or moisture-resistant elements.
 - .3 Efficiency, maintenance, or safety of any operational element.
 - .4 Visual qualities of sight-exposed elements.
 - .5 Work of Owner or separate contractor.
- .2 Include in request:
 - .1 Identification of Project.
 - .2 Location and description of affected Work.
 - .3 Statement on necessity for cutting or alteration.
 - .4 Description of proposed Work, and products to be used.
 - .5 Alternatives to cutting and patching.
 - .6 Effect on Work of Owner or separate contractor.
 - .7 Written permission of affected separate contractor.
 - .8 Date and time work will be executed.

1.4 MATERIALS

- .1 Required for original installation.
- .2 Change in Materials: Submit request for substitution in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Concrete lintel block, reinforcing steel and concrete fill for openings if required at new penetrations in walls or steel lintels as may be permitted by consultant.
- .4 Portland Cement based Concrete Patching Compound compatible with new slab, precast concrete slabs or other flooring to make good a smooth, suitable surface to accept the direct application of new VCT or resilient sheet flooring.
- .5 Portland Cement based Concrete for new floor openings or floor leveling, or patching of floor openings.
- .6 All other materials not listed in other Sections, but detailed on the Drawings.

1.5 EXECUTION

- .1 The Trades requiring cuts, holes or sleeves for their work shall locate them.
- .2 Do not cut, drill or sleeve load-bearing members without obtaining prior written approval from the Consultant for each condition.
- .3 Cut holes carefully, leaving holes no longer than required, with clean, true and smooth edges.

-
- .4 Fit items to the tolerances established by industry 'Best Practice' standard for applicable type of work.
 - .5 Make patches undetectable in the finished work. All other work not listed in other Sections, but detailed on the Drawings, is to be done in a professional manner and to the industry 'Best Practice' standard for the described work.
 - .6 Execute cutting, fitting, and patching including excavation and fill if required, to complete Work.
 - .7 Fit several parts together, to integrate with other Work.
 - .8 Uncover Work to install ill-timed Work.
 - .9 Remove and replace defective and non-conforming Work.
 - .10 Provide openings in non-structural elements of Work for penetrations of mechanical and electrical Work.
 - .11 Execute Work by methods to avoid damage to other Work, and which will provide proper surfaces to receive patching and finishing.
 - .12 Employ original installer to perform cutting and patching for weather-exposed and moisture-resistant elements, and sight-exposed surfaces.
 - .13 Cut rigid materials using masonry saw or core drill. Pneumatic or impact tools not allowed on masonry work without prior approval.
 - .14 Restore work with new products in accordance with requirements of Contract Documents.
 - .15 Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
 - .16 At penetration of fire rated wall, ceiling, or floor construction, completely seal voids with firestopping material, full thickness of the construction element.
 - .17 Refinish surfaces to match adjacent finishes: For continuous surfaces refinish to nearest intersection; for an assembly, refinish entire unit.
 - .18 Conceal pipes, ducts and wiring in floor, wall and ceiling construction of finished areas except where indicated otherwise.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1: General

.1 SECTION INCLUDES

- .1 Progressive cleaning.
- .2 Final cleaning.

.2 RELATED SECTION

- .1 Section 01 77 00 - Closeout Procedures.
- .2 Section 01 11 00 – Summary of Work.

.3 REFERENCE STANDARDS

- .1 CCDC 2 – 2020 Stipulated Price Contract.

.4 GENERAL CLEANINESS DURING CONSTRUCTION

- .1 Refer also to Section 01 11 10, item 1.33 'Periodic Cleaning' and coordinate with this Section.
- .2 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
- .3 Store volatile wastes in covered metal containers, and remove from premises daily.
- .4 Prevent accumulation of wastes which create hazardous conditions.
- .5 Provide adequate ventilation during use of volatile or noxious substances.
- .6 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .7 Provide on-site dump containers for collection of waste materials, and rubbish.
- .8 Remove waste materials, and rubbish from site.
- .9 Schedule cleaning operations so that resulting dust and other contaminants will not fall on wet, newly painted surfaces.
- .10 Sandblast and wirebrush and existing exterior finishes to be internalized within new addition

.5 FINAL CLEANING

- .1 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.
- .2 Broom-clean paved surfaces; rake clean other surfaces of grounds.
- .3 Remove snow and ice from access to building, if applicable.
- .4 Maintain cleaning until project, or portion thereof, is occupied by Owner.

Products

.1 NOT USED

- .1 Not Used.

Execution

.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Section 01 11 00 - Summary of Work, article 1.44.
- .2 CCDC 2 - 2020 Stipulated Price Contract.

1.2 INSPECTION AND DECLARATION

- .1 Refer to Section 01 11 00 – Summary of Work, article 1.46 for a detailed list of requirements.
- .2 Contractor's Inspection: Contractor and Subcontractors: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Consultant in writing of satisfactory completion of Contractor's Inspection and that corrections have been made.
- .3 Consultant's Inspection: Consultant and Contractor will perform inspection of Work to identify obvious defects or deficiencies. Contractor to correct Work accordingly.
- .4 Completion: submit written certificate that following have been performed:
 - .1 Work has been completed and inspected for compliance with Contract Documents.
 - .2 Defects have been corrected and deficiencies have been completed.
 - .3 Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - .4 Certificates required by Fire Commissioner and Utility companies have been submitted.
 - .5 Operation of systems has been demonstrated to Owner's personnel.
 - .6 Work is complete and ready for final inspection.
- .5 Final Inspection: when items noted above are completed, request final inspection of Work by Owner, Consultant and Contractor If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request re-inspection.
- .6 Declaration of Substantial Performance: when Owner and Consultant consider deficiencies and defects have been corrected and it appears requirements of Contract have been substantially performed, make application for certificate of Substantial Performance.
- .7 Commencement of Lien and Warranty Periods: date of Owner's acceptance of submitted declaration of Substantial Performance shall be date for commencement for warranty period and commencement of lien period unless required otherwise by lien statute of Place of Work.
- .8 Final Payment: when Owner and Consultant consider final deficiencies and defects have been corrected and it appears requirements of Contract have been totally performed, make application for final payment. If Work is deemed incomplete by Owner and Consultant, complete outstanding items and request re-inspection.

- .9 Payment of Holdback: after issuance of Certificate of Substantial Performance of Work, submit an application for payment of holdback amount in accordance with the Stipulated Price Contract.

1.3 CLEANING

- .1 In accordance with Section 01 74 11 – Cleaning.
- .2 Remove waste and surplus materials, rubbish and construction facilities from the site immediately following completion of work and prior to final inspection.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 As-built, samples, and specifications.
- .2 Equipment and systems.
- .3 Product data, materials and finishes, and related information.
- .4 Operation and maintenance data.
- .5 Spare parts, special tools and maintenance materials.
- .6 Warranties and bonds.
- .7 Final site survey.

1.2 RELATED SECTIONS

- .1 Section 01 45 00 - Quality Control.
- .2 Section 01 77 00 - Closeout Procedures.
- .3 Section 01 78 10 - Guarantee/Warranty Form
- .4 Section 01 91 00 - Commissioning.
- .5 Mechanical Division: Commissioning
- .6 Section 01 11 00 Summary of Work, article 1.43.

1.3 SUBMISSION

- .1 Submit one copy of completed project operation and maintenance volumes and as-built drawings in final form 15 days prior to substantial performance. For equipment put into use with Owner's permission during construction, submit Operating and Maintenance Manuals within 10 days after start-up. For items of Work delayed materially beyond date of Substantial Performance, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.
- .2 Prepare instructions and data using personnel experienced in maintenance and operation of described products.
- .3 Copy will be returned after inspection with Consultant's comments.
- .4 Revise content of documents as required prior to final submittal.
- .5 Submit 2 copies of revised volumes of data in final form within 10 days after final inspection.
- .6 For contract drawings (architectural, site services, landscaping, structural, mechanical, and electrical), transfer neatly as-built notations onto second and third set and submit all

three sets. Cost of only the transfer of these as-built sets into digital format is paid from Cash Allowance. Completion of digital as-built to the Consultant is a mandatory requirement of Total Completion of the Contract.

- .7 Ensure spare parts, maintenance materials and special tools provided are new, undamaged or defective, and of same quality and manufacture as products provided in Work.
- .8 If requested, furnish evidence as to type, source and quality of products provided.
- .9 Defective products will be rejected, regardless of previous inspections. Replace products at own expense.
- .10 Pay costs of transportation.

1.4 FORMAT

- .1 Organize data in the form of an instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf [219 x 279] mm with spine and face pockets.
- .3 When multiple binders are used, correlate data into related consistent groupings. Identify contents of each binder on spine.
- .4 Cover: Identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
- .5 Arrange content under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.5 CONTENTS - EACH VOLUME

- .1 Table of Contents: provide title of project;
 - .1 date of submission; names,
 - .2 Addresses, and telephone numbers of Consultant and Contractor with name of responsible parties;
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation; delete inapplicable information.

- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.6 AS-BUILTS AND SAMPLES

- .1 In addition to requirements in Sections 00 21 13 Instructions to Bidders, 01 11 00 Summary of Work and the Stipulated Price Contract terms, maintain at the site for Owner one record copy of:
 - .1 Contract Drawings.
 - .2 Specifications.
 - .3 Addenda.
 - .4 Change Orders and other modifications to the Contract.
 - .5 Reviewed shop drawings, product data, and samples.
 - .6 Field test records.
 - .7 Inspection certificates.
 - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction. Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual. Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition. Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Consultant.

1.7 RECORDING ACTUAL SITE CONDITIONS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual, provided by Consultant.
- .2 Provide felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress. Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: legibly mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.

- .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
- .4 Field changes of dimension and detail.
- .5 Changes made by change orders.
- .6 Details not on original Contract Drawings.
- .7 References to related shop drawings and modifications.
- .5 Specifications: legibly mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
 - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.

1.8 DIGITAL AS-BUILT DRAWINGS

- .1 Retain the services of a CAD drafting company acceptable to the Consultant.
- .2 Transfer to digital file all information recorded on As-Built drawings. Layering of information as per Consultant's instructions.
- .3 The Consultant will provide CAD file of contract documents.
- .4 The cost for preparing digital As-Built drawings will be deducted from the Cash Allowances.

1.9 EQUIPMENT AND SYSTEMS

- .1 Each Item of Equipment and Each System: include description of unit or system, and component parts. Give function, normal operation characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.

- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's coordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Mechanical Sections.
- .15 Additional requirements: As specified in individual specification sections.

1.10 MATERIALS AND FINISHES

- .1 Building Products, Applied Materials, and Finishes: include product data, with catalogue number, size, composition, and colour and texture designations. Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and Weather-exposed Products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional Requirements: as specified in individual specifications sections.

1.11 MAINTENANCE MATERIALS

- .1 On completion of project, submit to Architect two (2) copies of Operations Data and Maintenance Manual in English, made up as follows:
 - .1 Bind data in vinyl hard covered, 3 ring loose leaf binder for 215 x 280 mm size paper.
 - .2 Enclose title sheet, labeled "Operation Data and Maintenance Manual", project name, date and list of contents.
 - .3 Organize contents into applicable sections of work to parallel project's specification break-down. Mark each section by labeled tabs protected with celluloid covers fastened to hard paper dividing sheets.
- .2 Include following information, plus data specified.
 - .1 Maintenance instruction for finished surface and materials.
 - .2 Copy of hardware and paint schedules.

- .3 Description, operation and maintenance instructions for equipment and systems, including complete list of equipment and parts list. Indicate nameplate information such as make, size, capacity, serial number.
- .4 Names, addresses and phone numbers of sub-contractors and suppliers.
- .5 Guarantees, Warranties and bonds showing:
 - .1 Name and address of project.
 - .2 Guarantee commencement date (date of Final Certificate of Completion).
 - .3 Duration of guarantee.
 - .4 Clear indication of what is being guaranteed and what remedial action will be taken under guarantee.
 - .5 Signature and seal of Contractor.
 - .6 Additional material used in project listed under various Sections showing name of manufacturer and source of supply.
- .3 Neatly type lists and notes. Use clear drawings, diagrams or manufacturers' literature.
- .4 Include one complete set of final shop drawings (bound separately) indicating corrections and changes made during fabrication and installation.

1.12 STORAGE, HANDLING AND PROTECTION

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

1.13 WARRANTIES AND BONDS

- .1 Refer to Section 00 21 13 'Instructions to Bidders' for bonding requirements for this project, both at the time of tender submission and throughout the duration of the construction period.
- .2 Refer to the Stipulated Price Contract for Warranty requirements and conditions for the standard warranty which is required for the work of this contract.
- .3 Extended warranties are required to be issued by manufacturers, fabricators, suppliers and/or installers, sometimes jointly, due to their unique position in the construction process and their ability to guarantee a particular section of work. Refer to individual requirements of extended warranties requested as well as Section 01 11 00 article 1.36.
- .4 Unless specifically noted otherwise, all extended warranties shall commence on the date of Substantial Performance of the Work as certified by the Consultant.
- .5 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

- .6 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal. Use Guarantee/Warranty Form as provided in Section 017810 Sample Guarantee/Warranty Form, whenever standard preprinted trade or manufacturer's Guarantee/Warranty forms are not available. Provide written form for each warranty specified in Section 01 11 00 Summary of Work, Article 1.36.
- .7 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work.
- .8 Date at beginning of time of warranty start shall be Date of Substantial Performance.
- .9 Verify that documents are in proper form, contain full information, and are notarized.
- .10 Co-execute submittals when required.
- .11 Retain warranties and bonds until time specified for submittal.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

1. GENERAL

1. To be made out on the letterhead of Guarantor or Warrantor which usually is a Subcontractor.
2. This format is to be used only when standard preprinted trade or manufacturer's forms are not available. Preprinted forms are to include all elements of information shown on this sample or as a minimum.
3. Comply with Requirements for Guarantee/Warranty as specified in Section 01 78 10, Closeout Submittals.

To: The Halton Catholic District School Board

Date: _____

SECTION _____

TITLE _____

GUARANTEE/WARRANTY TO:

OWNER The Halton Catholic District School Board

PROJECT Notre Dame CSS – Cosmo & Culinary Interior Renovation

ARCHITECT Hossack Architecture

REFERENCE (to specifications or drawings)

TIME Period of Guarantee/Warranty: _____ years

GUARANTEE/
WARRANTY Starting Date: Substantial Performance as certified by Consultant

Date: _____

(Description of Guarantee/Warranty)

Upon written notification from the Owner or the Consultant that the above work is defective any repair or replacement work required shall be to the Consultant's satisfaction at no cost to the Owner.

This guarantee shall not apply to defects caused by the work of others, maltreatment of materials, negligence or Acts of God.

SUBCONTRACTOR

Signature

Date

Authorized Signing
Officer:

(Name Printed)

Title

Name of Firm:

Address:

Telephone Number

CONTRACTOR

Signature

Date

Authorized Signing
Officer:

(Name Printed)

Title

Name of Firm:

CORPORATE SEAL

Address:

Telephone Number

END OF SECTION

PART 1 GENERAL

1.1 Interior Site Photos

These photographs are provided for convenience only. Bidders remain responsible to inspect the site and assume existing site conditions. The following photos were taken January 2025 & December 2025.

1.1.1 Existing Culinary Classroom (Future Cosmetology)





1.1.2 Existing Cosmetology Classroom (Future Culinary Arts)





PART 1 GENERAL

1.1 Related Sections

1. Section 01 11 00 - Summary of Work
2. Section 01 56 00 – Temporary Barriers and Enclosures
3. Section 01 73 03 – Execution Requirements
4. Section 01 33 00 - Submittal Procedures
5. Section 09 91 22- Painting
6. Electrical Sections

1.2 Scope

1. Scope includes but is not limited to:
 - .1 Demolition or alteration of all components, equipment, fitments and finishes as required to execute the work.
 - .2 Cutting and removal of slabs on grade.
 - .3 Making good of all finishes or surfaces to remain as result of selective demolition.

1.3 Existing Conditions

1. Take over structures to be demolished or altered based on their condition on date that tender is accepted, at time of examination prior to tendering.
2. Contractor may confirm the prior removal of all asbestos containing materials in documentation left on site following prior abatement work contract. Should areas of asbestos be found which are not documented as removed or included in the scope of this work for removal, it shall be reported to the Consultant and Owner's representative for review and instructions for removal.
3. Prior to beginning alteration or demolition, confirm with Owner that no items to be salvaged or turned over to the owner remain in the work areas.

1.4 Protection

- .1 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades parts of existing building to remain. Provide bracing, shoring and underpinning required. Make good damage and be liable for injury caused by demolition.
- .2 Take precautions to support structures and, if safety of building being demolished or adjacent structures or services appears to be endangered, cease operations and notify Consultant.
- .3 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.

Part 2 Products **NOT USED**

Part 3 Execution

3.1 Work

- .1 Dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction. Confirm in Divisions 15 and 16 for removal and re-use of mechanical and electrical materials and equipment.
- .2 Refer to drawings for furniture, materials or equipment to be removed and turned over to the owner. Carefully remove such items and store in location designated by Owner.
3. For a scope of work refer to all Drawings and also coordinate items to be altered, re-built, cleaned or otherwise “made good” as a result of the cutting and patching scope of work described in Section 01 73 03 Execution Requirements or other Sections.

3.2 Preparation

- .1 Disconnect electrical, telephone/PA and data service lines in work areas without disrupting main service to building and in accordance with regulations of authorities having jurisdiction. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .2 Disconnect and cap designated mechanical services in accordance with requirements of local authority having jurisdiction.
 - .1 Natural gas supply lines, if applicable to be removed by gas company by qualified tradesman in accordance with gas company instructions.
 - .2 Remove, cap or dispose of other underground services as indicated in drawings.
 - .3 Do not disrupt active or energized utilities traversing premises designated to remain undisturbed.
- .3 Ground scans to locate hidden or buried services in the work area have NOT previously been done. Prior to cutting, demolition or removal of any slabs on grade or areas where services may be concealed, engage a private locate firm to provide magnetic and X-ray scans of all areas involved. This is the responsibility of the General Contract and costs for such scans are to be included in the base contract price.

3.3 Disconnection and Removal of Materials and Equipment

- .1 Contractor shall cooperate with the Owner to determine which materials are to be removed and retained by Owner. The Owner will decide which items or equipment they wish to retain as their property and all other materials shall be removed from the premises by this Contractor. The equipment which is to be retained by the Owner shall be stored on site where directed by the Owner.
- .2 Refer to mechanical and electrical drawings and for disconnection and removal and/or relocated existing electrical, ductwork, piping and/or equipment.

3.4 Temporary Removals and Replacement

- .1 All items to be removed and installed shall be completed so that replaced materials are left in a clean undamaged state. If required to be replaced due to damage, the contractor shall include in his price for the component to be replaced and installed at no additional cost to the Contract.

3.5 Selective Demolition

- .1 Follow best trade practices for all demolition and alteration work. This includes but is not limited to the following items.
 - .1 The school will be vacant during July and August 2025. Ensure demolition work does not disrupt any ongoing aspect of the operation of the school including the period after Substantial Performance.
 - .2 Confirm all demolition work (including potential noise, vibration, tools or equipment noise, etc.) in advance with the principal of the school on a daily basis. Similarly, notify all building occupants in advance at each possible interruption in services or utilities.
 - .3 Protect all areas from damage and intrusion by means of locking rooms under construction when not in use, use of dust tight screens and temporary partitions and hoarding. Demolish to minimize dusting. Refer to drawings for locations and other Specification Sections for requirements.
 - .4 Signage to be posted at all times. Take precautions to demolish only areas as necessary to complete the work, and avoid damage to adjacent areas. Make good all areas affected by demolition or renovation activities, whether specifically included in the contract documents or not.
 - .5 The Contractor shall be responsible for damage to all areas affected by renovation or alteration activities.
 - .6 Prior to demolition, the Contractor shall carefully examine the drawings in relation to the site conditions, to ensure that all intended work can be carried out without ambiguity. Incorrect demolition of any work by the Contractor, will be back-charged to him. Any discrepancies between the drawings and the site conditions, must be reported to the Consultants immediately.
 - .7 Demolish or remove interior and exterior elements as indicated.
 - .8 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
 - .9 At end of each day's work, leave work in safe condition so that no part is in danger of toppling or falling. Protect interiors of parts not to be demolished from exterior elements at all times.
 - .10 Do not sell or burn materials on site.
 - .11 Remove contaminated or dangerous materials from site and dispose of in safe manner to minimize danger at site or during disposal, in accordance with all governing legislation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 02 20 00 – Earthwork
- .2 Section 03 20 00 - Concrete Reinforcement
- .3 Section 03 30 20 - Cast-in-Place Concrete
- .4 Section 07 92 10 - Joint Sealing

1.2 MEASUREMENT PROCEDURES

- .1 No measurement will be made under this Section. Include costs in items of work for which concrete formwork and falsework is required.

1.3 REFERENCES

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
 - .2 CAN/CSA-O86-01-94(R2006), Engineering Design in Wood (Limit States Design).
 - .3 CSA O121-M1978(R2003), Douglas Fir Plywood.
 - .4 CAN3-O188.0-M78, Standard Test Methods for Mat-Formed Wood Particleboards and Waferboard.
 - .5 CSA S269.1-1975, Falsework for Construction Purposes.
 - .6 CAN/CSA-S269.3-M92(R2003), Concrete Formwork.
- .2 Council of Forest Industries of British Columbia (COFI)
 - .1 COFI Exterior Plywood for Concrete Formwork.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings for formwork and falsework in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3 for formwork drawings.
- .3 Indicate sequence of erection and removal of formwork/falsework.
- .4 Each shop drawing submission shall bear stamp and signature of qualified professional engineer registered or licensed in Province of Ontario, Canada.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Place materials defined as hazardous or toxic waste in designated containers.
- .2 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .3 Use sealers, form release and stripping agents that are non-toxic, biodegradable and have zero or low VOC's.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CAN/CSA-O86-01.
 - .2 For concrete with special architectural features, use formwork materials to CAN/CSA-A23.1.
- .2 Pan forms: permanent steel as indicated.
- .3 Tubular column forms: round, smooth steel forms in two half sections, internally treated with release material.
- .4 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm dia. in concrete surface.
 - .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .5 Form liner:
 - .1 Plywood: high density overlay, Douglas Fir to CSA O121, T and G edge, 12 mm thick.
 - .2 Plastic laminate, vinyl, polyethylene, neoprene or approved products new and acceptable to the Consultant to provide the surface texture and forms required for the design as shown.
- .6 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps.
- .7 Form coating: Formaseal as manufactured by Master Builders for wood forms and as recommended by manufacturer for form liner.
- .8 Joint tape: non-staining, water-impermeable, self-releasing, where required.
- .9 Tie hole plugs: 25mm dia. tapered PVC hole plugs to be provided on all exposed walls.
- .10 Falsework materials: to CSA-S269.1.

- .11 Sealant: to Section 07 92 10 - Joint Sealing.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Obtain Consultant's approval for use of earth forms framing openings not indicated on drawings.
- .3 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .4 Fabricate and erect falsework in accordance with CSA S269.1 and COFI Exterior Plywood for Concrete Formwork.
- .5 Do not place shores and mud sills on frozen ground.
- .6 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .7 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/CSA-A23.1.
- .8 Obtain Consultant's permission before framing openings not indicated.
- .9 Align form joints and make watertight. Keep form joints to minimum.
- .10 Locate horizontal form joints for exposed columns 2700 mm above finished floor elevation.
- .11 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners , joints, unless specified otherwise.
- .12 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
- .13 Line forms for following surfaces:
 - .1 Outer face of beams and joists.
 - .2 Soffit of girders, beams and slabs that are specified to be exposed.
- .14 Clean formwork in accordance with CAN/CSA-A23.1, before placing concrete.
- .15 Obtain approval from soils testing engineer for bearing surfaces prior to erection of forms.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 3 days for walls and sides of beams.
 - .2 3 days for columns.

- .3 7 days for beam soffits, slabs, decks and other structural members, or 3 days when replaced immediately with adequate shoring to standard specified for falsework.
- .4 2 days for footings and abutments.
- .2 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .3 Re-use formwork and falsework subject to requirements of CAN/CSA-A23.1.
- .4 Be responsible for the safety of the structure, both before and after the removal of forms, until the concrete has reached its specified 28 day strength.
- .5 When forms are stripped during the curing period, cure and protect the exposed concrete in accordance with Section 03300.
- .6 Movement and displacement of formwork during construction, variations in excess of specified tolerances and marked and disfigured surfaces that cannot be repaired by specified methods will be considered defective work performed by this Section.
- .7 Reconstruct defective formwork and replace concrete and reinforcement placed in defective formwork at no additional cost to the Owner.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Formwork & Accessories
- .2 Section 03 30 20 - Cast-in-Place Concrete
- .3 Section 04 21 13 - Masonry.

1.2 MEASUREMENT PROCEDURES

- .1 Reinforcing steel will be measured in tonnes of steel incorporated into work, computed from theoretical unit mass specified in CAN/CSA-G30.18 for lengths and sizes of bars as indicated or authorized in writing by Consultant.

1.3 REFERENCES

- .1 American Concrete Institute (ACI)
 - .1 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
- .2 American National Standards Institute/American Concrete Institute (ANSI/ACI)
 - .1 ANSI/ACI 315-99, Details and Detailing of Concrete Reinforcement.
- .3 American Society for Testing and Materials (ASTM)
 - .1 ASTM A 775/A 775M-91c, Specification for Epoxy-Coated Reinforcing Steel Bars.
- .4 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1-04, Concrete Materials and Methods of Concrete Construction.
 - .2 CSA-A23.2-14, Test Methods and Standard Practices for Concrete
 - .3 CAN3-A23.3-04, Design of Concrete Structures for Buildings.
 - .4 CSA G30.3-M1983(R1991), Cold Drawn Steel Wire for Concrete Reinforcement.
 - .5 CSA G30.5-M1983(R1991), Welded Steel Wire Fabric for Concrete Reinforcement.
 - .6 CSA G30.14-M1983(R1991), Deformed Steel Wire for Concrete Reinforcement.
 - .7 CSA G30.15-M1983(R1991), Welded Deformed Steel Wire Fabric for Concrete Reinforcement.
 - .8 CAN/CSA-G30.18-M92(R2002), Billet-Steel Bars for Concrete Reinforcement.
 - .9 CAN/CSA-G40.21-04, Structural Quality Steels.
 - .10 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

- .11 CSA W186-M1990, Welding of Reinforcing Bars in Reinforced Concrete Construction.

1.4 SHOP DRAWINGS

- .1 Submit shop drawings including placing of reinforcement in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Indicate bar bending details, lists and quantities of reinforcement on shop drawings.
- .3 On placing drawings, indicate sizes, spacings, locations and quantities of reinforcement, mesh, chairs, spacers, hangers, and mechanical splices, with identifying code marks to permit correct placement without reference to structural drawings. Prepare reinforcement drawings in accordance with ANSI/ACI 315 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure and Reinforcing Steel Manual of Standard Practice - Metric Supplement 2004 by Reinforcing Steel Institute of Ontario.
- .4 Design and detail lap lengths and bar development lengths to CAN3-A23.3, unless otherwise indicated. Provide Class B tension lap splices unless otherwise indicated.

1.5 SUBSTITUTES

- .1 Substitution of different size bars permitted only upon written approval of the Consultant

Part 2 Products

2.1 MATERIALS

- .1 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise. Use Grade 400R bars for all reinforcing unless noted otherwise, to sizes as shown on the drawings.
- .2 Cold-drawn annealed steel wire ties: to CSA G30.3.
- .3 Deformed steel wire for concrete reinforcement: to CSA G30.14.
- .4 Welded wire fabrics: Where no reinforcement is shown, provide 152 x 152 MW 18.7 x MW 18.7 (6" x 6" x 6/6) welded wire fabric at 37mm (1½ ") below the finished surface of slabs on grade or walks, or toppings 62mm (2½ ") in thickness or greater. Lap ends and sides of fabric in accordance with requirements of CSA Standard CAN/CSA-A23.1, but in any event, not less than 300mm (12").
- .5 Chairs, bolsters, bar supports, spacers: to CAN/CSA-A23.1.
- .6 Mechanical splices: subject to approval of Consultant.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CAN/CSA-A23.1, ANSI/ACI 315, and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures unless indicated otherwise.
- .2 Obtain Consultant's approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Consultant, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Consultant with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 2 weeks prior to commencing reinforcing work.
- .2 Upon request inform Consultant of proposed source of material to be supplied.

Part 3 Execution

3.1 STORAGE OF REINFORCING

- .1 Reinforcing shall be stored off the ground to keep it free from dirt and to maintain its fabricated form.

3.2 FIELD BENDING

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Consultant.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

3.3 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CAN/CSA-A23.1.
- .2 Prior to placing concrete, obtain Inspector's approval of reinforcing material and placement. Provide minimum 48 hours notice to both Inspector and Consultant, prior to placing concrete.

- .3 Locate reinforcing bars to provide proper concrete cover. Reinforcing cover will be carefully inspected by the Consultant, and reinforcing with inadequate cover will not be acceptable.
- .4 Fold all the wired behind bars, away from form faces.
- .5 Modify bars on site to accommodate box-outs, inserts, etc., as directed by the Consultant.

3.4 FIELD CUTTING OF REINFORCING

- .1 Field cut reinforcing bars only where permitted by the Consultant.

END OF SECTION

Part 1 General

1.1 GENERAL REQUIREMENTS

- .1 Division 1, General Requirements, is a part of this section and shall apply as if repeated here.

1.2 WORK IN OTHER SECTIONS

- .1 Related Work Specified in Other Sections

Section 02 20 00 – Earthwork
Section 02 55 00 – Site Services
Section 03 10 00 – Concrete Formwork & Accessories
Section 03 20 00 – Concrete Reinforcing
Section 04 20 00 – Unit Masonry
Section 05 10 00 – Structural Metal Framing
Section 05 50 00 – Miscellaneous Metal
Section 07 46 10 – Cementitious Surfacing System
Division 15 – Mechanical
Division 16 – Electrical

1.3 REFERENCE STANDARDS

CSA-A23.1-14 – Concrete Materials and Methods of Concrete Construction
CSA A23.2-14 – Test Methods and Standard Practices for Concrete
CAN/CSA-A3001: Portland Cement
CAN/CSA-A23.5-M86: Supplementary Cementing Materials
CAN/CSA-A362-93: Blended Hydraulic Cement
CSA G30.18-09 (R2014): Carbon steel bars for concrete reinforcement
CSA G30.3-M1983 (R1998): Cold-Drawn Steel Wire for Concrete Reinforcement
ASTM A820/A820M-16, Standard Specification for Steel Fibres for Fibre Reinforced Concrete.

1.4 SAMPLES

- .1 At least (3) weeks prior to commencing work, inform the Consultant of the proposed mix design and proposed source of ready mixed concrete.
- .2 A sample of the finishes shall be prepared and remain as the minimum acceptable standard for the project.

1.5 CERTIFICATES

- .1 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1.
- .2 Provide certification that mix proportions selected will produce concrete of specified quality and yield and that strength will comply with CSA-A23.1.

1.6 QUALITY ASSURANCE

- .1 The Contractor shall employ an independent inspection and testing company to carry out all testing and inspection as required. The Consultant will appoint the inspection and testing company. The cost of inspection and testing shall be paid by the Contractor, out of the Cash Allowance carried for this testing under Division 1.
- .2 Samples and methods of moulding shall conform to the requirements of CSA-A23.2.
- .3 Additional testing shall be made if there is a distinct change in job conditions or if required by the Consultant or the authority having jurisdiction.
- .4 Compression tests shall be performed in accordance with CSA-A23.2 and good practice.
- .5 Failure to meet strength requirements will result in rejection of materials, strengthening or replacement of those portions that failed to develop the specified strength.
- .6 Concrete slump shall be tested at time that cylinders are cast and at such other times deemed necessary.
- .7 **The addition of water and admixtures on the site is hereby prohibited and unacceptable for the project.**

1.7 SUBMITTALS

- .1 Submit shop drawings in accordance with Section 01300 Submittals.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Designate a cleaning area for tools to limit water use and runoff.
- .2 Carefully coordinate the specified concrete work with weather conditions.
- .3 Ensure emptied containers are sealed and stored safely for disposal away from children.
- .4 Prevent plasticizers, water-reducing agents and air-entraining agents from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with an inert, non-combustible material and remove for disposal. Dispose of all waste in accordance with applicable local, provincial and national regulations.
- .5 Choose least harmful, appropriate cleaning method which will perform adequately.

Part 2 Products

2.1 MATERIALS

- .1 Formwork: As specified in Section 03100.
- .2 Formwork Lumber:
 - .1 Plywood and wood formwork materials to CSA-A23.1. Formwork materials brought on site shall be new.

-
- .2 Panels shall be fabricated for use as form panels, finished one side with form coating, with sealed edges and a minimum thickness of 17mm.
 - .3 Panels shall be smooth and free from defects which would show up on concrete surfaces exposed to view.
 - .4 Form Coating: Formaseal, as manufactured by Sternson Construction Products.
 - .5 Joint Tape: Non-staining, water impermeable, self-releasing.
 - .6 Form Ties: Removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25mm diameter in concrete surface, and not leaving metal closer than 25mm to the surface of the concrete.
 - .7 Tie Hole Plugs: 25mm dia. tapered P.V.C. hole plugs.
 - .8 Reinforcing Steel: As specified in Section 03200.
 - .9 Reinforcing Steel: Billet steel, grade 400R, deformed bars to CAN/CSA-G30.18 to sizes shown on structural drawings. Where none is shown, provide 15M bars at 300mm centres as minimum steel.
 - .10 Wire Mesh: Welded Wire Fabric to sizes and locations shown on drawings. Where none is shown, provide 152x152xMW18.7xMW18.7 W.W.F. one layer as minimum.
 - .11 Portland Cement: to CAN/CSA-A3001, Type GU.
 - .12 Water: to CSA-A23.1.
 - .13 Aggregates: To CSA-A23.1. Coarse aggregates to be normal density. Use blend of 10mm and 20mm for coloured patterned concrete slabs.
 - .14 Air Entraining Admixture: To CAN/CSA3-A23.5.
 - .15 Chemical Admixtures: To CAN/CSA3-A23.5 water reducing type WN. Consultant to approve accelerating or set retarding admixtures during cold and hot weather placing.
 - .16 Colour Admixtures: Integral coloured pigments to C-979-86. Two (2) colours to be selected by Consultants from manufacturer's standard range.
 - .17 Non-Shrink Grout: Sternson M-Bed Superflow or approved equal.
 - .18 Floor Hardener: Surflex TR trap rock hardener, shake on, by Euclid Chemical Company. Application rate of 5kg/m² (1.0 lb/ft²).
 - .19 Interior Cure and Seal Compound: Interior slabs shall be W. R. Meadows "Intex". No resin-based compounds will be accepted.
 - .20 Exterior Cure and Seal Compound: Exterior concrete slabs and gutters shall be W. R. Meadows "Sealtight CS-309".

- .21 Expansion Joint Filler: Shall be Sealtight asphalt expansion joint filler, W. R. Meadows.
- .22 Joint and Sawcut Filler: Shall be Loadflex by Sternson or Jointflex by CPD.
- .23 Joint Tape: Shall be Sealtight Gusset Tape by W. R. Meadows.
- .24 Premoulded Membrane: Shall be Sealtight 7100-312 (PMPC), W. R. Meadows.

2.2 CONCRETE MIXES

- .1 Proportion normal density concrete in accordance with CSA A23.1, to give following properties for concrete in foundation walls, footings, composite deck toppings and any other unspecified concrete:
 - .1 Cement: Type GU Portland cement, minimum 325 kg/m³
 - .2 Maximum 25% slag cement content
 - .3 Minimum compressive strength at 28 days: 25 MPa.
 - .4 Nominal size of coarse aggregate: 20 mm.
 - .5 Slump at time and point of discharge: 50 to 100 mm.
 - .6 Air content: 0 to 3%.
- .2 Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1 to give following properties: for concrete in slabs-on-grade, structural slabs and columns:
 - .1 Cement: Type GU Portland cement, minimum 325 kg/m³
 - .2 Maximum 25% slag cement content
 - .3 Minimum compressive strength at 28 days: 32 MPa.
 - .4 Nominal size of coarse aggregate: 20 mm.
 - .5 Slump at time and point of discharge: 60 to 100 mm.
 - .6 Air content: 0 - 3% maximum.
- .3 Proportion normal density concrete in accordance with CSA-A23.1, to give following properties: for concrete in exterior structural slabs and sidewalks/curbs:
 - .1 Cement: Type GU Portland cement, minimum 275 kg/m³
 - .2 Maximum 25% slag cement content
 - .3 Minimum compressive strength at 28 days: 32 MPa.
 - .4 Class of exposure: C-2.
 - .5 Nominal size of coarse aggregate: 20 mm.
 - .6 Slump at time and point of discharge: 60 to 100 mm.
 - .7 Air content: 5 to 8%.
- .4 Proportion normal density concrete in accordance with CSA-A23.1, to give following properties: for concrete in grouted masonry blocks and concrete in metal pans.
 - .1 Cement: Type GU Portland cement, minimum 275 kg/m³
 - .2 Maximum 25% slag cement content
 - .3 Minimum compressive strength at 28 days: 20 MPa.
 - .4 Nominal size of coarse aggregate: 10 mm.
 - .5 Slump at time and point of discharge: 50 to 100 mm.
 - .6 Air content: 0 - 3% maximum.
- .5 Proportion normal density concrete in accordance with CSA-A23.1, Alternative 1 to give

following properties: for concrete fill.

- .1 Cement: Type GU Portland cement, minimum 250 kg/m³
 - .2 Maximum 25% slag cement content
 - .3 Minimum compressive strength at 28 days: 10 MPa.
 - .4 Nominal size of coarse aggregate: 10 mm/20 mm.
 - .5 Slump at time and point of discharge: 100 mm.
 - .6 Air content: 0 - 4% maximum.
- .6 Do not change job mix formula without prior approval of the Consultant.
- .7 In addition to 28 day strength tests, 7 days test may be carried out. If average strength at 7 days is less than 70% of specified 28 day strength, check mix at once and adjust to ensure required strength is obtained.

Part 3 Execution

3.1 WORKMANSHIP

- .1 All concrete shall be as set forth in CSA-A23.1 and shall be composed of cement, fine and coarse aggregates and water.
- .2 Concrete shall be delivered and discharged within 1½ hours after the introduction of the mixing water at the batch plant.
- .3 Mixing, placing, compaction, curing, hot and cold weather protection shall conform to CSA-A23.1. Use power vibrators in sufficient number and in location and duration to the Consultant's complete satisfaction as required.
- .4 Obtain the Consultant's approval before placing concrete. Provide 24 hour notice prior to placing of concrete.
- .5 Pumping of concrete is permitted only after approval of equipment and mix.
- .6 Ensure reinforcement and inserts are not disturbed during concrete placement in order to maintain proper coverage.
- .7 Prior to placing of concrete obtain the Consultant's approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .8 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .9 Do not place load upon new concrete until authorized by the Consultant.

3.2 FORMWORK

- .1 Verify lines, levels and column centres before proceeding with formwork and ensure dimensions agree with drawings.
- .2 Construct forms to produce finished concrete conforming to shape, dimensions, locations and

levels indicated within tolerances required by CSA-A23.1.

- .3 Align form joints and make watertight. Keep form joints to minimum.
- .4 Use 25mm chamfer strips on all vertical and horizontal corners of exterior retaining walls as indicated on drawings.
- .5 All surfaces of formwork which face concrete, which will be exposed to view are to be coated with protective form coating to minimize transfer of wood grain to finished concrete.
- .6 Clean formwork in accordance with CSA-A23.1 before placing concrete.
- .7 Re-use of formwork is subject to requirements of CSA-A23.1.
- .8 When forms are stripped during the curing period, cure and protect the exposed concrete.
- .9 Movement and displacement of formwork during construction, variations in excess of specified tolerances and marked and disfigured surfaces that cannot be repaired by specified methods will be considered defective work performed by this Section.
- .10 Reconstruct defective formwork and replace concrete and reinforcement placed in defective formwork at no additional cost to the Owner.

3.3 INSERTS

- .1 Co-ordinate and verify that the Electrical Contractor has set all ducts, boxes and other inserts and openings as indicated or specified elsewhere. Sleeves and openings greater than 100 x 100 mm not indicated on structural or civil drawings must be approved by the Consultant.
- .2 Co-ordinate and verify that the Mechanical Contractor has set all floor drains, cleanouts, trench drains to provide a smooth, flush appearance with the '**FINISHED FLOOR SURFACE**' and to ensure a positive and uniform slope towards the drains.
- .3 Do not eliminate or displace reinforcement to accommodate inserts or hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Consultant before placing of concrete.
- .4 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete. With the Consultant's approval, grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be at least 100 mm in diameter. Drilled holes to be minimum 25 mm larger in diameter than bolts used. Protect anchor bolt holes from water accumulations. Set bolts and fill holes with non-shrink grout or epoxy (as noted on drawings).
- .5 Set hollow metal frames, plumbed, squared and braced with blocking in locations shown on drawings.

3.4 GROUTING

- .1 Grout underside of steel column bearing plates with non-shrinking grout to manufacturer's instructions. Place grout to cover steel shims left in place.

3.5 FINISHING

- .1 Finish all concrete surfaces in accordance with Section 03350.

3.6 EXPANSION CONTROL

- .1 Expansion Joints: Install expansion joint material between slabs on grade and masonry walls, for interior slabs and at max. 6000mm spacing for exterior slabs and curbs, and between slabs on grade and concrete curbs.
- .2 Control Joints: Sawcut control joints at a maximum spacing of 3000mm in each direction and where noted on drawings. Cut joints within 24 hours of placing and to a depth as detailed on drawings.

3.7 WATER/VAPOUR CONTROL

- .1 Butt joints tight together and tight to foundation wall. Seal all joints with gusset tape including foundation wall junctions.
- .2 Protect during placing of concrete to ensure the integrity of the barrier is maintained. Repair immediately any penetrations or areas damaged in accordance with the manufacturer's recommendations.

3.8 CURING AND PROTECTION

- .1 Cure and protect newly finished slabs and steps in accordance with CSA A23.1.
- .2 Coat exterior slabs, curbs with curing compound and leave for 30 days. Apply sealer after curing period has expired.
- .3 Cure finished concrete surfaces in a manner which will leave the surface with a uniform appearance and with a minimum of discolouration after drying. Ensure that curing compounds are compatible with adhesives for finishes to be applied later.
- .4 For all concrete slabs that are to remain exposed, curing compound is to be applied at a rate required for use as a sealer/hardener, in accordance with the manufacturer's instructions.

3.9 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by the Consultant in accordance with CSA-A23.1.
- .2 The Consultant will take additional test cylinders during cold weather concreting. Cure cylinders on job site under same conditions as concrete which they represent.
- .3 Inspection or testing by Consultant will not augment or replace contractor quality control nor relieve him of his contractual responsibility.

3.10 TOLERANCES

- .1 Cast-in-Place concrete shall be constructed within the dimensional tolerances specified in CSA-A23.1, as specified elsewhere in this section. Concrete floor slabs shall be constructed as moderately flat slabs and within the tolerances listed below.
- .2 Conform in line, level and plumbness to the following tolerances. These are maximum values.
- .3 Variation from vertical, in lines and surfaces of walls piers:

:	In height of 3m (10')	-	6mm (1/4")
- .4 Variation from level or from grades shown in floors grade:

:	In any 3m (10')	-	3mm (1/8")
:	In any bay up to 6m (20')	-	6mm (1/4")
:	In any 12m (40')	-	12mm (1/2")
- .5 Variation from straight or from correct position in walls:

:	In length up to 6m (20')	-	12mm (1/2")
:	In any 12m (40')	-	12mm (1/2")
- .6 Variation in size and location of sleeves, floor open and the like and in location of bolts, inserts and fastenings:

:		-	6mm (1/4")
- .7 Variation in location of bolts, inserts, sleeves and fastenings when in group:

:		-	3mm (1/8")
- .8 Variation in cross-section of slabs, walls and piers:

:	Maximum oversize	-	12mm (1/2")
:	Maximum undersize	-	6mm (1/4")
- .9 There shall be no variations from required level at junction of walls and floors.
- .10 Where drains occur, floors shall be properly and uniformly sloped to allow complete drainage of the area.

3.11 DEFECTIVE CONCRETE

- .1 Concrete is defective when:
 - .1 Containing visible honeycombing or embedded debris.
 - .2 Concrete damaged by freezing or which is unsatisfactory due to placement at too high a temperature.
 - .3 Average 28 day strength of any three consecutive strength tests is less than specified minimum 28 day strength.
 - .4 Any 28 day strength test result in less than 88% of specified minimum 28 day strength.
 - .5 Cracking occurs in locations other than at control and construction joints.
 - .6 Curing is not carried out strictly according to the specifications.

-
- .2 Remove and reconstruct in entirety any defective concrete footing, slabs, walls as directed by the Consultant.

3.12 COLD WEATHER PROTECTION

- .1 Refer to CSA Standards CSA-A23.1 and CSA-A23.2 Provisions and Publications. Include for tarped heated enclosures - no non-freeze additives such as calcium will be tolerated on this project.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for concrete floor hardeners, slip resistant coatings, and sheet curing materials.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 01 51 00 – Temporary Utilities
- .3 Section 03 33 00 – Cast-in-Place Concrete

1.3 REFERENCES

- .1 Health Canada - Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 CSA-A23.1-09: Concrete Materials and Methods of Concrete Construction

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets.
 - .1 WHMIS MSDS acceptable to Human Resources Development Canada-Labour and Health Canada for concrete floor hardeners.
 - .2 Indicate VOC content.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard, packaging material in appropriate on-site bins for recycling.
- .3 Dispose of unused chemical additive materials at an official hazardous materials collections site approved by Consultant.
- .4 Unused chemical additive materials must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .5 Fold up metal banding, flatten and place in designated area for recycling.
- .6 Dispose of unused chemical additive materials at an official hazardous materials collections site approved by Consultant.

1.6 ENVIRONMENTAL REQUIREMENTS

- .1 Temporary lighting:
 - .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 m² of floor being finished.
- .2 Electrical power:
 - .1 Sufficient electrical power to operate equipment normally used during construction.
- .3 Work area:
 - .1 Water tight protection against rain and detrimental weather conditions.
- .4 Temperature:
 - .1 Maintain ambient temperature of not less than 10 degrees Celsius or C° from 7 days before installation to at least 48 hours after completion of Work and maintain relative humidity not higher than 40% during same period.
 - .2 Maintain substrate temperature at 10 C° minimum.
- .5 Moisture:
 - .1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.
- .6 Safety:
 - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
 - .1 Ventilate area of work as directed by Consultant by use of approved portable supply and exhaust fans.
 - .2 Ventilate enclosed spaces in accordance with Section 01 51 00 - Temporary Utilities.
 - .3 Provide continuous ventilation during and after coating application.
 - .4 Sufficient to prevent carbon monoxide or high levels of carbon dioxide and other injurious gases from affecting concrete.

1.7 SCOPE OF WORK

- .1 Provide liquid hardener at all exposed concrete slab-on-grade areas, and where exposed concrete is indicated on architectural drawings or in room finish schedule.

Part 2 Products

2.1 FLOOR HARDENER

- .1 Concrete floor sealer (SCONC): where concrete curing agent/sealer/hardener is required, provide Shur-Seal as manufactured by Paul M. Wolff Co. Inc. (714) 974-0630 or Sure Hard manufactured by Dayton Superior's Canada Limited.

Part 3 Execution

3.1 EXAMINATION

- .1 Examine area and conditions under which the work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work and which do not conform to manufacturer's recommendations. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- .1 On freshly poured concrete surfaces, no additional surface preparation will be required. All surfaces must be clean, sound and absorptive. Remove any concrete laitance and patch, fix all cracks and damaged areas. New concrete should be properly cured a minimum of seven (7) days, prior to placing the concrete floor hardener, in accordance with CSA A23.1 by one of the following methods: water, plastic sheeting or burlap.
- .2 On areas where forms are recently removed, remove all form oil and breaking compound residue to assure penetration of the product into the surface.
- .3 When applying near windows, mask the glass.
- .4 Avoid contact with plant life, glass, aluminum, and other finished surfaces. Where contact occurs, immediately wipe with a damp cloth or flush with water.
- .5 Avoid contact with asphaltic concrete.
- .6 On previously sealed existing concrete floors, completely strip floor of sealers and contaminants prior to application. Apply as for freshly poured surfaces.

3.3 APPLICATION REQUIREMENTS

- .1 Two applications are required. The first application at 5m²/litre followed by the second application at 10m²/litre as final coat in strict accordance with manufacturer's specifications.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 This Section specifies work which shall be performed by:
Section 04 22 01: STRUCTURAL LOAD BEARING CONCRETE MASONRY UNIT (CMU) CONSTRUCTION.

1.2 QUALITY ASSURANCE

- .1 Requirements of Regulatory Agencies:
Modify requirements of the Specifications only as jurisdictional authorities may direct.

1.3 REFERENCES

- .1 ASTM C270-89: Standard Specification for Mortar for Unit Masonry.
- .2 CSA A179-04 (R2009): Mortar and Grout for Unit Masonry.
- .3 CSA A371-04 (R2009): Masonry Construction for Buildings.
- .4 CSA S304.1-04: Masonry Design for Buildings (Limit States Design).

1.4 SUBMITTALS

- .1 Affidavits:
Submit to Consultants affidavits of an inspection company that mortar and grout materials conform to requirements of the Specifications, if requested.

1.5 DELIVERY, STORAGE AND HANDLING

- .1 Handle and store cementitious materials protected against moisture.
- .2 Handle and store all mortar materials to prevent contamination by foreign materials, and damage by freezing or excessively high temperatures.

1.6 SITE CONDITIONS

- .1 Environmental Requirements:
When air temperature is less than 5° C, mix mortar as specified in CSA A371.

Part 2 Products

2.1 MATERIALS

- .1 Use materials only as specified in CSA Standard A179 referenced from CSA A371 and CSA S304.1 as applicable. Ensure that water and aggregate used in mortar, other than in walls buried in earth, will cause no efflorescence.
- .2 Incorporate only materials from same source in mortar exposed to view.
- .3 Water: Verify that water used contains no salts to cause efflorescence.
- .4 Portland Cement: to CAN/CSA-A3001, Type GU; grey colour, unless indicated elsewhere.

- .5 Masonry Cement: to CAN/CSA-A3002, Type S.
- .6 Hydrated Lime: to ASTM C207, Type S-Special.
- .7 Mortar Aggregate: natural sand, to CSA A179, standard masonry type; clean, dry, protected against dampness, freezing and foreign matter.
- .8 Grout Coarse Aggregate: to CSA A179, maximum 10 mm size, 27 percent by volume.
- .9 Grout Fine Aggregate: to CSA A179, clean well graded sharp sand; 54 percent by volume.
- .10 Water: potable, clean and free of deleterious amounts of acids, alkalies or organic materials.

2.2 ADMIXTURES

- .1 Plasticizer: water reducing type, reducing porosity and absorption to increase bond strength.
- .2 Water Repellent: mixture of calcium carbonate and hydrous magnesium aluminum silicate powders.

2.3 MIXES

- .1 Mortar for Concrete Masonry Units: to CSA A179, Type S using the Proportion Specification Method c/w water repellent addition.
- .2 Mortar for Calcium Silicate Masonry Units: to CSA 179, Proportion Specification Method, consisting of 1-1-6 mix of Portland cement, hydrated lime and aggregate, c/w integral colour.
- .3 General: Ensure that water and aggregates used are all from same source and will meet required strengths. Batch mortar and grouts are acceptable provided source is approved prior to commencement of work.
- .4 Mix mortars as specified in CSA A179. Use only dry aggregate. Test for bulking to determine accurate proportioning.
- .5 Do not incorporate calcium chloride in mortar mix. In cold weather non-chloride accelerating admixtures may be utilised such as Accelguard 80 by Euclid Chemical Canada Inc., or equivalent meeting specified requirements of ASTM Specification C270.
- .6 Dirt resistant additives: aluminum tristearate, calcium stearate or ammonium stearate.
- .7 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.
- .8 Colouring Additive: A mineral-oxide pigment, harmless to mortar set and strength, shall be provided. Colour shall be one (1) colour per masonry unit type, as selected by the Consultant.

2.4 GROUT

- .1 Grout in Reinforced Masonry Cores, Bond Beams and Lintels:
 - : 20 MPa strength at 28 days
 - : 175 – 200 mm slump, mixed to CSA – A179, fine grout.

Part 3 Execution

3.1 MIXING

- .1 Mix mortar to consistency required for working.
- .2 Mix grout to semi-fluid consistency.
- .3 Incorporate colour and admixtures into mixes in accordance with manufacturer's instructions. Use clean mixer for coloured mortar.
- .4 Prehydrate pointing mortar by mixing ingredients dry, then mix again adding just enough water to produce damp unworkable mix that will retain its form when pressed into ball. Allow to stand for not less than 1 hour nor more than 2 hour then remix with sufficient water to produce mortar of proper consistency for pointing.

3.2 INSTALLATION

- .1 Grout fully all pockets in concrete foundation walls where structural components installed, under bearing plates at piers and elsewhere as noted on drawings.
- .2 Grout solid all reinforcing installed in concrete block walls.
- .3 Protect all mortar and grout installed from freezing or from excessive heat which will prevent bonding or decrease the required compressive strength.

3.3 PREPARATION

- .1 Protection:
 - Provide waterproof protection over construction surfaces at mixing areas to prevent deposit on them of mortar and mortar materials.

3.4 MORTAR TYPES

- .1 For laying concrete and brick unit masonry, use mortar type:
 - “S” in masonry walls in contact with earth.
 - “S” in masonry walls for all structural walls.
 - “N” in non-structural applications.

END OF SECTION

Part 1 General

1.1 DESCRIPTION

- .1 General Requirements:
 - .1 Division 1, General Requirements, is a part of this Section and shall apply as if repeated here.
 - .2 Work performed by other Sections and which is related to this Section is specified in:
 - .1 Section 031000: Concrete Formwork: for dovetail anchor slots in concrete.
 - .3 Supply of work which shall be installed by this Section is specified in:
 - .1 Section 051223: Structural Steel: to furnish bearing plates
 - .2 Section 051223: Structural Steel: to furnish masonry anchors attached to steel structure
 - .3 Section 053100: Metal Decking: to furnish bearing plates. Miscellaneous inserts and attachment devices to support the installations of other Sections, frames and miscellaneous metal work
 - .4 This Section shall include performance of work which is specified in:
 - .1 Section 040512: Mortar

1.2 SYSTEM DESCRIPTION

- .1 Tolerances:
 - .1 Lay masonry to tolerances specified in CSA A371-94 and:
 - .2 Level within 6 mm in any bay or 6 m maximum distance, and 13 mm in 12 m or more.
 - .3 Opening sizes within 6 mm of designated dimension.
 - .4 With joints to dimensions indicated, but in no case greater than 13 mm.

1.3 QUALITY ASSURANCE

- .1 Requirements of Regulatory Agencies:
 - .1 Construct masonry as required by jurisdictional authorities.
 - .2 Before commencing masonry work, verify that site conditions will allow construction of masonry within required limitations for wall heights, wall thickness, openings, bond, anchorage, lateral support, and compressive strengths of masonry units and mortars.
 - .3 Construct masonry fire rated assemblies, which are validated by UDI, ULC, or NRC fire tests, in complete accordance with the test design specification. Fire rated assemblies constructed otherwise will be acceptable only on presentation of authorisation by jurisdictional authorities.

1.4 REFERENCE STANDARDS

- .1 CAN3-S304-M84, or CSA S304.1-94 as applicable, for masonry design
- .2 CSA A370-94 and CSA A371-94 for masonry construction specified in this Section.
- .3 ASTM A924/A924M-95, Specification for General Requirements for Steel Sheet Metallic Coated by the Hot-Dip Process.

- .4 CAN/CGSB-37.2-M88, Emulsified, Asphalt, Mineral Colloid Type, Unfilled, for Dampproofing and Waterproofing, and for Roof Coatings.
- .5 CAN3-A165 Series -M85, Concrete Masonry Units.
- .6 CSA A370-94, Connectors for Masonry.
- .7 CSA -S371-M84, Masonry Construction for Buildings.
- .8 CAN3-S304-M84, Masonry Design for Buildings.
- .9 CSA S304.1-94, Masonry Design for Buildings (Limit States Design).

1.5 SUBMITTALS

- .1 Samples:
 - .1 Submit samples of unit masonry for review.
- .2 Affidavits:
 - .1 Submit affidavits by an approved independent testing laboratory stating that materials supplied are in accordance with the Specifications, if requested.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Isolate masonry units from contact with ground and other materials until laid, to prevent staining.
- .2 Ensure that moisture content of concrete masonry units is maintained within specified limits from time of shipment from plant to time of installation.
- .3 Cover masonry unit stockpiles while stored to prevent exposure to weather. Keep water out of all holes and reglets in units during freezing weather.
- .4 Handle and store masonry units to prevent soiling and chipping.
- .5 Deliver products to the place on site as directed, and to meet installation schedule.

Part 2 Products

2.1 MATERIALS

- .1 Meet specified requirements of CSA A370.94 and CSA A371-94 for materials unless specified otherwise.
- .2 Asphalt Emulsion: To meet specified requirements of CAN/CGSB-37.2-M88.
- .3 Joint Packing at Walls:
 - .1 Fire Separation Packing: at tops of fire rated walls and partitions: Thermafiber 200 degree glass fibre insulation by Canadian Gypsum Company, Limited, or Fire barrier fibre firestopping by AD Distributors Ltd.
 - .2 Expansion Joint Packing: Glass fibre insulation, rigid board, density of 48 kg/cu.m.; or Rodofam by Sternson Limited, or closed cell neoprene DA2015 by Dur-O-Wal Ltd.

- .4 Joint Reinforcement:
 - .1 Provide joint reinforcement in width to ensure that longitudinal rods at faces of wall have minimum mortar cover of 16 mm and that they are centred on shells of hollow core units.
 - .2 For Interior Single Wythe Walls: 4.76 mm dia. longitudinal and cross rods, welded steel rod, galvanised, truss design. Manufacturers: Dur-O-Wal (a Hohmann and Barnard Company) or Blok-Lok (a Hohmann and Barnard Company).
 - .3 For information on horizontal reinforcing in load bearing and non-load bearing concrete block walls, see 'Horiz. Wall Reinf. Schedule', on Structural Drawings S-2, and S-3.
- .5 Galvanizing:
 - .1 For Joint Reinforcement, Bond Ties, Anchors, and Accessories in Exterior Walls: To meet specified requirements of ASTM Specification A153 , Class B, hot dip.
 - .2 For Joint Reinforcement, Anchors, and Accessories in Interior Walls: Manufacturer's standard mill galvanising.
- .6 Reinforcing Steel: For reinforced block lintels: to meet specified requirement of CSA Standard G30.18.
- .7 Dovetail Anchor: 25 mm x 2 mm formed sheet steel dovetail brick anchor galvanised, with end bent to form hook, to suit dovetail anchor slot specified for installation by formwork constructor.
- .8 Weep Holes: Plastic tube, 10 mm OD x 100 mm long, or 10 mm x 38 mm x 90 mm long rectangular; or DA1069 Cell Vent by Dur-O-Wall Limited.
- .9 Concrete Masonry Units:
 - .1 To meet specified requirements of CAN3-A165 Series - M85.
 - .2 Include all special shapes, such as end, bond, sash groove and lintel units, required for complete masonry installation indicated on Drawings. Use bullnose corner block at all door jambs, vertical external corners and where otherwise indicated on Drawings.
 - .3 Modular size units.
 - .4 Provide 100% solid units where required by jurisdictional authorities.
 - .5 Moisture controlled ("M") units acceptable to Consultant.
 - .6 Normal Weight Units: For use in walls in earth:
 - .1 Hollow Units: H/20/A/O.
 - .2 75% Solid Units: S/20/A/M.
 - .3 Solid Units: S/20/A/O:
 - .4 For use at interior exposure and as otherwise indicated on Drawings:
 - .5 For use in exterior walls exposed to the weather:
 - .6 Hollow Units: H/20/A/M.
 - .7 Solid Units: S/20/A/M.
 - .7 Supply lintel blocks to Section 03300 for fabrication of lintels by Section 03300.
- .10 Horizontal Masonry Reinforcing: Fero Slotted Block ties (type 1) 16 gauge sheet metal, hot dipped galvanized, insulation support, 4.76 mmØ, V-tie, hot dipped galvanized with welded truss type (not ladder type) reinforcing for back up block, as specified.
- .11 Thru-wall Flashing and Air/Vapour Barrier Sheet Membrane Treatment: Self-adhering SBS modified bitumen membrane reinforced with non-woven fibrous glass. Acceptable

materials: Blueskin TW by Bakor Inc., Mississauga or sheet air/vapour barrier membrane as specified as in Section 07 26 00 - Sheet Vapour Retarders.

Part 3 Execution

3.1 PROTECTION

- .1 Cover exposed tops of masonry walls when laying is not in progress and until protected by completed construction. Cover with non-staining waterproof material to overhang top edges of wall by 600 mm minimum and secured to prevent dislodgement.
- .2 Protect exposed external corners of masonry with materials which will not damage or soil finished surfaces.
- .3 Protect all finished surfaces from mortar droppings.
- .4 Take particular care to protect faces of concrete unit masonry from mortar droppings and smears as laying proceeds.
- .5 Turn over or cover scaffolds and mortar boards at completion of each day's work to avoid staining of finished surfaces by splashed rain.

3.2 LAYING MASONRY

- .1 Lay masonry to meet specified requirements of CSA A370-94 and CSA A371-94, unless otherwise specified.
- .2 Lay masonry to course as shown on Drawings and to minimise cutting of units.
- .3 Co-ordinate coursing of dissimilar sized units only as approved by Consultant.
- .4 Use only dry and unfrozen materials.
- .5 Remove sections of masonry which have been frozen before laying of masonry continues.
- .6 Lay masonry in running bond with vertical joints of alternate courses in line.
- .7 Lay concrete unit masonry with thick ends of webs on top.
- .8 Joints:
 - .1 Make joints of uniform thickness with vertical joints from course to course maintained plumb.
 - .2 Provide full bed and head joints for shear walls.
 - .3 When laying is resumed on walls previously laid with mortar either partially or totally set, remove loose units and mortar from top and adjoining surfaces. Remove mortar completely when masonry is removed and replaced with new.
 - .4 Form tooled concave joints wherever exposed to view, whether behind cabinets, fitments, and wall accessories, or not. When mortar has become "thumb-print" hard, tool joints and clean off burrs with trowel or burlap. Use a tool with a bearing surface of 550 mm minimum length on horizontal joints to avoid uneven depressions.
 - .5 Rake out joints to masonry exposed to view to provide for caulking:

- .1 at junction of interior and exterior walls with columns.
- .2 at junction of interior with exterior walls.
- .3 intersections of walls and partitions where joint reinforcement is installed.
- .4 at caulked joints where indicated typically.
- .9 Stop off horizontal runs of walls by racking back a half unit in each horizontal course: do not touch.
- .10 Do not wet concrete units.
- .11 Distribute masonry units of varying colours and textures to avoid spotty appearance over wall surfaces exposed to view. Do not use units which contrast too greatly with overall range.
- .12 Use chipped and blemished units only where concealed. Do not use defective or broken units. Do not lay concrete units with markedly smooth face that will appear slick where exposed to view, whether painted or not.
- .13 Maintain bracing of walls and piers continuously during construction until structure provides support.
- .14 Lintels:
 - .1 Build in Lintels supplied by Section 055000. Set and level lintels on a bed or mortar.
 - .2 Build in precast concrete block lintels fabricated under work of Section 033000.
 - .3 Provide means to prevent damage due to differential movement resulting from expansion or contraction and from deflection of lintel.
- .15 Built-In Items:
 - .1 Verify that built-in items specified in other Sections are available for building in before laying of masonry commences. Co-operate in the setting and aligning of built-in items and provide for later installation of items which are installed by other Sections, to avoid cutting, fitting, and patching.
 - .2 Build masonry around pressed steel door frames supplied and set as specified in other sections. Ensure that anchors are well secured and that frames are true and plumb. Completely fill frames with mortar as each course is laid. Maintain protective frame covering and ensure that no mortar is left on frame faces.
- .16 Cope, cut and split concrete masonry units with power-driven abrasive discs. Cut units wherever electrical outlets, grilles, and pipes occur. Allow 3.2 mm clearance around items which are incorporated in walls.
- .17 Do not expose open cells, cores or frogs of masonry units to view.
- .18 Coat faces of concrete covered with less than 200 mm of masonry veneer at exterior walls and parapets with prime coat and one dampproof coat of asphalt emulsion.
- .19 Locate bearings and piers as indicated on Drawings; provide solid masonry units at bearings.
- .20 Extend walls and partitions at top to deck, slab or structural members, as applicable, except where otherwise noted on Drawings. Incorporate both lateral support and deflection space at termination of walls as required by this Section. Where walls terminate at bottoms of steel joists, close space at joists to deck or slab with metal lath and plaster on one side of joist or with 16 mm thick fire rated, Type X. gypsum board secured to each side of joists, if infilling with masonry is impractical; and to meet

specified requirements of Section 092116. Ensure that construction at joists completely closes and seals space.

.21 Masonry Solid Wall Anchorage:

- .1 Use dovetail anchors for slots at concrete construction.
- .2 Keep masonry a minimum of 12.7 mm clear of faces of structural members or as indicated on Drawings, and fill space with glass fibre board, leaving space for caulking at joints exposed to view or the weather.
- .3 Bed anchors solidly in mortar joints.
- .4 Fill cores of hollow units solidly with mortar where anchors are embedded.
- .5 Co-ordinate with Section 031000 to ensure that dovetail anchor slots in concrete are located correctly. Assist in their installation if requested.

.22 Joint Reinforcement:

- .1 Install joint reinforcement in : Single wythe masonry walls and partitions.
- .2 Place reinforcement continuously in horizontal joints at 400 mm o/c, beginning with course 400 mm above bearing, unless otherwise specified or indicated on Structural Drawings, specifically the 'Horiz. Wall Reinf. Schedule', on Structural Drawings S-2 and S-3.
- .3 Place reinforcement additionally in courses 200 mm, 400 mm and 800 mm above and below openings, and extending 600 mm beyond jambs of openings.
- .4 Where changes in wall thickness occur, extend reinforcement of lesser width 450 mm beyond changes of width.
- .5 Lap reinforcement a minimum of 150 mm at splices.
- .6 Do not run reinforcement through control joints.
- .7 Wherever walls and partitions intersect one another, or each other, continue reinforcement through. Do not carry reinforcement through intersections where lateral support anchors are installed or at intersections of walls and partitions with solid piers.

.23 Deflection Space:

- .1 Incorporate a deflection space between tops of non-load-bearing walls and partitions and structure to prevent transference of structural loads to masonry.
- .2 Fill deflection space with glass fibre board compressed to 50% of original thickness to completely seal space.
- .3 Co-ordinate laying of masonry with installation of lateral support specified in this Section and as provided by Section 055000.

.24 Penetrations of Masonry:

- .1 Fill voids of masonry to within 19 mm of structural members, pipes, ducts and conduit that penetrate masonry walls and partitions, unless otherwise indicated.
- .2 Keep masonry units similarly clear of such penetrations.
- .3 Finish mortar smooth at face of masonry.
- .4 Pack remainder of annular void surrounding penetrating item with fire separation packing to within 12.7 mm of face of masonry to allow for sealant.

.25 Shrinkage Control Joints:

- .1 Incorporate vertical shrinkage control joints in walls of which concrete masonry units are a part.
- .2 Install control joints at junctions of walls and columns, at intersections of unit concrete masonry load-bearing walls, and wherever indicated on Drawings, and otherwise in wall with no openings, at a maximum spacing of 6000 mm o/c. Carry joints full height of walls.

- .3 Ensure complete vertical separation through walls incorporating control joints. Make control joints 9.5 mm wide, rake back 19 mm at junctures with concrete, and leave joints free and clear for caulking, as specified in Section 079210.
- .4 construct control joints of standard block and fill void between block with 20 MPa concrete grout to form a continuous key full height of joint by installation of continuous building paper between concrete key and block on one side of joint.
- .26 Expansion Joints:
 - .1 Incorporate expansion joints in walls where indicated on Drawings.
 - .2 Maintain expansion joints free of mortar with temporary filler when laying masonry. Pack joints full height with glass fibre board compressed to 50% of original thickness.
 - .3 Leave clean space in joints for caulking as specified in Section 079210.
- .27 Fire Separations:
 - .1 Construct fire separation walls tightly to construction at perimeter, and without openings or voids.
 - .2 Do not reduce the thickness of masonry fire separations to less than the thickness indicated for the required fire separation rating.

3.3 ADJUSTMENT AND CLEANING

- .1 Patch damaged masonry in walls which have been rejected as unacceptable.
- .2 Point all holes in mortar joints except weepholes.
- .3 Point all voids in concrete unit masonry faces.
- .4 Cut out defective mortar joints to a minimum depth of 13 mm and repoint.
- .5 Clean concrete masonry units with dry brushes and as otherwise recommended by the supplier to remove mortar and stains.
- .6 Do not use wire brushes for cleaning.
- .7 Should specified cleaning methods be insufficient, proceed with other methods only with approval.
- .8 Protect adjacent materials, construction and finished surfaces from damage while cleaning.
- .9 Ensure that all efflorescence and mortar deposits are removed from surfaces to receive coating.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures
- .2 Section 03 30 00 – Cast-in-Place Concrete
- .3 Section 04 21 13 – Masonry
- .4 Section 09 91 22 – Painting

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A53/A53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless
 - .2 ASTM A269-02, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service
 - .3 ASTM A307-02, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer
 - .2 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating
 - .3 CISC/CPMA 1 – 73B, Quick Drying, One-Coat Paint for Use on Structural Steel
 - .4 CISC/CPMA 2 – 75, Quick Drying, Primer for use on Structural Steel
- .3 Canadian Standards Association (CSA International)
 - .1 G40.20-04: General Requirements for Rolled or Welded Structural Quality Steel
 - .2 G40.21-04 (R2009): Structural Quality Steel
 - .3 CAN/CSA G164-M92 (R2003): Hot Dip Galvanizing of Irregularly Shaped Articles
 - .4 CSA S16.1-09: Limit States Design of Steel Structures
 - .5 CAN/CSA – S136-07: North American Specification of the Design of Cold-formed Steel Structural Members
 - .6 CSA W47.1-09: Certification of Companies for Fusion Welding of Steel
 - .7 CSA W59-03 (R2008): Welded Steel Construction (Metal Arc Welding)
 - .8 CSA NSS.3-1965 (r2003): Resistance Welding Qualification Code for Fabricators of Structural Members in Buildings
- .4 The Environmental Choice Program
 - .1 CCD-047a-98, Paints, Surface Coatings
 - .2 CCD-048-98, Surface Coatings - Recycled Water-borne

1.3 SUBMITTALS

- .1 Shop Drawings
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, Shipping, Handling and Unloading:
 - .1 Deliver, store, handle and protect materials in accordance with manufacturer recommendations.
- .2 Storage and Protection:
 - .1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
 - .2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections and plates: to CSA-G40.20/G40.21, Grade 350W for hollow structural sections Class H and Grade 300W for Plates and Flat Shapes.
- .2 Welding materials: to CSA W59.
- .3 Bolts and anchor bolts: to ASTM A307.
- .4 Stainless steel tubing: to ASTM A269, Type 316 alloy, Seamless welded with AISI No. 4 finish.
- .5 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 PRIMERS, COATINGS AND SHOP PAINTING

- .1 Interior Steel in Dry Areas: Quick drying oil alkyd conforming to CISC/CPMA 2.75.
- .2 Exterior Steel, Interior Steel in Unheated Areas, Steel Embedded in Concrete: Hot dip galvanized conforming to CSA G164, minimum Z275 coating. Galvanizing of structural steel components and loose lintels: refer to Section 05 12 23.

- .3 Galvanized Coating Touch-Up: W.R. Meadows “Galvafroid” or Kerry Industries “Z.R.C.” zinc rich coating or similar manufacturer containing minimum 90% zinc by weight.
- .4 Apply two (2) shop coat(s) of primer or coating as indicated above and according to manufacturers recommendations. Do not prime aluminum, stainless steel or those components to be galvanized or encased in concrete.
- .5 Use primer unadulterated, as provided by manufacturer. Paint on dry surfaces free from rust scale and grease. Do not paint when temperature is lower than 10 deg. Celsius and rising.
- .6 Clean surfaces to be field welded; do not paint.

2.3 FASTENINGS

- .1 Use nuts and bolts conforming to ASTM A307, A325, and A563 as applicable.
 - .1 For interior work, use cadmium-plated fastenings where other protection is not specified.
 - .2 For exterior work, use Type 300 or 400 stainless steel.

2.4 ANCHORS AND SHIMS

- .1 For exposed anchorage of aluminum, if applicable, use stainless steel and otherwise to match metal anchored. For non-exposed work, anchors and shims may be galvanized steel.

2.5 PIPE

- .1 To ASTM A53, extra strong steel pipe for bollards.

2.6 BITUMINOUS PAINT

- .1 Alkali-resisting to meet specified requirements of CAN/CGSB-1.108, Type 2. Use to insulate contact between dissimilar metals.

2.7 FABRICATION

- .1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.
- .2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.
- .3 Where possible, fit and shop assemble work, ready for erection.
- .4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.
- .5 Weld all connections where possible, and bolt where not possible unless indicated otherwise on drawings.
- .6 Weld all stainless steel by the Argon Arc Process. Grind smooth and polish joints, crevice-free, and flush without seams.

2.8 LIST OF MISCELLANEOUS METAL FABRICATIONS

- .1 This Section includes, but is not limited to the following list. Note: Galvanize all exterior items and other items noted. Prime paint all interior items.
 - .1 Anchors, Bolts, Inserts, Sleeves for work in this Section.
 - .2 Hangers and Supports (for work in this Section).

Part 3 Execution

3.1 GENERAL

- .1 Supply and install all miscellaneous metal work indicated on the Drawings and not indicated in work of other Sections in addition to items listed below.

3.2 ERECTION

- .1 Do welding work in accordance with CSA W59 unless specified otherwise.
- .2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.
- .3 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.
- .4 Exposed fastening devices to match finish and be compatible with material through which they pass.
- .5 Provide components for building by other sections in accordance with shop drawings and schedule.
- .6 Make field connections with bolts to CSA-S16.1, or weld.
- .7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.
- .9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding. Spray or brush apply a minimum of three (3) coats of zinc-rich paint to achieve a dry film thickness of 8 mils. Apply a finish coat of aluminum paint to provide a colour blend with the surround galvanizing.

3.3 LATERAL SUPPORT:

- .1 Install deflection space and lateral support for non-load-bearing masonry walls and partitions in accordance with specified requirements of CSA-A371-94 and CSA-S304.1-94.
- .2 50.8mm x 50.8mm x 6.4mm angles 100mm long on both sides of walls at joist bridging location. Spacing not to exceed 1800mm.
- .3 Finish: Prime paint.

3.4 MASONRY WALL LATERAL SUPPORT:

- .1 Steel angle clips: 75 x 75 x 6 x 100mm

3.5 LINTELS:

- .1 As required to complete all work as part of this project. Steel lintels shall be provided over all openings including Mechanical, Electrical and Architectural Drawings and as shown on the drawings.
- .2 Steel of sizes shown on Lintel Schedule, Structural Drawings.
- .3 Provide concealed angle clips welded to lintels and anchored with bolts at lintel supports.
- .4 Finish: Prime paint for interior and galvanized for exterior locations.
- .5 Finish: Prime paint for interior and prime painted for exterior locations.

These items refer to components which are not normally supplied by the manufacturer but required to secure the Miscellaneous Specialty items.

3.6 WALL BRACKETS AND HOOKS

- .1 As shown on Drawings - prime paint.

3.7 GALVANIZED STEEL

- .1 Galvanize steel members, fabrications, and assemblies after fabrication by the hot dip process in accordance with CSA G164, minimum Z275 coating.
- .2 Galvanize bolts, nuts and washers and iron and steel hardware components in accordance with CSA G164.
- .3 Safeguard products against steel embrittlement in conformance with ASTM A143.
- .4 Design features which may lead to difficulties during galvanizing shall be pointed out prior to dipping.
- .5 The composition of metal in the galvanizing bath shall be not less than 98.0% zinc.

3.8 ERECTION

- .1 Erect work in accordance with shop drawings and in coordination with trades whose work relates to this Section
- .2 Erect work plumb, straight, square and accurately fitted with tight joints at intersections.
- .3 Where possible install work in one continuous piece.
- .4 Anchor all components to structure, walls, and floors as required with weld or other methods of anchorage approved by the Consultant.

3.9 TOUCH-UP AND REPLACEMENT

- .1 Touch-up adjacent primed surfaces burned, scratched or otherwise damaged during erection with prime paint, to match shopcoat, or galvafrid for galvanized when erection is completed.

- .2 Paint over bare areas on galvanized surfaces and welds with zinc rich paint.
- .3 Replace damaged or unacceptable materials indicated by the Consultants.

3.10 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 03 10 00 – Concrete Forms and Accessories.
- .2 Section 08 11 14- Steel Doors and Frames.
- .3 Section 07 50 13 – Common Work Results for Roofing*
- .4 Section 07 50 16 – Rough Carpentry for Roofing *coordinate responsibilities with this Section and Work Division Table in Section 07 50 13.

1.2 REFERENCES

- .1 Canadian Standards Association (CSA International)
 - .1 CSA B111-[1974(R1998)], Wire Nails, Spikes and Staples.
 - .2 CAN/CSA-G164-[M92(R1998)], Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CSA O121-[M1978(R1998)], Douglas Fir Plywood.
 - .4 CAN/CSA-O141-[91(R1999)], Softwood Lumber.
 - .5 CSA O151-[M1978(R1998)], Canadian Softwood Plywood.
 - .6 CAN/CSA-O325.0-[92(R1998)], Construction Sheathing.
- .2 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber [2000].

1.3 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.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Divert unused wood materials from landfill to recycling, reuse, composting facility approved by Consultant.
- .3 Do not dispose of preservative treated wood through incineration.
- .4 Do not dispose of preservative treated wood with materials destined for recycling or reuse.

- .5 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill approved by Consultant.
- .6 Dispose of unused wood preservative material at official hazardous material collections site approved by Consultant.
- .7 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other locations where they will pose health or environmental hazard.

Part 2 Products

2.1 LUMBER MATERIAL

- .1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
- .2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:
 - .1 Douglas fir Graded 122-C, construction or No. 2 Pine, pressure treated in accordance with CSA 080M.
 - .2 Board sizes: "Standard" or better grade.
 - .3 Dimension sizes: "Standard" light framing or better grade.
 - .4 Post and timbers sizes: "Standard" or better grade.

2.2 PANEL MATERIALS

- .1 Douglas fir plywood (DFP): to CSA O121, standard construction, good one side with waterproof adhesive.

2.3 ACCESSORIES

- .1 Nails, spikes, staples, screws, bolts anchors lag screws, special fastening devices and supports required for erection of all carpentry components: to CSA B111. Use galvanized components where exposed to exterior atmosphere.

2.4 FINISHES

- .1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work and interior highly humid areas.

Part 3 Execution

3.1 GENERAL

- .1 Supply and install all other carpentry shown on drawings or as required for completion of work. Co-operate with other trades in installing items supplied by other sections, cut openings in woodwork when so required and make good disturbed surfaces.

3.2 PREPARATION

- .1 Do all wood framing in accordance with the Ontario Building Code and Can3-086M-1983.
- .2 Machine dressed work shall be slow fed using sharp cutters and finished members shall be free from drag, feathers, slivers or roughness of any kind.
- .3 Frame materials with tight joints rigidly held in place.
- .4 Design construction methods for expansion and contraction of the materials.
- .5 Erect work plumb, level, square and to required lines.
- .6 Be responsible for methods of construction for ensuring that materials are rigidly and securely attached and will not be loosened by the work of other trades.

3.3 FURRING AND BLOCKING

- .1 Supply and install furring and blocking, required.
- .2 Align and plumb faces of furring and blocking to tolerance of 1:600.

3.4 ROUGH BUCKS AND NAILERS

- .1 Install wood bucks and nailers, as indicated, including wood bucks and linings around frames for doors and windows.
- .2 Except where indicated, otherwise, use material at least 38 mm thick secured with 9 mm bolts located within 300 mm from ends of members and uniformly spaced at 1200 mm between.
- .3 Countersink bolts where necessary to provide clearance for other work.

3.5 ROOF FASCIAS, CANTS, NAILERS CURBS

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

3.6 PRESSURE TREATED WOOD

- .1 Use wood pressure treated in accordance with CSA 080M for all wood members in contact with exterior walls and roofs.
- .2 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

3.7 INSTALLATION OF HOLLOW METAL FRAMES

- .1 Set frames plumb and square in their exact location and at correct elevation. Firmly block and brace to prevent shifting. Shim up where required to ensure proper alignment dimensions from finished floor to head of frame. Install temporary wood spreaders at mid-height.
- .2 Where pressed steel frames are installed in concrete walls, secure frames to concrete using lead expansion shields and anchor bolts through pipe sleeves. Perform drilling of concrete as required. Fill recessed bolt heads flush to frame face with approved metal filler and sand smooth.
- .3 Install fire rated door frames in accordance with requirements of National Fire Code Volume 4, produced by The National Fire Protection Association (NFPA 80).

3.8 GENERAL

- .1 Supply and install all other carpentry shown on drawings or as required for completion of work. Co-operate with other trades in installing items supplied by other sections, cut openings in woodwork when so required and make good disturbed surfaces.

3.9 ERECTION

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

3.10 SCHEDULES

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 06 10 11 – Rough Carpentry.
- .3 Section 06 47 00 – Plastic Laminates.
- .4 Section 08 80 50 – Glazing.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)
 - .1 ANSI A208.1-[99], Particleboard.
 - .2 ANSI A208.2-[94], Medium Density Fiberboard (MDF).
- .2 American Society for Testing and Materials (ASTM)
 - .1 ASTM E1333-[96], Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates From Wood Products Using a Large Chamber.
 - .2 ASTM D2832-[92(R1999)], Standard Guide for Determining Volatile and Non-volatile Content of Paint and Related Coatings.
 - .3 ASTM D5116-[97], Standard Guide for Small-Scale Environmental Chamber Determinations of Organic Emissions from Indoor Materials/Products.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-71.20-[M88], Adhesive, Contact, Brushable.
- .4 Canadian Standards Association (CSA)
 - .1 CSA B111-[74(R1998)], Wire Nails, Spikes and Staples.
 - .2 CSA O112.4-[M1977(R1999)], Standards for Wood Adhesives.
 - .3 CSA O112.5-Series-M-[1977(R1999)], Urea Resin Adhesives for Wood (Room- and High-Temperature Curing).
 - .4 CSA O112.7-Series M-[1977(R1999)], Resorcinol and Phenol-Resorcinol Resin Adhesives for Wood (Room- and Intermediate-Temperature Curing).
 - .5 CSA O115-[M1982(R2001)], Hardwood and Decorative Plywood.
 - .6 CSA O121-[M89(R1998)], Douglas Fir Plywood.
 - .7 CAN/CSA O141-[91R1999], Softwood Lumber.
 - .8 CSA O151-[M1978(R1998)], Softwood Plywood.
 - .9 CSA O153-[M1980(R1998)], Poplar Plywood.
 - .10 CSA Z760-[94], Life Cycle Assessment.
- .5 Environmental Choice Program (EPC)
 - .1 ECP-44-[92], Adhesives.

- .2 ECP-45-[92], Sealants and Caulking Compounds.
- .3 ECP-76-[98], Surface Coatings.
- .6 International Organization for Standardization (ISO)
 - .1 ISO 14040-[97], Environmental Management-Life Cycle Assessment - Principles and Framework.
 - .2 ISO 14041-[98], Environmental Management-Life Cycle Assessment - Goal and Scope Definition and Inventory Analysis.
- .7 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA LD-3-[95].
- .8 National Hardwood Lumber Association (NHLA)
 - .1 Rules for the Measurement and Inspection of Hardwood and Cypress [, January 1996].
- .9 National Lumber Grades Authority (NLGA)
 - .1 Standard Grading Rules for Canadian Lumber [, 2000].

1.3 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.
 - .1 Scales: profiles full size, details 1/2 full size.
- .3 Indicate materials, thicknesses, finishes and hardware.

1.4 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate samples: sample size 300 x 300 mm samples of each type of paneling laminate and each type of solid wood or plywood to receive stain or natural finish.
- .3 Submit a typical prototype unit representative of the work of this section.

1.5 QUALIFICATION

- .1 Millwork manufacturer to have not less than 5 years proven first class experience in institutional millwork and shall be able to provide a maintenance bond as specified.

1.6 GUARANTEE

- .1 This architectural woodworker shall furnish the owner with a two (2) year maintenance bond, to the full value of the architectural woodwork sub-contract. Millwork contractor is to submit a letter from their insurer stating that they will provide the bond at the beginning of the project. The Guarantee shall cover replacing and/or refinishing to make good any defects in architectural woodwork due to faulty workmanship or defective

materials supplied by this architectural woodworker, which appear during a two (2) year period following the date of substantial completion of the project.

1.7 INSPECTION

- .1 Architectural woodwork shall be manufactured and/or installed to AWMAC Quality Standards and shall be subject to an inspection at the plant and site by an appointed inspector. Such inspection costs shall be paid from Cash Allowances. Shop drawings shall be submitted for review or approval before any work is commenced. Any work which does not meet the Consultant or Owner's Quality Standards shall be replaced by this architectural woodworker, at no additional cost to the owner and to the satisfaction of the consultant and the inspector.

1.8 DELIVERY, STORAGE, AND HANDLING

- .1 Protect millwork against dampness and damage during and after delivery.
- .2 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 10 % or less for interior work in accordance with following standards:
 - .1 CAN/CSA-O141.
 - .2 NLGA Standard Grading Rules for Canadian Lumber.
 - .3 AWMAC premium grade, moisture content as specified.
- .2 Hardwood lumber: moisture content 10% or less for interior work in accordance with following standards:
 - .1 National Hardwood Lumber Association (NHLA).
 - .2 AWMAC premium grade, moisture content as specified.
 - .3 Species: to be Maple unless otherwise noted.
- .3 Hardwood plywood: to CSA O115, of thickness indicated, rotary cut face veneer, birch plywood, veneer core, No. 1 grade. Select veneers to provide book match veneer strips to be 240 mm wide minimum.
 - .1 Species: to be Birch, unless otherwise noted.
- .4 Nails and staples: to CSA B111, galvanized for exterior work, interior high-humidity areas and for treated lumber; plain finish elsewhere. Use spiral thread nails except where specified elsewhere.
- .5 Particle Board core: to CAN3-0188.1-M78, Grade R, 720 kg/m³ density in thicknesses indicated.
- .6 Plywood core for shelving: to CSA 0120.

2.2 PLASTIC LAMINATE

- .1 Refer to Section 06 47 00.

2.3 CABINET HARDWARE

- .1 Furnish and install all hardware to custom casework as follows:
 - .1 Cupboard Doors - 19 mm thick.:
 - .1 Hinges 200 Series 110° Salice
 - .2 Roller Catches 807N 2G (SgDr) Onward
 - .3 Elbow Catches T03222 C15 (DhDr)
 - .4 Door Pulls CBH235-3 1/2" C32D
 - .5 Cupboard Locks 8703/8704 14a National
 - .2 Shelving:
 - .1 Plaster strips KV255 Zinc Knappe & Vogt
 - .2 Shelf Clips KV256 Zinc Knappe & Vogt
 - .7 Display Case:
 - .1 Pilaster Strips: Brush Finish
 - .2 Shelf Brackets: Brush Finish
 - .3 Aluminum sliding track, top and bottom to accommodate sliding glass doors
 - .4 Lock sets and all required hardware for sliding glass door display system
 - .5 Glazing: 12mm tempered glass for shelves. 8mm tempered glass for sliding doors. Glazing to display cases to be provided by Section 08 80 50 and installed by the Section 06 40 00.
- .2 This section shall also include accessories such as rubber door silencers (2 per drawer or door), and other items necessary for the completion of the millwork.
- .3 Cabinet Keying: Key all cabinet and drawer locks alike for the entire school, except teachers' closets.

2.4 PLASTIC LAMINATE CABINETWORK

- .1 All cabinet frames whether for base, wall or tall floor standing cases, shall be fabricated so each is a self-contained module. Front side top and bottom, exterior and interior surfaces shall be finished allowing future relocation of any module, into any bench arrangement, without need of any additional finishing.
- .2 Gables and panels shall be fabricated from 19 mm thick plastic laminate surfaced panels with a plastic laminate applied to exposed edges.
- .3 Rails shall be fabricated and machined to join the gables and form a rigid cabinet frame.
- .4 Tops (applies to wall and tall units only) shall be fabricated utilizing the same material and edge finish as gables.
- .5 Backs in base cupboards shall be fabricated from a 6 mm hardboard.

- .6 Shelves shall be fabricated from 19 mm birch plywood with solid birch edge and lacquer finish. All shelves shall be adjustable at 13 mm increments and each will be supported by a shelf support resting in four pilaster strips attached to the gables.
- .7 Doors shall be fabricated from 19 mm thick plastic laminate surfaced panels. All four edges shall be P.V.C. edging.
- .8 Drawer fronts shall be fabricated utilizing the same material and edge finish as doors. All four edges shall P.V.C. edging. Fronts will be secured to drawer bodies with five screw nails through the front of the drawer body into the core of the drawer front.
- .9 Drawer bodies shall consist of box construction fabricated from 13 mm birch plywood with solid birch edge, front, sides and back with a 6 mm hardboard bottom dadoed and glued into box members. Joint front, sides and back with carefully fitted glued and tenoned joints. Alternately, Blum Metabox drawer body and side can be used.
- .10 Solid hardwood glazed door fronts and frames shall receive lacquer finish. Glazing shall be 3mm tempered clear glass.
- .11 Finish:
 - .1 Plastic Laminate surfaced panels shall be finished both sides in the same colours, patterns, and grain as selected by the Consultant.
 - .2 Solid hardwood glazed doors and drawer bodies shall be sanded, then sealer coated, and sanded with two finish coats of catalytic type acid resistant varnish.

2.5 **PLASTIC LAMINATE on PLYWOOD cabinetwork**

Refer to AD drawings (binder C) for locations

- .1 Plastic Laminate factory glued to plywood core, thickness as shown or specified.
- .2 Plastic laminate graphics to be book matched or run in same direction where applicable. All exposed finished casework, drawer, cupboard and door fronts shall have vertical grain orientation.
- .3 Use solid hardwood for exposed edges, typical for Library/Learning Commons millwork.
- .4 Case bodies: $\frac{3}{4}$ " plywood, finish with plastic laminate factory adhered. Typical for gables and panels
- .6 Backs: $\frac{1}{4}$ " plywood, finished with plastic laminate. Backs in wall and tall cabinets shall be securely glued and screw nailed into the check out provided in the backs of gables, tops, and bottoms.
- .7 Shelving: $\frac{3}{4}$ " plywood, finish with plastic laminate factory adhered. All shelves shall be adjustable at 13mm increments and each will be supported by a shelf support resting in four pilaster strips attached to the gables.
- .8 Drawers:
 - .1 $\frac{3}{4}$ " plywood, finish with plastic laminate. All four edges shall have plastic laminate edging. Fronts will be secured to drawer bodies with five screw nails through the front of the drawer body into the core of the drawer front.
 - .2 Drawer box including front, back and sides shall consist of box construction, carefully fitted glued and tenoned joints.
 - .3 Drawer bottom to be $\frac{1}{4}$ " plywood, plastic laminate finished, dadoed and glued into box members.

- .9 Casework doors: 3/4" plywood, plastic laminate finished with plastic laminate to all four sides. Locks to be provided as indicated on details.
- .10 All cabinet frames whether for base, wall or tall floor standing cases, shall be fabricated so each is a self-contained module. Front side top and bottom, exterior and interior surfaces shall be finished allowing future relocation of any module, into any bench arrangement, without need of any additional finishing.
- .11 Rails shall be fabricated and machined to join the gables and form a rigid cabinet frame.
- .12 Tops (applied to wall and tall units only) shall be fabricated utilizing the same material and edge finish as gables.
- .13 Toe kick rail (behind rubber or ceramic base, as applicable) shall have a 4" x 3/4" section, waterproof fir plywood, machined to receive four screw nails for attachment to bottom front edge of gables. Cabinet base shall be plywood attached to cabinet separately, insuring the plastic laminate plywood gables do not come in contact with the floor.

2.6 SHOP FABRICATION

- .1 Shop install cabinet hardware.
- .2 Provide cutouts for plumbing fixtures, inserts, appliances, outlet boxes and other fixtures.
- .3 Shop assemble work for delivery to site in size easily handled and to insure passage through building openings.

2.7 PLASTIC LAMINATED TOPS

- .1 Coordinate with Section 06 47 00.
- .2 19 mm thick particle board core with post-forming grade plastic laminate finish bonded with resorginal formaldehyde resin glue to a particleboard core. All countertop front face to return vertically 35 mm ± . All front and backsplash edges to be rounded.
- .3 Underside to receive a backing sheet, sanded one side and bonded same as surfacing material.
- .4 Exposed edges to be finished with same material as used for the top.
- .5 Drip grooves to be cut into underside of the top where exposed edges occur.
- .6 Splash backs, curbs and curb shelves are to be of similar construction as the tops.
- .7 Use acid resistant post-forming grade laminate, where indicated on drawings. Colour: black.
- .8 At all wall termination, provide backsplash return.

2.8 MOULDING AND TRIMS

- .1 Fabricate mouldings in maximum practical lengths to profile shown. Install with concealed fasteners.
- .2 Note requirement for this Section to supply and install solid maple or birch wood trim with clear satin trim where noted on drawings or AD drawings in Binder C.

2.9 FABRICATION

- .1 Set nails and countersink screws apply wood filler 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.
- .6 Obtain governing dimensions before fabricating items which are to accommodate or abut appliances, equipment and other materials.
- .7 Ensure adjacent parts of continuous laminate work match in colour and pattern.
- .8 Form shaped profiles and bends as indicated, using postforming grade laminate to laminate manufacturer's instructions.
- .9 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.
- .10 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .11 Apply laminated plastic liner sheet where indicated.

2.10 DISPLAY CASES

- .1 Display Cases: Provide and install appropriate hinges, keyed locks and wood/glass shelf supports required for all display cases as described on drawings. Glazing to be provided by section 08 80 50. Refer to Section 08 80 50.
- .2 Display/Trophy Case Finish:
 - .1 Linseed oil, Forbo Tackboard surfacing to interior of all display cabinets where felt or tackboard is indicated, or equivalent product by other manufacturer approved by the Consultant. Colour to be selected by Architect.

2.11 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 Set and secure all material and components in place, rigid, plumb and square.

- .4 Provide heavy duty fixture attachments for wall mounted cabinets.
- .5 Use draw bolts in countertop joints.
- .6 At junction of plastic laminate 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 After installation, fit and adjust operating hardware for wood and laminated plastic cabinet doors, drawers and shelves.

2.12 CLEANING

- .1 Clean millwork, cabinet work, drawers and outside surfaces.
- .2 Remove excess glue from surfaces.

2.13 PROTECTION

- .1 Protect millwork and cabinet work from damage until final inspection.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 08 12 10 Flush Wood Doors

1.2 REFERENCES

- .1 CAN/CGSB-71.20-M88 Adhesive, Contact, Brushable
- .2 CAN3-A172-M79 High Pressure Paper Base, Decorative Laminates.
- .3 CSA O112 Series-M1977(R2001) CSA Standards For Wood Adhesives.
- .4 CSA O121-M1978(R2003) Douglas Fir Plywood.
- .5 CSA O151-04 Canadian Softwood Plywood.

1.3 SAMPLES

- .1 Submit duplicate samples of joints, edging, cutouts and postformed profiles in accordance with the General Conditions.

1.4 MAINTENANCE DATA

- .1 Provide maintenance data for laminated plastics work for incorporation into Operation and Maintenance Manual.

1.5 PRODUCT HANDLING

- .1 Cover finished laminated plastic 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.
- .2 Do not store or install materials in areas where relative humidity is less than 25% or greater than 60% at 22 deg C.

Part 2 Products

2.1 GENERAL

- .1 Products manufactured by one of the following companies are suggested for use on this project.
 - .1 Cyanamid Canada Inc., Montreal (Formica).
 - .2 Domtar Construction Materials, Arborite Division, LaSalle Quebec (Arborite).
 - .3 Wilsonart International, Temple, Texas (Wilsonart).
 - .4 Nevamar Corporation, Odenton Md.

- .2 Allow for 6 colours from manufacturer's full range. Final Selection of Plastic Laminate surface characteristics including colour, texture and pattern is to be made by the Consultant by means of a Colour Schedule to be issued at a later date. Use the following materials specifications as a base bid:

2.2 MATERIALS

- .2 Laminated plastic for flatwork: to CAN3-A172, Grade GP, Type SD, 1.25mm (0.050") thick; based on full colour range with velour finish. Acceptable products:
 - .1 Formica Laminate Grade 10.
 - .2 Nevamar H-5 General Purpose Grade.
 - .3 Wilsonart General Purpose HGS Type 107.
- .3 Laminated plastic for postforming work: to CAN3-A172, Grade PF, Type S, 1.07mm (0.042") thick, based on full colour range with velour finish. Acceptable products:
 - .1 Formica Laminate Grade 12.
 - .2 Nevamar HF-5 Horizontal Post Forming Grade.
 - .3 Wilsonart Postforming Type 350.
- .4 Laminated plastic backing sheet: supplied by same manufacturer as facing sheet; not less than 0.508 mm (0.02") thick and same colour as face laminate. Sanded one side. Acceptable products:
 - .1 Formica Laminate Grade 20.
- .5 Laminated plastic cabinet liner sheet material or for MCP Board or Cladboard material: supplied by same manufacturer as facing sheet, not less than 0.760 mm (0.028") thick, white colour. Acceptable products:
 - .1 Formica Laminate Grade 20.
 - .2 VF-3 Vertical Post Forming Grade by Nevamar.
 - .3 Wilsonart Vertical Surface Type 335.
- .6 Plywood core: Douglas Fir Plywood to CSA-O121 or Canadian Softwood Plywood to CSA-O151 solid two sides, 19 mm (¾") thick.
- .7 Particleboard core: to CAN3-O188.1, Grade R, sanded faces, of thickness indicated.
- .8 Adhesive for laminated plastic: to be CSA approved and one of the following types as selected by the laminate manufacturer as being suitable for the application:
 - .1 Urea resin adhesive to CSA O112 Series.
 - .2 Contact adhesive to CAN/CGSB-71.20.
 - .3 Resorcinol resin adhesive to CSA O112.

- .4 Polyvinyl adhesive to CSA O112.
- .5 Two component epoxy thermosetting adhesive.
- .9 Sealer: water resistant sealer or glue acceptable to laminate manufacturer.
- .10 Sealant: of a type recommended by the laminate manufacturer and in accordance with Section 079210 - Joint Sealers; colour to be selected by the Consultant.
- .11 Draw bolts and splines: as recommended by fabricator.
- .12 Apply laminate backing sheet to reverse side of core of plastic laminate work.
- .13 Apply laminated plastic liner sheet to interior of cabinetry, including all exposed surfaces such as gable ends, doors and drawers, and where otherwise 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 (18") oc, 75 mm (3") from edge. Make flush hairline joints.
- .4 Provide cutouts for inserts, grilles, appliances, outlet boxes and other penetrations. Round internal corners, chamfer edges and seal exposed core.
- .5 At junction of laminated plastic counter back splash and adjacent wall finish, apply small bead of sealant.
- .6 Where laminated plastic is site applied, adhere laminated plastic over entire surface. Make corners with hairline joints. Use full sized laminate sheets. Make joints only where indicated or approved. Slightly bevel arises. Cap exposed edges with anodized aluminum extrusions.
- .7 For site application, offset joints in plastic laminate facing from joints in core.

END OF SECTION

01 11 00 – Summary of Work

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- 1.1.1 Conform to all sections in this document and to the requirements of the Canadian Roofing Contractors Association Roofing Manual Specifications as referred to herein.
- 1.1.2 Abide by all Federal, Provincial, Municipal and Local Laws or Codes, rules and regulations that in any way affect Work including all amendments up to the Project date. No plea of misunderstanding will be considered on account of ignorance thereof. Notify the Consultant immediately in writing of any provisions in Drawings, Specifications or Contract, which are contrary to or inconsistent with any law, rule or regulation.
- 1.1.3 Where documents differ, the most stringent interpretation will apply.

1.2 TYPE OF FACILITY

- 1.2.1 This Contract will be carried out on the premises of an institutional building.
- 1.2.2 Exercise appropriate care and keep construction noise and disruption to an absolute minimum and to the satisfaction of the Owner.
- 1.2.3 Take special precautions where alterations are required above and in all areas occupied by staff, or pedestrians.

PART 2 ROOF REPLACEMENT

2.1 DEMOLITION PHASE

- 2.1.1 Remove and dispose of all the following existing components and assemblies within the Scope of Work, including but not limited to:
 - .1 Roof membranes, overlay board, insulation, vapour retarder to the level of the existing metal.

2.2 RECONSTRUCTION PHASE

- 2.2.1 As directed by the owner's representative:
 - .1 All deteriorated deck shall be replaced or repaired.
 - .2 All deteriorated wood components shall be replaced or repaired.
 - .3 Structural deck shall be cleaned and prepared for the application of new roofing components.

2.3 NEW ROOF ASSEMBLY:

2.3.1 2-Ply Modified Bituminous Roof Replacement –

- .1 Supply and install the new roofing system comprised of the following (from the top down):
 - (a) 1-Ply of modified bitumen granulated cap sheet torched in place
 - (b) 1-Ply modified bitumen base sheet pre-laminated to 13mm (0.5") high density polyisocyanurate insulation in low rise foam adhesive
 - (c) 75mm (3.0") Polyisocyanurate insulation in low rise foam adhesive
 - (d) 75mm (3.0") Polyisocyanurate insulation mechanically attached
 - (e) Self Adhesive Vapour Barrier
 - (f) Metal deck (existing)

- (g) Membrane Flashings: 1-ply modified bitumen base sheet in Type III asphalt; and 1-ply modified bitumen cap sheet, torched in place.
- (h) Conform to Section 07 52 16 – SBS Modified Bituminous Membrane Roofing.

2.4 EXISTING ASSEMBLIES:

2.4.1 The Contractor's must cut and confirm the roof assemblies. No additional costs will be accepted or approved for/or by the Owner. The existing roofing assemblies appear to be:

.1 Roof Areas A1, A2 & E1:

- (a) 2-Ply Modified Bituminous Membranes
- (b) 13mm (0.5") Fibreboard Overlay
- (c) Tapered fibreglass insulation
- (d) 150mm (6") Polyisocyanurate insulation
- (e) Kraft Vapour Retarder
- (f) Metal Deck

2.4.2 containers and transfer to an approved municipal and/or provincial disposal site(s).

END OF SECTION 01 11

07 52 16 - Styrene-Butadiene-Styrene Modified Bituminous Membrane Roofing

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- 1.1.1 All conditions of Contract and Divisions 0 and 1 apply to this section and to requirements of Canadian Roofing Contractors Association Roofing Manual Specifications as referred to herein.
- 1.1.2 Abide by all Federal, Provincial, Municipal and Local Laws or Codes, rules and regulations that in any way affect work including all amendments up to project date.

1.2 SECTION INCLUDES

- 1.2.1 Roof Areas A1, A2, A3, B1, B2, B3, C, D1, D2, E1 & E2.

1.3 CO-ORDINATION

- 1.3.1 Co-ordinate work of this Section with work of:
 - .1 Section 01 11 00 Summary of Work
 - .2 Section 06 10 00 Rough Carpentry.
 - .3 Section 07 62 00 Sheet Metal Flashing and Trim.
 - .4 Section 07 92 00 Joint Sealants.

1.4 STANDARDS

- 1.4.1 CAN/CSA O80 SERIES-08 – Wood Preservation.
- 1.4.2 CAN/CGSB 19.13-M87: Single Compound, One-Component, Elastomeric, Chemical Curing.
- 1.4.3 CSA A123.23: Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.
- 1.4.4 CGSB 37-GP-9MA: Primer, Asphalt, Unfilled, for Asphalt Roofing, Dampproofing and Waterproofing.
- 1.4.5 CSA A123.23: Mat Reinforcing, Fibrous Glass, for Membrane Waterproofing Systems and Built-up Roofing.
- 1.4.6 ASTM C165-12: Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
- 1.4.7 ASTM D6164/D6164M-11: Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements.
- 1.4.8 ASTM A653/A653M-10: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
- 1.4.9 ASTM E84-12: Standard Test Method for Surface Burning Characteristics of Building Materials
- 1.4.10 UL 790: Standard Test Methods for Fire Tests of Roof Coverings
- 1.4.11 UL 1256: Fire Test of Roof Deck Constructions.

1.5 SYSTEM DESCRIPTION

- 1.5.1 Roof Area:
 - .1 Modified Bituminous Roofing System: 1-Ply granulated modified bitumen membrane (cap sheet) torched in place; 1-ply modified bitumen base sheet pre-laminated to 13mm (0.5") high density polyisocyanurate insulation adhered; over two layers of

polyisocyanurate insulation 1st layer secured and 2nd layer adhered, over self adhered base in place over the existing metal deck. Membrane flashing to be 2-ply of modified bitumen membranes: 1-ply modified bitumen membrane base sheet in asphalt; and 1-ply granulated modified bitumen membrane cap sheet torched in place.

1.6 QUALIFICATIONS

- 1.6.1 Contractor qualifications are listed in the GENERAL CONDITIONS under section 01 43 23 CONTRACTOR QUALIFICATIONS.

1.7 QUALITY CONTROL

- 1.7.1 Quality controls are listed in the GENERAL CONDITIONS under section 01 45 00 QUALITY CONTROL – GOOD ROOFING PRACTICES

1.8 PRE-START MEETING

- 1.8.1 A pre-start meeting is to be scheduled one week prior to any work commencing. The roofing contractor, the consultant, the on-site contact and/or Owner's representative should be present. The following items will be discussed at the pre-start meeting:
- .1 methods and procedures relating to the roof assembly installation
 - .2 on-site procedures
 - .3 on-site material storage
 - .4 the construction schedules

1.9 DELIVERY, STORAGE & HANDLING

- 1.9.1 Delivery, storage, and handling are listed in the GENERAL CONDITIONS under section 01 66 00 STORAGE & DELIVERY OF MATERIALS.

PART 2 PRODUCTS

2.1 MATERIALS

- 2.1.1 Roof Membrane (Modified Bitumen – Cap Sheet): Modified bituminous cap membranes, 250gm/sq.m. granulated top surface and thermofusible bottom surface. Composite reinforced, conforming to CSA A123.23 Type C
- 2.1.2 Roof Membrane (Modified Bitumen – Pre-Laminated Base Sheet): Modified bituminous membranes, pre-laminated to 13mm (0.5") high density polyisocyanurate insulation, 180gm/sq.m., conforming to CSA A123.23 Type B
- 2.1.3 Flashing Membrane (Modified Bitumen – Cap Sheet): Modified bituminous cap membranes, 250gm/sq.m. granulated top surface and thermofusible bottom surface. Composite reinforced, conforming to CSA A123.23 Type C
- 2.1.4 Flashing Membrane (Modified Bitumen – Base Sheet): Modified bituminous membranes, 180gm/sq.m, thermofusible top surface and sanded bottom surface. Composite reinforced with SBS rubber modified asphalt conforming to CSA A123.23 Type C
- 2.1.5 Liquid Applied PMMA Membrane Flashings: Two-component polymethacrylate liquid membrane with catalyst and mesh reinforcement. UV stable and VOC compliant. Conforming to ASTM D5147.
- 2.1.6 Insulation: 75mm (3.0") Polyisocyanurate insulation (4'x8' boards). Type: closed cell polyisocyanurate foam roof board insulation with inorganic coated glass facer, meeting the requirements of CAN/ULC S704, Type 2 Class 3 materials and ASTM C1289, Type II, Class 2, Grade 2.
- 2.1.7 Insulation Sump: Polyisocyanurate, pre-manufactured, one-piece drain sump. Meeting the

requirements of CAN/ULC S704. Drain sumps to be 2440mm x 2440mm (8'x8') to achieve 4% taper.

- 2.1.8 Insulation (Cavity Infill): Semi-rigid mineral wool insulation board for exterior use, conforming to ASTM C612 and CAN/ULC S702. Acceptable product: Cavityrock by Rockwool, or approved alternate.
- 2.1.9 Base Sheet Vapour Barrier (Metal Decks): Modified bituminous membranes with inorganic reinforcing mat, high strength, non-woven glass fibres. Sanded top and self-adhering bottom surface, conforming to CSA A123.23 Type A
 - .1 Vapour Barrier Adhesive: As recommended by the Vapour Barrier Manufacturer.
- 2.1.10 Gypsum Board (Metal Decks): 13mm (0.5") Gypsum subdeck boards (4'x8' sheets). Acceptable Product: DensDeck Prime Roof Board by Georgia Pacific or approved alternate.
 - .1 Gypsum Fasteners: As recommended by Manufacturer.
- 2.1.11 Self-Adhering Membrane (Perimeter Parapets): Self-adhering, self-sealing, composite membrane consisting of a high softening point with SBS rubberized asphalt compound.
- 2.1.12 Self-Adhering Membrane Adhesive (Perimeter Parapets): Rubber based adhesive for self-adhering membranes.
- 2.1.1 Asphalt Protection Board: 6.35mm (1/4") thick (4'x4' boards), torch safe, semi-rigid protection board.
- 2.1.2 Mastic: One-part, solvent & asbestos free, moisture curing elastomer.

2.2 ACCESSORIES

- 2.2.1 Wood Blocking, Plywood Sheathing: Construction grade; free from warping and visible decay; pressure-treated spruce, to CAN/CSA O80 SERIES-08.
- 2.2.2 Metal Flashing: 26 gauge pre-painted galvanized; Series 8000 baked enamel finish; colour to match existing, to ASTM A653/A653M-10. 24-gauge metal for all cleats and hook strips. Colour to be confirmed by the Owner.
- 2.2.3 Pitch Pan: Pre-manufactured type; 16 oz. copper, fully soldered, minimum 152.4 mm (6") high above finished roof level, complete with copper caps.
- 2.2.4 Pitch Pan Sealant: M-1 Structural sealant and 1-part pourable sealer.
- 2.2.5 Sealant: single component; moisture cure; polyurethane sealant conforming to CAN/CGSB19.13M87.
- 2.2.6 Fasteners: 25 mm square or round head, ring shanked galvanized or non-ferrous type, length as required to suit application.
- 2.2.7 Drains: New Copper Retrofit Drain, with flange, dome, and blue drain seals Platinum Plus by Platinum Technologies Inc.
- 2.2.8 Control Flow Mechanism: As supplied by the drain manufacturer (if required by Municipality) Platinum Plus by Platinum Technologies Inc.
- 2.2.9 Tall Cones: all sizes (1.5" – 12"): Platinum Plus by Platinum Technologies Inc.
- 2.2.10 Gooseneck Flashing: Electrical Roof Flashings by Platinum Plus by Platinum Technologies Inc.
- 2.2.11 Vent Stacks: Prefabricated, insulated, 3" or 4". Spun aluminum with a vandal proof cap by Platinum Plus by Platinum Technologies Inc.
- 2.2.12 Vent Stack Paint: Rust-Oleum ROCEpoxy DTM Epoxy Mastic 9100 in aluminum colour SKU 9115402
- 2.2.13 Hot Stack Paint: Furnace stacks. B-vent (Hot)Stacks, Double-Duty Aluminum by Tremco.

- 2.2.14 Termination Bar: 10' Alum Term Bar – Item NO. – Term-10 (#90354) by Platinum Technologies Inc.
- 2.2.15 Gas Line Supports: Rubber supports with raised galvanized steel channel and adjustable threaded rods and clamp by MiFab Inc. or approved alternate
- 2.2.16 Gas Line Paint: Paint to conform to CSA B149.1. Tremclad Yellow by Tremco or Corrostop by SICO.
- 2.2.17 Concrete Pavers: Wire mesh reinforced with 6-8% air entrainment and to 30 MPa. Size to be 610 mm x 610 mm (24" x 24"). Thickness of 45 mm (1.75"). Colour to be natural with Diamond texture top surface.
- 2.2.18 Concrete Paver Insulation Pad: Closed cell extruded polystyrene (XPS) insulation, Type IV. Compressive strength of 240 KPa (35 psi) and formed using the Hydrovac process. Size 508 mm x 508 mm (20" x 20") thickness of 25 mm (1").
- 2.2.19 Foam Gasket: EMSEAL MST Multi-Use Sealant Tape or EMSEAL UST Sealant Tape.
- 2.2.20 Overflow Scuppers: 24ga, pre-painted sheet metal open-box type with fully soldered joints, 204mm (8") width and 102mm (4") height. Scuppers to be installed 102mm (4") above finished roof height.
- 2.2.21 Downspouts: Standard residential pre-fabricated aluminum downspouts and hangers. Colour to match new metal flashings.

NOTE: The contractor must supply all primers, mastics, and membranes from a single source Manufacturer. No alternates will be accepted without written approval from the Consultant

PART 3 EXECUTION

3.1 PREPARATION

- 3.1.1 Supply and install perimeter safety warning as prescribed by the Provincial Occupational Health and Safety Code and all local codes before starting any other work.
- 3.1.2 It is the contractor's responsibility to obtain all required permits for this project and must carry this cost in his bid price.
- 3.1.3 The ground areas around the building are to be protected as much as possible. All disposal boxes must be placed on planks. The interior areas of the building, where the roofing contractor has access, are to be protected.
- 3.1.4 It is the responsibility of the roofing contractor to contact the Owner to mark the exact location of buried utilities.
- 3.1.5 Remove the existing roofing down to the existing structural roof deck. Dispose of all debris at an appropriate licensed dump site. No garbage is to be stored on the roof. Remove the existing metal flashings and membrane flashings down to the existing substrates.
- 3.1.6 Inspect the structural deck and report any deficiencies to the Owner/Owner's Representative. Do not apply any new roofing over deficiencies, other than temporary waterproofing, until all deficiencies have been corrected.
- 3.1.7 Should the metal deck be found to be deteriorated, requiring replacement, the roofing Contractor is responsible to document all areas with photographs and measurements indicated on a roof plan, on a daily basis and provide them to both the Consultant and Owner. Metal deck replacement quantities proposed for replacement are to be approved in writing by the Consultant and Owner prior to any area being replaced.
 - .1 If surface corrosion is observed on the metal deck surface, the corrosion is to be wire brushed and coated with two (2) coats of rust inhibiting paint.
 - .2 Should the existing metal deck require replacement, the roofing contractor is

responsible to have an engineer review the installation of the metal deck and provide a written and stamped report indicating that the deck has been installed according to code requirements and is structurally adequate. All reports are to be submitted to the Consultant and Owner.

- 3.1.8 Should the concrete/siporex decks be found to be deteriorated, requiring extensive repairs, the roofing Contractor is responsible to document all areas with photographs and measurements indicated on a roof plan, on a daily basis and provide them to both the Consultant and Owner.
- 3.1.9 Do not remove more of the existing roofing than can be completely waterproofed in one day.
- 3.1.10 The roofing contractor shall be responsible for all roof leaks (both on the existing roofing assembly and the new roofing assembly) at the building once they begin to set-up and load materials onto the roof at the beginning of the project.
- 3.1.11 The roofing contractor is responsible to disconnect and reconnect any mechanical, electrical conduit, cabling, and/or gas lines which are affecting the roof installation. The roofing contractor is responsible for all satellites. The satellites are to be moved and put back in the approximate same location. Roofing contractor is responsible for repositioning satellites to obtain proper signal.
- 3.1.12 Should wall anchors, roof anchors, and/or davit arm bases require re-certification it will be the roofing contractor's responsibility to do so and is to be carried in the tender price.
- 3.1.13 Remove all designated redundant equipment, pipes, cones, pitch pans, conduits, unused anchors, davits and equipment as identified by the Owner.

3.2 FIRE WATCH

- 3.2.1 It is absolutely required that in all areas where a thermofusible (torch applied) membrane was applied, the work area be carefully inspected for fire, **a minimum of 3 hours** after work has stopped for the day, using an infrared gun and before the crew leaves the roof.
- 3.2.2 Comply with Section 01 51 16 – Temporary Fire Protection.

3.3 VAPOUR BARRIER (METAL DECKS)

- 3.3.1 Clean and prepare the gypsum boards for the installation of vapour barrier primer. Ensure all substrates are clean, dry and free from any contaminants that could affect adhesion of the primer and/or vapour barrier.
- 3.3.2 All substrates to receive vapour barrier are to be primed. The primer is to be applied by brush, roller or sprayer. Allow primer to be dry to touch prior to applying the vapour barrier.
- 3.3.3 Over the clean, dry and primed substrates gypsum boards, apply 1-ply vapour barrier membrane self-adhered in place.
- 3.3.4 Roll out the vapour barrier and allow it to relax prior to application. Cut lengths to fit the application. Set in place and pull back the release film 152.4mm to 304.8mm (6" to 12") and place it on the prepared surface. Remove the release film from the remainder of the sheet and apply pressure to ensure proper contact with prepared surface.
- 3.3.5 Overlaps: side laps to be 76.2mm (3") and end laps to be 152.4mm (6").
- 3.3.6 Commence the vapour barrier application at the lowest edge of drain. Proceed up the slope from the lowest point on the roof.
- 3.3.7 At terminations and penetrations, the vapour barrier is to be extended up the vertical surface, above the insulation a minimum of 50.8mm (2").

3.4 INSULATION

- 3.4.1 Ensure vapour barrier is clean, dry, continuous, and ready for insulation application.
- 3.4.2 Install first layer of 75mm (3.0") polyisocyanurate insulation boards secured to the metal deck with 8 fasteners per 4'x8' board over the vapour retarder. Butt boards tightly together. Stagger all joints.
- 3.4.3 Install second layer of 51mm (2.0") polyisocyanurate insulation boards in ribbons of adhesive 13mm wide 150mm apart over the first layer of insulation. Butt boards tightly together. Stagger all joints.
- 3.4.4 Keep insulation a minimum of 75mm (3") from heat emitting devices and a minimum of 52mm (2") from sidewalls of CAN/ULC S604 Type "A" chimneys and CN/CGA 149.2 Type B & L vents, (commonly called B-Vents or Hot Stacks).
- 3.4.5 Ensure that all insulation boards are fully supported, joints staggered, and all edges are butted tight with no gaps between boards.
- 3.4.6 Do not apply more insulation than can be covered with membranes in the same Workday.
- 3.4.7 Install sloped prefabricated insulation sumps 2438.4mm x 2438.4mm (8'x8') around all roof drains. Adjust the insulation thickness to accommodate the sumps.
- 3.4.8 No damaged or wet insulation will be accepted. All rejected materials will be marked and must be stored on site. They are not to be removed until the Project is completed

3.5 MEMBRANE APPLICATION – BASE SHEET PRE-LAMINATED TO HIGH DENSITY POLYISOCYANURATE INSULATION

- 3.5.1 Verify all substrates to receive base sheet pre-laminated to high density polyisocyanurate insulation are clean, dry and free from contaminants that could affect installation.
- 3.5.2 Install base sheet pre-laminated to high density polyisocyanurate insulation in a full mopping of Type II asphalt, at a rate of not less than 20 lbs. per 100 sq. ft. over the existing fibreboard overlay. Butt boards tightly together. Stagger all joints.
- 3.5.3 The first parts of the side laps are to be fully adhered and pressed in place using a membrane roller, then hot air weld the remaining part of the side laps.
- 3.5.4 Over the clean dry base sheet pre-laminated to high density polyisocyanurate insulation Apply protection membrane centered over the joint. Ensure the protection membrane lies flat, with no wrinkles, fishmouths, or blisters and are fully bonded in place.
- 3.5.5 Ensure that all boards are fully supported, joints staggered, and all edge are butted tight with no gaps between boards.
- 3.5.6 No damaged or wet boards will be accepted. All rejected materials will be marked and must be stored on site. They are not to be removed until the project is completed.

3.6 PROTECTION MEMBRANE

- 3.6.1 Over the clean and dry end laps of the pre-laminated base sheet, wood blocking at curbs and perimeters, prior to installing the modified bituminous base sheet flashings, apply protection membrane. Apply 13" strip of protection membrane centered over the joints and vertical to horizontal transitions. Ensure the protection membrane lie flat, with no wrinkles, fishmouths, or blisters and are fully bonded.

3.7 MEMBRANE APPLICATION – CAP SHEET

- 3.7.1 Verify all substrates to receive cap sheet membranes are clean, dry and free from contaminants that could affect adhesion of the and installation.
- 3.7.2 Unroll the granulated modified bituminous cap sheet membranes and allow them to relax, as

per manufacturer's written instructions.

- 3.7.3 Offset all cap sheet membranes 457mm (18") from the base sheet membranes.
- 3.7.4 Beginning at the drains, perpendicular to the slope and shingled to shed water, install the modified bituminous cap sheet torched in place to the base sheet. The modified bituminous cap sheet field membranes are to be terminated 101mm (4") above the field.
- 3.7.5 Install the cap sheet membrane in parallel courses with the end laps staggered a minimum of 914.4mm(36") from each other and a minimum of 914.4mm(36") from the base sheet membranes. Side laps are to be 76.2mm (3") and end laps are to be 152.4mm (6"). All corners, at end laps are to be cut as per membrane manufacturer's requirements.
- 3.7.6 Install the cap sheet membrane, torched in place. Ensure that approximately 6.35mm (1/4") bleed out is achieved at all laps.
- 3.7.7 Ensure that the cap sheet membranes lie flat, with no wrinkles, fishmouths, or blisters, and are fully bonded to the underlying substrate(s).
- 3.7.8 Ensure the roofing substrates and/or construction elements pose no fire hazards during the use of torch equipment. Do not torch on to wood substrates or at locations that could project flames onto combustible materials.

3.8 NIGHT SEAL

- 3.8.1 Roofer is responsible to have all roofs closed-in and in a watertight condition at the end of each production day.
- 3.8.2 It is the Foreman's responsibility to thoroughly check this detail at the end of each day before leaving the roof.

3.9 MEMBRANE FLASHINGS

- 3.9.1 1-Ply of modified bituminous base sheet membrane mopped in place and 1-ply of modified bituminous cap sheet membrane torched in place.
- 3.9.2 Unroll the modified bituminous membrane flashings and allow them to relax, as per manufacturer's written instructions.
- 3.9.3 Install flashings, including laps, splices, joints, bonding, adhesion and attachment as required and in accordance with manufacturer's written instructions and details.
- 3.9.4 Ensure that all membrane flashings are smooth, free from wrinkles, blisters, fishmouths and fully bonded in place.
- 3.9.5 Flashing membranes are to be terminated 304.8mm (12") above the base of vertical surfaces at all locations. If weep holes are present, terminate membrane flashings 1-course below the weep holes/weepers.
 - .1 membrane to be installed in 1-meter widths with 76.2mm (3") side laps. Cap sheet flashing side laps to be staggered 101.6mm (4") from the cap sheet field membrane overlaps.
 - .2 Continuously seal the top edge of the granulated modified bituminous cap sheet membrane flashings with elastomeric sealant.
 - .3 At high wall locations, a termination bar is to be installed through the flashing membranes, approximately 12.7mm (0.5") below the top of the membrane. It is to be secured 152.4mm (6") on centre.
 - .4 Fully cover the membrane flashings with new pre-painted metal flashings.
 - .5 Supply and install new cross-broken metal to match the existing pattern and profile where existing.

3.9.6 Equipment Curb Flashings:

- .1 Build-up all unit curbs a minimum of 203mm (8") above the finished roof level to accommodate the height of the new roofing assembly where required.
- .2 Install 6.35mm (1/4") asphalt recovery board over exposed substrate. Asphalt recovery board is to be continuous. It is to extend from the top of the deck to the top of the curb.
- .3 Temporarily disconnect each HVAC/fan unit, completely lift the unit off the curb and set it on the roof while flashing the curb. The curb is to be set on plywood, protecting the roof membrane. Once the curb has been flashed, the unit is to be lifted off the roof and set back on the curb. Then once the unit has been reinstalled and reconnected it is to be tested to ensure it is working properly. The unit work must be performed only by qualified HVAC contractors. Roofing contractor is responsible for these costs in his bid price.
- .4 After the application of the modified bituminous base sheet field membrane, apply 1 ply of modified bituminous base sheet flashing membrane mopped in place, extending over top of the curb, and down onto the field of the roof a minimum of 4.0".
- .5 After the application of the modified bituminous cap sheet field membrane, apply 1 ply of modified bituminous cap sheet flashing membrane torched in place, extending onto the field of the roof. Extending a minimum of 4.0" beyond the 1st ply onto the field of the roof and extending over top of the curb. Ensure that the laps of the 2nd ply do not coincide with the laps of the 1st ply.
- .6 The cap sheet flashing membrane is to be nailed every 6.0" o.c. at the top of the curb.
- .7 Fully cover the membrane flashings with new pre-painted 26-gauge metal.
- .8 Install new foam gasket over top of the metal flashings prior to reinstalling mechanical equipment. Ensure foam gasket is continuous, creating a permanent seal between the mechanical equipment/skylights and metal flashings.
- .1 All existing scuppers through separation curbs are to be left in place and roofed in with new membrane flashings as instructed above.
- .2 Fully cover the membrane flashings with new pre-painted 26-gauge metal.

3.9.7 Liquid-Applied, Reinforced PMMA Membrane Flashings

- .1 After the application of the 2-ply modified bituminous base and cap sheet field membranes, install mastic/sealant around the base of the metal support post and the field membranes.
- .2 After mixing catalyst, apply primer to clean and prepared substrate using approved rollers or brushes. Allow primer to cure prior for a minimum of 30-45 minutes prior to the installation of the liquid applied PMMA membranes
- .3 After mixing, apply resin to substrate at a rate of 0.14 to 0.31 kg/ft² (1.5 to 3.3 kg/m²) (depending on substrate, as approved by material manufacturer) using approved rollers or brushes. The PMMA resin should be spread evenly onto the surface.
- .4 Roll PMMA Fleece reinforcement directly into the resin, avoiding any folds and wrinkles. Use a roller to work the resin into the fleece, saturating from the bottom up. The fleece should darken in appearance, with no white spots showing. When required peel back fleece and apply additional resin onto the substrate, then slowly roll the fleece back into the resin, using care to remove any air pockets. All side and end laps of scrim must have a minimum 102mm (4.0") overlap.
- .5 Apply an even coat of resin over top of the installed fleece at a rate of 0.09 kg/ ft² (1.0 kg/m²) using approved rollers. Use caution not to spread resin too thin.

3.10 FINISH

- 3.10.1 Perform a daily clean up to collect all wrappings, empty containers, and any other debris from the project site.
- 3.10.2 Upon completion, all debris is to be disposed of in a legally acceptable manner.
- 3.10.3 Prior to the final inspection, the Contractor is to perform a pre-inspection to review all work and to verify that all flashings have been completed as well as the application of all caulking.

END OF SECTION 07 52 16

07 62 00 - Sheet Metal Flashing & Trim

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- 1.1.1 Conform to all sections in this document and to the requirements of the Canadian Roofing Contractors Association Roofing Manual Specifications as referred to herein.
- 1.1.2 Abide by all Federal, Provincial, Municipal and Local Laws or Codes, rules and regulations that in any way affect Work including all amendments up to the Project closeout. No plea of misunderstanding will be considered on account of ignorance thereof. Notify the Consultant immediately in writing of any provisions in Drawings, Specifications or Contract, which are contrary to or inconsistent with any law, rule or regulation.
- 1.1.3 Where Documents differ, the most stringent interpretation will apply.

1.2 CO-ORDINATION

- 1.2.1 Co-ordinate the Work of this Section with the Work of:
 - .1 Section 06 10 00 Rough Carpentry
 - .2 Section 01 11 00 Summary of Work
 - .3 Section 07 52 16 SBS Modified Bituminous Membrane Roofing
 - .4 Section 07 92 00 Joint Sealants

1.3 SECTION 07 92 00 JOINT SEALANTS.REFERENCE STANDARDS

- 1.3.1 Sheet metal work, products and accessories shall be in accordance with the most current applicable industry standards including but not limited to:
- 1.3.2 THE ALUMINUM ASSOCIATION INC. (AAI)
 - .1 AAI-Aluminum Sheet Metal Work in Building Construction
 - .2 AAI DAF45-[03]; Designation System for Aluminum Finishes.
- 1.3.3 AMERICAN SOCIETY FOR TESTING AND MATERIALS INTERNATIONAL (ASTM)
 - .1 ASTM A167: Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
 - .2 ASTM A240/A240M: Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
 - .3 ASTM A606: Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - .4 ASTM A653/A653M: Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
 - .5 ASTM A792/A792M: Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by Hot-Dip Process.
 - .6 ASTM B32:Solder Metal.
 - .7 ASTM B370:Copper Sheet and Strip for Building Construction.
 - .8 ASTM B813; Flux
 - .9 ASTM D41; Asphalt Primer
 - .10 ASTM D226; Asphalt or Tar Saturated Roofing felt.
 - .11 ASTM D1970; Self-Adhering Ice Dam Protection
 - .12 ASTM D523:Test Method for Specular Gloss.

- .13 ASTM D822: Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .14 ASTM F1667; Nails, Spikes and Staples
- 1.3.4 CANADIAN ROOFING CONTRACTORS ASSOCIATION (CRCA)
 - .1 Roofing Specifications Manual, latest edition.
- 1.3.5 CANADIAN SHEET STEEL BUILDING INSTITUTE (CSSBI)
 - .1 CSSBI Bulletin SSF-3; Care & Maintenance of Prefinished Sheet Steel Building Products.
 - .2 CSSBI Technical Bulletin S-8; Quality & Performance Specification for Prefinished Sheet metal Used for Building Products.
- 1.3.6 CANADIAN STANDARDS ASSOCIATION (CSA INTERNATIONAL)
 - .1 CSA A123.3: Asphalt Saturated Organic Roofing Felt.
 - .2 AAMA/WDMA/CSA 101/I.S.2/A440-[2008], Standard/Specification for Windows, Doors, and Unit Skylights.
 - .3 CSA A123.22; Self-Adhering Polymer Modified Eave Protection
 - .4 CSA B111: Wire Nails, Spikes and Staples.
- 1.3.7 GREEN SEAL ENVIRONMENTAL STANDARDS
 - .1 Standard GS-03-[93]; Anti-Corrosive Paints.
 - .2 Standard GS-11-[97]; Architectural Paints.
 - .3 Standard GS-36-[00]; Commercial Adhesives.
- 1.3.8 HEALTH CANADA/WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)
 - .1 Safety Data Sheets (SDS).
- 1.3.9 SHEET METAL & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION (SMACNA)
 - .1 SMACNA Manual, latest Edition

1.4 APPROVAL

- 1.4.1 Do not install any metal work until the membrane flashings have been inspected and accepted by the Owner's Representative. The colour is to be determined by the Owner.
- 1.4.2 In all cases and prior to the fabrication of the finished product, supply and install a sample for approval by the Owner's representative.

1.5 SCHEDULE

- 1.5.1 Schedule the Work so that the membrane flashings are not left exposed for more than thirty (30) days.

1.6 WARRANTY

- 1.6.1 Guarantee the metal flashing in conjunction with the membrane roofing for TWO (2) year. Submit on the same form as for the membrane roofing, CRCA Warranty.

1.7 QUALITY CONTROL

- 1.7.1 Quality control for Work of this Section is to be performed by the Consultant under the work of and as specified in Section 01 10 10 General Requirements.
- 1.7.2 Work of this Section is to be carried out by a specialist having a minimum of five (5) years of related experience.
- 1.7.3 Work is to be performed in accordance with the practices and details of SMACNA Architectural

Manual – 6th Edition (Sheet Metal and Air Conditioning Contractors National Association Inc.), unless otherwise required in the Contract Documents.

PART 2 PRODUCTS

2.1 COMPATIBILITY

- 2.1.1 Compatibility between roofing materials is an essential requirement of the Contract.

2.2 METAL COUNTERFLASHINGS

2.2.1 PREFINISHED STEEL METAL:

- .1 Pre-painted galvanized steel, 26-gauge core nominal thickness, Series 8000 with a baked enamel finish to ASTM A653.
- .2 The finish is to be Dofasco Perspectra Series, Valspar WeatherX factory baked finish, or an approved alternate.
- .3 The colour is to be approved by the Owner.

2.2.2 GALVANIZED STEEL:

- .1 Galvanized sheet steel, Z275 (G90) zinc coating. Thickness as specified or shown on the Drawings.

2.2.3 HOOK, STARTER, LOCK STRIP / CLEAT:

- .1 Fabricated from pre-finished steel, 24-gauge core nominal thickness, Z275 (G90) zinc coating to ASTM A653. Width minimally 102mm (4"). Colour to match prefinished sheet metal where exposed. Starter strips are to be continuous.

2.2.4 COPPER:

- .1 Copper to be 0.8mm (16 oz.) cold rolled to ASTM B370.

2.2.5 SOLDER & FLUX:

- .1 Solder to be lead-free.
- .2 Flux is a rosin, cut hydrochloric acid or commercial preparation suitable for materials to be soldered.

2.2.6 WEDGES:

- .1 Rolled Plumber sheet lead.

2.2.7 ISOLATION COATING:

- .1 Asphalt based back paint for application to sheet metal in contact with masonry. Use asphalt primer to ASTM D41.

2.2.8 PITCH PAN:

- .1 Size as specified in the Summary of Work or as shown in the Detail. One piece pre-fabricated aluminum or fabricated from 24-gauge pre-painted steel or 16 oz. Copper.

2.2.9 PITCH PAN FILLER:

- .1 One (1) or two (2) part elastomer such as ChemLink M-1 Sealant, Sopramastic SP-2 or approved alternate.

2.2.10 TOUCH-UP PAINT:

- .1 As recommended by the prefinished sheet metal Manufacturer.

2.2.11 FASTENERS:

- .1 Nails: Hot dipped galvanized steel flat head roofing nails of length and thickness to suit

the application.

- .2 Where exposed, use Hex Head screws with 12.7mm (1/2") dome and neoprene washers as supplied by Weather Guard, or equal.
- .3 Fasteners for masonry and concrete: Tapcon fasteners with "Climaseal" corrosion resistant finish, or an approved equivalent, of sufficient length to provide a minimum 38mm (1.5") penetration into the substrate.
- .4 Expansion Fasteners: A tamper-proof nail drive anchor which has a body formed from Zamac alloy. Zamac Nail-in.

PART 3 EXECUTION

3.1 GENERAL

- 3.1.1 Apply in accordance with the Drawings, Specifications and the requirements of the jurisdictional authorities and the Canadian Roofing Contractors Association's Roofing Manual.
- 3.1.2 Regard the Manufacturer's printed recommendations and Specifications as a minimum requirement for materials, methods and quality of Work not otherwise specified herein.
- 3.1.3 Make adjustments to the specified procedures caused by weather and site conditions only with the Owner's approval.
- 3.1.4 Maintain all the equipment in good working order to ensure control of roofing operations and protection of the Work. Equipment and laying techniques are to meet the approval of the Consultant.

3.2 FABRICATION

- 3.2.1 Shop fabricate the flashings and trims in accordance with the applicable requirements of SMACNA Architectural Manual and in accordance with the Contract Documents. Form sheet metal on a bending brake. Shaping, trimming and seaming on a bench.
- 3.2.2 Form sections square, true, and accurate to size, free from distortion, oil canning and other defects detrimental to the appearance and performance, and to the dimensions as indicated/required.
- 3.2.3 Fabricate the cap flashings, starter strips, and base counter flashings less than 304.8mm (12") in height in 2440mm (96") maximum lengths. Form the counter flashings between 304.8mm and 609.6.35mm (12" and 24") in height in 1219.2mm (48") maximum lengths.
- 3.2.4 Provide a counter flashing and an intermediate vertical flashing where the cap flashing is greater than 610 mm (24") above the top of the roofing membrane. Form the vertical flashings in 1220 mm (48") maximum lengths.
- 3.2.5 Provide an "S-Lock" joint at all end joints and at all horizontal joints between the cap flashing and the vertical flashing and between the vertical flashing and the base counter flashing.
- 3.2.6 Hem all exposed edges at least 12.7mm (1/2") for appearance and stiffness.
- 3.2.7 Provide a horizontal stiffening "V" or "X" break on all face metal exceeding 228.6mm (9") in girth. Centre the V or X break in mid-span of the panel. Cross break the metal face flashing on all parapet flashings exceeding 457.2mm (18") in girth.
- 3.2.8 Mitre and form the standing seams at all corners. Make allowances for movement at the joints.
- 3.2.9 Apply an isolation coating to the metal surfaces to be embedded in concrete or mortar joints.

3.3 PITCH PAN FABRICATION / INSTALLATION

- 3.3.1 All boxes shall be minimum 152.4 mm (6.0") high above finished roof surface, with 102 mm (4.0") roof flange as approved by the Consultant. Make all seams continuous and soldered. Tapered rain collars to be included.

- 3.3.2 Install new pitch pans where required and as shown on Drawings.
- 3.3.3 Fill the bottom two-thirds (2/3) of the pitch pan with polyurethane foam. Apply polyurethane pitch pocket sealant on the exposed interior face and fill the top third of the pitch pan with the pourable sealer. The pourable sealer is to extend 13 mm (1/2") above the pitch pan at the centre and cove it to shed water.
- 3.3.4 Once the sealant has cured, apply the specified storm collar and clamp to existing protrusion to provide complete protection over the pitch pan. Apply sealant if required.

3.4 SCUPPER FABRICATION AND INSTALLATION

- 3.4.1 Fabricate scuppers from copper. Fabricate scuppers to suit a 102 mm (4") diameter down spout and in general accordance with CRCA standard flashing detail FL 9. Solder all joints in the scupper. Ensure flange is continuous by filling in outside corners.
- 3.4.2 Fabricate deck flange to provide a 152 mm (6") wide apron. Ensure flange is continuous by filling in outside corners. Apply isolation coating on deck flange. Provide a gravel stop soldered in place across scupper opening.
- 3.4.3 Provide copper or stainless steel strainers for outlet.
- 3.4.4 Install new scuppers at existing and/or new scupper locations, where applicable. Set pre-primed flange in a full bed of rubberized mastic for BUR and Modified bitumen membranes.
- 3.4.5 Install scuppers in general accordance with CRCA standard flashing detail FL 9 or to Detail.

3.5 COPPER SLEEVE FABRICATION AND INSTALLATION- IF REQUIRED

- 3.5.1 Fabricate sleeve flashing for existing penetrations from copper.
- 3.5.2 Provide a two piece or split sleeve with a minimum height of 305 mm (12").
- 3.5.3 Fabricate deck flange to provide a 152 mm (6") wide apron. Ensure flange is continuous by filling in outside corners.
- 3.5.4 Fabricate sleeve and flange with flat lock joints suitable for field soldering.
- 3.5.5 Apply isolation coating on surface of penetration.
- 3.5.6 Install copper sleeve flashing around penetrations.
- 3.5.7 Close and solder all joints and seams. Clean copper on joint surfaces to receive solder with steel wool. Flux and fill joints with molten solder.
- 3.5.8 Wipe and wash clean all traces of acid from the flux immediately after the joints are made.
- 3.5.9 Install split storm collar in strict accordance with Manufacturer's recommendations. Apply silicone sealant, as specified in Section 07 92 00 - Joint Sealants, at joint between storm collar and gas line penetration.
- 3.5.10 Install rain collar with sealant bead.

3.6 SHEET METAL UNDERLAYMENT INSTALLATION- IF REQUIRED

- 3.6.1 Install self-adhesive bituminous membrane as per the Detail Drawings, according to Manufacturer's instructions.
- 3.6.2 Provide membrane underlayment beneath sheet metal flashings at all locations, except where membrane flashings are present.
- 3.6.3 Ensure all surface areas are free from frost, dust, grease, oil, loose or spalled material.
- 3.6.4 Apply primer as per Manufacturer's printed instructions. Allow the primer to dry and install underlayment membrane on the same day as priming.
- 3.6.5 Proceed only when weather is favourable. Should installation be undertaken at temperature

below 4°C (40°F), consult Manufacturer regarding special procedures.

- 3.6.6 Maintain the recommended minimum side lap and end lap as per the Manufacturer's printed instructions.
- 3.6.7 Roll the membrane underlayment immediately after placement to ensure continuous adhesion. The roller to be of the type and size recommended by the Manufacturer.
- 3.6.8 Ensure the continuity of the membrane underlayment is maintained at all penetrations and terminations. Apply membrane sealant as required to fill inaccessible gaps following the Manufacturer's instructions.
- 3.6.9 Do not cover the membrane underlayment until it is reviewed and approved by the *Consultant*.

3.7 TERMINATION BAR INSTALLATION

- 3.7.1 Provide continuous termination bar along top of membrane flashings where indicated on Drawings and at locations and where membrane flashings terminate at the base of a wall and no other means of mechanical securement is specified or indicated.
- 3.7.2 Install the termination bar 3 mm (1/8") below the top edge of the base flashing membrane and mechanically secure to the masonry wall using 38 mm (1 1/2") "Tapcon" fasteners, or Zamac Nail-ins at 152 mm (6") o.c.
- 3.7.3 Seal the top of the termination bar with rubberized mastic or polyurethane based sealant.

3.8 METAL DRIP EDGE FLASHING INSTALLATION- IF REQUIRED

- 3.8.1 Install new pre-finished aluminum metal drip edge along eaves at area of work.
- 3.8.2 Metal is to extend onto perimeter wood substrate 52 mm (2") minimum. Fasten metal to wood substrate with roofing nails installed every 152 mm (6") on-centre, along edge. Nails are to be set in 25 mm (1") and parallel from edge of metal.
- 3.8.3 Metal drip flashings to be fabricated up to 3048 mm (10') lengths and overlapped at joints 76.2mm (3") minimum. Apply sealant within joints prior to securement.

3.9 SHEET METAL INSTALLATION

- 3.9.1 Install the cap flashings, counter flashings, starter strips, and other miscellaneous sheet metal Work in accordance with the Contract Documents.
- 3.9.2 Provide a continuous starter (hook) strip where detailed or required to present a true, non-waving, leading edge. Fasten the starter strip to the substrate at a minimum of 304.8mm (12") on centre in a "Z" pattern using roofing nails of at least 25.4mm (1") length.
- 3.9.3 Ensure the parapet cap flashings are installed with a minimum positive slope of 2% toward the roof area. The slope is to be provided by the installation of continuous wood shims, plywood or wood blockings as detailed in accordance with Section 00 61 00 – Rough Carpentry.
- 3.9.4 Install cross-broken flat stock metal to entire parapet wall over 304.8mm (12") in height.
- 3.9.5 Caulk all horizontal joints less than 1:100 slope (1%).
- 3.9.6 Join all sheet metal with evenly spaced flat lock seams 25.4mm (1") wide to allow for thermal movement.
- 3.9.7 Counter flash bituminous flashing membranes at roof joints, walls, perimeters, parapets and curbs. Flash joints in metal flashings using S-locks and standing seams forming tight fit over hook strips. Construct internal and external mitres.
- 3.9.8 End joints where adjacent lengths of metal flashing meet to be made using an "S-lock" joint. This is to be executed by inserting the end of one length in a 25.4mm (1") deep "S" lock formed in the end of the adjacent length. The concealed portion of the "S" lock is to extend 25.4mm

- (1") outwards and is to be nailed to the substrate. Face nailing of joints will not be permitted.
- 3.9.9 Insert the top edge of the sheet metal flashing under the cap flashings to form weather tight junctions.
 - 3.9.10 Turn the top edge of the flashings into recessed reglets or mortar joints a minimum of 25.4mm (1"). Fasten the sheet metal flashing into the reglet joint at a maximum spacing of 457.2mm (18") or more often if required.
 - 3.9.11 Ensure all fasteners are located a minimum of 304.8mm (12") above the surface of the roofing membrane, unless otherwise detailed.
 - 3.9.12 Where detailed or required, saw cut existing/new reglets into the masonry surfaces to receive metal flashings. The reglet is to be a minimum 19.05mm wide x 13 mm deep (3/4" x 1/2").
 - 3.9.13 Lock seam corners. Do not use pop rivets.
 - 3.9.14 Install the sheet metal with concealed fasteners. Exposed fastening is permitted only upon the Consultant's approval.
 - 3.9.15 Use lead plugs or an approved expansion shield and screw in place with rubber washers where metal is installed over concrete or masonry.
 - 3.9.16 Install sheet metal in a uniform manner, level, true to line, free of warp or distortions.
 - 3.9.17 Install metal flashings under cap flashings and behind other claddings a minimum of 38mm (1.5") to form a weather tight junction.
 - 3.9.18 All outside perimeter cap flashings are to completely cover all fascia, or otherwise extend a minimum of 76.2mm (3") below deck or wood blocking level.
 - 3.9.19 Properly cover the area to be protected with the metal flashings lightly touching the gravel pour and firmly secured to prevent movement or stripping by the wind.
 - 3.9.20 No irregular or badly fitted metal work will be accepted. Provide metal strips, cleats, as required.
 - 3.9.21 Install self-adhering modified bituminous membrane over all exposed masonry, concrete or wood to be flashed with metal. Secure in place.
 - 3.9.22 At walls or junctions, re-cut the reglet joint, wedge the flashings with lead wedge at 304.8mm (12") o.c. Turn top edge of flashing into reglet or mortar joint a minimum of 25.4mm (1").

3.10 SEALANTS

- 3.10.1 Apply sealant at the junction between the sheet metal counterflashing and the reglet joint in accordance with Section 07 92 00 – Joint Sealants.

3.11 CLEANING

- 3.11.1 Remove completely from surfaces and crevices the flux residue, other deposits, stains and protections and wash the visible metal left unpainted

END OF SECTION 07 62 00

07 92 00 - Joint Sealants

PART 1 GENERAL

1.1 GENERAL CONDITIONS

- 1.1.1 Conform to all sections in this document and to the requirements of the Canadian Roofing Contractors Association Roofing Manual Specifications as referred to herein.
- 1.1.2 Abide by all Federal, Provincial, Municipal and Local Laws or Codes, rules and regulations that in any way affect Work including all amendments up to the Project closeout. No plea of misunderstanding will be considered on account of ignorance thereof. Notify the Consultant immediately in writing of any provisions in Drawings, Specifications or Contract, which are contrary to or inconsistent with any law, rule or regulation.
- 1.1.3 Where Documents differ, the most stringent interpretation will apply.

1.2 CO-ORDINATION

- 1.2.1 Co-ordinate Work of this Section with Work of:
 - .1 Section 06 10 00 Rough Carpentry
 - .2 Section 01 11 00 Summary of Work
 - .3 Section 07 52 16 SBS Modified Bituminous Membrane Roofing
 - .4 Section 07 62 00 Sheet Metal Flashing and Trim.

1.3 REFERENCE STANDARDS

- 1.3.1 Sealant work, materials, products and accessories shall be in accordance with the most current applicable industry standards including but not limited to:
- 1.3.2 AMERICAN SOCIETY FOR TESTING AND MATERIALS INTERNATIONAL, (ASTM)
 - .1 ASTM C919:-Use of Sealants in Acoustical Applications.
 - .2 ASTM C920; Elastomeric Joint Sealants, Type S, grade NS.
 - .3 ASTM C1311; Solvent Release Sealants
- 1.3.3 DEPARTMENT OF JUSTICE CANADA (JUS)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- 1.3.4 GENERAL SERVICES ADMINISTRATION (GSA) - FEDERAL SPECIFICATIONS (FS)
 - .1 TT-S-00227E; Sealing Compound Elastomeric Type- Multi-Component, Class A, Type 2.
 - .2 TT-S-00230C; Sealing Compound elastomeric Type- Single component, Class A, Type 2.
- 1.3.5 HEALTH CANADA/WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS)
 - .1 Safety Data Sheets (SDS).
- 1.3.6 TRANSPORT CANADA (TC)
 - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.4 CLIMATE CONDITIONS

- 1.4.1 ENVIRONMENTAL LIMITATIONS
 - .1 Do not proceed with the installation of joint sealants under the following conditions:
 - (a) When ambient and substrate temperature conditions are outside the limits permitted by the joint sealant manufacturer.

(b) When joint substrates are wet.

.2 Joint-Width Conditions:

(a) Do not proceed with the installation of joint sealants where the joint widths are less than those allowed by the joint sealant manufacturer for the applications indicated.

.3 Joint-Substrate Conditions:

(a) Do not proceed with the installation of joint sealants until contaminants capable of interfering with adhesion are removed from the joint substrates.

1.5 ENVIRONMENTAL REQUIREMENTS

1.5.1 Comply with the requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Safety Data Sheets (SDS) acceptable to Labour Canada.

1.5.2 Conform to the manufacturer's recommended temperatures, relative humidity, and substrate moisture content for the application and curing of sealants including special conditions governing use.

1.6 WARRANTY

1.6.1 Provide all applicable material and labour Warranties offered by the material Manufacturer for a minimum of two (2) years.

1.6.2 Defective joint sealant installation covered under Warranty is to include but not be limited to:

.1 joint leakage, hardening, craze cracking, crumbling, melting, bubbling, shrinkage, runs, sags, change of colour, loss of adhesion, loss of cohesion and staining of adjoining or adjacent material surfaces.

1.6.3 Carry out all replacement and repair Work during the Warranty period as directed by the Consultant and at no additional cost to the Owner.

1.7 QUALITY CONTROL

1.7.1 Quality control for Work of this Section is to be performed by the Consultant under the Work of and as specified in Section 01 10 10 General Requirements.

PART 2 PRODUCTS

2.1 COMPATIBILITY

2.1.1 All materials in a sealant system are to be compatible with each other and with the substrate.

2.1.2 Colour or colours of the sealants are to be selected are to match existing substrate and are to be approved by the Consultant.

2.2 SEALANT MATERIALS

2.2.1 Exterior Metal To Wood, Masonry, Stone Or Porous Surfaces:

.1 One-part elastomeric, non-sag urethane based sealant. Accepted products:

(a) "Dymonic" as manufactured by Tremco

(b) "Sikaflex 1-A" as manufactured by Sika Canada

(c) "Vulkem 931" by Mameco as manufactured by Tremco

(d) "SK-1 Structural Sealant" as supplied by Chemlink.

2.2.2 Exterior And Interior Metal To Metal And Metal To Glass Joints:

- .1 One-part Silicone based sealant. Accepted Products:
 - (a) "Spectrum 2" as manufactured by Tremco
 - (b) "Contractors SCS 1000 Sealant" as manufactured by GE Silicones Canada
 - (c) "DC 999-A Silicone Building & Glazing Sealant" as manufactured by DowCorning Canada.

2.3 JOINT BACKING

- 2.3.1 Extruded polyethylene, urethane, neoprene or vinyl foam recommended by sealant Manufacturer. Extruded closed-cell foam, Shore "A" Hardness 20, Tensile Strength of 140-200 Kpa.
- 2.3.2 Circular shape with a diameter 25% greater than the joint width before installation.

2.4 VOID FILLER

- 2.4.1 Glass fibre or Rockwool insulation with a nominal density of 14 kg/m³ (2.86 lbs. / cu. ft.) Sized for 25% compression.

2.5 BOND BREAKER TAPE

- 2.5.1 Pressure sensitive plastic tape which will not bond to sealants. Supplied or recommended by the sealant Manufacturer.

2.6 PRIMER

- 2.6.1 As recommended by the sealant Manufacturer to assure adhesion of the compound and to prevent staining of the substrate.

2.7 CLEANING AGENTS

- 2.7.1 Joint cleaning compounds as recommended by the sealant Manufacturer. Xylol (Xylene), Methyl Ethyl Ketone (MEK) or non-corrosive type compatible with joint forming materials.

PART 3 EXECUTION

3.1 EXAMINATION

- 3.1.1 Inspect existing conditions, and substrates upon which Work of this Section is dependent. Report to the *Consultant* in writing any defects or discrepancies. Commencement of Work implies acceptance of existing conditions and assuming full responsibility for the finished condition of the Work.
- 3.1.2 Verify, before commencing Work, that the joint size, depth and substrate will not adversely affect execution, performance or quality of completed Work; and that the joints can be sealed in an acceptable condition by means of preparation specified in this Section. Verify site conditions together with sealant Manufacturer's representative.
- 3.1.3 Defective Work resulting from application to unsatisfactory joint conditions will be considered the responsibility of those performing the Work of this Section.

3.2 GENERAL

- 3.2.1 Apply in accordance with the Drawings, Specifications and requirements of the jurisdictional authorities and the Canadian Roofing Contractors Association's Roofing Manual.
- 3.2.2 Regard the Manufacturer's printed recommendations and Specifications as a minimum requirement for materials, methods and quality of Work not otherwise specified herein.
- 3.2.3 Make adjustments to the specified procedures caused by weather and site conditions only with the Consultants approval.

- 3.2.4 Conform to the Details.
- 3.2.5 Examine joints before caulking to ensure that the configuration, surface and widths are suitable for the sealant and service, and that the execution of caulking and performance of sealants will not be adversely affected.
- 3.2.6 Verify, before commencing the Work, that the joint size, depth and substrate will not adversely affect the execution, performance or quality of the completed Work; and that joints can be sealed in an acceptable condition by means of the preparation specified in this Section. Verify the site conditions together with the sealant Manufacturer's representative.
- 3.2.7 Defective Work resulting from the application to unsatisfactory joint conditions will be rejected.

3.3 REMOVAL & PREPARATION

- 3.3.1 Remove the existing sealant and backing material and all deleterious material from the joint. Use the method of surface preparation suitable for substrate that does not damage adjacent surfaces, as recommended by the sealant Manufacturer.
- 3.3.2 Rake out joints, cracks and crevices to receive sealant to a depth measuring half (1/2) the joint width.
- 3.3.3 Brush, scrub, scrape or grind the inner face surfaces to remove loose mortar, dust, oil, grease, oxidation, mill scale, and other materials which will affect the adhesion and integrity of the sealant.
- 3.3.4 Wipe down metal surfaces with clean cellulose sponges or rags soaked in solvent compatible with the sealant, and dry with clean cloths. Ensure solvents do not damage painted surfaces.
- 3.3.5 Ensure that surfaces have not been coated with release agents, coating or other treatments, or that, if present, they are entirely removed.
- 3.3.6 Examine joint sizes and correct to achieve width to depth ratio of 1:2 with joint size no less than 12.7mm (1/2") width and 25.4mm (1") depth.
- 3.3.7 Install joint filler to achieve correct depth, if required.
- 3.3.8 Where necessary to prevent staining, mask adjacent surfaces prior to priming and sealant application.
- 3.3.9 Apply bond breaker tape where required to sealant Manufacturer's printed instructions.

3.4 JOINT DEPTH

- 3.4.1 Provide the following Depth To Width Ratios:
 - .1 Masonry:
 - (a) 6.35mm (1/4") deep, up to 12.7mm (1/2") wide
 - (b) 9.53mm (3/8") deep, up to 19.05mm (3/4") wide
 - (c) 12.7mm (1/2") deep, up to 25.4mm (1") wide
 - (d) 19.05mm (3/4") deep, up to 50.8mm (2") wide.
 - .2 Non Porous Materials:
 - (a) Joint depth and width to be not be less than 6.35mm (1/4").

3.5 PRIMING

- 3.5.1 Prime the inner face surfaces of joints as necessary for the substrate, in accordance with the sealant Manufacturer's Specification, to provide full adhesion and to prevent staining of the face surface at the joint.

- 3.5.2 Prime surfaces prior to installing the joint backing rod.

3.6 JOINT FILLING AND BACKING

- 3.6.1 Install joint backing where required to maintain the joint depth.
- 3.6.2 Pack joints tightly with sealant in accordance with the Manufacturer's Specifications using pressure guns. Fill joints completely to the required depths with sealant compound. Use sufficient pressure to fill all voids and joints. Sealant is to bond to both sides of the joint.
- 3.6.3 Apply bond breaker tape, prior to applying sealant, where joints are of insufficient size to install backer rod or at 90° junctions or where recommended by the sealant Manufacturer or *Consultant*. Ensure bond surface area meets the minimum required size recommended by the sealant Manufacturer.
- 3.6.4 Mask, with masking tape, all surfaces adjacent to joints which are likely to become coated with sealant during sealant application.
- 3.6.5 Apply sealant using gun dispenser with proper size nozzle for joint to be sealed to leave a weather tight, airtight installation.
- 3.6.6 Fill joints completely to required depths with sealant compound. Use sufficient pressure to fill all voids and joints solid. Sealant shall bond to both sides of the joints but not to backing material. ***Superficial pointing with skin bead is not acceptable.***
- 3.6.7 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets or embedded impurities. Neatly tool surface to create a slightly concave joint.
- 3.6.8 Slope sealant surface at top of surface reglet flashings to create positive water shed.
- 3.6.9 Finish joints smooth, free of wrinkles, ridges, air pockets and imbedded foreign materials. Tool joints to a slight concave surface using a soap/water mixture.
- 3.6.10 Cure sealants in accordance with the sealant Manufacturer's instructions.
- 3.6.11 Do not cover up sealants until proper curing has taken place.
- 3.6.12 Do not allow sealants to cover or spot surfaces outside of joints. Use masking tape on all surfaces adjacent to joints which may become coated with sealant during the caulking process.

3.7 CLEAN UP

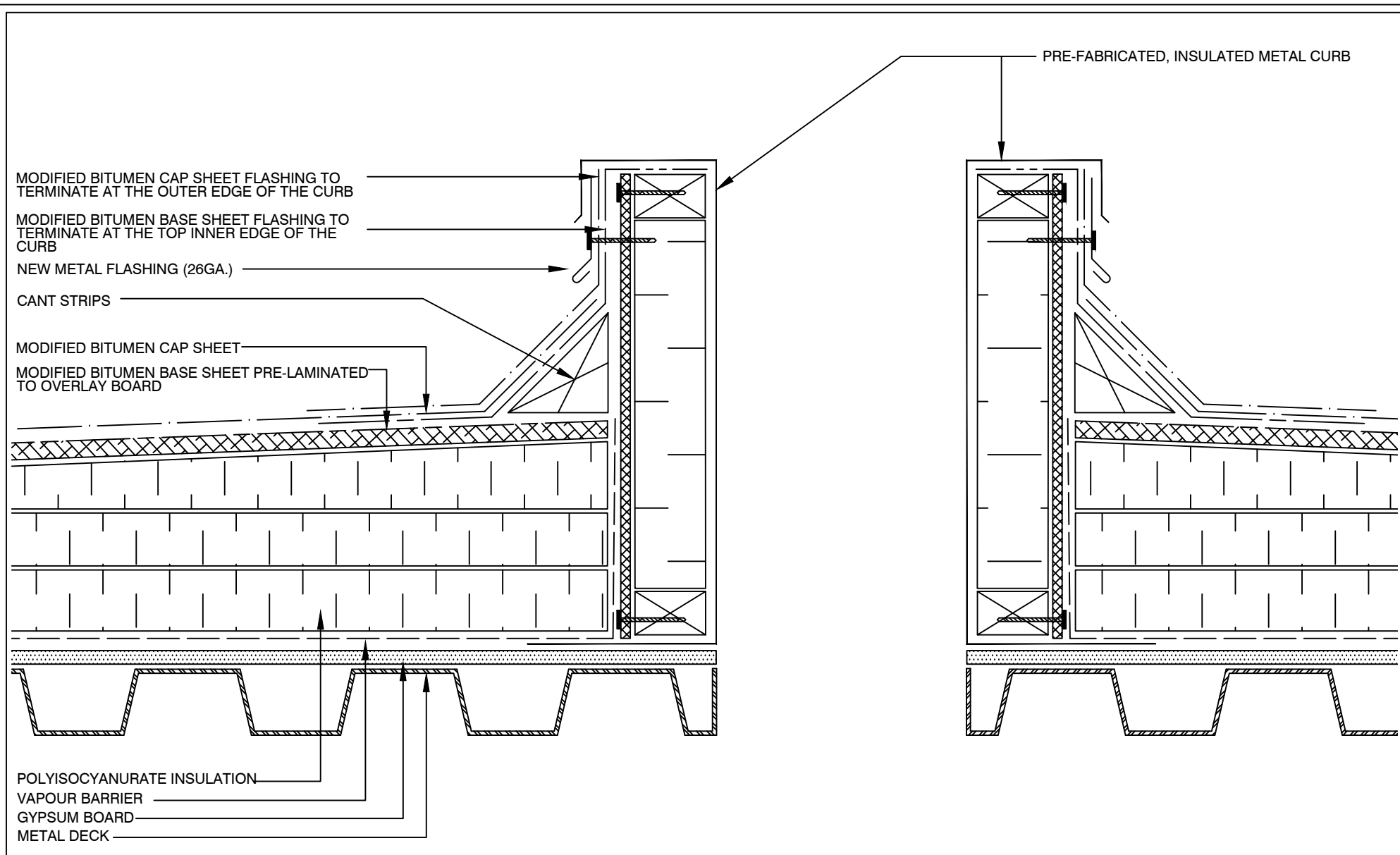
- 3.7.1 Remove from surfaces of other work sealant smears, droppings and masking tape immediately after caulking. Use recommended cleaners as required.
- 3.7.2 Clean surfaces soiled by Work of this Section. Do not use chemicals, scrapers, or other tools in cleaning which will damage surfaces. Make good other Work.
- 3.7.3 Clean up and remove from the job site on a daily basis, all rubbish and surplus materials resulting from this Work.
- 3.7.4 Joint sealants shall be protected from physical damage and the elements until such time as the sealant will not be affected by same.

END OF SECTION 07 92 00

SCHEDULE A – LIST OF PLANS & DETAILS

Dwg #	Drawing Title	Issued/Revised	Date
	Metal Deck Details		
MB2	Curb Detail	For BID	January 2026

END OF LIST OF PLANS AND DETAILS



73 INDUSTRIAL PARKWAY NORTH - UNIT #3
AURORA - ONTARIO - L4G 4C4
TEL (905) 503-1300 - FAX (905) 503-2002

CLIENT

HALTON CATHOLIC SCHOOL BOARD

PROJECT ADDRESS

Notre Dame Catholic Secondary School
2333 Headon Rd, Burlington

DRAWING TITLE

MECHANICAL CURB DETAIL

FILE NO.

260054

SCALE

N.T.S.

DATE

February 2026

DRAWING NUMBER

1

THIS DRAWING IS THE PROPERTY OF TRI-TECH PINNACLE GROUP INC.
AND MAY NOT BE REPRODUCED WITHOUT CONSENT

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials, preparation and application for caulking and sealants.

1.2 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 07 62 00 – Sheet Metal Flashing and Trim.
- .3 Section 08 11 14 – Steel Doors and Frames.
- .4 Section 04 21 13 - Masonry.
- .5 Section 07 46 13 – Preformed Metal Siding.

1.3 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C919-[02], Standard Practice for Use of Sealants in Acoustical Applications.
- .2 Canadian General Standards Board (CGSB)
 - .1 CGSB 19-GP-5M-[1984], Sealing Compound, One Component, Acrylic Base, Solvent Curing (Issue of 1976 reaffirmed, incorporating Amendment No. 1).
 - .2 CAN/CGSB-19.13-[M87], Sealing Compound, One-component, Elastomeric, Chemical Curing.
 - .3 CGSB 19-GP-14M-[1984], Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing (Reaffirmation of April 1976).
 - .4 CAN/CGSB-19.17-[M90], One-Component Acrylic Emulsion Base Sealing Compound.
 - .5 CAN/CGSB-19.24-[M90], Multi-component, Chemical Curing Sealing Compound.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .4 General Services Administration (GSA) - Federal Specifications (FS)
 - .1 FS-SS-S-200-[E(2)1993], Sealants, Joint, Two-Component, Jet-Blast-Resistant, Cold Applied, for Portland Cement Concrete Pavement.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 Transport Canada (TC)

- .1 Transportation of Dangerous Goods Act, 1992 (TDGA).

1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturer's product to describe.
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit manufacturer's instructions in accordance with Section 01 33 00 - Submittal Procedures.
 - .1 Instructions to include installation instructions for each product used.

1.5 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 01 61 00 - Common Product 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 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal of paper, plastic, polystyrene, corrugated cardboard, or packaging material [in appropriate on-site bins] for recycling.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .5 Unused [sealant] material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.
- .6 Divert unused joint sealing material from landfill to official hazardous material collections site approved by Consultant.
- .7 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.
- .8 Fold up metal banding, flatten, and place in designated area for recycling.

1.7 PROJECT CONDITIONS

- .1 Environmental Limitations:

- .1 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.
 - .2 When joint substrates are wet.
- .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

1.8 ENVIRONMENTAL 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 (MSDS) 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.

1.9 WARRANTY

- .1 Submit a warranty that caulking work will not leak, crack, crumble, melt, shrink, run, lose adhesion or stain adjacent surfaces, in accordance the General Conditions of the Contract, but for two (2) years total. Contractor shall supply all labour, materials, tools and equipment to repair and/or replace any work judged to be defective by the Consultant and sealant manufacturer at no additional cost to the owner for a period of 2 years from the date of Substantial Completion.
- .2 Submit a manufacturer's warranty against defects in materials and workmanship covering the components of the sealant for a period of ten (10) years. The manufacturer shall supply a non-pro-rated warranty covering labour, materials, tools and equipment to repair and/or replace any materials defects at no additional cost, for a period of 10 years

Part 2 Products

2.1 SEALANT MATERIALS

- .1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .2 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.
- .3 Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Primers: type recommended by sealant manufacturer.
- .2 Joint Fillers:
 - .1 General: compatible with primers and sealants, outsized 30 to 50%.
 - .2 Polyethylene, urethane, neoprene or vinyl: extruded closed cell foam, Shore A hardness 20, tensile strength 140 to 200 kPa.
 - .3 Neoprene or butyl rubber: round solid rod, Shore A hardness 70.
 - .4 Polyvinyl chloride or neoprene: extruded tubing with 6 mm minimum thick walls.
 - .5 Bond breaker: pressure sensitive plastic tape which will not bond to sealants.
 - .6 Sealant Type A: One component, chemical curing, conforming to CAN2-19.13-M82, Class C-2-25-B-N; multi-component, chemical curing, conforming to CAN2-19.24-M80, Type 2, Class B.
 - .7 Sealant Type B: Multi-component, chemical curing mildew resistant conforming to CGSB 19-GP-22M.
 - .8 Sealant type C: Multi-component, acrylic emulsion base, conforming to CGSB 19-GP-17M.
 - .9 Sealant type D: One component, polyurethane base, chemical curing, conforming to CAN2-19.13-M82, Class C-1-25-B-N; or multi-component, chemical curing, conforming to CAN2-19.24-M80, type 1.
 - .10 For exterior aluminum to masonry, aluminum to wood and aluminum to metal joints: high performance, single component modified elastomeric joint sealant conforming to CAN2-19.24-M80. Acceptable Materials: Sonolastic Ultra by Degussa.
 - .11 For interior aluminum to masonry, aluminum to wood and aluminum to metal joints: high performance, single component low odour sealant conforming to CAN/CGSB-19.13-M87. Acceptable materials: Spectrem 2 by Tremco.
- .3 Color of Sealants: to be selected by Consultant. Allow for a total of two (2) colours for Type A, two colours for Type B, two colours for Type C and one colour for Type D. Locations as directed on site by Consultant.
- .4 Joint cleaner: xylol, methylethyl-ketone or non-corrosive type recommended by sealant manufacturer and compatible with joint forming materials.
- .5 Vent tubing: 6 mm inside diameter extruded polyvinyl chloride tubing.

2.3 JOINT CLEANER

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

Part 3 Execution

3.1 PROTECTION

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

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .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 New Work:
 - .1 Remove dust, paint, loose mortar and other foreign matter. Dry joint surfaces.
 - .2 Remove rust, mill scale and coatings from ferrous metals by wire brush, grinding or sandblasting.
 - .3 Remove oil, grease and other coatings from non-ferrous metals with joint cleaner.
 - .4 Prepare concrete, masonry, glazed and vitreous surfaces to sealant manufacturer's instructions.

- .5 Examine joint sizes and correct to achieve depth ratio 1/2 of joint width with minimum width and depth of 6 mm, maximum width 25 mm.
- .6 Install joint filler to achieve correct joint depth.
- .7 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .8 Apply bond breaker tape where required to manufacturer's instructions.
- .9 Prime sides of joints to sealant manufacturer's instructions immediately prior to caulking.
- .2 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.
 - .9 Apply sealant to joints between window or door frames to adjacent building components around perimeter of every external window or door opening, to control joints in masonry walls and where indicated. In masonry cavity construction, vent caulked joints from cavity to 3 mm beyond external face of wall by inserting vent tubing at bottom of each joint and maximum to 1500 mm o.c. vertically. Position tube to drain to exterior.
 - .10 Apply sealant to close gaps at all junctures of all interior walls meeting exposed ceilings. Provide required foam backer rods to ensure integrity of sealant bead when applied to juncture. Tool finish smooth to receive paint finish.
 - .11 Use sealants specified in the following locations:
 - .1 Type A: Joints between windows or door frames and adjacent building components; control and expansion joints and all other locations where sealing is required, except in locations designated for Type B, C and D. Ensure that sealant chosen (from the several specified under "MATERIALS") for each location is recommended by manufacturer for use on surfaces encountered.
 - .2 Type B: Joints between splash backs and walls.
 - .3 Type C: Joints between interior metal door frames and partitions.
 - .4 Type D: Joints in horizontal surfaces between concrete slabs.
- .3 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.

- .4 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.

3.7 WORK INCLUDED

- .1 Work shall include but not limited to the following areas:
 - .1 exterior and interior hollow metal frames and screens; both sides;
 - .2 exposed control and expansion joints in masonry walls, masonry corners, joints in front of steel lintels bearing on exterior brick jambs;
 - .3 joints at all washroom vanities, hair dryers, hand dryers, electrical panels, access doors and adjacent surfaces. (Use sanitary caulking.)
 - .4 joints between masonry and concrete surfaces.
 - .5 joints between gypsum board and masonry, or other materials.
 - .6 joints between louvres and other surfaces.
 - .7 exterior siding, prefinished metal fascia, flashing and trim.
 - .8 penetrations through roofs, floors and walls other than firestopping
 - .9 at all other locations on drawings, except as noted below.
- .2 Sealing of joints to the underside of exposed precast slab to be by precast installer.
- .3 Sealing of all joints at top of walls meeting exposed flat or sloped precast ceilings to be included in this section.

3.8 REQUIRED INSPECTION

- .1 Contractor to engage exterior sealant manufacturer's representative to review in order to provide manufacturer's warranty. Manufacturer's representative shall review substrate conditions as prepared on site and prior to the application of the sealant. If requested, manufacturer to supply a written copy of this warranty.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S101, 1989.
 - .2 CAN/ULC-S102, 1988.

1.2 TEST REPORTS

- .1 Submit product data including certified copies of test reports verifying fireproofing applied to substrate as constructed on project will meet or exceed requirements of Specification.
- .2 Submit test results in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.
- .3 For assemblies not tested and rated, submit proposals based on related designs using accepted fireproofing design criteria.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate 300 x 300 mm size sample of exposed fireproofing for approval of texture and colour.

1.4 PROTECTION

- .1 At outdoor temperatures less than 5EC, ensure that a 5EC air and substrate temperature is maintained during and for 24 hours after application. Ensure that natural ventilation to properly dry the fireproofing during and subsequent to its application is provided. In enclosed areas lacking openings for natural ventilation, ensure that interior air is circulated and exhausted to the outside.
- .2 Provide temporary enclosures to prevent spray from contaminating air beyond application area.
- .3 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of fireproofing materials.

Part 2 Products

2.1 MATERIALS

- .1 **Sprayed fireproofing:** ULC certified cementitious or fireproofing qualified for use in ULC Designs to provide 1 hour fire resistance rating to **all floor supporting structural steel members**. Contractor to state ULC Design compliance in data submissions in accordance with Section 01 33 00 – Submittals.

- .1 Acceptable Material: “W.R. GRACE”, Type MK-6.
- .2 Acceptable Material: “CAFECO/ISOLATEK INTERNATIONAL” Type 300.
- .3 Acceptable Material: AD Fire Protection systems, AD Type 5.
- .2 Curing compound: type recommended by fireproofing manufacturer, qualified for use in ULC Designs specified.
- .3 Primer: As required by ULC design where applicable, or as recommended by AD Fire Protection Systems.

Part 3 Execution

3.1 PREPARATION

- .1 Discuss fireproofing methods and final product with principal building inspector prior to application to ensure that finished installation will be acceptable. Record in writing all materials and methods to be employed to achieve final approval of installation.
- .2 Contractor to prepare a mock-up of the fireproofing on site. Architect and GC to review to determine if level of finish is acceptable.
- .3 Substrate shall be free of material, which would impair bond.
- .4 Verify that painted substrate [s] are compatible and have suitable bonding characteristics to receive fireproofing.
- .5 Remove incompatible materials.
- .6 Ensure that items required to penetrate fireproofing are placed before installation of fireproofing.
- .7 Ensure that ducts, piping, equipment, or other items which would interfere with application of fireproofing are not positioned until fireproofing work is completed.

3.2 APPLICATION

- .1 Apply bonding adhesive or primer to substrate if recommended by manufacturer.
- .2 Apply fireproofing to correspond with tested assemblies, or acceptable calculation procedures to provide following fire resistance ratings.
- .3 Apply fireproofing over substrate, building up to required thickness to cover substrate with monolithic blanket of uniform density and texture.

3.3 INSPECTION AND SITE TESTS

- .1 Inspection and testing of fireproofing will be carried out by a third party agency designated by Consultant.
- .2 Cost of testing will be paid from Cash Allowance specified in Section 011100 – Summary of Work, section 1.29.

- .3 Arrange for final inspection of the work of this section by municipal building inspector.

3.4 PATCHING

- .1 Patch damage to fireproofing caused by testing or by other trades before fireproofing is concealed, or if exposed, before final inspection.

3.5 LOCATIONS- SPRAYED FIREPROOFING

- .1 Fireproofing is required on all structural steel supporting floor loads. Refer to structural drawings.

END OF SECTION

Part 1 General

1.1 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 26 and 33 respectively.

1.2 REFERENCES

- .1 Underwriters Laboratories of Canada (ULC)
 - .1 ULC-S115-[1995], Fire Tests of Firestop Systems.

1.3 SAMPLES

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

1.4 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.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

1.6 SYSTEM DESCRIPTION

- .1 Firestopping Materials: CAN4-S115M ASTM E814 to achieve a fire protection rating as noted on Drawings.
- .2 It is the intent of this Section that in conjunction with Divisions 26 and 33 a competent, single source be responsible for the firestopping and smoke seals of the entire project.

1.7 QUALITY ASSURANCE

- .1 Manufacturer: Company specializing in manufacturing products of this Section with minimum five years documented experience.
- .2 Applicator: Approved, licensed and supervised by the manufacturer of firestopping materials. Company with minimum five years documented experience.
- .3 Product: Manufactured under ULC Follow-up Program. Each container or package shall bear ULC label.

1.8 REGULATORY REQUIREMENTS

- .1 Conform to applicable code for fire protection ratings.
- .2 Provide certificate of compliance for authority having jurisdiction indicating approval.

1.9 DELIVERY, STORAGE AND HANDLING

- .1 Deliver and store materials in a dry, protected area, off ground in original, undamaged, sealed containers with manufacturer's labels and seals intact.

1.10 PROJECT AND SITE CONDITIONS

- .1 Application temperature and ventilation as per Manufacturer's instructions.

1.11 SEQUENCING AND SCHEDULING

- .1 Sequence work to permit installation of firestopping and smoke seal materials to be installed after adjacent work is complete and before closure of spaces.

Part 2 Products

2.1 MATERIALS

- .1 A/D Firebarrier Firestop Systems, by A/D Fire Protection Systems Inc., capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN4-S115 and not to exceed opening sizes for which they are intended.
- .2 Mineral Wool Backing Insulation: ULC labeled, preformed non-combustible material (A/D Firebarrier Mineral Wool) by A/D Fire Protection Systems Inc.
- .3 Retainers: Clips to support mineral wool.
- .4 Firestopping Sealant: ULC labeled, single component silicone based, A/D Silicone Firebarrier Sealant by A/D Fire Protection Systems Inc.
- .5 Firestopping Seal: ULC labeled, single component water-based seal, A/D Firebarrier Seal by A/D Fire Protection Systems Inc.
- .6 Firestopping Foam: ULC labeled, two components silicone foam, A/D Firebarrier RTV Foam by A/D Fire Protection Systems Inc.
- .7 Firestopping Mortar: ULC labeled, non-combustible fibre reinforced, foamed cement mortar, A/D Firebarrier Mortar by A/D Fire Protection Systems Inc.
- .8 Damming Material: In accordance with tested assembly being installed as applicable and as acceptable to authorities having jurisdiction.

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 without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.
- .5 Verify that openings are ready to receive the Work of this Section.
- .6 Confirm compatibility of surfaces to receive firestopping and smoke seal materials.
- .7 Beginning of installation means acceptance of existing surfaces and substrate.

3.2 INSTALLATION

- .1 Install firestopping in wall cavities in accordance with the OBC 3.1.11., in cavities 25mm and greater, spaced 3.0m max. vertically and 20m max. horizontally.
- .2 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.
- .3 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.
- .4 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .5 Tool or trowel exposed surfaces to a neat finish.
- .6 Remove excess compound promptly as work progresses and upon completion.
- .7 Apply in sufficient thickness to achieve rating to uniform density and texture.
- .8 Protect installed material until cured or set.

3.3 INSPECTION

- .1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials 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 Refer to Drawings for horizontal and vertical fire stop locations and for typical firestopping detail at cavity wall, for top of wall fire separation assembly and for fire separation locations.

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 fire stopping and smoke seal materials.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 07 92 10 - Joint Sealing: Caulking of joints between frames and other building components.
- .3 Section 08 71 10 - Door Hardware - General: Supply of finish hardware, including weatherstripping and mounting heights.
- .4 Section 09 91 23 - Interior Painting.
- .5 Section 09 91 13 - Exterior Painting.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM A653/A653M-[01a], Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .2 ASTM B29-[92(1997)], Specification for Refined Lead.
 - .3 ASTM B749-[97], Specification for Lead and Lead Alloy Strip, Sheet and Plate Products.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma-[84], Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA International)
 - .1 G40.20/G40.21-[98], General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59-[M1989(R2001)], Welded Steel Construction (Metal Arc Welding) (Metric Version).
- .4 Canadian Steel Door Manufacturers' Association, (CSDMA).
 - .1 CSDMA, Specifications for Commercial Steel Doors and Frames, [1990].
 - .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, [1990].
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA 80-[99], Standard for Fire Doors and Fire Windows.
 - .2 NFPA 252-[99], Standard Methods of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN4-S104-[80(R1985)], Fire Tests of Door Assemblies.

- .2 CAN4-S105-[85(R1992)], Fire Door Frames Meeting the Performance Required by CAN4-S104.
- .7 CAN/ULC-S701-[01], Thermal Insulation, Polystyrene, Boards and Pipe Covering.
- .8 CAN/ULC-S702-[97], Thermal Insulation, Mineral Fibre, for Buildings.
- .9 CAN/ULC-S704-[01], Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 DESIGN REQUIREMENTS

- .1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -35°C to 35°C.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

1.4 WORK INCLUDED

- .1 A single manufacturer shall fabricate products included within the scope of this Section.
- .2 Manufacturer shall be a member in good standing of the Canadian Steel Door Manufacturers Association (CSDMA).
- .3 Supply only of steel frame products including frames, transom frames, sidelight and window assemblies with provision for glazed, paneled or louvered openings, fire labeled and non-labeled, as scheduled or detailed by the Consultant.
- .4 Supply only of flush steel doors with provision for glazed, paneled or louvered openings, insulated and un-insulated, fire labeled, with or without temperature rise ratings and non-labeled, as scheduled or detailed by the Consultant.
- .5 Supply only of steel panels, similar in construction to steel doors, with flush or abetted bottoms for steel frames, transom frames, sidelight and window assemblies, fire labeled and non-labeled, as scheduled or detailed by the Consultant.

1.5 RELATED WORK

- .1 Building-in of frame product into unit masonry, previously placed concrete, structural or steel or wood stud walls.
- .2 Supply and installation of wood, plastic or composite core doors.
- .3 Supply and installation of builders' hardware except as specified for acoustic assemblies.
- .4 Drilling and tapping for surface mounted or non-templated builders' hardware.
- .5 Caulking of joints between frame product and other building components.
- .6 Supply and installation of gaskets or weather-strip.
- .7 Supply and installation of louvers or vents.

- .8 Supply and installation of glazing materials.
- .9 Site touch-up and painting.
- .10 Wiring for electronic or electric hardware.
- .11 Field measurements.
- .12 Fasteners for frame product in previously placed concrete, masonry or structural steel.
- .13 Steel lintels, posts, columns or other load-bearing elements.
- .14 Field welding.

1.6 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, or louvred, arrangement of hardware and fire rating and finishes.
- .3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing and fire rating finishes.
- .4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.
- .5 Submit test and engineering data, and installation instructions.

1.7 REQUIREMENTS

- .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.

1.8 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.
- .3 Divert unused paint and sealant materials from landfill to official hazardous material collections site approved by Consultant.
- .4 Do not dispose of unused paint and sealant materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

- .5 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
- .6 Divert unused wood materials from landfill to recycling, reuse or composting facility wherever possible.
- .7 Damaged or broken glazing materials are not recyclable. These materials must not be disposed of with materials destined for recycling.

1.9 TESTING AND PERFORMANCE

- .1 Door constructions covered by this specification shall be certified as meeting Level “A” (1,000,000 cycles) and Twist Test Acceptance Criteria (deflection not to exceed 6.4 mm /13.6kg force, total deflection at 136.1kg force not to exceed 63.5 mm and permanent deflection not to exceed 3.2 mm) when tested in strict conformance with ANSI-A250.4-1994. Test shall be conducted by an independent nationally recognized accredited laboratory.
- .2 Fire labeled product shall be provided for those openings requiring fire protection and temperature rise ratings, as determined and scheduled by the Architect. Doors, frames, transom frames and sidelight assemblies shall be tested in strict accordance with CAN4-S106. Product shall be listed by Underwriters Laboratories of Canada under an active Factory Inspection Program and shall be constructed as detailed in Follow-Up Service procedures issued to the manufacturer.
- .3 Should any door or frame specified by the Architect to be fire rated, not qualify for labeling due to design, hardware, glazing or any other reason, the Consultant shall be so advised before manufacturing commences.
- .4 Core materials for exterior doors shall attain a thermal resistance rating of RSI 1.06 (R6.0) when tested in accordance with ASTM C177 or ASTM C518.
- .5 Product shall be manufactured by a firm experienced in the design and production of standard and custom commercial steel door and frame assemblies, the integration of builders’ or electronic hardware and glazing materials and their impact on the scope of work.
- .6 Manufacturer shall be assessed and registered as meeting the requirements of Quality Systems under ISO 9001.
- .7 Product quality shall meet standards set by the Canadian Steel Door Manufacturers Association.

1.10 TEST REPORTS

- .1 All alternates to this specification shall be submitted to the Architect for acceptance ten (10) days prior to bid date, complete with test reports from independent, nationally recognized testing authorities, certifying that:
 - .1 Steel door and frame assemblies furnished under this section meet the acceptance criteria of ANSI-A250.4-1994, Level “A”.

- .2 Insulated door cores furnished in exterior doors under this Section meet the specified thermal resistance rating.
- .2 All reports shall include name of testing authority, date of test, location of test facility, descriptions of test specimens, procedures used in testing and indicate compliance with acceptance criteria of the test.

1.11 WARRANTY

- .1 All steel door and frame product shall be warranted from defects in workmanship for a period of one (1) year from date of shipment.
- .2 All steel door and frame product shall be warranted against rust perforation for a period of ten (10) years when the installed and finish painted with a commercial quality paint to the manufacturers recommendations.
- .3 Finish paint adhesion on all door and frame product shall be warranted for a period of ten (10) years when the product has been properly cleaned and finish painted with a commercial quality paint applied as recommended by the paint manufacturer. This warranty shall not exceed that provided by the paint manufacturer.

Part 2 Products

2.1 MATERIALS

- .1 Doors shall be fabricated from tension leveled steel to ASTM A924-M97, galvanized to ASTM A653-M97, Commercial Steel (CS), Type B, coating designation ZF75, known commercially as paintable Galvanneal.
 - .1 Acceptable Manufacturer: Flemming
 - .2 Acceptable Alternate Manufacturer: Trillium Steel Doors Limited, or others meeting these exact specifications outlined in this section and accepted in writing during the tender period.
- .2 Door Cores:
- .3 Honeycomb:
 - .1 Structural small cell (25.4 mm maximum) kraft paper “honeycomb”. Weight: 36.3 kg per ream (minimum), density: 16.5 kg/m³ (minimum), sanded to the required thickness.
- .4 Polystyrene:
 - .1 Rigid extruded, fire retardant, closed cell board, density 16kg/m², thermal values: RSI 1.06 minimum, conforming to ASTM C578.
- .5 Temperature Rise Rated (TRR):
 - .1 Solid slab core of non-combustible, inorganic composite to limit temperature rise on the “unexposed” side of door to 250°C at 30 or 60 minutes, as required by governing building code requirements and determined and scheduled by the Architect.

- .6 Adhesives:
 - .1 Honeycomb Cores and Steel Components: Heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene) based, low viscosity, contact cement or ULC approved equivalent.
- .7 Interlocking Edge Seams:
 - .1 Resin reinforced polychloroprene (RRPC), fire resistant, high viscosity, sealant/adhesive or UL approved equivalent.
- .8 Polystyrene Cores:
 - .1 Heat resistant, epoxy based, low viscosity, contact cement.
- .9 Primer:
 - .1 Rust inhibitive touch-up only.
- .10 Exterior Top Caps:
 - .1 Rigid polyvinylchloride (PVC) extrusion.

2.2 DOOR FABRICATION

- .1 This section is based on doors and frames as manufactured by Fleming. Doors and frames by other manufacturers are acceptable subject to be similar to the one specified and meeting the terms of this section.
- .2 Doors shall be swinging, 44.4 mm thick of the types and sizes indicated on the Architect's schedules or drawings.
- .3 Exterior doors shall be lock seam, flush.
- .4 Face sheets for exterior doors shall be fabricated from (16) gauge steel.
- .5 Longitudinal edges of exterior doors shall be fully welded, ground smooth with no visible seams.
- .6 Face sheets of interior doors shall be fabricated from 18 gauge steel, except for heavy traffic doors (noted **HT** in Door Schedule) face sheet to be 16 gauge.
- .7 Longitudinal edge of heavy traffic doors (noted **HT** in Door Schedule) shall be mechanically interlocked, fully welded, ground smooth with no visible seams. Do not fill seams.
- .8 Interior doors shall be stiffened, insulated and sound deadened with honeycomb core laminated under pressure to each face sheet.
- .9 Stiffened, insulated and sound deadened with Fleming's propriety core where Temperature Rise Rated (TRR) fire labeled doors are specified on the Architect's schedules.
- .10 Longitudinal edges of interior doors shall be mechanically interlocked, adhesive assisted with edge seams and tack-welded every 150 mm and filled flush.

- .11 Door faces of all steel doors shall be fabricated without visible seams, free of scale, pitting, coil brakes, buckles and waves.
- .12 Formed edges shall be true and straight with a minimum radius for the thickness of steel used.
- .13 Lock and hinge edges shall be beveled 3 mm in 50 mm unless builders' hardware or door swing dictates otherwise.
- .14 Top and bottom of doors shall be provided with inverted, recessed, 16 gauge steel end channels, welded to each face sheet at 150 mm on center maximum.
- .15 Exterior doors shall be provided with factory installed flush PVC top caps. Fire labeled exterior doors shall be provided with factory installed flush steel top caps.
- .16 Unless ineligible due to design, size, hardware or glazing specified on the Architects' or hardware Suppliers' schedules or details, fire labeled doors shall be provided for those openings requiring fire protection ratings and temperature rise ratings, as determined and scheduled by the Architect.
- .17 Exterior doors and high traffic doors shall be internally reinforced with 20 gauge continuous; interlocking steel stiffeners at 150mm O.C. max, with voids between stiffeners filled and insulated with 24kg/m³ density loose batt type fiberglass material to suit fully welded design.
- .18 Doors shall be factory blanked, reinforced, drilled and tapped for fully templated mortised hardware only, in accordance with the final approved schedule and templates provided by the hardware supplier.
- .19 Doors shall be factory blanked and reinforced only for mortised hardware that is not fully templated.
- .20 Doors shall be factory reinforced only for surface mounted hardware.
- .21 Templated holes 12.7mm diameter and larger shall be factory prepared, except mounting and through bolt holes, which shall be by the contractor responsible for installation on site, at the time of application. Templated holes less than 12.7mm diameter shall be factory prepared only when required for the function of the device (for knobs, levers, cylinders, thumb or turn pieces) or when these holes over-lap function holes.
- .22 Drilling and tapping for surface mounted hardware or mortised hardware that is not fully templated shall be by the contractor responsible for installation on site, at the time of application.
- .23 Hinge and pivot reinforcements shall be 10 gauge steel minimum high frequency type reinforcing.
- .24 Hinge reinforcements for acoustic doors and doors in excess of 2450mm rabbet height shall be 10 gauge minimum with each cutout provided with 114.3mm heavy weight (4.6mm) high frequency type.
- .25 Lock, strike and flush bolt reinforcements shall be 12 gauge steel minimum.

- .26 Reinforcements for concealed closers and holders shall be 12 gauge steel minimum.
- .27 For surface mounted hardware, reinforcements shall be 16 gauge steel minimum.
- .28 All pairs of fire labeled doors shall be provided with 12 gauge steel surface mounted flat bar astragal, shipped loose for application on site, by the contractor responsible for installation.
- .29 Pairs of doors up to 2450mm x 2450mm, to 1½ hour fire rating maximum shall be provided without astragals. Lock edge seam of such doors shall be tacked-welded and ground smooth. All other fire labeled pairs shall be provided with 12 gauge steel surface mounted flat bar astragal, shipped loose for application on site, by the contractor responsible for installation.
- .30 Where electrically or electronically operated hardware is specified on the Architects' schedules or details of the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes, where indicated on the templates, shall be provided and interconnected with CSA Approved 12.7mm diameter conduit and connectors.
- .31 Prepare doors to receive security door contacts – refer to electrical drawings for locations. Door contacts to be installed at 100 mm from the latch side door edge.

2.3 GLAZING

- .1 Where 6mm thick glazing materials are specified on the Architects schedules or details, doors shall be provided with 20 gauge steel glazing trim and snap-in glazing stops.
- .2 Where other than 6mm glazing is specified on the Architect's schedules or details, doors shall receive 20 gauge steel trim and screw fixed glazing stops. Screws shall be #6 x 32mm oval head scrulox (self-drilling) type at 300mm on center maximum.
- .3 Glazing trim and stops shall be accurately fitted, butted at corners, with removable glazing stops located on the 'push' side of the door.
- .4 Provide frames as required to suit fire rated glazing specified in Specification Section 08 80 50. Frames to accommodate multi-layered intumescent glazing to meet ¾ hour fire-resistance rating.

2.4 LOUVER

- .1 Where specified on the Architect's schedules or details, non-labeled doors shall be prepared in accordance with the louver manufacturer's details.
- .2 Where specified on the Architect's schedules or details, fire labeled doors shall be prepared for UL listed sight-proof fusible link louvers in accordance with the louver manufacturer's details.
- .3 Louvers shall be supplied and installed by others.

2.5 FINISHING

- .1 Remove weld slag and splatter from exposed surfaces.
- .2 All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth uniform surfaces.
- .3 On exposed surfaces where zinc coating has been removed during fabrication, doors shall receive a factory applied touch-up primer.
- .4 Primer shall be fully cured prior to shipment.

2.6 PANELS

- .1 Panels shall be fabricated from the same materials, construction and finished in the same manner as doors as specified in Section 2.1.

2.7 PRIMER

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

2.8 PAINT

- .1 Field paint steel doors and frames in accordance with Section[s] [09 91 23 - Interior Painting], [09 91 13 - Exterior Painting]. Protect weatherstrips from paint. Provide final finish shall be free of scratches or other blemishes.

2.9 FRAMES FABRICATION GENERAL

- .1 Steel:
 - .1 Frame product shall be fabricated from tension leveled steel to ASTM A924-M97, galvanized to ASTM A653-M97, Commercial Steel (CS), Type B, coating designated ZF75, known commercially as paintable Galvanneal.
- .2 Primer:
 - .1 Rust inhibitive touch up only.
- .3 Miscellaneous:
 - .1 Door Silencers: GJ-64, Single Stud rubber/neoprene type
 - .2 Thermal Breaks: Rigid polyvinylchloride (PVC) extrusion
 - .3 Fiberglass: Loose batt type, density: 24kg/m³ (minimum), conforming to ASTM C665.
- .4 General:
 - .1 All steel frame product shall be as manufactured by Fleming of the types, sizes and profiles indicated on the Architects' schedules or details.
 - .2 Exterior frames shall be thermally broken, Fleming *Therma-Frame* Series, fabricated from 16 gauge steel.
 - .3 Exterior frame product shall be supplied profile welded (PW)

- .4 Interior and exterior sections of thermally broken frames shall be separated by a continuous PVC thermal break.
 - .1 Thermally broken sections shall not be assembled by means of screws, grommets or other fasteners and welds shall not cause thermal transfers between interior and exterior surfaces of the frame sections.
 - .2 Closed sections (mullions and center rails) of thermally broken frames shall be factory insulated with 24kg/m³ loose batt type fiberglass material.
- .5 Insulation of open sections (jamb, heads and sills) on exterior frame product shall be provided and installed by the contractor responsible for installation.
- .6 Interior frames shall be Fleming F-Series, fabricated from 16 gauge steel.
- .7 Interior frame product shall be supplied profile welded (PW)
- .8 Knocked-down and knocked-down drywall frames shall not be acceptable.
- .9 Jamb, heads, mullions, sills and center rails shall be straight and uniform throughout their lengths.
- .10 Frame product shall be square, free of defects, wraps or buckles.
- .11 Corner joints shall be profile welded (PW) (continuously welded on the inside of the profiles' faces, rabbets, returns and soffit intersections with exposed faces filled and ground to a smooth, uniform, seamless surface)"
- .12 Joints at mullions, transom bars, sills or center rails shall be coped accurately, butted and tightly fitted, with faces securely welded, matching corner joint faces.
- .13 All steel mullions will be fabricated from the same materials as specified for the steel frames. Steel mullions will be fabricated as a fully assembled three piece unit consisting of a front, back and full height one piece attachment clip as per Fleming F Series. The attachment clip will completely fill the stop area of the mullion on both sides and span the void between each side forming a grid channel like structure. Mullions used as hinge mullions or strike mullions between doors will be filled with grout by the general contractor either prior to or following installation of the frame. The head of the frame shall have an opening sufficient for the grout to be poured in to the mullion.
- .14 Mullions shall be fabricated with continuous 20 gauge galvanized steel internal reinforcing clips.
- .15 Frame product shall be fabricated with integral door stops having a minimum height of 16mm.
- .16 Glazing stops shall be formed 20 gauge steel, 16mm height channel, accurately fitted, butted at corners and fastened to frame sections with #6 x 32mm oval head scrulox (self-drilling) type screws at 300mm on center maximum.
- .17 Where required due to site access, as indicated on the Architects' schedules or details, when advised by the contractor responsible for co-ordination or installation, or when

shipping limitations so dictate, frame product shall be fabricated in sections for splicing in the field.

- .1 Field spliced jambs, heads and sills shall be provided with 16 gauge steel splice plates securely welded into one section, extending 100mm minimum each side of splice joint.
- .2 Field splices at closed sections (mullions or center rails) shall be 16 gauge steel splice angles securely welded to the abutting member. Face of splice angle shall extend 100mm minimum into closed sections when assembled.
- .3 Field splice joints shall be welded, filled and ground to present a smooth uniform surface by the contractor responsible for installation after assembly.
- .18 Each door opening shall be provided with two (2) temporary steel jamb spreaders welded to the base of the jambs or mullions to maintain proper alignment during shipping and handling. Spreaders shall be removed by the contractor responsible for installation prior to anchoring of frame to floor.
- .19 Each door opening shall be prepared for GJ-64 or equivalent, single stud door silencers, three (3) for single door openings, two (2) for double door openings. Silencers shall be shipped loose for installation by the contractor after finish painting.
- .20 Unless ineligible due to design, size, hardware or glazing specified on the Architects' or Hardware Suppliers' schedules or details, fire labeled frame product shall be provided for those openings required fire protection ratings as determined and scheduled by the Architect.
- .21 Hardware Preparations:
 - .1 Frame product shall be blanked, reinforced, drilled and tapped for fully template mortised hardware only, in accordance with the final approved schedule and template provided by the hardware supplier.
 - .2 Frame product shall be factory blanked and reinforced only for mortised hardware that is not fully template.
 - .3 Frame product shall be reinforced only for surface mounted hardware.
 - .4 Drilling and tapping for surface mounted hardware or mortised hardware that is not fully template shall be by the contractor responsible for installation on site, at the time of application.
 - .5 Frames shall be prepared for 114.3mm standard weight hinges (minimum).
 - .6 Hinge and pivot reinforcements shall be 10 gauge steel minimum reinforcing, high frequency type shall be provided.
 - .7 Hinge reinforcements for acoustic frames and frames in excess of 2450mm rabbet height shall be 10 gauge minimum with each cutout provided with 114.3mm heavy weight (4.6mm) high frequency type.
 - .8 Strike reinforcements shall be 16 gauge steel minimum.
 - .9 Reinforcements for surface mounted hardware, concealed closers and holders and flush bolts shall be 12 gauge steel minimum.
 - .10 Mortised cutouts shall be protected with 22 gauge steel minimum guard boxes.
 - .11 Where electrically or electronically operated hardware is specified on the Architects schedules or details or the final approved schedule and templates provided by the hardware supplier, hardware enclosures and/or junction boxes,

where indicated on templates, shall be provided and inter-connected with CSA Approved 12.7mm diameter conduit and connectors.

- .12 Prepare frames to receive security door contacts – refer to electrical drawings for locations. Door contacts to be installed at 100 mm from the latch side door edge.

.22 Anchorage:

- .1 Frame product shall be provided with anchorage appropriate to floor, wall and frame construction.
- .2 Each wall anchor shall be located immediately above or below each hinge reinforcement on the hinge jamb and directly opposite on the strike jamb, except as indicated below.
- .3 Frame product installed in unit masonry partitions shall be provided with 4.0mm diameter steel wire anchors, 18 gauge steel adjustable stirrup and strap or “T” type anchors as conditions dictate.
- .4 Where frame product is installed prior to construction of the adjacent wall, each jamb shall be provided with 16 gauge steel floor anchors. Each anchor shall be provided with two (2) holes for mounting to the floor and shall be securely welded to the inside of the jamb.
- .5 Floor anchors for thermally broken exterior frames shall be designed so as not to permit thermal transfers from exterior to interior surfaces of the frame sections.
- .6 Frame product installed in drywall partitions shall be provided with 20 gauge steel snap-in or “Z” type stud type anchor.
- .7 Jambs of frames in previously placed concrete, masonry or structural steel shall be punched and dimpled to accept machine bolt anchors, 6.4mm diameter, located not more than 150mm from the top and bottom of each jamb. Anchor preparations and guides shall also be located immediately above or below the intermediate hinge reinforcing and directly opposite on the strike jamb. Each preparation shall be provided with 16 gauge anchor bolt guides.
- .8 Anchor bolts and expansion shell anchors for the above preparations shall be provided by the contractor responsible for installation.
- .9 After sufficient tightening of the anchor bolts, the heads shall be welded do as to provide a non-removable application. Welded bolt head and dimple shall be filled and ground to present a smooth uniform surface by the contractor responsible for installation, prior to finish painting.
- .10 Where indicated on the Architects’ schedules or details, channel extensions shall be provided from the top of the frame assembly to the underside of the structure above. Extensions shall be fabricated from 12 gauge steel formed channel, mounting angles welded to inside of frame head and adjusting brackets. Formed channels, adjusting brackets and fasteners shall be shipped loose. Channels shall be mechanically connected to mounting angles and adjusting brackets with supplied fasteners, on site, by contractor responsible for installation.

.23 Finishing:

- .1 Remove weld slag and spatter from exposed surfaces.
- .2 All tool marks, abrasions and surface blemishes shall be filled and sanded to present smooth and uniform surfaces.

- .3 On exposed surfaces where zinc has been removed during fabrication, frame product shall receive a factory applied touch-up primer.
- .4 Primer shall be fully cured prior to shipment.

2.10 SIZES AND TOLERANCES

- .1 All sizes and tolerances shall be in accordance with the Canadian Steel Door Manufacturers Association “Recommended Dimensional Standards for Commercial Steel Doors and Frames” as follows:
 - .1 Widths of door openings shall be measured from inside of frame jamb rabbet with a tolerance of +1.6mm, -0.8mm.
 - .2 Heights of door openings shall be measured from the finished floor (exclusive of floor coverings) to the head rabbet of the frame with a tolerance of ± 1.2 mm.
 - .3 Unless builders’ hardware dictates otherwise, doors shall be sized so as to fit the above openings and allow a 3mm clearance at jambs and head. A clearance of 19mm between the bottom of the door and the finished floor (exclusive of floor coverings) shall be provided. Tolerances on door sizes shall be ± 1.2 mm.
 - .4 Manufacturing tolerances on formed frame profiles shall be ± 0.8 mm for faces, door stop heights and jamb depths. Tolerances for throat openings and door rabbet shall be ± 1.6 mm and ± 0.4 mm respectively. Hardware cutout dimensions shall be as per template dimensions, +0.4mm, -0.

2.11 HARDWARE LOCATIONS

- .1 Hardware preparations in frame product shall be as noted below and locations on doors shall be adjusted for clearances specified in 2.4.
- .2 Top of upper hinge preparation for 114.3mm hinges shall be located 180mm down from head, transom mullion or panel as appropriate. The top of the bottom hinge preparation for 114.3mm hinges shall be located 310mm from finished floor as defined in 2.4.3. Intermediate hinge preparations shall be spaced equally between top and bottom cutouts. For dutch door frames, top and bottom hinge locations shall be as above, with the tops of intermediate hinges located at 930mm and 1403mm from finished floor.
- .3 Strike preparations for unit, integral, cylindrical and mortise locks and roller latches shall be centered 1033mm from finished floor. Strikes for deadlocks shall be centered at 1200mm from finished floor. Strikes for panic or fire exit hardware shall be located as per device manufacturer’s templates.
- .4 Push and/or pulls on doors shall be centered 10701mm from finished floor.
- .5 Preparations not noted above shall be as per hardware manufacturer’s templates.
- .6 Hardware preparation tolerances shall comply with the ANSI A115 series standards.

Part 3 Execution

3.1 SITE AND PROTECTION OF MATERIALS

- .1 The contractor responsible for installation shall remove wraps or covers from door and frame product upon delivery at building site.
- .2 All materials shall be thoroughly inspected upon receipt and all discrepancies, deficiencies and/or damages shall be immediately reported in writing to the supplier, All damage shall be noted on the carriers' Bill of Landing.
- .3 Contractor responsible for installation shall ensure all materials are properly stored on planks or dunnage in a dry location. Product shall be stored in a vertical position, spaced with blocking to permit air circulation between them. Materials shall be covered to protect them from damage from any cause.
- .4 Contractor shall notify the supplier in writing of any errors or deficiencies in the product itself before initiating any corrective work.

3.2 INSTALLATION GENERAL

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.
- .3 Install doors and frames in accordance with the Door and Hardware Institute "Installation guide for doors and hardware".
- .4 Set frame product plumb, square, aligned, without twist at correct elevation.
- .5 Frame Product Installation Tolerances:
 - .1 Plumbness tolerance, measured through a line from the intersecting corner of vertical members and the head to the floor, shall be $\pm 1.6\text{mm}$.
 - .2 Squareness tolerance, measured through a line 90° from one jamb at the upper corner of the product, to the opposite jamb, shall be $\pm 1.6\text{mm}$.
 - .3 Alignment tolerance, measured on jambs, through a horizontal line parallel to the plane of the wall, shall be $\pm 1.6\text{mm}$.
 - .4 Twist tolerance, measured at face corners of jambs, on parallel lines perpendicular to the plane of the wall, shall be $\pm 1.6\text{mm}$.
- .6 Fire labeled product shall be installed in accordance with NFPA-80.
- .7 Secure anchorages and connections to adjacent construction.
- .8 Brace frame product rigidly in position while building-in. Remove temporary steel shipping jamb spreaders. Install wood spreaders at mid points of frame rabbet height and at floor level to maintain frame widths. Provide vertical support at center of head for openings exceeding 1250mm in width. Remove wood spreaders after product has been built-in.
- .9 Frame product in unit masonry shall be fully grouted in place.

- .10 Install doors maintaining clearances outlined in Section 2.4.
- .11 Install louvers and vents.
- .12 Adjust operable parts for correct clearances and function.
- .13 Steel surfaces shall be kept free of grout, tar or other bonding materials or sealers.
- .14 Any grout or other bonding material shall be cleaned from products immediately following installation.
- .15 Exposed field welds shall be finished to present a smooth uniform surface and shall be touched-up with a rust inhibitive primer.
- .16 Exposed surfaces that have been scratched or otherwise marred during shipment, installation or handling shall be touched-up with a rust inhibitive primer.
- .17 Finish paint in accordance with Section 099116 and 099123.
- .18 Install glazing materials and door silencers.

3.3 INSPECTION

- .1 In accordance with Section 01 11 00, upon assignment of an inspection agency the following inspections shall be performed:
 - .1 review of shop drawings for compliance with specification
 - .2 shop inspection during production. Should inspection notification not be given suitable to review fabrication, destructive testing of one or more doors will be undertaken either in the shop or on site at no additional cost to the owner. Doors destroyed for invasive inspection shall be replaced as part of the contract price.
- .2 upon notification of initial door inspection, contractor shall notify inspector to witness installation practice and at periodic points for duration of installation period.

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 NOTES

- .1 Find the door Schedule on the drawings.
- .2 This schedule MUST be read in conjunction with a complete set of drawings.
- .3 Refer to the Drawings for door and frame types and details.

1.2 ABBREVIATIONS CODE

- .1 1. The following abbreviations are used in the Door Schedule.
- .2 B/F Barrier-Free
- .3 Code Reference
- .4 DC Door Contact (security)
- .5 FRG Fire Rated Glass
- .6 HM Hollow Metal
- .7 HT Heavy Traffic – see spec for welded seams, special reinforcing.
- .8 P Paint
- .9 TP Tempered Glass
- .10 20 MIN 20 minute fire rating
- .11 45 MIN 45 minute fire rating

1.3 DOOR SCHEDULE

- .1 Door Schedule designation “DC” refers to “Door Contacts” used in the security system. Refer to Electrical Drawings and Division 26 Specifications for locations, zoning and description of system.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 74 11 – Final Cleaning.
- .3 Section 01 78 00 - Closeout Submittals
- .4 Section 08 11 14 – Metal Doors and Frames.
- .5 Section 08 44 13 – Glazed Aluminum Curtain Wall.
- .6 Section 08 50 50 – Aluminum Windows.
- .7 Section 08 91 00 – Interior Glazed Systems
- .8 Section 07 92 10 - Joint Sealing: caulking of joints between frames and other building components.
- .9 Section 10 28 10 – Toilet, Bath and Laundry Accessories.
- .10 Section 12 35 53 – Wood Laboratory Casework

1.2 REFERENCES

- .1 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-12.1-M90, Tempered or Laminated Safety Glass.
 - .2 CAN/CGSB-12.3-M91, Flat, Clear Float Glass.
 - .3 CAN/CGSB-12.8-M97, Insulating Glass Units.
 - .4 CAN/CGSB-12.9-M91, Spandrel Glass.
 - .5 CAN/CGSB-12.11-M90, Wired Safety Glass.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA A440.2-09, Energy Performance Evaluation of Windows and Sliding Glass Doors.
- .3 Flat Glass Manufacturers Association (FGMA).
 - .1 FGMA Glazing Manual.
- .4 Laminators Safety Glass Association (LSGA).
 - .1 LSGA Laminated Glass Design Guide.

1.3 DESIGN REQUIREMENTS

- .1 Design glass to CAN/CGSB-12.20-M. Perform stress analysis. Design units to accommodate live, dead, lateral, wind, seismic, handling, transportation, and erection loads.

1.4 SUBMITTALS

- .1 Shop drawings: Submit shop drawings in accordance with Section 013300 – Submittal Procedures. Co-ordinate location with Consultant.
- .2 Samples: Submit a 300 x 300 sample of all glass products in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Certificates: Submit manufacturer's certification that glass and glazing materials are compatible.
- .4 Curtain wall and glazing systems to comply with O.B.C. requirements for 'wall acting as guards'.

1.5 QUALITY ASSURANCE

- .1 Installers qualifications: Perform Work of this Section by a company that has a minimum of five years proven experience in the installation of glazing units of a similar size and nature.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material for recycling.
- .3 Unused or damaged glazing materials are not recyclable and must not be diverted to municipal recycling programs.
- .4 Divert unused or damaged wood materials from landfill to recycling facility approved by Consultant.
- .5 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
- .6 Divert unused caulking material from landfill to official hazardous material collections site approved by Consultant.
- .7 Plastic caulking tubes are not recyclable and must not be diverted for recycling with other plastic materials.

1.7 WARRANTY

- .1 Contractor hereby warrants glass against defects and failure, including leakage, under normal conditions of use, in accordance with the Contract, but for ten (10) years total, as follows:
- .2 Supplier shall submit a written warranty from the insulated glass manufacturer to replace or repair any defects in materials or sealed units for a period of ten (10) years from the date of Substantial Completion.
- .3 Mirrors:

- .1 Submit a warranty for mirrors, covering the repair or replacement of defective work in accordance with the Contract, but for five (5) years total.
- .2 Warranty shall apply against defects in workmanship and materials and, against silver deterioration and loosening of fastenings.

Part 2 Products

2.1 MATERIALS

- .1 Acceptable Manufacturers:
 - .1 AFG Glass Inc
 - .2 Libby-Owens Ford
 - .3 PPG Industries
- .2 Fire Rated Glazing ('FRG'): Fire rated glazing to be impact safety rated, intumescent laminated glazing to meet required fire resistance rating. Ensure door frame and screen frames are constructed to accommodate required glass thickness. Refer to drawing A01 "Fire Separations Plans & OBC Data Matrix" for fire separation ratings. Intumescent laminated glazing to be supplied by:
 - .1 Fireswiss by Glas Trosch
 - .2 Pyrostop by Pilkington
 - .3 ContraFlam by Vetrotech
- .3 Georgian Wired ('GW') rated glazing: not to be used on this project.
- .4 Interior Tempered Safety Glass: CAN/CGSB-12.1-M, Type 2, Class B, Category II, clear, minimum 6 mm thick.
 - .1 All interior Vision Glass to non-fire rated interior doors and screens to be tempered 6 mm tempered clear float glass complete with etched tempered glass designation visible.
 - .2 Provide 19 mm thick tempered glass for use at architectural glass railing system.
- .5 Cosmetology Mirrors:
 - .1 Best quality, 6 mm thick float glass, with safety vinyl backing.
 - .2 Location: Refer to drawings.
- .6 Setting blocks: neoprene, 80 durometer hardness, 102 mm x 6 mm width to suit glass to extend from the fixed stop to the opposite face of the glazing unit.
- .7 Spacer Blocks: neoprene, thickness to provide a minimum glass to face clearance of 3mm.
- .8 Setting blocks (balustrades): Neoprene, 80 - 90 Shore A durometer hardness to ASTM D2240, 100 mm long x 6 mm high x 9 mm wide minimum, size designed for glass size and weight of glass unit.

- .9 Spacer shims (balustrades): Neoprene, 50 - 60 Shore A durometer hardness to ASTM D2240, 75 mm long x one half height of glazing stop x thickness to suit application. Self adhesive on one face.
- .10 Glazing tape: preformed polyisobutylene-butyl glazing tape with integral shim strip, 10-15 durometer, hardness, paper release, black colour. Acceptable materials: Tremco Polyshim II by Tremco Ltd. or approved alternate.
- .11 Gasket: black neoprene "U" cavity type with lock strip.
- .12 Sealant: one component silicone, Spectrem 2 by Tremco Ltd. Refer to Section 07 92 10.
- .13 Display cases: shelves to be 13 mm tempered glass shelves with polished rounded edges. Doors to be tempered 8mm tempered glass.
- .14 Science Lab millwork upper cabinet door glazing to be 6mm tempered glass. Provide to Div. 6 for installation.

2.2 FABRICATION

- .1 Fabricate in accordance with CSA-A440/A440.1, reviewed shop drawings and manufacturer's written instructions, supplemented as follows:
- .2 Make field measurements before cutting and assembling materials.
- .3 Maintain minimum bite or lap of glass as recommended by the glazing unit manufacturer.
- .4 Each glass lite shall be labeled with the name of the product, weight and quality and year manufactured.
- .5 If requested, provide owner or consultant access to the plant or shop to review fabrication. Consultant or owner to provide 24 hour advance notice of visit.
- .6 Fabricate argon filled thermal units with air space filled minimum 90% filled with argon gas.

Part 3 Execution

3.1 GENERAL

- .1 Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 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.

3.3 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.

3.4 INSTALLATION

- .1 Install glazing in accordance with reviewed shop drawings and manufacturer's written instructions. Install glazing with full contact and adhesion at perimeter. Maintain edge clearance recommended by glass manufacturer.
- .2 Inspect all glazing channels prior to application. All openings in joints and channels to be sealed shall be clean, dry and free of dust, oil, grease, loose mortar or any foreign material.
- .3 All surfaces to receive glazing tape shall be wiped dry with a clean rag dampened in Xylol, followed by a dry wipe.
- .4 Examine all sashes prior to glazing to determine if the openings are square and plumb. Any butt and miter joints which are open shall be sealed prior to glazing. Adjust all operating sashes and glaze in the closed position.
- .5 Compression Glazing:
 - .1 When butt joint is in a vertical direction, the glazier shall first run the tape on the head and sill members while going over the joint. If joints at the sash run horizontally, the tape must be applied first to the jambs so that it crosses over the joint.
 - .2 When an offset condition exists at each corner where a horizontal member passes behind vertical mullions, two different sized tapes shall be used to equalize the pressure seal. The thinner tape is to applied first on the glazing leg closest to the interior. The thicker tape shall be cut to the length between the two tapes and applied.
 - .3 Each section of tape shall butt the adjoining tape and be united with a tool to eliminate any openings. Lapping of the adjoining tapes at the corners is not permitted.
 - .4 Remove paper backing just prior to setting glass and apply a toe bead of sealant 150 mm long in each of the corners.
 - .5 Position one setting block at the quarter point of each corner on the sill members or as recommended by IGMA guidelines.
 - .6 Set the glass on the setting blocks and press firmly in place. Snap in the interior glazing stops.
 - .7 Set the spacer blocks to prevent any “walking” of the lite.
- .6 Mirrors:
 - .1 Install mirrors by means of concealed vandalproof clips. If clips are used, install cushioning tape completing around perimeter of mirror back, set in concealed

- location within 25 mm of edge. Install fixed mirrors in washrooms at two different heights as indicated on drawings.
- .2 Follow manufacturer's installation recommendations.
- .7 Wire glass:
 - .1 Install any wired glass with the wire parallel to the opening.
 - .2 Install wired glass in fire rated metal doors with 5 mm gap between glazing stops, in accordance with ULC and NFPA 80 requirements. Strike and point exposed joints between metal and glass.
- .8 Balustrade Glazing
 - .1 Install glass balustrades to extent, locations, sizes and details shown.
 - .2 Install glass with bottom edge, in pocket to depth minimum 10% of exposed height.
 - .3 Maximum vertical space between ends of glass lights or between ends of glass lights and building walls shall be 20 mm except where shown otherwise.
 - .4 Mount glass rigidly in base pocket to proper spacing, level, alignment and plumb, using neoprene setting blocks, shims and additional components as recommended by manufacturer for complete and secure installation.
- .9 Replace any loose glazing stops and tighten all screws.
- .10 If part of manufacturer's window design, Contractor shall include for needle point (cap beads) at all lower horizontal rail joints of all sash/glazing units at the discretion of and as may be requested by the Consultant or owner.
- .11 All sealed units (windows and curtainwall systems) to be set into an inner continuous perimeter bead of compatible black sealant to ensure a full seal.

3.5 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Remove traces of primer, caulking.
- .3 Remove glazing materials from finish surfaces.
- .4 Remove labels after work is complete.
- .5 Immediately upon job completion and when sealants have cured, remove any temporary protection and clean all exposed interior and exterior surfaces. Use proper cleaning materials only which will not harm the window components or any adjacent surfaces.
- .6 Ensure all temporary labels have been removed and fully cleaned.
- .7 Mirrors: Clean mirrors using non-abrasive soap or detergent and rinse with clean water. Leave in clean, polished condition for Owner occupancy.

3.6 INSPECTION

- .1 Where inspection is called for elsewhere in the specification, perform Window air and water leakage test to ensure installation meets performance requirements stated herein. Should test fail, take remedial measures and re-test a different location at not additional cost to the owner until the test passes.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 04 21 13 – Masonry
- .3 Section 09 22 16 – Non-structural Metal Framing.
- .4 Supply of access doors for mechanical and electrical devices in mechanical and electrical sections.

1.2 REFERENCES

- .1 Aluminum Association
 - .1 Designation for Aluminum Finishes-[1997].
- .2 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C36/C36M-[01], Specification for Gypsum Wallboard.
 - .2 ASTM C79/C79M-[01], Standard Specification for Treated Core and Non-treated Core Gypsum Sheathing Board.
 - .3 ASTM C442/C442M-[01], Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.
 - .4 ASTM C475-[01], Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
 - .5 ASTM C514-[01], Specification for Nails for the Application of Gypsum Board.
 - .6 ASTM C557-[99], Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.
 - .7 ASTM C630/C630M-[01], Specification for Water-Resistant Gypsum Backing Board.
 - .8 ASTM C840-[01], Specification for Application and Finishing of Gypsum Board.
 - .9 ASTM C931/C931M-[01], Specification for Exterior Gypsum Soffit Board.
 - .10 ASTM C954-[00], Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness.
 - .11 ASTM C960/C960M-[01], Specification for Pre-decorated Gypsum Board.
 - .12 ASTM C1002-[01], Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
 - .13 ASTM C1047-[99], Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
 - .14 ASTM C1280-[99], Specification for Application of Gypsum Sheathing Board.
 - .15 ASTM C1177-[01], Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

- .16 ASTM C1178/C1178M-[01], Specification for Glass Mat Water-Resistant Gypsum Backing Board.
- .3 Association of the Wall and Ceilings Industries International (AWCI)
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-[M86(R1988)], Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .2 CAN/CGSB-71.25-[M88], Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.
- .5 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102-[1988(R2000)], Surface Burning Characteristics of Building Materials and Assemblies.

1.3 DELIVERY, STORAGE AND HANDLING

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

1.4 SITE ENVIRONMENTAL REQUIREMENTS

- .1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material [in appropriate on-site] for recycling.
- .3 Divert unused gypsum from landfill to gypsum recycling facility for disposal approved by Consultant.
- .4 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
- .5 Divert unused wood materials from landfill to [recycling] [composting] facility approved by Consultant.

- .6 Divert unused paint and caulking material from landfill to official hazardous material collections site approved by Consultant.
- .7 Do not dispose of unused paint and caulking materials into sewer systems, into lakes, streams, onto ground or in other locations where it will pose health or environmental hazard.

Part 2 Products

2.1 MATERIALS

- .1 Standard board: to ASTM C36/C36M, 13mm, 16 mm or 19 mm thick or as indicated, tapered edges.
- .2 Standard board: to ASTM C36/C36M, X Rated, 16 mm or 19 mm thick or as indicated, tapered edges.
- .3 Water-resistant board: to ASTM C630/C630M, 13 mm water resistant, tapered edges (WRGB in Finish Schedule).
- .4 Abuse resistant/Fire rated: to CSA A82.27-M1977 Fire-Rated Type X, 5/8" thick, "Abuse Resistant Fire Code" gypsum board panels, tapered edges, by CGC, Fibrerock interior AquaTuff panel. All gypsum board to have anti-microbial and anti-mould properties.
- .5 All gypsum board to have Anti-Microbial and Anti Mold properties. Acceptable Manufacturers; CGC inc., Certain Teed, or others meeting these specifications at time of tender.
- .6 Nails: to ASTM C514.
- .7 Steel drill screws: to ASTM C1002.
- .8 Stud adhesive: to CAN/CGSB-71.25.
- .9 Laminating compound: as recommended by manufacturer, asbestos-free.
- .10 Concrete Anchors: Phillips Red Head TW-614 or equivalent. Do not use powder activated fasteners for ceiling support.
- .11 Tie Wire: #16 ga. galvanized soft annealed steel wire.
- .12 Caulking: Acoustical sealant.
- .13 38 mm thick mineral wool batts ULC labeled, if indicated on drawings.
- .14 Casing beads, corner beads, control joints and edge trim: to ASTM C1047, 0.5 mm base thickness commercial sheet steel with G90 zinc finish, perforated flanges, and one piece length per location.
- .15 Sealants: in accordance with Section 07 92 10 - Joint Sealing.

- .16 Insulating strip: rubberized, moisture resistant, [3] mm thick [cork] [closed cell neoprene] strip, [12] mm wide, with self sticking permanent adhesive on one face, lengths as required.
- .17 Joint compound: to ASTM C475, asbestos-free.

2.2 ACOUSTIC WALL ASSEMBLY AND NOISE BARRIER CEILING MATERIALS

- .1 **Location: Music Practice Rooms:**
- .2 Acoustic insulation inside partitions: AFB Acoustic Fire Batt by Rockwool or equivalent product by Fibrex, or Quietzone by Owens Corning.
- .3 Steel deck closures: Emseal 25V Expanding Foam Sealant sized and shaped to fit flutes.
- .4 Acoustic Insulation: mineral fibre acoustical batt insulation, as specified under Section 07210. Thickness of 90% of wall assembly cavity depth; Acceptable products:
 - .1 Fibrex 'Sound Attenuation Fire Batt (SAFB)'
 - .2 Johns Manville 'Sound-SHIELD'.
 - .3 Rockwool 'AFB'.
 - .4 Owens-Corning 'QuietZone'.
 - .5 Certain Teed 'Noise Reducer'.
- .5 Acoustical sealant: CAN/CGSB-19.21-M87; non-skinning acoustic sealant, non-hardening type.
- .6 Acoustical compound: pre-mixed perlite plaster.
- .7 Fasteners: use mechanical fasteners to secure batts into position as recommended by manufacturer.

Part 3 Execution

3.1 ERECTION

- .1 Do application and finishing of gypsum board in accordance with ASTM C840 except where specified otherwise.
- .2 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C840 except where specified otherwise.
- .3 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .4 Install work level to tolerance of [1:1200].

3.2 APPLICATION

- .1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical works are approved.
- .2 Apply single layer gypsum board to metal furring or framing using screw fasteners and laminating adhesive. Maximum spacing of screws 300 mm on centre.
 - .1 Single-Layer Application:
 - .1 Apply gypsum board on ceilings prior to application of walls in accordance with ASTM C840.
 - .2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.
 - .2 Double-Layer Application:
 - .1 Install gypsum board for base layer and exposed gypsum board for face layer.
 - .2 Apply base layer to ceilings prior to base layer application on walls; apply face layers in same sequence. Offset joints between layers at least 250 mm.
 - .3 Apply base layers at right angles to supports unless otherwise indicated.
 - .4 Apply base layer on walls and face layers vertically with joints of base layer over supports and face layer joints offset at least 250 mm with base layer joints.
- .3 Apply water-resistant gypsum board [where [wall tiles] [coating] to be applied] [and] [adjacent to [slop sinks] [janitors closets] [___]]. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. [Do not apply joint treatment on areas to receive tile finish.]
- .4 Apply gypsum board to concrete block surfaces, where indicated, using laminating adhesive.
- .5 Apply type X gypsum board where indicated, in accordance with U.L.C. requirements and with supplement to the National Building Code of Canada to obtain the required fire protection, fire rating and fire separation.
- .6 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.
- .7 Where indicated on drawings, staple blanket to wallboard in accordance with ULC design requirements. Blanket shall be continuous and tightly fitted between studs and at perimeter.
- .8 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.
- .9 Install gypsum board with face side out.
- .10 Do not install damaged or damp boards.

- .11 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.
- .12 Where a floor or roof structural member interferes with an interior partition wall at which a smoke or fire separation is required, a gypsum board enclosure with a fire rating not less than required for the wall must be provided to continue the required, a gypsum board enclosure with a fire rating not less than required for the wall must be provided to continue the required separation to the floor or roof above (typical)

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 [150] mm on centre] [using contact adhesive for full length].
- .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 Construct control joints of [preformed units] [two back-to-back casing beads] set in gypsum board facing and supported independently on both sides of joint.
- .5 Provide continuous polyethylene dust barrier behind and across control joints.
- .6 Locate control joints [where indicated] [at changes in substrate construction] [at approximate [10] m spacing on long corridor runs] [at approximate [15] m spacing on ceilings].
- .7 Install control joints straight and true.
- .8 Construct expansion joints [as detailed], at building expansion and construction joints. Provide continuous dust barrier.
- .9 Install expansion joint straight and true.
- .10 Install cornice cap where gypsum board partitions do not extend to ceiling.
- .11 Fit cornice cap over partition, secure to partition track with two rows of sheet metal screws staggered at [300] mm on centre.
- .12 Splice corners and intersections together and secure to each member with 3 screws.
- .13 Seal with acoustical sealant at ceilings, floors, wall intersections and all penetrations such as electrical outlets.
- .14 Install access doors to electrical and mechanical fixtures specified in respective sections.
- .1 Rigidly secure frames to furring or framing systems.

- .15 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.
- .16 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:
 - .1 Levels of finish:
 - .1 Level 0: No taping, finishing or accessories required.
 - .2 Level 1: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
 - .3 Level 2: Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surfaces free of excess joint compound; tool marks and ridges are acceptable.
 - .4 Level 3: Embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .5 Level 4: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.
 - .6 Level 5: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
- .17 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.
- .18 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.
- .19 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
- .20 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
- .21 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- .22 Mix joint compound slightly thinner than for joint taping.
- .23 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.
- .24 Allow skim coat to dry completely.

- .25 Remove ridges by light sanding or wiping with damp cloth.
- .26 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM C645-[00], Specification for Nonstructural Steel Framing Members.
 - .2 ASTM C754-[00], Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-1.40-[97], Primer, Structural Steel, Oil Alkyd Type.
- .3 Environmental Choice Program (ECP).
 - .1 CCD-047a -[98], Paints - Surface Coatings.
 - .2 CCD-048-[98], Surface Coatings - Recycled Water-borne.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal [paper] [plastic] [polystyrene] [corrugated cardboard] packaging material in appropriate on-site bins for recycling.
- .3 Divert unused metal materials from landfill to metal recycling facility approved by Consultant.
- .4 Divert unused gypsum materials from landfill to recycling facility approved by Consultant.

Part 2 Products

2.1 MATERIALS

- .1 Non-load bearing channel stud framing: to ASTM C645, roll formed from 0.59mm thickness hot dipped galvanized steel sheet, for screw attachment of gypsum lath and metal lath. Knock-out service holes at 150 mm centres.
- .2 Floor and ceiling tracks: to ASTM C645, in widths to suit stud sizes, 30 mm legs for floor track, 50 mm for ceiling track.
- .3 Metal channel stiffener: 38 mm size, 2 mm thick cold rolled galvanized steel.
- .4 Metal Accessories: CSA A82.30-1965 (R-1971).
- .5 “Unistrut” support channel framing, by Tyco Electrical and Metal Products.

Part 3 Execution

3.1 ERECTION

- .1 Align partition tracks at floor and ceiling and secure at 600 mm on centre maximum.
- .2 Place studs vertically at 400 mm on centre and not more than 50 mm 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.
- .3 Erect metal studding to tolerance of 1:1000.
- .4 Attach studs to bottom track using screws.
- .5 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .6 Install steel frames and anchor frames securely to studs using minimum of three (3) anchors per jamb for jambs up to 2100 mm high and a minimum of four (4) anchors per jambs for jambs over 2100 mm high.
- .7 Provide two (2) studs at each side of openings wider than stud centre specified.
- .8 Install, cut to length, piece of runner horizontally over door frames and at top and bottom of rough opening in glazed partitions.
- .9 Provide 38 mm x 89 mm vertical and horizontal wood studs secured between metal studs for attachments of bathroom fixtures, accessories, cabinet work, and other fixtures, including grab bars, towel rails, attached to steel stud partitions.
- .10 Install steel stud or furring channel between studs for attaching electrical and other boxes.
- .11 Extend all partitions to underside of deck above for sound and fire separation.
- .12 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs.

3.2 CEILING FURRING TO CANOPIES & CEILING PANELS

- .1 Provide to all interior and exterior canopies where shown to receive wood slat or plywood finishes.
- .2 Framing channel to be model P1000 (1-5/8") ; 12 ga.
- .3 For exterior locations provide with 4 m dia. Holes at 500 o.c. for drainage and hot dip galvanize.
- .4 Provide shop drawings for layouts.
- .5 Refer to drawings for locations.

3.3 CEILING FURRING

- .1 Install runners level to tolerance of 3 mm over 3.5 m. Provide runners at interruptions of continuity and change in direction.
- .2 Frame with furring channels, perimeter of openings to accommodate access panels, light fixtures, diffusers, grilles, etc.
- .3 Furr for bulkheads within or at termination or ceilings.
- .4 Install furring channels at 400 mm o.c. maximum.

3.4 WALL FURRING

- .1 Install steel furring, as indicated.
- .2 Frame opening and around built-in equipment on four (4) sides with channels.
- .3 Box-in beads, columns, pipes, and around exposed services.

3.5 FIRE RATED ASSEMBLIES

- .1 If required, install Metal Stud System and Furring in accordance with appropriate ULC Design and with supplement to the National Building Code of Canada 1985.

3.6 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 07 92 10 - Joint Sealing.

1.2 REFERENCES

- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
 - .1 ANSI A108/A118/A136.1-10, Installation of Ceramic Tile.
- .2 American Society for Testing and Materials (ASTM International) International
 - .1 ASTM C144-04, Specification for Aggregate for Masonry Mortar.
 - .2 ASTM C206 - 03(2009) Standard Specification for Finishing Hydrated Lime.
 - .3 ASTM C 207-06, Specification for Hydrated Lime for Masonry Purposes.
 - .4 ASTM C979-05, Specification for Pigments for Integrally Coloured Concrete.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
 - .2 CAN/CGSB-75.1-M88, Tile, Ceramic.
- .4 Canadian Standards Association (CSA International)
 - .1 CAN/CSA-A3000-08, Cementitious Materials Compendium.
- .5 Terrazzo Tile and Marble Association of Canada (TTMAC)
 - .1 Tile Specification Guide 09300, Tile Installation Manual.
 - .2 Tile Maintenance Guide.

1.3 SUBMITTALS

- .1 Product data:
 - .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Include manufacturer's information on:
 - .1 Ceramic tile, marked to show each type, size, and shape required.
 - .2 Chemical resistant mortar and grout (Epoxy and Furan).
 - .3 Cementitious backer unit.
 - .4 Dry-set Portland cement mortar and grout.
 - .5 Divider strip.
 - .6 Elastomeric membrane and bond coat.
 - .7 Reinforcing tape.
 - .8 Levelling compound.
 - .9 Latex-Portland cement mortar and grout.

- .10 Commercial Portland cement grout.
 - .11 Organic adhesive.
 - .12 Slip resistant tile.
 - .13 Waterproofing isolation membrane.
 - .14 Fasteners.
- .2 Shop drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 indicating:
 - .1 Tile layout, patterns, and colour arrangement.
 - .2 Perimeter conditions, junctions with dissimilar materials.
 - .3 Setting details.
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
 - .2 Base tile: submit 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
 - .3 Floor tile: submit 300 x 300 mm sample panels of each colour, texture, size, and pattern of tile.
 - .4 Trim shapes, bullnose cap and cove including bullnose cap and base pieces at internal and external corners of vertical surfaces, each type, colour, and size.
 - .5 Adhere tile samples to [11] mm thick plywood and grout joints to represent project installation.
 - .6 Prepare a 2 m x 3m Mock up sample on site to ensure demonstration of installation details and quality control.
- .4 Certificates: Submit manufacturer's certificates stating that materials supplied are in accordance with this specification.
- .5 Closeout submittals: Submit recommended maintenance instructions and listing of recommended maintenance Products for incorporation into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.4 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- .2 Store material so as to prevent damage or contamination.
- .3 Store materials in a dry area, protected from freezing, staining and damage.
- .4 Store cementitious materials on a dry surface.

1.5 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of all packaging materials at appropriate recycling facilities.

- .2 Collect and separate for disposal packaging material in appropriate on-site bins for recycling.
- .3 Unused adhesive, sealant and coating materials must be disposed of at an official hazardous material collections site as approved by the Consultant.
- .4 Unused adhesive, sealant and coating materials must not be disposed of into the sewer system, into streams, lakes, onto the ground or in other location where it will pose a health or environmental hazard.
- .5 Broken ceramic materials must be diverted from landfill to a local facility as approved by Consultant.

1.6 ENVIRONMENTAL CONDITIONS

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 °C for 48 h before, during, and 48 h after, installation.
- .2 Do not install tiles at temperatures less than 12 °C or above 38 °C.
- .3 Do not apply epoxy mortar and grouts at temperatures below 15 °C or above 25 °C.

1.7 EXTRA MATERIAL

- .1 Provide maintenance materials in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide minimum 5% of each type and colour of tile required for project for maintenance use. Store where directed.
- .3 Maintenance material to be of same production run as installed material.

1.8 EXTENDED WARRANTY

- .1 Submit a warranty for entire wall tile installation, covering materials and labour and the repair or replacement of defective work in accordance with the Contract, but for three (3) years total.

Part 2 Products

2.1 WALL TILE

- .1 Ceramic tile (Designation: **CWT.1**): to CAN/CGSB-75.1, Type 5, Class MR 4
 - .1 Size: 2.5" x 8", 2.5" x 10", or 2" x 10", or Similar, glossy surface.
 - .2 Three (3) colours to be selected from full colour line. Thin-set application.
 - .3 Acceptable Materials: 'Hanoi' by Centura or 'Gem Series' by Olympia Tile or 'Remedy' by Daltille
 - .4 Locations: Cosmetology Millwork Backsplash

- .2 Ceramic tile 'Wood Look' (Designation: **CWT.2**): to CAN/CGSB-75.1, Type 5, Class MR 4
 - .1 Size: 12" x 36", 12" x 48", or 12" x 24", or Similar, matte surface.
 - .2 One (1) colour to be selected from full colour line. Thin-set application.
 - .3 Acceptable Materials: 'Tineo' by Centura or 'Western Wood' by Olympia Tile or 'Acreage' by Daltile
 - .4 Locations: Cosmetology Styling Accent Wall
- .3 Ceramic tile 'White' (Designation: **CWT.3**): to CAN/CGSB-75.1, Type 5, Class MR 4
 - .1 Size: 12" x 24",
 - .2 two (2) textures to be selected from full texture line. Thin-set application.
 - .3 Acceptable Materials: 'Simplicity' by Centura
 - .4 Locations: Culinary Arts dishwashing accent wall
- .4 Acceptable Materials: by Centura, by Olympia Tile or by Daltile
- .5 Locations: Refer to Interior Elevations
- .6 Tile Edging: Purpose-made, aluminum, finish to be selected by consultant, metal edge strips as manufactured Schluter Systems at all exposed tile edging: Profile – JOLLY; thickness as required for tile and tile set.

2.2 TRIM SHAPES

- .1 Conform to applicable requirements of adjoining floor and wall tile.
- .2 Use slip resistant trim shapes for horizontal surfaces of wet areas.
- .3 Use trim shapes sizes conforming to size of adjoining field wall tile, including existing spaces, unless specified otherwise.
- .4 Internal and External Corners: Provide trim shapes as follows where indicated.
 - .1 Bullnose shapes for external corners including edges.
 - .2 Coved shapes for internal corners.
 - .3 Special shapes for:
 - .1 Base to floor internal corners to provide integral coved vertical and horizontal joint.
 - .2 Base to floor external corners to provide bullnose vertical edge with integral coved horizontal joint. Use as stop at bottom of openings having bullnose return to wall.
 - .3 Wall top edge internal corners to provide integral coved vertical joint with bullnose top edge.
 - .4 Wall top edge external corners to provide bullnose vertical and horizontal joint edge.
- .5 Provide cove and bullnose shapes for where indicated and required to complete tile work.

2.3 MORTAR AND ADHESIVE MATERIALS

- .1 Manufacturer's of commercial mortar, grout and adhesive having Product considered acceptable for use:
 - .1 Mapei
 - .2 Laticrete
 - .3 Flextile
- .2 Walls: Mortarcrete Latex Mortar conforming to ANSI A108/A118/A136.1, manufactured by L & M Ceramo Inc.
- .3 Floors:
 - .1 Cement Mortar: Mixture of 1 part Portland cement, 4 parts dry sand and 1/10 hydraulic lime. Materials shall conform to the following:
 - .2 Portland Cement: To CAN/CSA-A3000, Type 10.
 - .3 Hydrated Lime: To ASTM C-206 or 207, Type 5.
 - .4 Sand: To ASTM C144, passing 1.6 mm sieve.
 - .5 Water: Potable, containing no contaminants which cause efflorescence.
 - .6 Thin Set Mortar: ANSI A108/A118/A136.1, field mixed, blended sand-Portland cement-latex mortar, "Kerabond/Keralastic by Mapei."
 - .1 Acceptable Alternates: "Laticrete 4237 distributed by Ceratec Inc., or Flextile 52 thin set.
 - .2 Latex Additive: "Cemtex" by Master Builders, Laticrete 2022" distributed by Ceratec Inc.,

2.4 GROUT

- .1 Colouring Pigments:
 - .1 Pure mineral pigments, limeproof and nonfading, complying with ASTM C979.
 - .2 Colouring pigments to be added to grout by manufacturer.
 - .3 Job coloured grout are not acceptable.
 - .4 Use in Commercial Portland Cement Grout, Dry-Set Grout, and Latex-Portland Cement Grout.
- .2 Chemical-Resistant Grout for Walls:
 - .1 Epoxy grout: to ANSI A108/A118/A136.1, having quality, colour and characteristics to match epoxy bond coat. Adhesive and grout by same manufacturer.
 - .2 Epoxy Grout: "Latapoxy SP-100" Stainless, chemical resistant epoxy grout by Laticrete International. Colour from manufacturer's full range. Alternate: Kerapoxy by Mapei.
- .3 Floors:
 - .1 Polymer modified grout as manufactured by MAPEI.

2.5 WATERPROOFING MEMBRANE

- .1 Waterproof Membrane System made from black, cold-applied, self-curing, liquid rubber polymer and an integral reinforcing fabric.
- .2 'Mapelastic' by Mapei or '9235 Waterproofing' by Laticrete International Inc.

2.6 ACCESSORIES

- .1 Prefabricated Movement Joints: purpose made Schluter, Dilex-KSN aluminum, sized as required for tile and mortar bed. Colour to be selected by consultant. To be installed directly above slab saw-cuts. Refer to floor pattern drawing for locations.
- .2 Reinforcing mesh: 50 x 50 x 1.6 x 1.6 mm galvanized steel wire mesh, welded fabric design, in flat sheets.
- .3 Divider strips:
 - .1 Laminated strips, core 32 x 3 mm black neoprene, outsides (both sides) brass 32 x 1.29 mm complete with anchors, both sides spaced at 150 mm on centre.
 - .2 Brass complete with anchors, both sides spaced at 150 mm on centre.
- .4 Cleavage plane: polyethylene film to CGSB 51-34.
- .5 Transition Strips: purpose made metal extrusion; stainless steel type.
- .6 Reducer Strips: purpose made metal extrusion; stainless steel type; maximum slope of 1:2.
- .7 Sealant: in accordance with Section 07 92 10 - Joint Sealing.
- .8 Floor sealer and protective coating: to tile and grout manufacturers recommendations.

2.7 MIXES

- .1 Portland Cement:
 - .1 Scratch coat: 1 part portland cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water, and latex additive where required. Adjust water volume depending on water content of sand.
 - .2 Slurry bond coat: portland cement and water mixed to creamy paste. Latex additive may be included.
 - .3 Mortar bed for floors: 1 part portland cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand.
 - .4 Mortar bed for walls and ceilings: 1 part portland cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand.
 - .5 Levelling coat: 1 part portland cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.
 - .6 Bond or setting coat: 1 part portland cement, 1/3 part hydrated lime, 1 part water.
 - .7 Measure mortar ingredients by volume.

- .2 Dry set mortar: mix to manufacturer's instructions.
- .3 Organic adhesive: pre-mixed.
- .4 Mix bond and levelling coats, and grout to manufacturer's instructions.
- .5 Adjust water volumes to suit water content of sand.

2.8 PATCHING AND LEVELING COMPOUND

- .1 Portland cement base, acrylic polymer compound, manufactured specifically for resurfacing and levelling concrete floors. Products containing gypsum are not acceptable.
- .2 Have not less than the following physical properties:
 - .1 Compressive strength - 25 MPa.
 - .2 Tensile strength - 7 MPa.
 - .3 Flexural strength - 7 MPa.
 - .4 Density - 1.9.
- .3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.
- .4 Ready for use in 48 hours after application.

2.9 CLEANING COMPOUNDS

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and levelling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

Part 3 Execution

3.1 WORKMANSHIP

- .1 Install tiles in accordance with manufacturer's instructions and TTMAC Specification Guide 09300 Tile Installation Manual. Manufacturer's installation instructions govern over TTMAC Installation Manual.
- .2 Waterproofing membrane: Apply with a trowel on prepared substrate to a total dry film thickness of 1.143 mm in accordance with manufacturer's printed directions. Carry up walls to 50 mm high.
- .3 Apply tile [or backing coats] to clean and sound surfaces.
- .4 Fit tile around corners, fitments, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .5 Maximum surface tolerance 1:800.

- .6 Make joints between tile uniform and approximately [1.5 mm] wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .7 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .8 Install floor tiles as per pattern. Layout and install flash cove tile first, before floor tile, ensuring a flush edge on the horizontal surface by feathering to masonry walls as required to produce a straight line on the floor. Install floor tiles to pattern supplied by Architect at a later date. Contact consultant to review when approximately no more than 10 sq. m has been installed.
- .9 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .10 Make internal angles square, external angles rounded.
- .11 Make internal angles square, external angles chamfered at 45° with narrow tile strip.
- .12 Construct cove base, as described using all special pieces available for inside and outside corners.
- .13 For Floors: Use bull nose edged tiles at termination of wall tiles, except where tiles abut projecting surface or differing plane.
- .14 Seal grouted joints with sealer.
- .15 Keep building expansion joints free of mortar or grout.
- .16 For Walls: Use round edged tiles at termination of wall tile panels, except where panel abuts projecting surface or differing plane.
- .17 Install divider strips at junction of tile flooring and dissimilar materials.
- .18 Allow minimum 24 h after installation of tiles, before grouting.
- .19 Clean installed tile surfaces after installation and grouting cured.

3.2 FLOOR TILE

- .1 Install in accordance with TTMAC to applicable thinset detail.

3.3 FLOOR SEALER AND PROTECTIVE COATING

- .1 Apply in accordance with manufacturer's instructions.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals.
- .3 Section 06 10 10 - Rough Carpentry: Wood strapping.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C635-07, Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.
 - .2 ASTM C636-08, Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels.
 - .3 ASTM E1264-08e1, Classification for Acoustical Ceiling Products.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.

1.3 DESIGN CRITERIA

- .1 Design ceiling suspension systems in accordance with ASTM C636 and manufacturer's printed directions.
- .2 Design tile ceiling system for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority. Acoustic panel system is not designed to carry the weight of electrical equipment.
- .3 Design hanger anchor and entire suspension system static loading not to exceed 25% of their ultimate capacity including lighting fixture dead loads.
- .4 Design tile suspension system to support weight of mechanical and electrical items such as air handling boots and lighting fixtures, and with adequate support to allow rotation/relocation of light fixtures. Acoustic panel system is not designed to carry the weight of mechanical and electrical equipment.
- .5 Design subframing as necessary to accommodate, to avoid conflicts and interferences where ducts or equipment prevent regular spacing of hangers.
- .6 Maximum deflection 1/360 of span to ASTM C635 deflection test.

1.4 SUBMITTALS

- .1 Submit submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop drawings: Submit shop drawings in accordance with Section 01 33 00 indicating:
 - .1 Suspension system layout including hangers and supports for acoustic tile system.

- .2 Acoustic panel system including suspension system, hangers, supports and panel sizes and locations.
- .3 Conditions at abutting, intersecting, and penetrating construction.
- .4 Dimensioned locations of lighting fixtures, diffusers, sprinkler heads and other items that pierce the ceiling plane.
- .3 Samples: Submit two each 300 x 300 mm samples of each individual tile and grid type in accordance with Section 01 33 00.
- .4 Certificates: Submit written certification stating that suspended ceiling system is designed for adequate support of electrical fixtures as required by the current bulletin of the Electrical Safety Authority.

1.5 REGULATORY REQUIREMENTS

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

1.6 QUALITY ASSURANCE

- .1 Mock-up:
 - .1 Construct one 4 m² mock-up for each type of ceiling system incorporating typical light fixture and other typical mechanical and electrical fixtures.
 - .2 Test the adequacy of the suspension system to support the fixtures without deflection of ceiling or failure of hanging wire anchorage. Supply copy of Test Results to Consultant.
 - .3 Change materials and installation methods if tests indicate proposed system is inadequate and re-test as necessary until system approved.
 - .4 Give early notice to Consultant and Mechanical and Electrical Trades and co-operate with them in selecting suitable location for sample ceiling and timing of installation and test.
 - .5 Do not commence general installation work until sample ceiling approved, then install ceiling to conform with approved samples.
 - .6 Mock-up may form part of final Work, if acceptable to Consultant. Remove and dispose of mock-ups which do not form part of Work.

1.7 WASTE MANAGEMENT AND DISPOSAL

- .1 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan

1.8 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.

1.9 EXTRA MATERIALS

- .1 Provide extra materials of acoustic units in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide acoustical units amounting to 2 % of gross ceiling area for each pattern and type required for project.
- .3 Extra materials to be from same production run as installed materials.
- .4 Clearly identify each type of acoustic unit, including colour and texture.
- .5 Store where directed by Consultant.

1.10 DELIVERY, STORAGE AND HANDLING

- .1 Transport, handle and store material in manner to prevent warp, twist, damage to panel edges and surfaces in accordance with Manufacturer's recommendations.
- .2 Any warped and/or damaged panels and trim shall be rejected and be replaced by new, straight, undamaged and acceptable material at no cost to Owner.
- .3 Bent, twisted or otherwise damaged Tee grid suspension components shall not be used under any circumstances. Replace such damaged items with new undamaged material at no additional cost to Owner.
- .4 Store material in warm, dry place away from water and the elements. Protect against undue loading stresses and shock.
- .5 All packaged material shall be delivered in original manufacturers wrappers and containers with labels and seals intact. All cartons shall bear U.L. label.

Part 2 Products

2.1 MATERIALS

- .1 Acoustic units for suspended ceiling system: to CAN/CGSB-92.1 and ASTM E1264.
- .2 Acoustic Ceiling Panels, Designation LAP: Acoustic Ceiling Panels, wet formed mineral fibre panels, by Armstrong World Industries Canada Inc. (Contact: Ruth Shannon; cell: 416-540-5284). Colour: White; Types as noted below:
- .3 **Panel Types:**
 - .1 Type 1: LAP(CER):600 x 1200 mm x 15.9 mm thick; "Fine Fissured Ceramaguard No. 607" by Armstrong Square Lay-In, Location: For use at Culinary Arts & Cosmetology Classroom and any additional areas as indicated.
- .4 Acceptable alternates: similar purpose-designed high humidity ceiling panels by CGC Interiors and CertainTeed Ceilings Canada.

- .5 Suspension system: 23.8 mm (15/16") "Prelude XL" exposed tee bar grid, including wall moulding, by Armstrong. Colour: white. Acceptable alternate: similar suspension system by CGC Interiors, Oakville and Chicago Metallic Corp. Grid sizes to suit ceiling panel types as shown on drawings. Location: For use at classrooms where grid needs to be replaced as determined on site by contractor.
- .6 Hangers: 2.6 mm galvanized soft annealed steel wire.
- .7 Accessories: splices, clips, retainers, etc., as required for complete and secure installation of suspension system.
- .8 Adhesive: low VOC type recommended by acoustic unit manufacturer.
- .9 Staples, nails and screws: to CSA B111 non-corrosive finish as recommended by acoustic unit manufacturer.
- .10 Hold down clips: purpose made clips to secure tile to suspension system, approved for use in fire-rated systems.

2.2 EXAMINATION

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

2.3 INSTALLATION

- .1 Install acoustical ceiling systems in accordance with manufacturer's written instructions, reviewed shop drawings, and ASTM C636, listed in order of precedence.
- .2 Install acoustic units parallel to building lines with edge unit not less than 50% of unit width.
- .3 Scribe acoustic units to fit adjacent work. Butt joints tight, terminate edges with moulding.
- .4 Support suspension system main runners at 1200 oc maximum with hangers from structure. Assembly shall support super-imposed loads. Maximum permissible deflection, 1/360 of span.
- .5 Attach cross member to main runner to provide rigid assembly.
- .6 Install suspension assembly to manufacturer's written instructions.
- .7 Install flush edge moulding at junction of acoustic unit ceiling and other materials around entire length of joint. Secure to construction. Butt joints neatly, square and true in alignment.
- .8 Set acoustic units in place.
- .9 Set all ceiling levels by the use of transit or laser level.

- .10 Remove and replace acoustic tiles with broken edges, or damaged, marked, discoloured, soiled, or stained faces.
- .11 Provide for Owner twelve (12) complete, undamaged ceiling tiles, sealed and boxed. Leave in location as directed by Architect.

2.4 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.

2.5 ADJUSTMENTS AND CLEANING

- .1 Clean soiled or discoloured surfaces of exposed work on completion of work.
- .2 Replace components which are visibly damaged, marred or uncleanable.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 Submittal Procedures.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM D2047-04, Standard Test Method for Static Coefficient of Friction of Polish-Coated Floor Surfaces as Measured by the James Machine.
 - .2 ASTM F710-08, Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
 - .3 ASTM F1303-04 (2009), Standard Specification for Sheet Vinyl Floor Covering with Backing.
 - .4 ASTM F1516-08, Standard Practice for Sealing Seams of Resilient Floor Products by the Heat Weld Method.
 - .5 ASTM F1869-10, Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.3 SUBMITTALS

- .1 Shop drawings: Submit shop drawings indicating seam layout and welding procedures in accordance with Section 01 33 00.
- .2 Samples: Submit the following samples in accordance with Section 01 33 00:
 - .1 Two 250 x 200 mm samples of each type and colour of sheet material specified.
- .3 Closeout submittals: Submit maintenance and cleaning data for incorporating into Operations and Maintenance Manuals in accordance with Section 01 78 00.

1.4 SITE CONDITIONS

- .1 Maintain air temperature and structural base temperature at flooring installation area above 15°C for 48 hr before, during and 48 hr after installation.
- .2 Store materials for 2 days prior to installation in area of Work to achieve temperature stability.
- .3 Do not lay flooring in conditions of high humidity or where exposed to cold drafts. In hot weather, protect from direct sunlight.

1.5 MAINTENANCE

- .1 Submit extra 5% or to nearest full roll of each colour, pattern and type of flooring material required for maintenance use. Identify each roll. Store where directed. Submit maintenance material in one piece and of same production run as installed materials.

Part 2 Products

2.1 MATERIALS

- .1 General: All materials under Work of this Section, including but not limited to, primers and adhesives are to have low VOC content limits.
- .2 Slip Resistant Sheet Vinyl (SSF):
 - .1 To ASTM F 1303, Type 1, Grade 1, Class B safety flooring (slip resistant flooring with enhanced cleaning capabilities).
 - .2 Slip resistance rating: Conforming to ASTM D2047, 0.8 dry/wet.
 - .3 Thickness: 2 mm, Width: 2000 mm, Length: 20 m, Weight: 2.66 kg/sq.m.
 - .4 Colour: To be selected by Consultant.
 - .5 Location: For use in Culinary Arts Classroom
 - .6 Acceptable product and manufacturer: 'Altro Illustra', 'Tarasafe Ultra' by GerFlor. or approved alternative.
- .3 Welding rod: Type as recommended by flooring manufacturer.
- .4 Accessories: Types as recommended by flooring manufacturer.
- .5 Primers and adhesives: Low VOC, waterproof, of types recommended by flooring manufacturer for specific material on applicable substrate, above, on or below grade.
- .6 Concrete skim coat compound: High-performance, rapid-setting cement based skim coating compound. 'Ultra SkimCoat' by Mapei or approved alternative for filling minor voids and leveling existing substrate.

Part 3 Execution

3.1 EXAMINATION

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

3.2 SUBFLOOR TREATMENT

- .1 Remove subfloor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with subfloor filler.
- .2 Apply sub-floor filler to low spots and cracks to achieve floor level to a tolerance of 1:1000, allow to cure.
- .3 Meet ASTM F710 Standard for Concrete or other monolithic floors.
- .4 Clean and remove deleterious materials from surfaces to receive Work in accordance with adhesive manufacturer's recommendations.

- .5 Prime concrete to flooring manufacturer's printed instructions.

3.3 PREPARATION

- .1 Safety flooring shall be installed over subfloors conforming to ASTM F710 for concrete.
- .2 Moisture Testing: Moisture emissions from concrete subfloors must not exceed 3 lbs per 1000sf per 24 hours (1.4 kg H₂O/24 hr/93 m²) for acrylic adhesive and 5lbs for polyurethane adhesive via the Calcium Chloride Test Method (ASTM F1869).
- .3 The pH level of the subfloor surface shall not be higher than 9.9. If higher, subfloor must be neutralized.

3.4 FLOORING APPLICATION

- .1 Apply adhesive uniformly using recommended trowel in accordance with flooring manufacturers instructions. Do not spread more adhesive that can be covered by flooring before initial set takes place.
- .2 Run sheets in direction of traffic. Double cut sheet joints and continuously seal according to manufacturer's printed instructions. Remove adhesive seepage of seams or surface while adhesive is still wet.
- .3 Heat weld seams in accordance with ASTM F1516 and manufacturer's printed instructions.
- .4 As installation progresses and after installation, roll flooring with minimum 45 kg roller to ensure full adhesion.
- .5 Cut flooring neatly around fixed objects.
- .6 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.
- .7 Install reducing edge strips at unprotected or exposed edges where flooring terminates or where there are two finishes of different thicknesses.
- .8 Drains: Fit safety flooring and mechanically fasten to drain outlets to ensure a permanent, watertight installation in accordance with manufacturer's written instruction.
- .9 Coved Installation: Where safety flooring is coved up wall surfaces and other abutments, installation shall be in accordance with manufacturer's written instructions.
- .10 Where existing safety flooring work has been damaged and where indicated on drawings, repair and clean flooring to the acceptance of the Consultant.

3.5 CLEANING

- .1 Forty-eight hours after installation, clean vinyl surfaces with a mild soap solution approved by finish manufacturer. Rinse clean and let dry.

3.6 PROTECTION OF FINISHED WORK

- .1 Protect floors from time of final set of adhesive until accepted by Consultant.
- .2 Prohibit traffic on floor for 48 hours after installation.
- .3 Cover cleaned surfaces with fibre reinforced, clean, non-staining clean, kraft paper. Secure in position with gummed tape to prevent drifting. Remove covering when directed by Consultant.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 03 30 00 – Cast-in-Place Concrete.
- .3 Section 03 35 05 – Concrete Floor Hardeners.

1.2 REFERENCES

- .1 American Society for Testing and Materials (ASTM International)
 - .1 ASTM F1066-[99], Specification for Vinyl Composition Floor Tile.
 - .2 ASTM F1344-[00], Specification for Rubber Tile.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20-[95], Surface Sealer for Floors.
 - .2 CAN/CGSB-25.21-[95], Detergent-Resistant Floor Polish.

1.3 SAMPLES

- .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Submit duplicate tile in size specified.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .2 Collect and separate for disposal recyclable packaging material in appropriate on-site bins for recycling.
- .3 Dispose of unused finish and adhesive materials at official hazardous material collections site approved by Consultant.
- .4 Do not dispose of unused finish and adhesive materials into sewer system, into streams, lakes, onto ground or in other locations where it will pose health or environmental hazard.

1.5 ENVIRONMENTAL REQUIREMENTS

- .1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hours before, during and for 7 days after installation.

Part 2 Products

2.1 MATERIALS

- .1 Luxury Vinyl Tile (LVT): 2.5mm - 3mm tile thickness, plank format, with 20 year commercial warranty. Minimum 20mil wear layer. Allow for total of three (2) colours from full line of Abstract, Wood, Stone or Concrete. Size to be selected by architect.
 - .1 Mirra, by Centura
 - .3 I.D. Latitude, by Tarkett
 - .3 Natural Creations Arbor Art, by Armstrong
 - .4 Spacia First 20, by Mannington
 - .5 Lavencia, by Altro
 - .6 Creation 55 by Gerflor
- .2 Resilient base (RR): rubber, top set coved, 3 mm thick, rubber, 100 mm high minimum 1200 mm long, including premoulded end stops and external corners. Acceptable materials: non-shrink Rubber Wall Base with toe as manufactured by Johnsonite. Colours: four (4) from full Johnsonite "Coloright" colour line. Locations: as described as 'RR' on Room Finish Schedule.
- .3 SPEC NOTE ENVIRONMENT: Many adhesives contain volatile organic compounds (VOCs) which, when released, may contribute to reduced air quality. Many VOCs also react with nitrogen oxides in the presence of sunlight to produce ground level ozone and photochemical smog. The specification of products that do not contain VOCs in excesses of 5% by weight when tested in accordance with one of the following: (1) EPA Method 24-24A, 40 C.F.R., Part 60, Appendix A (1991) (2) Method 18,48 Federal Register 48, no. 202 (1983), (3) Method 1400 NIOSH Manual of Analytical Methods, Volume 1 (1984), (4) Environmental Protection Agency Method 8240 GC/MS Method for Volatile Organics (1986). The Environmental Choice guideline ECP 44 provides acceptable standards for products that provide reduced environmental impacts. Note, however that generic flooring adhesives will not bond to linoleum because of its oil base.
- .4 SPEC NOTE ENVIRONMENT: Many adhesives contain volatile organic compounds (VOCs) which, when released, may contribute to reduced air quality. Many VOCs also react with nitrogen oxides in the presence of sunlight to produce ground level ozone and photochemical smog. The specification of products that do not contain VOCs in excesses of 5% by weight when tested in accordance with one of the following: (1) EPA Method 24-24A, 40 C.F.R., Part 60, Appendix A (1991) (2) Method 18,48 Federal Register 48, no. 202 (1983), (3) Method 1400 NIOSH Manual of Analytical Methods, Volume 1 (1984), (4) Environmental Protection Agency Method 8240 GC/MS Method for Volatile Organics (1986). The Environmental Choice guideline ECP-44 provides acceptable standards for products that provide reduced environmental impacts. Note, however that generic flooring adhesives will not bond to linoleum because of its oil base.

- .5 Primers and adhesives: waterproof, recommended by flooring manufacturer for specific material on applicable substrate, above, at or below grade. Use Johnsonite 990 Solvent Free Environmentally Safe White Acrylic Cove Base Adhesive for rubber base. Use ONLY “Flextile S-710” for VCT and no alternate.
- .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, with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.
- .8 Polyethylene sheet: to CAN2 51.33-M77, Type 2, for protection.
- .9 Nose filler: Epoxy caulking compound Johnsonite 930 or approved alternate.
- .10 Transition strips; as required between adjacent flooring finishes: manufactured by Johnsonite or Mercer or Finercraft to suit conditions at the place of the work for smooth transition. Colour to later selection by Consultant from manufacturer’s full range. Adhesive to be as recommended by manufacturer.
- .11 Vinyl Reducing Strip: Johnsonite RRS-XX-C; to suit thickness of flooring; colours selected by Consultant.
- .12 Vinyl Adaptor: Johnsonite CTA-XX-K; colours selected by Consultant.

Part 3 Execution

3.1 INSPECTION

- .1 Ensure concrete floors are dry, by using test methods recommended by tile manufacturer. Inspect for negative alkalinity, carbonization or dusting.
- .2 Commencement of work indicates acceptance of conditions by flooring installer.

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.

3.3 TILE APPLICATION

- .1 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.
- .2 Lay flooring with joints parallel to building lines to produce symmetrical tile pattern. Border tiles minimum half tile width.

- .3 Install tiles in corridor as per pattern provided by Consultant. Pattern will be provided at a later date.
- .4 Cut tile and fit neatly around fixed objects.
- .5 Install flooring in pan type floor access covers. Maintain floor pattern.
- .6 Terminate flooring at centerline of door in openings where adjacent floor finish or colour is dissimilar.
- .7 Install metal edge strips at unprotected or exposed edges where flooring terminates.
- .8 At doorways to incrapack units, extend tile and base fully into door opening to incrapack classroom.
- .9 Install solid colour vinyl strip to form gymnasium game lines, as indicated on drawings. Cut field tiles tight and smooth contour against game lines. Strips to be minimum of 300 mm long on curves and of indicated width and colour.

3.4 STAIR APPLICATION

- .1 Stair treads to be full one-piece tread and riser combo as described above with contrasting edge strip for the full width of stair. Joints are not acceptable. Areas to receive stair treads shall be clean, fully enclosed, weathertight, and maintained at a uniform temperature of at least 70°F for 24 hours before, during, and after the installation in completed. The stair treads and adhesives shall be conditioned in the same manner. Stair steps shall be smooth, flat, level, permanently dry, clean and free of all foreign material, such as dust, paint, grease, oils, solvents, curing and hardening compounds, sealers, asphalt and old adhesive residue. An epoxy caulking nose filler shall be applied to ensure a tight fit and eliminate any open spaces between the step edge and stair tread nosing. Stair treads shall be trimmed to within 1/16" of the riser and stringer to allow for expansion. Adhesives shall be applied to the stair step surface and the back and nosing area of the stair tread. Stair treads shall be rolled, with a J-hand roller, after installation, to ensure proper bonding. Caulk at edges of stair & tread.

3.5 BASE APPLICATION

- .1 Lay out base to keep number of joints at minimum. Use lengths as long as practicable and not less than minimum 500 mm long.
- .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. Use premoulded end pieces at flush door frames.

- .7 Miter internal corners. Use premoulded corner pieces at all external corners and ensure full adhesion through to ends of corner pieces. See detail for termination at door frames.
- .8 Install toeless type base before installation of carpet on floors.
- .9 Leave in the building one (1) complete carton of each of two (2) colours of floor tile and twelve (12) tiles of each of the remaining colours. Colours of extra tile to be specified by Consultant.

3.6 INITIAL MAINTANANCE AFTER INSTALLATION

- .1 Broom sweep or vacuum thoroughly.
- .2 Do not wet mop, wash, scrub, or strip the floor. These procedures will be done by the Owner.

3.7 PROTECTION OF FINISHED WORK

- .1 Following broom sweeping, protect new floors with 0.15 mm thick Polyethylene cover and lay planking in all necessary traffic areas to minimize damage by other trades. Maintain until just before final inspection.
- .2 Prohibit traffic on floor for 48 hours after installation.

3.8 PREPARATION FOR INSPECTION

- .1 Only if so notified by Consultant, and in the presence of the Owner, scrub the floor using a neutral detergent and a floor machine of 170-250 rpm capability equipped with a scrub brush or a scrubbing pad (3M blue or equal).
- .2 Broom sweep, lightly rinse/mop and allow to dry. Note: Do not flood the floor with rinse water, scrubbing, or stripping solutions.
- .3 VCT floors to be waxed/polished by the Contractor. The Owner will provide materials (seal/wax). Contractor to allow for application of three (3) coats of Owner-supplied sealer/waxes.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 06 40 00 - Architectural Woodwork.
- .3 Section 05 12 23 – Structural Steel for Buildings.
- .4 Section 05 50 00 – Metal Fabrications.
- .5 Section 08 11 14 – Metal Doors and Frames.
- .6 Section 09 91 27 – Finish and Colour Notes.
- .7 Section 09 91 30 – Door and Room Finish Schedule.

1.2 REFERENCES

- .1 Architectural Painting Specifications Manual, Master Painters Institute (MPI).
- .2 Ontario Painting Contractors Association (OPCA) Architectural Specification Manual - referenced as OPCA Manual, latest Edition. Paint formulations and methods referred to herein refer to this Manual. If contractor is unfamiliar with this reference standard, contact the OPCA at (416) 498-1897.

1.3 WARRANTY

- .1 At outset of the contract, contractor to register with the OPCA for the inspection service paid for from Cash Allowances.
- .2 Upon completion of the inspection program, contractor to furnish an OPCA 2 Year Guarantee. The Guarantee shall warrant that the work has been performed with respect to the standards and requirements incorporated in the OPCA specification manual-latest edition.

1.4 ENVIRONMENTAL PERFORMANCE REQUIREMENTS

- .1 Do not apply paint finish in areas where dust is being generated.
- .2 Conform to requirements of OPCA Manual.
- .3 Comply with the requirements of Section 01 35 30- Health and Safety.

1.5 JOB MOCK-UP

- .1 Complete a mock-up room to be reviewed and approved by Owner, Consultant, and OPCA Inspector for approval on application of block filler and finish paint coats.

1.6 SCHEDULING OF WORK

- .1 Submit work schedule for various stages of painting to Consultant for approval. Submit schedule minimum of 72 hours in advance of proposed operations.
- .2 Obtain written authorization from Consultant for any changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.7 EXTRA MATERIALS

- .1 Submit one - four litre can of each type and colour of [primer] [stain] [finish coating]. Identify colour and paint type in relation to established colour schedule and finish system.
- .2 Deliver to Contractor and store where directed.

1.8 DELIVERY, HANDLING AND STORAGE

- .1 Labels shall clearly indicate:
 - .1 Manufacturer's name and address.
 - .2 Type of paint or coating.
 - .3 Compliance with applicable standard.
 - .4 Colour number in accordance with established colour schedule.
- .2 Remove damaged, opened and rejected materials from site.
- .3 Provide and maintain dry, temperature controlled, secure storage.
- .4 Observe manufacturer's recommendations for storage and handling.
- .5 Store materials and supplies away from heat generating devices.
- .6 Store materials and equipment in a well ventilated area with temperature range 7°C to 30°C.
- .7 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .8 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.
- .9 Remove paint materials from storage only in quantities required for same day use.
- .10 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .11 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 FINISHES AND COLOURS

- .1 Review the requirements outlined in Section 099127, Finish Schedule and Colour Notes. A separate colour schedule will be issued after contract award.
- .2 Allow for Six (6) colours total from all formulations for this project including room wall accent colours.

1.10 WASTE MANAGEMENT AND DISPOSAL

- .1 Paint, stain and wood preservative finishes and related materials (thinners, solvents, etc.,) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
- .2 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .3 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .4 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground the following procedures shall be strictly adhered to:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in an approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).
- .5 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.
- .6 Set aside and protect surplus and uncontaminated finish materials: galvanized touch up; wood stain, prefinished metal touch up paint. Deliver to or arrange collection by recycling organization for verifiable re-use or re-manufacturing.
- .7 Close and seal tightly partly used sealant and adhesive containers and store protected in well ventilated fire-safe area at moderate temperature.

Part 2 Products

2.1 MATERIALS

- .1 Acceptable Manufacturer's: Where OPCA code numbers are not referenced, use Products from one of the following manufacturers:
 - .1 Benjamin Moore & Co. Ltd.
 - .2 ICI (Glidden) Paints.
 - .3 Para Paints.
 - .4 Pratt & Lambert Inc.
 - .5 The Sherwin-Williams Company.
- .2 Manufacturers of intumescent coatings having Product considered acceptable for use:
 - .1 A/D Fire Protection Systems Inc.
 - .2 Carboline.
- .3 Paint materials for paint systems shall be products of a single manufacturer.
- .4 Acceptable products: Per Chapter 5 OPCA Manual and as listed.
- .5 Paint materials for each paint system to be products of a single manufacturer.
- .6 Use low-VOC and low-odour paints only.

Part 3 Execution

3.1 GENERAL

- .1 Prepare surfaces to receive paint per Chapter 3 OPCA Manual.
- .2 For doors supplied by Relocatable Contractor as indicated in the Door Finish schedule, clean and re-prime all surfaces prior to painting. Refer to AD drawings for Door Finish Schedule.

3.2 APPLICATION

- .1 Sand and dust between each coat to remove defects visible from distance up to 1.5 m.
- .2 Finish closets and alcoves as specified for adjoining rooms.
- .3 Apply each coat at the proper consistency. Each coat of finish should be fully dry and hard before applying the next coat, unless the manufacturer's instructions state otherwise.
- .4 Method of application to be as approved by Consultant. Apply paint by [brush] [roller] [air sprayer] [airless sprayer]. Conform to manufacturer's application instructions unless specified otherwise.
- .5 Brush and Roller Application:

- .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
- .2 Work paint into cracks, crevices and corners.
- .3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
- .4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple unless approved by Consultant.
- .5 Remove runs, sags and brush marks from finished work and repaint.
- .6 Spray application:
 - .1 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.
 - .2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.
 - .3 Apply paint in a uniform layer, with overlapping at edges of spray pattern.
 - .4 Brush out immediately all runs and sags.
 - .5 Use brushes to work paint into cracks, crevices and places which are not adequately painted by spray.
- .7 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by Consultant.
- .8 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
- .9 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
- .10 Sand and dust between coats to remove visible defects.
- .11 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.
- .12 Finish inside of cupboards and cabinets as specified for outside surfaces.
- .13 Finish closets and alcoves as specified for adjoining rooms.
- .14 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

3.3 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Refer also to Finish Notes in Section 099127- Finish and Colour Notes.
- .2 Paint exposed conduits, pipes, hangers and other mechanical and electrical equipment occurring in finished areas as well as inside cupboards and cabinet work. Colour and

texture to match adjacent surfaces, except as noted otherwise. Coordinate with mechanical trades applying banding and labeling after pipes have been painted. Do not paint white PVC covers on exposed mechanical water, drain and other lines

- .3 Paint gas piping standard yellow where visible on roof or in service spaces. Do not paint gas meter or gas equipment in wall niche yellow—colour to later selection by Architect.
- .4 Paint surfaces inside of ductwork and elsewhere behind grilles where visible using primer and one coat of matte black paint.
- .5 Paint both sides and edges of plywood backboards for equipment before installation.
- .6 Leave equipment in original finish except for touch-up as required, and paint conduits, mounting accessories and other unfinished items.

3.4 PAINT SYSTEMS

- .1 System references listed are based on Chapters 4A and 4B of OPCA Manual and are OPCA Premium Grade, unless noted otherwise.

3.5 INTERIOR FINISHES

- .1 Wood, where applicable:
 - .1 Casework and miscellaneous wood items:
 - .1 Exterior surfaces: INT. 1-A, Alkyd Semi-Gloss Finish, Premium Grade
 - .2 Interior surfaces: INT. 1-A, Alkyd Semi-Gloss Finish, Premium Grade
 - .2 Gypsum board: INT.4-B, Latex Eggshell Finish, Premium Grade.
 - .3 Concrete Block: INT.8-C -modified; Latex Semi-Gloss Finish, Premium Grade. Modified system refers to all work where 2 full coats of block filler shall be applied.
 - .4 Concrete Block: Alkyd Gloss Finish, Premium Grade - shown on Room Finish Schedule as P-GF (Paint - Gloss) finish.
 - .5 Concrete Floors; refer to Section 03 35 05- Concrete Floor Hardeners and Sealers for liquid sealer.
 - .6 Miscellaneous metal:
 - .1 Primed: INT. 12-A, Alkyd Semi-Gloss Finish, Premium Grade
 - .2 Galvanized: INT. 13-A, Alkyd Semi-Gloss Finish, Premium Grade
 - .3 INT. 12-G, Water based Epoxy finish, two coats on a rust inhibitive primer for all exposed steel on Stairs 1S1 & 1S2 including exposed steel nosing at porcelain tile stair landing, stair stringer, pickets and railings”.
 - .7 Galvanized metal: INT. 13-A, Alkyd Semi-Gloss Finish, Premium Grade
 - .8 Hollow Metal Doors and Frames: Without exception, all wipecoated Galvanized Hollow Metal Doors, Frames and Screens, interior and exterior shall be field cleaned with solvent, galvanized prime paint coated and then finished with INT. 13-A Premium Grade, Gloss Finish. Base coat primer shall be submitted for review in advance of door/frame

painting shall be rejected by Consultant. For exterior hollow metal frames, if any, adjacent to aluminum windows, provide finish coat as an exterior premium grade metallic gloss finish to match anodized windows or Aluminum Composite panels. Colour to be confirmed by Architect during construction.

3.6 EXTERIOR PAINTING

- .1 Exterior exposed steel: Shop primed with an inorganic zinc primer over commercial blast cleaning 63-75 micrometers (2-3 mils). Field coat of 75-100 micrometers (3-4 mils) of high build epoxy. Colour to be selected by the Consultant.
- .2 Galvanized steel: Touch up any welds, cuts or damage with 'Galvafroid' Paint by W.R. Meadows.

3.7 INSPECTIONS

- .1 Register with OPCA at the outset of the project.
- .2 Provide Architect with all formulations at outset of project.
- .3 Provide inspections by representative of the Ontario Painting Contractors Association (OPCA) in compliance with the terms of the Canadian Painting Contractors Association Inspection and Guarantee Program.
- .4 Cooperate at all times with the paint inspection agency in the performance of their duties as required as part of the work of this Section.
- .5 OPCA inspection costs to be paid from Cash Allowance.

END OF SECTION

Part 1 General

1.1 GENERAL FINISH NOTES

- .1 The Material and Colour Schedule will be issued by the Consultant after tender. It shall be read in conjunction with the Drawings, Specifications, Room Schedule and Door Schedule. Colour and material references named will be based on one manufacturer, as carried by the Contractor or, in the case that no specific manufacturer is carried, based on the Consultant's choice.
- .2 Approved alternative manufacturers will be acceptable only as indicated in the specifications. However, approved alternate products submitted must match the products named in the Specification to the Consultant's selection. Alternate products other than those named in the specifications will not be allowed unless previously approved by the Consultant.
- .3 Consult Consultant prior to painting any surface not included in the formulae as listed.
- .4 Final colour for exterior painted surfaces and prominent interior areas shall be approved on the job site by the Consultant.
- .5 Provide one (1) accent paint wall in each classroom. Architect to confirm accent paint location and colour at later date.
- .6 Paint samples: Contractor to submit paint samples for all areas required to "Match Adjacent Finish".
- .7 All similar paint formulations are to be identical when dry. Variations in tone, texture or sheen shall not be accepted.
- .8 Submit two 300 mm x 300 mm paint samples of each colour required for approval by the Architect.
- .9 Exact locations of accent paint called for in the Material and Colour Schedule, to be issued after Contract award, not specifically identified on the drawings are to be verified on site with the Consultant.

1.2 EXTERIOR FINISH NOTES

- .1 All exposed metal (doors, frames, lintels, stairs, handrails, mechanical equipment, etc.) to be painted except for prefinished metal louvres, stainless steel, and aluminum. Mechanical equipment is to be painted whether delivered to the site pre-painted or not (exhaust fans, goosenecks, exhaust stacks, supports, HVAC units, HRU units, etc.). Colours to match adjacent material-generally either to match brick or tan to match flashing or siding material. Do not paint exposed white PVC pipe covers on interior. Architect will advise on jobsite which other items mentioned above, if any, do not require painting.

- .2 All unfinished metal work provided by landscaping is to be painted by Section 099122- Painting.

1.3 INTERIOR FINISH NOTES

- .1 All heating units, recessed convectors, grilles, pipes, access panels, hangers and miscellaneous exposed metal work (except stainless steel or anodized aluminum) to be painted to match the surfaces on which they occur unless noted otherwise on the colour schedule, prefinished in suitable colour or directed by the Consultant. If prefinished equipment is damaged, it shall be re-painted. Painting to be by formulations specified in Section 099122- Painting.
- .2 All interior fitments, casework, millwork, etc. to be melamine unless otherwise noted. Refer to Sections for specific requirements regarding materials, construction, finishes and hardware. Note that drawer and cupboard interiors are to be considered as exposed surfaces and will therefore be finished.
- .3 Do not paint over nameplates, identification tags, etc.
- .4 Make good all existing surfaces and finishes that are damaged during construction.

1.4 ABBREVIATIONS LEGEND

- .1 The following abbreviations are used in the Room Finish Schedule (Refer to Section 09 91 30- Room Finish Schedule).

.2	<u>Code</u>	<u>Reference</u>
.3	BK	Brick
.4	CB	Concrete Block
.5	CWT	Ceramic Wall Tile
.6	EXP	Exposed Ceiling
.7	EWPM	Exposed Waterproof Membrane
.8	GB	Gypsum Board
.9	LAP	Lay-in Acoustic Panel
.10	LAP(CER)	Lay-in Acoustic Panel with Ceramic Coating
.11	LVT	Luxury Vinyl Tile
.12	PF	Pre-Finished
.13	P.GF	Paint - Gloss Finish
.14	PT	Paint
.15	RR	Resilient Rubber
.16	S.CONC	Sealed Concrete
.17	SSF	Safety Sheet Flooring

END OF SECTION

PART 1 - GENERAL

1.1 General Notes

1. Find the **Room Finish Schedule** on the drawings.
2. This schedule **MUST** be read in conjunction with a complete set of drawings.
3. Refer to interior elevations, plans sections and reflected ceiling plans to coordinate finish notes and extents of materials.
4. Refer to various specifications sections for different types of materials including, but not limited to:
 - .1 Flooring materials such as resilient tile.
 - .2 Ceiling materials such as Lay-In Acoustical panel.
 - .3 Ceramic wall tiling.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 33 00 – Submittal Procedures.

1.2 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Shop Drawings:
 - .1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.
- .3 Samples:
 - .1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.3 WASTE MANAGEMENT AND DISPOSAL

- .1 Remove from site packaging materials at appropriate recycling facilities.
- .2 Dispose of recyclable packaging material in appropriate on-site bin for recycling.

Part 2 Products

2.1 MATERIALS

- .1 Tack Boards (TB) - As supplied by CPE Design Solutions Inc, ASI or Global School Products Inc.:
 - .1 NATURAL CORK TACKBOARDS 12.7mm (1/2") factory prelaminated consisting of 6mm (1/4") thick a.s.p. natural cork laminated to 6mm (1/4") particle board or masonite substrate under mechanical pressure in maximum panel sizes of 1219mm x 2438mm (4'0" x 8'0"). Bonding of materials by a waterproof adhesive that will not delaminate or rupture at the contact surfaces.
 - .2 All tackboards shall meet the minimum requirements of the applicable building code and/or Ontario Fire Marshall's office.
 - .4 Shop finish rear faces of tackboard units being installed in horizontal sliding trim to a matte black finish.
 - .5 Refer to Construction Drawings for locations & sizes required.
 - .6 Tackboard Mounting Heights: Coordinate with interior elevations.

- .2 Linoleum Bulletin Boards (BB) - As manufactured by FORBO.
 - .1 FORBO BULLETIN BOARDS (BB) 12.7mm (1/2") thick panels cut to sizes as indicated on drawings.
 - .2 All bulletin boards shall meet the minimum requirements of the applicable building code and/or Ontario Fire Marshall's office.
 - .3 Perimeter Trim: 9500 Elite Reveal by ASI group or approved alternate. Trim to be selected by consultant from manufactures full range.
 - .4 Location: Cosmetology Classroom. Refer to interior elevation for quantity.
 - .5 Linseed oil, Forbo Tackboard, surfacing to also be applied to include on inside of all display cases by Section 06 40 00.
 - .6 Colour to be selected by consultant from manufactures full range
- .3 White Boards (WB) - "Vit-Rite: Rite on, Wipe off" model as supplied by CPE Design Solutions Inc, ASI or Global School Products Inc.:
 - .1 WHITEBOARD – VITRITE
Whiteboards consisting of a sandwich type construction composed of face panel, core and balancing rear sheet, in maximum panel sizes of 1524mm (5'0") x 4877mm (16'0") with no joints.
 - .2 Face Panel – 22 gauge high quality enameling steel base with a porcelain enamel writing surface used to a ground coat of not less than 0.076mm (.003") nor more than 0.127mm (.005") after firing at temperatures between 700°C (1300°F) and 800°C (1500°F) in accordance with the Porcelain Enamel Institute Standards PEI S104 as regards to durability, smoothness of texture, colour continuity and a gloss factor of 6 – 8 as measured by 45° glossometer.
 - .3 Core – 11.1mm (7/16") impregnated sound absorbing fibreboard laminated under heat and pressure to face panel and back sheet utilizing adhesives that ensure rupturing of the component materials before failure of joint contact surfaces.
 - .4 Back up balancing sheet – 28 gauge zinc coated stretcher leveled steel in one unjointed section. Overall thickness of Whiteboard lamination shall be 12.7mm (1/2").
 - .5 Colour: White
 - .6 Refer to Construction Drawings for locations & sizes required.
 - .7 Manufacturer's Warranty: warrant White Boards for a period of 10 years against defects due to normal usage and wear.
 - .8 All whiteboards to have a magnetic surface.
 - .9 All connecting whiteboards to have splice joints. Refer to interior elevations.
 - .10 White Board Mounting Heights: Coordinate with interior elevations.
- .4 White Board, and Tack Board Fixed Trim: Series 200 to match details and profiles shown on architectural drawings. Aluminum to be 6063-T5 alloy with 0.051 mm thick clear anodized satin finish, free from extruding draw marks and surface scratches; components as follows:
 - .1 Perimeter Trim: extruded aluminum trim for all tackboards and also vertical jambs of chalkboards; e.g. No. 205.

- .2 Divider Bar: extruded aluminum trim to adjacent chalkboard/tackboard panels and adjacent tackboard panels of elevations greater than 2,440 mm; e.g. No. 207.
- .3 Marker Tray: extruded aluminum triangular box section for chalkboard elevation only complete with contour fitting end castings; 102 mm projection from finished wall; e.g. No. 212.
- .4 Marker Tray Over Millwork: extruded aluminum trims section for elevations mounted directly on or above millwork; 70 mm projection from finished wall; e.g. No. 264.
- .5 Refer to Construction Drawings for locations & sizes required.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 INSTALLATION

- .1 Install where indicated on drawings and as per manufacturer's instructions.

3.3 DEMONSTRATION AND TRAINING

- .1 Provide demonstration of operation to the Owner and his representatives.
- .2 Provide training for operation, maintenance and repairs.

3.4 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.
- .3 Clean aluminum with damp rag and approved non-abrasive cleaner.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

Part 1 General

1.1 KITCHEN EQUIPMENT

- .1 This Kitchen Equipment schedule has been prepared by:

KITCHEN CONSULTANT
Van Vekzen & Radchenko Design Associates Ltd.
99, 1262 Don Mills Road,
North York, Ontario M3B 2W7
T: 416 447.6483

Part 2 Products

- .1 Refer to the catalogue cuts and details for the Kitchen Equipment on the following pages.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

MECHANICAL SPECIFICATIONS

HCDSB NOTRE DAME CSS Cosmetology & Culinary Arts Interior Renovation

2333 Headon Forest Dr.,
Burlington, ON L7M 3X6

RDZ Project No.: 25192



RDZ ENGINEERS LIMITED
17A - 30 Pennsylvania Ave.
Vaughan, Ontario
L4K 4A5



2026 02 18	1	Issued for Tender	VK	GR
2026 02 06	0	Issued for Permit	VK	GR
Date	Revision	Description	Prep. By	Check By

DIVISION 20

MECHANICAL COMMON WORK

SECTION 20 05 01	FORM OF SUPPLEMENTARY MECHANICAL TENDER
SECTION 20 05 05	MECHANICAL WORK GENERAL INSTRUCTIONS
SECTION 20 05 10	BASIC MECHANICAL MATERIALS AND METHODS
SECTION 20 05 20	MECHANICAL VIBRATION CONTROL
SECTION 20 05 25	MECHANICAL INSULATION
SECTION 20 05 35	DEMOLITION AND REVISION WORK
SECTION 20 05 40	MECHANICAL WORK COMMISSIONING
SECTION 20 05 50	TESTING, ADJUSTING AND BALANCING
SECTION 20 05 55	FIRESTOPPING AND SMOKE SEAL SYSTEMS

DIVISION 21

FIRE PROTECTION

SECTION 21 13 00	FIRE PROTECTION SPRINKLER SYSTEM
SECTION 21 20 05	FIRE EXTINGUISHERS

DIVISION 22

PLUMBING

SECTION 22 11 00	DOMESTIC WATER PIPING AND SPECIALTIES
SECTION 22 13 00	DRAINAGE AND VENT PIPING AND SPECIALTIES
SECTION 22 30 00	PLUMBING EQUIPMENT
SECTION 22 42 00	PLUMBING FIXTURES AND FITTINGS
SECTION 22 66 00	ACID AND CORROSIVE RESISTANT DRAIN AND VENT PIPING SYSTEMS

DIVISION 23

HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

SECTION 23 11 23	NATURAL GAS PIPING SYSTEM
SECTION 23 21 00	HYDRONIC PIPING SPECIALTIES AND PUMPS
SECTION 23 30 00	HVAC AIR DISTRIBUTION
SECTION 23 34 00	HVAC FANS
SECTION 23 70 00	GAS FIRED MAKE UP AIR UNIT

DIVISION 25

INTEGRATED AUTOMATION

SECTION 25 05 01	FORM OF SUPPLEMENTARY CONTROLS TENDER
SECTION 25 05 05	AUTOMATIC CONTROLS AND INSTRUMENTATION

END OF SECTION

PROJECT NAME: Halton Catholic District School Board
Notre Dame Catholic Secondary School
Cosmetology & Culinary Arts Interior Renovations

RDZ PROJECT NUMBER: 25192

Following Supplementary Mechanical Bid Form is submitted by:

.....

(Bidding Company)

.....

(Street Address or P. O. Box No.)

.....

(City, Province and Postal Code)

Dated And which is an integral part of Bid Form.

In accordance with Instructions to Bidders, we provide the Supplementary Mechanical Bid Form. We understand that the information provided to be considered an integral part of Bid Form and is to be completed in full.

Where instructions are not provided, submit Supplementary Mechanical Bid Form by time of Bid closing, via e-mail addressed to:

RDZ Engineers Ltd.
Attention : Giovanni Rea
e-mail : Giovanni@rdzeng.ca

Supplementary Bid Form Signature:

.....

(Signature of Authorized Representative)

.....

(Print Name)

.....

(Title)

LIST OF MANUFACTURERS/SUPPLIERS

We submit, herein, typed or neatly printed, the names of the manufacturers upon whose products our Bid Price is based and which we will supply. If no name is indicated, or if name identified is not listed in issued documents, or if more than one name is indicated for a particular product, we will if requested, provide the base specified manufacturer's product. Where products are named in the specifications with only one (1) manufacturer/supplier, or are not listed herein, we are also prepared to provide the base specified named product. We will provide Canadian manufactured products if costs and quality are similar.

We understand that the first manufacturer specified for any product is the manufacturer upon whose product the design is based, and that the other manufacturers specified for a particular product are manufacturers acceptable to the Owner and whose product produces equivalent quality, performance and size. We further understand if we indicate a manufacturer other than the manufacturer whose product is the basis of the design, we are responsible for ensuring that the product supplied is equivalent in quality, performance and size to the base design product, and that any additional costs incurred as a result of use of such products will be borne by us. Acceptance of non-base specified manufacturers with respect to their equivalency shall be as sole discretion of Consultant.

We also acknowledge that failure to submit this list as specified or failure to submit within time defined may result in provision of base specified manufacturer's product, at discretion of Consultant.

SECTION	PRODUCT	MANUFACTURER/SUPPLIER & CATALOGUE NUMBER
20 05 20	Mechanical Vibration Control	
20 05 25	Mechanical Insulation	
20 05 55	Firestopping and Smoke Seal Systems	
22 13 00	Grease Interceptor	
22 66 00	Acid Neutralizer	
23 30 00	Diffusers and Grilles	
23 34 00	Utility Fan	
23 34 00	Centrifugal Inline Fan	
23 70 00	Gas Fired Make Up Air Unit	

END OF DOCUMENT

1. GENERAL

1.1 REFERENCES

- .1 *Issued for Construction documents are issued for Contractors' convenience for reference only and are a consolidation of issued drawings, specifications, and addenda. Consultant makes no representation of their completeness. Exact construction requirements to be based on official Bid issued drawings, specifications, and issued separate addenda. Contact Consultant for any clarifications.*

1.2 APPLICATION

- .1 This Section specifies requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly.

1.3 DEFINITIONS

- .1 The following are definitions of words found in Mechanical Divisions of the Specification and on associated drawings:
- .1 "concealed" – means hidden from normal sight in furred spaces, shafts, ceiling spaces, walls and partitions.
 - .2 "exposed" – means work normally visible, including work in equipment rooms, service tunnels, and similar spaces.
 - .3 "finished" - means when in description of any area or part of an area or a product which receives a finish such as paint, or in case of a product may be factory finished.
 - .4 "provision" or "provide" (and tenses of "provide") – means supply and install complete.
 - .5 "install" (and tenses of "install") – means secure in position, connect complete, test, adjust, verify and certify.
 - .6 "supply" – means to procure, arrange for delivery to site, inspect, accept delivery and administer supply of products; distribute to areas; and include manufacturer's supply of any special materials, standard on site testing, initial start-up, programming, basic commissioning, warranties and assistance to Contractor.
 - .7 "delete" or "remove" (and tenses of "delete" or "remove") – means to disconnect, make safe, remove obsolete materials and patch and repair/finish surfaces to match adjoining similar construction; include for associated re-programming of systems and/or change of documentation identifications to suit deletions, and properly dispose of deleted products off site unless otherwise instructed by Consultant.
 - .8 "BAS" – means building automation system; "BMS" – means building management system, "FMS" – means facility management system; and "DDC" means direct digital controls; references to "BAS", "BMS", "FMS" and "DDC" generally mean same.
 - .9 "governing authority" and/or "authority having jurisdiction" and/or "regulatory authority" and/or "Municipal authority" – means government departments, agencies, standards, rules and regulations that apply to and govern work and to which work must adhere.
 - .10 "Mechanical Divisions" – refers to Divisions 20, 21, 22, 23, 25 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Mechanical Contractor, unless otherwise noted.
 - .11 "Electrical Divisions" – refers to Divisions 26, 27, 28 and other Divisions as specifically noted, and which work as defined in Specifications and/or on drawings is responsibility of Electrical Contractor, unless otherwise noted.
 - .12 "board", "school board", "owner", "HCDSB" – Halton Catholic District School Board.
- .2 Wherever words "indicated", "shown", "noted", "listed", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean product referred to is "indicated", "shown", "listed", or "noted" on Contract Documents.

- .3 Wherever words "reviewed", "satisfactory", "as directed", "submit", or similar words or phrases are used in Contract Documents they are understood, unless otherwise defined, to mean that work or product referred to is "reviewed by", "to the satisfaction of", "submitted to", etc., Consultant.

1.4 DOCUMENTS

- .1 Documents for bidding include but are not limited to issued Drawings, Specifications and Addenda.
- .2 Specification is arranged in accordance with CSI/CSC 50 Division MasterFormat.
- .3 Drawings and Specifications are portions of Contract Documents and identify labour, products and services necessary for performance of work and form a basis for determining pricing. They are intended to be cooperative. Perform work that is shown, specified, or reasonably implied on the drawings but not mentioned in Specification, or vice-versa, as though fully covered by both.
- .4 Read Drawings and Specifications in conjunction with documents of other Divisions and, where applicable, Code Consultant's report.
- .5 Unless otherwise specifically noted in Specifications and/or on Drawings, Sections of Mechanical Divisions are not intended to delegate functions nor to delegate work and supply of materials to any specific trade, but rather to generally designate a basic unit of work, and Sections are to be read as a whole.
- .6 Drawings are performance drawings, diagrammatic, and show approximate locations of equipment and connecting services. Any information regarding accurate measurement of building is to be taken on site. Do not scale Drawings, and do not use Drawings for prefabrication work.
- .7 Drawings are intended to convey the scope of work and do not show architectural and structural details. Provide, at your cost, offsets, fittings, transformations, and similar products required as a result of obstructions and other architectural and/or structural details but not shown on Drawings.
- .8 Locations of equipment and materials shown may be altered, when reviewed by Consultant, to meet requirements of equipment and/or materials, other equipment or systems being installed, and of building, all at no additional cost to Contract.
- .9 Specification does not generally indicate specific number of items or amounts of material required. Specification is intended to provide product data and installation requirements. Refer to schedules, Drawings (layouts, riser diagrams, schematics, details) and Specification to provide correct quantities. Singular may be read as plural and vice versa in Specification.
- .10 Starter/motor control center (MCC)/variable frequency drive (VFD) schedule drawings are both mechanical and electrical, and apply to work of Mechanical Divisions and Electrical Divisions. Be responsible for reviewing starter, MCC, VFD, and motor specification requirements prior to Bid submission and confirm exact scope of work and responsibility of work between Mechanical Divisions and Electrical Divisions.
- .11 Drawings and Specifications have been prepared solely for use by party with whom Consultant has entered into a contract and there are no representations of any kind made by Consultant to any other party.

- .12 In the case of discrepancies between the drawings and specifications, documents will govern in order specified in "General Conditions", however, when scale and date of drawings are same, or where discrepancy exists within specification, most costly arrangement will take precedence.

1.5 IMPERIAL AND METRIC MEASUREMENTS

- .1 Generally, both metric and imperial units of measurement are given in Sections of Specification governed by this section. Measurement conversions may be generally "soft" and rounded off. Exact measurements to be confirmed based on application. Where measurements are related to installation and onsite applications, confirm issued document measurements with applicable local code requirements, and/or as applicable, make accurate measurements onsite. Where significant discrepancies are found, immediately notify Consultant for direction.

1.6 EXAMINATION OF DOCUMENTS AND SITE

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

1.7 WORK STANDARDS

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

- .17 Electrical Safety Authority (ESA);
 - .18 Factory Mutual Systems (FM);
 - .19 Institute of Electrical and Electronic Engineers (IEEE);
 - .20 Illuminating Engineering Society (IES);
 - .21 International Standards Organization (ISO);
 - .22 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS);
 - .23 National Building Code of Canada (NBC);
 - .24 National Environmental Balancing Bureau (NEBB);
 - .25 National Electrical Manufacturers Association (NEMA);
 - .26 National Fire Protection Association (NFPA);
 - .27 NSF International (NSF);
 - .28 Ontario Building Code (OBC);
 - .29 Ontario Electrical Safety Code (OESC);
 - .30 Occupational Health and Safety Act (OHSA);
 - .31 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA);
 - .32 Thermal Insulation Association of Canada (TIAC);
 - .33 Technical Standards and Safety Authority (TSSA);
 - .34 Underwriters' Laboratories of Canada (ULC);
 - .35 Workplace Hazardous Materials Information System (WHMIS);
 - .36 Material Safety Data Sheets by product manufacturers;
 - .37 local utility inspection permits;
 - .38 Codes, standards, and regulations of local governing authorities having jurisdiction;
 - .39 additional codes and standards listed in Trade Sections;
 - .40 Owner's standards.
-
- .4 Provide applicable requirements for barrier free access in accordance with latest edition of local governing building code.
 - .5 Where any governing Code, Regulation, or Standard requires preparation and submission of special details or drawings for review they are to be prepared and submitted. Pay associated costs associated with these submittals.
 - .6 Unless otherwise specified, equipment is to be installed in accordance with the equipment manufacturer's recommendations and instructions, and requirements of governing Codes, Standards, and Regulations. Governing Codes, Standards, and Regulations take precedence over manufacturer's instructions.
 - .7 Work is to be performed by journeyperson tradesmen who perform only the work that their certificates permit, or by apprentice tradesmen under direct on-site supervision of an experienced journeyperson tradesman. Journeyperson to apprentice ratio is not to exceed ratio determined as stated in Ontario College of Trades and Apprenticeship Act.
 - .8 Journeyperson tradesmen are to have a copy of valid trade certificates available at site for review by Consultant at any time.
 - .9 Experienced and qualified superintendent is to be on-site at times when work is being performed.
 - .10 Coordinate work inspection reviews and approvals with governing inspection department to ensure that construction schedule is not delayed. Be responsible for prompt notification of deficiencies to Consultant and submission of reports and certificates to Consultant.
 - .11 Properly protect equipment and materials on site from damage due to elements and work of trades, to satisfaction of Consultant. Equipment and materials are to be in new condition upon Substantial Performance of the Work.

- .12 Mechanical piping system work, including equipment, must comply in all respects with requirements of local technical standards authorities and CSA Standard B51, Boiler, Pressure Vessels and Pressure Piping Code. Where required, mechanical work products must bear a CRN number.
- .13 Electrical items associated with mechanical equipment are to be certified and bear stamp or seal of a recognized testing agency such as CSA, UL, ULC, ETL, etc., or bear a stamp to indicate special electrical utility approval.

1.8 PERMITS, CERTIFICATES AND FEES

- .1 Contact and confirm with local authorities having jurisdiction including utility providers, requirements for approvals from such authorities. Obtain and pay for permits, certificates, and approvals required to complete Work.
- .2 For heating plant work involving gas fired equipment, apply for, obtain, and pay for all permits, fees and service connections for the work and the inspections required by Authorities Having Jurisdiction in the area where the work will take place, including TSSA and ESA. Have the work inspected and certified by PV [Boilers and Pressure Vessels Reg], OE [Operating Engineers Reg.] and FS [Fuel Safety Reg.] branches of TSSA. At the end of the work, the new plant shall be fully TSSA certified by all branches noted herein.
- .3 Be responsible for ensuring that authorities having jurisdiction which require on-site inspection of work, have ample notification to perform inspection, with sufficient lead time to correct deficiencies in a manner that will not impede schedule of completion of Work.
- .4 Submit to Consultant, approval/inspection certificates issued by governing authorities to confirm that Work as installed is in accordance with rules and regulations of local governing authorities.
- .5 Include in each copy of operating and maintenance instruction manuals, copies of approvals and inspection certificates issued by regulatory authorities to certify that completed Work is in accordance with regulations of regulatory authorities and is acceptable to them.

1.9 REQUIREMENTS FOR CONTRACTOR RETAINED ENGINEERS

- .1 Professional engineers retained to perform consulting services with regard to Project work, i.e. seismic engineer, fire protection engineer, structural engineer, are to be members in good standing with local Association of Professional Engineers, and are to carry and pay for errors and omissions professional liability insurance in compliance with requirements of governing authorities in Place of the Work.
- .2 Retained engineer's professional liability insurance is to protect Contractor's Consultants and their respective servants, agents, and employees against any loss or damage resulting from professional services rendered by aforementioned Consultants and their respective servants, agents, and employees in regards to the Work of this Contract.
- .3 Liability insurance requirements are as follows:
 - .1 coverage is to be a minimum of \$1,000,000.00 inclusive of any one occurrence;
 - .2 insurance policy is not to be cancelled or changed in any way without insurer giving Owner minimum thirty days written notice;
 - .3 liability insurance is to be obtained from an insurer registered and licensed to underwrite such insurance in the Place of the Work;
 - .4 retained Consultants are to ascertain that Sub-Consultants employed by them carry insurance in the form and limits specified above;
 - .5 evidence of the required liability insurance in such form as may be required is to be issued to Owner, Owner's Consultant, and Municipal Authorities as required prior to commencement of aforementioned Consultant's services.

1.10 WORKPLACE SAFETY

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials. Submit WHMIS MSDS (Material Safety Data Sheets) for products where required, and maintain one copy at site in a visible and accessible location available to personnel.
- .2 Comply with requirements of Occupational Health and Safety Act and other regulations pertaining to health and safety, including worker's compensation/insurance board and fall protection regulations. When working in confined spaces, comply with requirements of Occupational Health and Safety Act - Ontario Regulation 632, "Confined Spaces".

1.11 PLANNING AND LAYOUT OF WORK

- .1 Base installation layout, design, terminations, and supply of accessories, on Contract Documents with specific coordination with reviewed shop drawings.
- .2 Plan, coordinate, and establish exact locations and routing of services with affected trades prior to installation such that services clear each other as well as other obstructions. Generally, order of right of way for services to be as follows:
 - .1 large ducts (main runs);
 - .2 cable tray and bus duct;
 - .3 conduit 100 mm (4") dia. and larger;
 - .4 smaller branch ductwork;
 - .5 conduit less than 100 mm (4") dia.
- .3 Unless otherwise shown or specified, conceal work in finished areas, and conceal work in partially finished and/or unfinished areas to extent made possible by the area construction. Install services as high as possible to conserve headroom and/or ceiling space. Notify Consultant where headroom or ceiling space appears to be inadequate prior to installation of the work.
- .4 Do not use Contract Drawing measurements for prefabrication and layout of piping, sheet metal work and such other work. Locations and routing are to generally be in accordance with Contract Drawings, however, prepare layout drawings for such work. Use established bench marks for both horizontal and vertical measurements. Confirm inverts, coordinate with and make allowances for work of other trades. Accurately layout work, and be entirely responsible for work installed in accordance with layout drawings. Where any invert, grade, or size is at variance with Contract Drawings, notify Consultant prior to proceeding with work.
- .5 Prepare plan and interference drawings (at a minimum drawing scale of 1:50 or 1/4"=1' 0") of the work for coordination with General Contractor. Arrange for preparation of detailed section drawings of ceiling spaces of corridors and any other congested areas. Sections are to be cross referenced with plan drawings so that trades may make use of section drawings. Section drawings to indicate lateral and elevation dimensions of major services within ceiling space. Lateral dimensions are to be from grid lines and elevations from top of floor slab. Obtain from Consultant, disks of engineering drawings for this use. Prints and/or disks of Contractors' interference drawings are to be distributed among other Trade Contractors and General Contractor. Submit drawings to Consultant for review. Failure of General Contractor to prepare and coordinate overall interface drawings of trades does not relieve respective Division Contractor of responsibility to ensure that work is properly planned and coordinated.
- .6 Carry out alterations in arrangement of work that has been installed without proper coordination, study, and review, even if in accordance with Contract Documents, in order to conceal work behind finishes, or to allow installation of other work, without additional cost. In addition, make necessary alterations in other work required by such alterations, without additional cost.

- .7 Shut-off valves, balancing devices, air vents, equipment and similar products, particularly such products located above suspended ceilings must be located for easy access for servicing and/or removal. Products which do not meet this location requirement are to be relocated to an accessible location at no additional cost.
- .8 Be responsible for making necessary changes, at no additional cost, to accommodate structural and building conditions that were missed due to lack of coordination by this Division.

1.12 COORDINATION OF THE WORK

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

1.13 EQUIPMENT AND MATERIALS

- .1 Be responsible for ordering of products (equipment and materials) in a timely manner in order to meet project-scheduling timelines. Failure to order products to allow manufacturers sufficient production/delivery time to meet project-scheduling timelines is an unacceptable reason to request for other suppliers or substitutions.
- .2 Provide Canadian manufactured products wherever possible and where required quality and performance is obtainable. Unless otherwise specified, all materials and apparatus shall be new and shall comply with applicable Canadian Standards Association (CSA) Standards and/or Underwriters Laboratories of Canada (ULC) Standards and the requirements of the authorities having jurisdiction. Unless otherwise specified, similar products i.e.: all valves, all control components, all vibration isolation, etc., shall be the product of one (1) manufacturer. Products are to meet or exceed latest ANSI/ASHRAE/IES 90.1 standards, as applicable. Do not supply any products containing asbestos materials or PCB materials.

- .3 Systems and equipment of this Project are to be "State of the Art" and be most recent and up to date series/version of product that is available at time of shop drawing review process. Products that have been stored or "on shelf" for an extended period of time will not be accepted. Software is to be of latest version available and be provided with updates available at time of shop drawing review process. Systems are to be designed such that its software is backwards compatible. Future upgrades are not to require any hardware replacements or additions to utilize latest software.
- .4 Materials and equipment scheduled and/or specified, have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for material and equipment, specified by manufacturer's name and model number. Unless otherwise noted, the Bid Price may be based on materials and equipment supplied by any of the manufacturers named as acceptable for the particular material or equipment. If acceptable manufacturers are not stated for a particular material or piece of equipment, base the Bid Price on material supplied by the base specified manufacturers.
- .5 Documents have been prepared based on product available at time of Bidding. If, after award of Contract, and if successful manufacturer can no longer supply a product that meets base specifications, notify Consultant immediately. Be responsible for obtaining other manufacturers product that complies with base specified performance and criteria and meets project timelines. Proposed products are subject to review and consideration by Consultant and are considered as substitutions subject to a credit to Contract. In addition, if such products require modifications to room spaces, mechanical systems, electrical systems, etc., include required changes. Such changes are to be submitted in detail to Consultant for review and consideration for acceptance. There will be no increase in Contract Price for revisions. Note that above conditions supplement and are not to supersede any specification conditions with regards to substitutions or failure to supply product as per issued documents.
- .6 Listing of a product as "acceptable" does not imply automatic acceptance by Consultant and/or Owner. It is responsibility of Contractor to ensure that any price quotations received and submittals made are for products that meet or exceed specifications included herein.
- .7 If materials or equipment supplied by a manufacturer named as acceptable are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted material or equipment is equivalent in quality, performance and operating characteristics (including energy consumption if applicable) to the specified materials or equipment, and, it shall be understood that any additional costs, and changes to associated or adjacent work resulting from provision of materials supplied by a manufacturer other than the specified manufacturer is included in the Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of specified equipment and the dimensions of such equipment differs from the specified equipment, prepare and submit for review, accurately dimensioned layouts of rooms affected, identifying architectural and structural elements, systems and equipment to prove that equipment in room will fit properly meeting design intent. There will be no increase in Contract Price for revisions.
- .8 In addition to the manufacturers specified or named as acceptable, other manufacturers of materials or equipment may be proposed to the Consultant for acceptance, listing in each case a corresponding credit for each alternative proposed, however, the Bid Price must be based on equipment or materials specified or named as acceptable. Certify in writing to the Consultant that the proposed alternative meets all space, power, design, energy consumption, and all other requirements of the specified or acceptable material or equipment. In addition, it shall be understood that there will be no increase in the contract Price by reason of any changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives. The Consultant has sole discretion in accepting any such proposed alternative material or equipment. Indicate any proposed substitutions in areas provided on Bid Form. Do not order such products until they are accepted in writing by Consultant.

- .9 Where products you intend to provide are proposed as "an equal" and/or "or approved equal", to specified products, certify in writing that the proposed product to be used in lieu of specified product, at least meets space, power, design, energy consumption, noise criteria and other requirements of the specified product and thus shall be equivalent to or better than the specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or equal" and/or "or approved equal" products shall be at the sole discretion of the Consultant. The Consultant's decision shall be final and shall not require explanation. There shall be no increase in the contract Price due to the Consultant's rejection of a proposed equivalent product.
- .10 Only base specified products, specified acceptable products or equipment listed as alternate will be considered for acceptance by the School Board. No proposed substitutions will be accepted.
- .11 Indicate in Form of Supplementary Mechanical Tender, names of manufacturers for proposed products to be supplied, and which were based specified or scheduled with a manufacturer's name. Names of proposed manufacturers on list must be one of names stated as acceptable for particular products, unless prior approval from Owner has been given for use of products by other manufacturers. Submit to Consultant for review as directed.

1.14 SHOP DRAWINGS

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

- .2 "REVISE AND RESUBMIT" – If Consultant's review of shop drawing is not final, Consultant to stamp shop drawing as stated above, mark submission with comments, and return submission. Revise shop drawing in accordance with Consultant's notations and resubmit.
- .7 Following is to be read in conjunction with wording on Consultant's shop drawing review stamp applied to each and every shop drawing or product data sheet submitted:

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

1.15 ENGINEERED SUBMITTALS

- .1 Submittals for items required to be sealed by a professional engineer (engineered) are to be duly prepared, sealed, and signed under direct control and supervision of a qualified professional engineer licensed in jurisdiction of the work. Professional engineer is to conform to requirements specified in this Section in article entitled Requirements for Contractor Retained Engineers.
- .2 Engineered submittals are to include, but not be limited to, following:
 - .1 complete CAD layout drawings indicating equipment, piping schematic, pipe routing and sizing, zones, devices, wiring schematics, and any other pertinent data;
 - .2 listing of design data used to determine system layout and sizing;
 - .3 complete copies of design calculations and listing of design data used in preparing calculations;
 - .4 list detailing standards, codes, regulations, etc. adhered to when designing system;
 - .5 items as noted in other Sections of the Specification.
- .3 Professional engineer responsible for engineered submittals is to perform periodic field reviews, including review of associated mock-ups where applicable, at locations wherever work as described by engineered submittal is in progress, during fabrication and installation of such work, and submit a field review report after each visit. Submit field review reports to Consultant and authorities having jurisdiction as required.

- .4 Field reviews are to be at intervals as necessary and appropriate to progress of work described by engineered submittal to allow engineer to be familiar with progress and quality of such work and to determine if work is proceeding in general conformity with Contract Documents including reviewed shop drawings and design calculations.
- .5 Upon completion of work as described by engineered submittal, professional engineer responsible for preparation of engineered submittal and for performing periodic field reviews is to prepare and submit to Consultant and, if applicable, authorities having jurisdiction, a letter certifying that work has been supplied and installed in accordance with requirements of Contract Documents, authorities having jurisdiction and engineered submittal.

1.16 EQUIPMENT LOADS

- .1 Supply equipment loads (self-weight, operating weight, housekeeping pad, inertia pads, etc.) to Consultant, via shop drawing submissions, prior to construction.
- .2 When choice of specific equipment is made by Contractor, actual weight, location and method of support of equipment may differ from those initially given to Consultants and thus from those assumed for design. Consequently, it is necessary to back-check equipment loads, location, and supports.
- .3 Where supporting structure consists of structural steel framing, it is imperative that equipment loads, location, and method of support be confirmed prior to fabrication of structural steel. Be responsible for confirming locations of equipment with Consultant prior to construction.

1.17 OPENINGS

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

1.18 SCAFFOLDING, RIGGING, AND HOISTING

- .1 Unless otherwise specified or directed, supply, erect and operate scaffolding, rigging, hoisting equipment and associated hardware required for work, and subject to review by and coordination with Consultant.
- .2 Immediately remove from site scaffolding, rigging and hoisting equipment when no longer required.
- .3 Do not place major scaffolding/hoisting equipment loads on any portion of structure without approval from Consultant.

1.19 TEMPORARY CRANES

- .1 Submit following to Consultant for review:
 - .1 Propose details showing existing structures and surfaces being used for lifting locations.
 - .2 Copies of approvals of authorities for work.

- .3 Copies of approvals of property management of buildings affected by hoisting work, allowing for work.
- .4 Copies of required insurance for work.

1.20 CHANGES OR REVISIONS TO THE WORK

- .1 Whenever Consultant proposes in writing to make a change or revision to design, arrangement, quantity or type of work from that required by Contract Documents, prepare and submit to Consultant for approval, a quotation being proposed cost for executing change or revision.
- .2 Quotation is to be a detailed and itemized estimate of product, labour, and equipment costs associated with change or revision, plus overhead and profit percentages and applicable taxes and duties.
- .3 If overhead and profit percentages are not specified, but allowable under Contract as confirmed with consultant prior to contract signing, then allowable maximum percentages for overhead and profit are to be as per TDSB Supplementary Conditions.
- .4 Unless otherwise specified in Divisions 00 or 01, following additional requirements apply to all quotations submitted:
 - .1 when change or revision involves deleted work as well as additional work, cost of deleted work (less overhead and profit percentages but including taxes and duties) is to be subtracted from cost of additional work before overhead and profit percentages are applied to additional work;
 - .2 material costs are not to exceed those published in local estimating price guides;
 - .3 mechanical material labour unit costs are to be in accordance with Mechanical Contractors Association of America Labor Estimating Manual, less 25%;
 - .4 electrical material labour unit costs are to be in accordance with National Electrical Contractors Association Manual of Labor Units at difficult level, less 25%;
 - .5 costs for journeyman and apprentice labour must not exceed prevailing rates at time of execution of Contract and must reflect actual personnel performing work;
 - .6 cost for site superintendent must not exceed 10% of total hours of labour estimated for change or revision, and change or revision must be such that site superintendent's involvement is necessary;
 - .7 costs for rental tools and/or equipment are not to exceed local rental costs;
 - .8 overhead percentage will be deemed to cover quotation costs other than actual site labour and materials, and rentals;
 - .9 quotations, including those for deleted work, to include a figure for any required change to Contract time.
- .5 Quotations submitted that are not in accordance with requirements specified above will be rejected and returned for re-submittal. Failure to submit a proper quotation to enable Consultant to expeditiously process quotation and issue a Change Order will not be grounds for any additional change to Contract time.
- .6 Make requests for changes or revisions to work to Consultant in writing and, if Consultant agrees, will issue Notice of Change.
- .7 Do not execute any change or revision until written authorization for the change or revision has been obtained from Consultant.

1.21 BREAKDOWN OF MECHANICAL WORK COST

- .1 Prior to submittal of first progress payment draw, submit a detailed breakdown of work cost to assist Consultant in reviewing and approving progress payment claims.

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

1.22 NOTICE FOR REQUIRED FIELD REVIEWS

- .1 Whenever there is a requirement for Consultant to perform a field review prior to concealment of any work, to inspect/re-inspect work for deficiencies prior to Substantial Performance of the Work, for commissioning demonstrations, and any other such field review, give minimum 5 working days' notice in writing to Consultant.
- .2 If Consultant is unable to attend a field review when requested, arrange an alternative date and time.
- .3 Do not conceal work until Consultant advises that it may be concealed.
- .4 When Consultant is requested to perform a field review and work is not ready to be reviewed, reimburse Consultant for time and travel expenses.

1.23 PRELIMINARY TESTING

- .1 When directed by Consultant, promptly arrange, pay for, and perform site tests on any piece of equipment or any system for such reasonable lengths of time and at such times as may be required to prove compliance with Specification and governing Codes and Regulations, prior to Substantial Performance of the Work.
- .2 When, in Consultant's opinion, tests are required to be performed by a certified testing laboratory, arrange and pay for such tests.
- .3 These tests are not to be construed as evidence of acceptance of work, and it is agreed and understood that no claim for delays or damage will be made for injury or breakage to any part or parts of equipment or system due to test where such injuries or breakage were caused by faulty parts and/or workmanship of any kind.
- .4 When, in Consultant's opinion, tests indicate that equipment, products, etc., are defective or deficient, immediately remove such equipment and/or products from site and replace them with acceptable equipment and/or products, at no additional cost.

1.24 TEMPORARY SERVICES

- .1 Coordinate with Prime Contractor, requirements for temporary services including but not limited to temporary heating, cooling and water. Unless otherwise noted, provide required services in compliance with requirements of local governing building code and local governing inspection authorities.
- .2 Maintain fire protection of areas which may include fire watch during temporary shutdowns of existing systems, in accordance with requirements of local governing code and local governing authorities.

1.25 MAINTAINING EQUIPMENT PRIOR TO ACCEPTANCE

- .1 Maintain equipment in accordance with the manufacturer's printed instructions prior to start-up, testing and commissioning.

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

1.26 CLEANING UP

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

1.27 RECORD (AS-BUILT) DRAWINGS

- .1 Drawings for this project have been prepared on a CAD system using AutoCAD software of release version reviewed with Consultant. For purpose of producing record "as built" drawings, copies of Contract Drawings can be obtained from Consultant, at expense of \$500.00 CDN plus HST, per drawing, up to first 5 drawings, and \$100.00 CDN plus HST, per any additional drawings thereafter. Drawings may also to be used for preparation of layouts and interference drawings.
- .2 As work progresses at site, clearly mark in red in a neat and legible manner on a set of bound white prints of Contract Drawings, changes and deviations from routing of services and locations of equipment shown on Contract Drawings, on a daily basis. Changes and deviations include those made by addenda, change orders, and site instructions. Use notes marked in red as required. Maintain white print red line as-built set at site for exclusive use of recording as-built conditions, keep set up-to-date at all times, and ensure set is always available for periodic review. As-built set is also to include the following:
 - .1 dimensioned location of inaccessible concealed work;
 - .2 locations of control devices with identification for each;
 - .3 location of piping system air vents;
 - .4 for underground piping and ducts, record dimensions, invert elevations, offsets, fittings, cathodic protection and accessories if applicable, and locate dimensions from benchmarks to be preserved after construction is complete;
 - .5 for fire protection systems, record actual locations of equipment, sprinkler heads, and valves, drains, and test locations, and deviations of pipe routing and sizing from that shown on the drawings;
 - .6 location of concealed services terminated for future extension.
- .3 Before applying for a Certificate of Substantial Performance of the Work, update a clean copy of Contract Drawing set in accordance with marked up set of "as-built" white prints including deviations from original Contract Drawings, thus forming an "as-built" drawing set. Submit "as-built" site drawing prints to Consultant for review. Make necessary revisions to drawings as per Consultant's comments, to satisfaction of Consultant.
- .4 Submitted drawings are to be of same quality as original Contract Drawings. CAD drawing files are to be compatible with AutoCAD software release version confirmed with Consultant.
- .5 Unless otherwise noted in Divisions 00 or 01, failure to maintain accurate record drawings will incur additional 5% holdback on progress claims until drawings are brought up to date to satisfaction of Owner and reviewed with Consultant.

1.28 OPERATING AND MAINTENANCE INSTRUCTION MANUALS

- .1 For each item of equipment for which a shop drawing is required (except for simple equipment), supply minimum 3, project specific, indexed copies of equipment manufacturers' operating and maintenance (O&M) instruction data manuals. Review exact quantity of manuals with Consultant. Consolidate each copy of data in an identified hard cover three "D" ring binder. Each binder to include:
 - .1 on front cover: project name; wording – "Mechanical Systems Operating and Maintenance Manual"; and date;
 - .2 introduction sheet listing Consultant, Contractor, and Subcontractor names, street addresses, telephone and fax numbers, and e-mail addresses;
 - .3 equipment manufacturer's authorized contact person name, telephone number and company website;
 - .4 Table of Contents sheet, and corresponding index tab sheets;
 - .5 copy of each "Reviewed" or clean, updated "Reviewed As Noted" shop drawing or product data sheet, with manufacturer's/supplier's name, telephone and fax numbers, email address, company website address, and email address for local source of parts and service; when shop drawings are returned marked "REVIEWED AS NOTED" with revisions marked on shop drawing copies, they are to be revised by equipment supplier to incorporate comments marked on "reviewed" shop drawings and a clean updated copy is to be included in operating and maintenance manuals;
 - .6 pressure test reports, and certificates issued by governing authorities;
 - .7 Operating data is to include:
 - .1 description of each system and its controls;
 - .2 control schematics for equipment/systems including building environmental controls;
 - .3 if applicable, BAS architecture and all required operating data;
 - .4 description of operation of each system at various loads together with reset schedules and seasonal variances;
 - .5 operation instruction for each system and each component;
 - .6 description of actions to be taken in event of emergencies and/or equipment failure;
 - .7 valve tag schedule, and flow diagrams to indicate valve locations.
 - .8 Maintenance data is to include:
 - .1 servicing maintenance, operation and trouble-shooting instructions for each item of equipment and each system;
 - .2 schedules of tasks, frequency, tools required, and estimated task time;
 - .3 complete parts lists with numbers.
 - .9 Performance data is to include:
 - .1 equipment and system start-up data sheets;
 - .2 equipment performance verification test results, and final commissioning report;
 - .3 final testing, adjusting and balancing reports.
 - .10 copies of warranties;
 - .11 items requested specifically in Section Articles.
- .2 Operating and maintenance instructions are to relate to job specific equipment supplied under this project and related to Owner's building. Language used in manuals is to contain simple practical operating terms and language easy for in-house maintenance staff to understand how to operate and maintain each system.

- .3 Before applying for a Certificate of Substantial Performance of the Work, assemble one copy of O&M Manual and submit to Consultant for review prior to assembling remaining copies. Incorporate Consultant's comments into final submission.
- .4 Provide 2 digital copies of contents of operating and maintenance manuals and load onto separate USB type flash drives and submit to Consultant. Prepare digital copies using version of Adobe Acrobat Portable Document Format or equal as confirmed with Consultant and enhanced with bookmarks and internal document links. Each PDF file name shall be the same as that indicated in the binder. The contents in each PDF file shall be searchable.

1.29 COMMISSIONING

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

1.30 WARRANTY

- .1 Unless otherwise specified, warrant mechanical work to be in accordance with Contract Documents and free from defects for a period of one (1) year from date of issue of a Certificate of Substantial Performance of the Work.
- .2 Where equipment includes extended warranty period, e.g., five (5) years, first year of warranty period is to be governed by terms and conditions of warranty in Contract Documents, and remaining years of warranty are to be direct from equipment manufacturer and/or supplier to Owner.
- .3 Warranty to include parts, labour, travel costs and living expenses incurred by manufacturer's authorized technician to provide factory authorized on-site service.
- .4 Repair and/or replace any defects that appear in Work within warranty period without additional expense to Owner. Be responsible for costs incurred in making defective work good, including repair or replacement of building finishes, other materials, and damage to other equipment. Ordinary wear and tear and damage caused wilfully or due to carelessness of Owner's staff or agents is exempted.
- .5 Do not include Owner deductible amounts in warranties.

- .6 It is understood that warranties are to commence from time of Substantial Performance of the Work, regardless of what is noted within following Sections of Specification. Be responsible for providing whatever "bridging" or additional extended warranty period is required from time that material is purchased until this time.
- .7 Submit signed and dated copies of extended warranties to Consultant which clearly states herein specified requirements.
- .8 Visit building during warranty period with Owner representatives. Owner to organize these visits. At these meetings, Owner representatives are to review performance of systems. If performance is satisfactory, then no further action needs to be taken. If unsatisfactory, then correct deficiencies, as directed by Owner representatives, to satisfaction of Owner's representatives. These site visits to occur:
 - .1 once during first month of building operation;
 - .2 once during third month of building operation;
 - .3 once between fourth and tenth month in a season opposite to first and third month visits.
- .9 The following table indicates the warranty period that shall be provided for the following equipment:

EQUIPMENT	ITEMS	WARRANTY
CONTROLS		3 YEAR
HVAC EQUIPMENT	Boilers, pumps, heat exchangers, expansion tank, air separator, DX cooling coil, condensing unit	As per equipment manufacturer's warranty

- .10 The Board reserves the right to initiate a service contract for all equipment with one of the board approved certified service companies. This shall not affect any of the above extended warranties provided by the manufacturers.

1.31 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION

- .1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for equipment/system manufacturer's authorized representative to visit site to examine installation, and after any required corrective measures have been made, to certify in writing to Consultant that equipment/system installation is complete and in accordance with equipment/system manufacturer's instructions.

1.32 EQUIPMENT AND SYSTEM START-UP

- .1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with following requirements:
 - .1 submit a copy of each equipment/system manufacturer's start-up report sheet to Consultant for review, and incorporate any comments;
 - .2 under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit a complete set of start-up documentation sheets signed by manufacturer/supplier and Contractor, to Consultant.

1.33 PROJECT CLOSEOUT SUBMITTALS

- .1 Prior to application for Substantial Performance of the Work, submit required items and documentation specified, including following:

- .1 Operating and Maintenance Manuals;
- .2 as-built record drawings and associated data;
- .3 extended warranties for equipment as specified;
- .4 operating test certificates, i.e. Sprinkler Test Certificate;
- .5 final commissioning report and TAB report;
- .6 identified keys for equipment and/or panels for which keys are required, and other items required to be submitted;
- .7 other data or products specified.

1.34 INSTRUCTIONS TO OWNER

- .1 Train Owner's designated personnel in aspects of operation and maintenance of equipment and systems as specified. Demonstrations and training are to be performed by qualified technicians employed by equipment/system manufacturer/supplier. Supply hard copies of training materials to each attendee.
- .2 Unless where specified otherwise in trade Sections, minimum requirements are for manufacturer/suppliers of each system and major equipment, to provide minimum two separate sessions each consisting of minimum 4 hours on site or in factory training (at Owner's choice), of Owner's designated personnel (for up to 6 people each session), on operation and maintenance procedures of system.
- .3 For each item of equipment and for each system for which training is specified, prepare training modules as specified below. Use Operating and Maintenance Manuals during training sessions. Training modules include but are not limited to:
 - .1 Operational Requirements and Criteria – equipment function, stopping and starting, safeties, operating standards, operating characteristics, performance curves, and limitations;
 - .2 Troubleshooting – diagnostic instructions, test and inspection procedures;
 - .3 Documentation – equipment/system warranties, and manufacturer's/supplier's parts and service facilities, telephone numbers, email addresses, and the like;
 - .4 Maintenance – inspection instructions, types of cleaning agents to be used as well as cleaning methods, preventive maintenance procedures, and use of any special tools;
 - .5 Repairs – diagnostic instructions, disassembly, component removal and repair instructions, instructions for identifying parts and components, and review of any spare parts inventory.
 - .6 The training sessions shall be scheduled and co-ordinated by the Commissioning Agent. The Commissioning Consultant shall video tape the sessions. Refer to Section 20 05 40 for further requirements.
- .4 Before instructing Owner's designated personnel, submit to Consultant for review a preliminary copy of training manual and a proposed schedule of demonstration and training dates and times. Incorporate Consultant's comments in final copy.
- .5 Obtain in writing from Consultant a list of Owner's representatives to receive instructions. Submit to Consultant prior to application for a Certificate of Substantial Performance of the Work, a complete list of systems for which instructions were given, stating for each system:
 - .1 date instructions were given to Owner's staff;
 - .2 duration of instruction;
 - .3 names of persons instructed;
 - .4 other parties present (manufacturer's representative, consultants, etc.).
- .6 Obtain signatures of Owner's staff to verify they properly understood system installation, operation and maintenance requirements, and have received operating and maintenance instruction manuals and "as-built" record drawings.

- .7 Submit to Consultant, copy of electronic version of training materials used to train Owner's designated personnel. Include in operating and maintenance manuals submission.

1.35 FINAL INSPECTION

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

2. PRODUCTS

NOT USED

3. EXECUTION

NOT USED

END OF SECTION

1. GENERAL

1.1 APPLICATION

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

1.2 SUBMITTALS

- .1 Submit shop drawings for all products specified in Part 2.
- .2 Submit the following to the Consultant for review:
 - .1 a sample of each proposed type of access door, as well as a copy of architectural reflected ceiling plan drawings showing proposed ceiling access door locations;
 - .2 location drawings for all required sleeves and formed openings in poured concrete or precast concrete construction;
 - .3 a list of equipment identification nameplates indicating proposed wording and sizes;
 - .4 a list of pipe and duct identification colour coding and wording;
 - .5 a proposed valve tag chart and a list of proposed valve tag numbering and identification wording;
 - .6 samples of materials and any other items as specified in succeeding Sections of this Division of the Specification.
- .3 Submit a spare belt set, tagged and identified, for each belt driven piece of equipment.
- .4 Submit an affidavit stating that lead free solder was used for all soldered joints in copper potable water, drainage and vent piping.

2. PRODUCTS

2.1 PIPE SLEEVES

- .1 Galvanized Sheet Steel – Minimum #16 gauge galvanized steel with an integral flange at one end to secure sleeve to formwork construction.
- .2 Polyethylene – Factory fabricated, flanged, high density polyethylene sleeves with reinforced nail bosses.
- .3 Waterproof Galvanized Steel Pipe – Schedule 40 mild galvanized steel pipe with a welded-on square steel anchor and water stop plate at sleeve midpoint.
- .4 Galvanized Steel or Cast Iron Pipe – Schedule 40 mild galvanized steel, or Class 4000 cast iron.

2.2 FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Firestopping and smoke seal system materials for mechanical penetrations through fire rated construction are specified in Section entitled Firestopping and Smoke Seal Systems and work is to be done as part of mechanical work.

2.3 WATERPROOFING SEAL MATERIALS

- .1 Modular, mechanical seal assemblies consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and pipe sleeve or wall opening, assembled with stainless steel bolts and pressure plates and designed so when bolts are tightened the links expand to seal the opening watertight. Select seal assemblies to suit pipe size and sleeve size or wall opening size.

- .2 Acceptable products are:
 - .1 Thunderline Corp. (Power Plant Supply Co.) "LINK SEAL" Model S-316;
 - .2 The Metraflex Co. "MetraSeal" type ES.

2.4 PIPE ESCUTCHEON PLATES

- .1 One-piece chrome plated brass or #4 finish type 302 stainless steel plates with matching screws for attachment to building surface, each plate sized to completely cover pipe sleeve or building surface opening, and to fit tightly around pipe or pipe insulation.

2.5 PIPING HANGERS AND SUPPORTS

- .1 Pipe hanger and support materials, including accessories, are to be, unless otherwise specified, in accordance with Manufacturers Standardization Society (MSS) Standard Practice Manual SP-58, Pipe hangers and Supports-Materials, Design and Manufacture, and where possible, MSS designations are indicated with each product specified below. Conform to following requirements:
 - .1 unless otherwise specified, ferrous hanger and support products are to be electro-galvanized;
 - .2 hangers and supports for insulated piping are to be sized to fit around insulation and insulation jacket.
- .2 Hangers and supports for horizontal suspended piping as follows:
 - .1 adjustable steel clevis hanger – MSS Type 1;
 - .2 adjustable swivel ring band hanger – MSS Type 10;
- .3 Supports for horizontal pipe on vertical surfaces as follows:
 - .1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
 - .2 heavy-duty steel pipe clip – MSS Type 26;
 - .3 single steel pipe hook – Myatt Fig. 156;
 - .4 epoxy coated steel pipe stays are not permitted.
- .4 Floor supports for vertical risers as follows:
 - .1 copper tubing riser clamp – MSS Type 8;
 - .2 heavy-duty steel riser clamp – MSS Type 8.
- .5 Supports for vertical piping on vertical surfaces as follows:
 - .1 steel offset pipe clamp – Anvil Fig. 103 or Myatt Fig. 170;
 - .2 heavy-duty steel pipe bracket or soil pipe bracket – MSS Type 26;
 - .3 extension split pipe clamp – MSS Type 12;
 - .4 epoxy coated steel pipe stays are not permitted.
- .6 Base support for vertical risers in excess of 6 m (20') high extending out from base mounted equipment is to consist of a base elbow support with flange.
- .7 For horizontal pipe on racks, Unistrut or equal galvanized steel pipe racks with pipe securing hardware as follows:
 - .1 standard galvanized steel U-bolts/clamps supplied by rack manufacturer;
- .8 Special hangers and supports for various applications as follows:
 - .1 vibration isolated riser supports – black steel riser clamps as specified above, complete with neoprene-steel-neoprene sandwich type vibration isolation pads between clamp and floor;
 - .2 for groups of pipes having same slope – MSS Type 32 welded steel brackets, Anvil Fig. 46 universal trapeze assemblies, or Unistrut or equal support assemblies, all with U-bolts, clamps, etc., to secure pipes in place;
 - .3 for sections of piping connected to vibration isolated equipment – hangers and supports as specified above but complete with MSS Type 48 spring cushions;

- .4 for piping on new roofs – Lexcor "Flash-Tite" or Thaler Roofing Specialties Products Inc. "MERS" Series insulated aluminum support risers with diameter, height, securement method and flashing to suit the application, channel type aluminum cross members, and galvanized steel pipe hangers and supports conforming to MSS SP-58, complete with all required accessories;
- .5 for plastic piping – generally as specified above but in accordance with pipe manufacturer's recommendations;
- .6 for fire protection piping – generally as above but ULC listed and/or FM approved, and in accordance with Chapter requirements of NFPA Standard applicable to piping system;
- .7 for bare horizontal copper piping – generally as above but factory vinyl coated to prevent direct copper/steel contact;
- .8 for bare copper vertical piping – corrosion resistant ferrous clamps with flexible rubber gasket type material (not tape) to isolate pipe from clamp;
- .9 insulation protection shields to and including 40 mm (1-½") dia. – MSS Type 40 galvanized steel shields with ribs to keep shield centred on hanger.
- .9 Hanger rods are to be electro-galvanized carbon steel (unless otherwise specified), round, threaded, to ASTM A36, complete with captive machine nuts with washers at hangers, sized to suit loading in accordance with Table 3 in MSS SP-58, but in any case minimum 9.5 mm (3/8") diameter.
- .10 Acceptable manufacturers are:
 - .1 E. Myatt & Co. Inc.;
 - .2 Anvil International Inc.;
 - .3 Empire Industries Inc.;
 - .4 Hunt Manufacturing Ltd.;
 - .5 Unistrut Canada Ltd.;
 - .6 Nibco Inc. "Tolco";
 - .7 Taylor Pipe Supports.

2.6 ACCESS DOORS

- .1 Access doors to be provided under work of Division 08 by General Trades Contractor.
- .2 Coordinate with Mechanical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services, where possible, be accessible from common access door. Coordinate work to ensure same common location access doors are not supplied by more than one Division.
- .3 Size access doors to suit the concealed work for which they are supplied, and wherever possible they are to be of standard size for all applications, but in any case they are to be minimum 300 mm x 300 mm (12" x 12") for hand entry and 600 mm x 600 mm (24" x 24") for body entry.
- .4 Access doors in fire rated construction are to be ULC listed and labelled and of a rating to maintain fire separation integrity.
- .5 Identify on reflected ceiling plans and wall elevation drawings, coordinated locations of proposed access door locations and submit to Consultant for review.

2.7 PRESSURE GAUGES AND THERMOMETERS

- .1 Pressure gauges as follows:
 - .1 adjustable, glycerine filled, 100 mm or 115 mm (4" or 4-½") diameter and each accurate to within 1% of scale range;
 - .2 type 304 stainless steel case with relief valve and polished stainless steel bayonet;

- .3 stainless steel rotary movement with stainless steel bushings and socket;
- .4 clear acrylic window;
- .5 dual scale white dial with a scale range such that working pressure of system is at approximate mid-point of scale;
- .6 black pointer.
- .2 Pressure gauge accessories and additional requirements as follows:
 - .1 a bronze ball type shut-off valve is to be provided in the piping to each pressure gauge;
 - .2 each pressure gauge for piping and equipment with normal everyday flow is to be equipped with a brass pressure snubber;
 - .3 pressure gauges in fire protection piping must be ULC listed and labelled;
- .3 Thermometers as follows:
 - .1 round, 125 mm (5") diameter, adjustable (90°) angle bimetal dial type thermometers, each accurate to within 1% of full scale;
 - .2 hermetically sealed stainless steel case with stainless steel ring;
 - .3 dampened bimetal coil;
 - .4 calibration adjustment screw;
 - .5 white aluminum dual scale dial with black and blue markings and a range such that working temperature of system is approximate mid-point of the scale;
 - .6 black aluminum pointer;
 - .7 double strength glass window;
 - .8 12 mm (½") NPT connection with 6.4 mm (¼") diameter stainless steel stem;
 - .9 suitable thermowell.
- .4 Acceptable manufacturers are:
 - .1 H.O. Trerice Co.;
 - .2 Weiss Instruments;
 - .3 Ashcroft.

2.8 EQUIPMENT BELT DRIVES

- .1 ANSI/RMA Standard V-belt type rated at minimum 1.5 times motor nameplate rating, and in accordance with following requirements:
 - .1 belts are to be reinforced cord and rubber, and multiple belts are to be matched sets;
 - .2 sheaves are to be cast iron or steel, secured to shafts with removable keys unless otherwise specified, standard adjustable pitch ($\pm 10\%$ range) for motors under 10 HP, fixed pitch type with split tapered bushing and keyway for motors 10 HP and larger, and, if required, replaced as part of mechanical work to suit system air/water quantity testing and balancing work;
 - .3 motor slide rail adjustment plates are to allow for centre line adjustment.
- .2 Supply a spare belt set (tagged and identified) for each belt drive and hand to Owner upon Substantial Performance of the Work.

2.9 EQUIPMENT DRIVE GUARDS AND ACCESSORIES

- .1 For V-belt drives – removable, 4-sided, fully enclosed, galvanized sheet steel guards to OSHA standards, cleaned, factory primed and painted with yellow equipment enamel, complete with a 2-piece full length hinged front panel to permit belt maintenance or replacement without removing guard, and 40 mm (1½") diameter tachometer openings at each shaft location.
- .2 For flexible couplings – removable "U" shaped galvanized steel guards to OSHA Standards with a 2.3 mm (3/32") thick frame and expanded mesh face.
- .3 For unprotected fan inlets and outlets – unless otherwise specified, removable 20 mm (¾") galvanized steel wire mesh with galvanized steel frames, all to OSHA Standards.

2.10 ELECTRIC MOTORS

- .1 Unless otherwise specified, motors are to conform to NEMA Standard MG1, applicable IEEE Standards, and applicable CSA C22.2 Standards, and are to meet NEMA standards for maximum sound level ratings under full load. Confirm motor voltages prior to ordering.
- .2 Vertically mounted and submersible motors are to be purposely designed for mounting in this attitude.
- .3 Efficiency of 1-phase motors to 1 HP is to be in accordance with CAN/CSA C747. Efficiency of 3-phase motors 1 HP and larger is to be in accordance with CAN/CSA C390 or IEEE 112B.
- .4 Unless otherwise specified, 1-phase motors smaller than ½ HP are to be 115 volt, continuous duty capacitor start type with an NEMA 48 or 56 frame size, solid base, heavy-gauge steel shell with solid die-cast end shields, dynamically balanced die-cast rotor, integral automatic reset thermal overload protection, Class "B" insulation, and a 1.15 service factor at 40°C (105°F) ambient temperature.
- .5 Explosion-proof 1-phase motors are to be totally enclosed, fan cooled, 115 volt continuous duty capacitor start type in accordance with CSA C22.2 No. 145, as specified for standard 1-phase motors but suitable for use in Class 1 Group D hazardous locations and complete with a rolled steel shell and a 1.0 service factor at 40°C (105°F) ambient temperature.
- .6 Unless otherwise specified, motors ½ HP and larger are to be totally enclosed, fan cooled, 3-phase, T-frame, squirrel cage continuous duty induction motors suitable for voltages indicated on Drawings, NEMA Design "B" for normal starting torque or Design "C" for high starting torque as required by the application, each complete with Class "B" insulation, a 1.15 service factor at 40°C ambient temperature, grease lubricated open ball bearings with grease fittings to permit re-lubrication without dismantling motor, a cast iron frame with cast iron feet where required, cast iron end bracket and precision machined bearing fit, and balanced carbon steel shaft assembly with die-cast aluminium rotor windings.
- .7 Explosion-proof 3-phase motors are to be totally enclosed fan cooled motors in accordance with CSA C22.2 No. 145, generally as specified above for standard 3-phase motors but suitable for use in Class 1 Group D hazardous locations and with a 1.0 service factor at 40°C (105°F) ambient temperature.
- .8 Motor(s) for 2-speed cooling tower(s) are to be as specified above but 2-speed single winding type.
- .9 Motor(s) for 2-speed fan(s) are to be as above but 2-speed double winding type.
- .10 Unless otherwise indicated, motors 30 HP and larger are to be complete with a heat sensing PTC thermistor in the end turn of stator winding for each phase and connected in series inside motor with 2 marked leads brought out to motor conduit box.
- .11 Motors for equipment with variable frequency drives are to be generally as specified above but inverter duty type to NEMA Standard MG-1 Part 31, quantified by CSA for operation from a variable frequency drive of type specified, and complete with Class "H" insulation. Motors are to be equipped with AEGIS, or approved equal, shaft grounding ring system to protect bearings from damage by diverting harmful shaft voltages and bearing currents to ground.
- .12 Motors for equipment which is scheduled or specified with a corrosion resistant coating or constructed from corrosion resistant materials are to be factory coated with a primer and epoxy paint finish.
- .13 Acceptable manufacturers are:
 - .1 TECO-Westinghouse Motors (Canada) Inc.;

- .2 Canadian General Electric;
- .3 Baldor Electric Co.;
- .4 U.S. Electrical Motors;
- .5 Weg Electric Corp.;
- .6 Marathon Electric;
- .7 Toshiba Corp.;
- .8 Leeson Canada.

2.11 MOTOR STARTERS AND ACCESSORIES

- .1 Motor starters must be capable of starting associated motors under the imposed loads. Confirm starter voltage matches motor prior to ordering.
- .2 Unless otherwise specified, starters for 1-phase motors are to be 115 volt, thermal overload protected manual starting switches with a neon pilot light, a surface or recessed enclosure to suit the application, and, where automatic operation is required, a separate H-O-A switch in an enclosure to match starter enclosure.
- .3 Unless otherwise specified, starters for 3-phase motors less than 50 HP are to be combination "quick-make" and "quick-break" fused disconnects and full voltage non-reversing across-the-line starters, each complete with and overload relay per phase, an enclosure to suit the application, and, a H-O-A switch, pilot lights, control transformer, auxiliary contacts, and other accessories as per motor starter schedule.
- .4 Starters for 2-speed double winding motors are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to permit equipment to coast down to low speed before it is operated at low speed.
- .5 Starters for reversible motors for cooling towers are to be generally as specified above but suitable for motor and equipped with a 45 second time delay to allow fan(s) to coast down to a stop before being operated in reverse rotation.
- .6 Unless otherwise specified, motor starter enclosures are to be in accordance with following NEMA ratings:
 - .1 enclosures located in sprinklered areas – Type 2;
 - .2 enclosures exposed to the elements – Type 3R, constructed of stainless steel;
 - .3 enclosures inside the building in wet areas – Type 3R, constructed of stainless steel;
 - .4 enclosures in explosion rated area – Type 7 with exact requirements to suit the area and application;
 - .5 enclosures except as noted above – Type 1;
 - .6 enclosures located in finished areas – as above but recess type with brushed stainless steel faceplate.
- .7 Fuses are to be, unless otherwise scheduled or specified, English Electric Ltd. HRC fuses, Form I Class "J" for constant running equipment and Form II Class "C" for equipment that cycles on and off.
- .8 Acceptable manufacturers are:
 - .1 Rockwell Automation Inc. - Allen-Bradley;
 - .2 Eaton Corp. – Cutler-Hammer;
 - .3 Eaton Corp. – Moeller Electric;
 - .4 Siemens Canada;
 - .5 Schneider Electric.

2.12 SPRINKLER PROOFING

- .1 Provide drip shields for protection of surface mounted equipment enclosures from water spray and dripping of liquids. Features of shields include:
 - .1 factory constructed by respective equipment manufacturers;
 - .2 constructed from non-combustible materials (sheet steel);
 - .3 enamel painted to match equipment;
 - .4 surfaces and edges filled/sanded smooth prior to painting;
 - .5 supported from equipment with structural steel rods/metal framing or other method approved by Consultant;
 - .6 structural support finish painted to match shield.
- .2 Include with equipment shop drawings, detailed dimensions of drip shields and methods of supporting.
- .3 Equipment with top cable/conduit entries to include additional sealing of entries with gasketting and/or waterproof sealant to prevent water from entering enclosure.
- .4 Design ventilation louvers such that live components are not exposed to water spray and dripping liquids.
- .5 Above requirements are additional minimum "sprinkler proof" standards for equipment specified as NEMA 1, 2 or 12.
- .6 Obtain CSA approval where required by local governing authorities.

2.13 MECHANICAL WORK IDENTIFICATION MATERIALS

- .1 Equipment nameplates are to be minimum 1.6 mm (1/16") thick 2-ply laminated coloured plastic plates, minimum 12 mm x 50 mm (½" x 2") for smaller items such as damper motors and control valves, minimum 25 mm x 65 mm (1" x 2-½") for equipment, and minimum 50 mm x 100 mm (2" x 4") for control panels and similar items. Additional requirements are as follows:
 - .1 unless otherwise specified or required, each nameplate is to be white, complete with bevelled edges and black engraved wording to completely identify equipment and its use with no abbreviations;
 - .2 wording is generally to be as per drawings, i.e. Fan EF-1, and is to include equipment service and building area/zone served, but must be reviewed prior to engraving;
 - .3 supply stainless steel screws for securing nameplates in place;
 - .4 nameplates for equipment suspended above floor level or generally not within easy viewing from floor level are to be increased in size so as to be easily readable from floor level.
- .2 Valve tags are to be coloured, 40 mm (1-½") square, 2-ply laminated plastic with bevelled edges, red-white, green-white, yellow-black, etc., to match piping identification colour, each complete with a 3.2 mm (1/8") diameter by 100 mm (4") long brass plated steel bead chain, and four lines of engraved maximum size identification wording, i.e.:

VALVE V12

200 mm (8")

CHILL. WATER

NORMALLY OPEN

- .3 Standard pipe identification is to be equal to Smillie McAdams Summerlin Ltd., Brady or Primark Manufacturing Inc. vinyl plastic with indoor/outdoor type vinyl ink lettering and directional arrows, as follows:

- .1 for pipe less than or equal to 150 mm (6") diameter, coiled type snap-on markers of a length to wrap completely around pipe or pipe insulation;
 - .2 for pipe larger than 150 mm (6") diameter, saddle type strap-on markers with 2 opposite identification locations and complete with nylon cable ties.
- .4 Identification wording and colours for pipe identification materials are to be as follows:

PIPE SERVICE	IDENTIFICATION COLOUR	LEGEND
domestic cold water	green	DOM. COLD WATER
domestic hot water supply	green	DOM. HW SUPPLY
domestic hot water recirculation	green	DOM. HW RECIRC.
storm drainage	green	STORM
sanitary drainage	green	SAN.
plumbing vent	green	SAN. VENT
acid sanitary drainage	yellow	ACID DRAIN
acid drainage vent	yellow	ACID VENT
fire protection sprinklers	red	F.P. SPRINKLER
natural gas	to Code	to Code, c/w pressure
natural gas vent	to Code	to Code
condenser water supply	green	COND. WTR. SUPPLY
condenser water return	green	COND. WTR. RETURN

- .5 Colours for pipe identification legends and directional arrows are to be as follows:

IDENTIFICATION COLOUR	LEGEND & ARROW COLOUR
yellow	black
green	white
red	white

- .6 Duct identification is to be custom made Mylar stencils with 50 mm (2") high lettering to accurately describe duct service, i.e. "AHU-1 SUPPLY", complete with a directional arrow, and coloured ink with ink pads and roller applicators. Ink colour is generally to be black but must contrast with lettering background.

2.14 FLEXIBLE CONNECTORS

- .1 Double wall stainless steel flexible connectors for piping connections to vibration isolated equipment, each selected by manufacturer to suit the application. Shop drawings or product data sheets must indicate construction and performance requirements that suit the application. Acceptable manufacturers are:
 - .1 Hyspan Precision Products Inc.;
 - .2 Senior Flexonics Ltd.;
 - .3 The Metraflex Co.

3. EXECUTION

3.1 GENERAL PIPING AND DUCTWORK INSTALLATION REQUIREMENTS

- .1 Unless otherwise noted, locate and arrange horizontal ducts above or at the ceiling on floors on which they are shown, arranged so that under consideration of all other work in the area, the maximum ceiling height and/or usable space is maintained.
- .2 Unless otherwise noted, install all work concealed in finished spaces, and concealed to the degree possible in partially finished and unfinished spaces. Refer to and examine the Architectural drawings and room finish schedules to determine finished, partially finished, and unfinished areas.
- .3 Install pipes and ducts parallel to building lines and to each other.
- .4 Neatly group and arrange all exposed work.
- .5 Do not make duct joints in wall or slabs.
- .6 Locate all dampers and any other equipment which will or may need maintenance or repairs and which are installed in accessible construction so as to be easily accessible from access doors. Where dampers and similar ductwork accessories occur in vertical ductwork in shafts or partitions, locate the accessories at the floor level.
- .7 Ensure that equipment and material manufacturer's installation recommendations and instructions are followed unless otherwise noted herein or on the drawings, and unless such instructions and recommendations contradict governing codes and regulations.
- .8 Carefully clean all ducts and fittings prior to installation. Temporarily cap or plug ends of ducts and equipment which are open and exposed during construction.
- .9 Install piping and ductwork which shall be insulated such that they have sufficient clearance to permit insulation to be applied continuously and unbroken around the duct except at fire barriers, in which case the insulation will be terminated at each side of the fire barrier.
- .10 Inspect surfaces and structure prepared by other trades before performing your work. Verify that surfaces or the structure to receive your work have no defects or discrepancies which could result in poor application or cause latent defects in installation and workmanship. Report defects in writing to the Consultant. Installation of your work will constitute acceptance of such surfaces as being satisfactory.
- .11 Ensure that exposed ferrous metal products, except ductwork and piping, have at least one (1) factory prime coat of alkyd metal primer, or paint such ferrous metal products with one (1) prime coat of alkyd metal primer on the job. Clean and wire brush ferrous metal products prior to application of prime coat.

- .12 Any ferrous piping that exhibits in excess of 5% surface rust, either inside or outside or both, is to be wire brush cleaned to bare metal and coated with suitable primer. Steel pipe, fittings and accessories are to be free of corrosion and dirt when work is complete or prior to being concealed from view. Where dirt is evident, clean piping prior to being concealed.
- .13 Provide continuous galvanized sheet metal drip pan under drain, water and water solution piping extending through rooms with electrical equipment such as electrical, elevator equipment and transformer rooms, and other spaces provided primarily for the installation of electrical equipment. Drip pans are to be complete with a drain pipe connection and drain piping is to be extended to closest drain.
- .14 For factory applied finishes, repaint or refinish surfaces damaged during shipment, erection or construction work. Quality of repair to finish shall be equal to finish provided by equipment manufacturer.
- .15 Provide screwed unions or flanges in piping connections to equipment and in regular intervals in long (in excess of 12 m [40']) piping runs to permit removal of sections of piping.
- .16 Unless otherwise specified and except where space limitations do not permit, piping elbows are to be long radius. Eccentric reducers are to be installed with straight side at top of piping.

3.2 DUCT, DAMPER AND SIMILAR MATERIAL OPENINGS

- .1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in poured concrete work, masonry, drywall and other building surfaces by the trade responsible for the particular construction in which the opening is required.
- .2 Ensure that openings for fire dampers to 14" (350 mm) high are sized to suit the damper arrangement with the folding blade out of the air stream.

3.3 PIPE JOINT REQUIREMENTS

- .1 Do not make pipe joints in walls or slabs.
- .2 Ream all piping ends prior to making joints.
- .3 Properly cut threads in screwed steel piping and coat male threads, unless otherwise noted, with red lead, Teflon tape or paste, or an equivalent thread lubricant. After the pipe has been screwed into the fitting, valve, union, or piping accessory, not more than two (2) pipe threads shall remain exposed.
- .4 Site bevel steel pipe to be welded or supply mill bevelled pipe. Remove all scale and oxide from the bevels and leave same smooth and clean. Ensure that personnel doing welding work are CWB certified welders and qualified for the particular pressure application worked on, and that all tests required by governing authorities are carried out, including X-ray tests where required for certain applications.
- .5 Use Bonney Forge Ltd. or equal welding tees or welding outlet fittings for piping branches off mains, welded or socket type for pipes with welded fittings and threaded type for pipes with screwed fittings.
- .6 Make all flanged joints with Cranite Ltd. or equivalent gasket materials to suit the application, and suitable bolts and nuts. Bolts shall not be longer than the length necessary to screw the nut up flush to the end of the bolt.
- .7 Bolts used for flanged connections in all piping with a working pressure of 100 psi (690 kPa) and greater shall be ASTM A-193, Grade B-7, with heavy hexagon nuts to ASTM A-194, CL-2H.

- .8 Provide suitable washers between each bolt head and the flange and between each nut and the flange.
- .9 A random check of bolted flanged connections will be made by the Consultant to verify that flanged connections are properly mated with no shear force acting on bolts. Supply all labour to disconnect and reconnect the selected flanged joints as directed by the Consultant. If improperly mated joints are found, remove and reinstall the affected piping at your expense so that the flanges mate properly. If improperly mated joints are found, additional joints will be checked, and you will be responsible for the repair of any other improper joints discovered.
- .10 Unless otherwise specified, make all soldered joints in copper piping using flux suitable for and compatible with the type of solder being used. Clean the outside of the pipe end and the inside of the fitting, valve, or similar accessory prior to soldering.
- .11 Install type "MJ" mechanical joint fittings and couplings in accordance with the manufacturer's recommendations.
- .12 Solvent weld PVC piping in accordance with manufacturer's recommendations and ASTM 2855. Solvent welds must be two (2) part, consisting of a priming and cementing stage. Primer and cement used must be compatible with the pipe material and approved by the pipe manufacturer. Use IPS Weld-on 719 cementing compound for cementing 8" (200 mm) diameter and larger piping. Ensure solvent (or cement) is evenly distributed around the joint and joined pipe and sockets are properly aligned prior to solvent or cement taking set.
- .13 Install PVC piping with gasketed joints in accordance with manufacturer's latest published specifications, instructions and recommendations with respect to pipe, coupling and fittings preparation and installation, and support anchoring and guiding of the piping system. Apply pipe and fitting manufacture supplied lubricant to gasket prior to mating components.

3.4 INSTALLATION OF PIPE SLEEVES

- .1 Pipe sleeves in poured concrete slabs, unless otherwise noted, shall be minimum No. 24 USS gauge (0.635 mm thick) flanged galvanized steel or, where permitted by governing authorities, factory fabricated plastic sleeves.
- .2 Sleeves in concrete or masonry walls shall be Schedule 40 galvanized steel pipe.
- .3 Sleeves in waterproof slabs shall be lengths of Schedule 40 mild galvanized steel pipe in accordance with the detail. Provide waterproof sleeves in the following locations:
 - .1 in mechanical room floor slabs, except where on grade;
 - .2 in slabs over mechanical, fan, electrical and telephone equipment rooms or closets;
 - .3 in all floors equipped with waterproof membranes;
 - .4 in the roof.
- .4 Size sleeves, unless otherwise noted, to leave 1/2" (12 mm) clearance around the pipes, or where pipe is insulated, a 1/2" (12 mm) clearance around the pipe insulation.
- .5 Pack and seal void between pipe sleeves and pipe or pipe insulation in non-fire rated construction for the length of sleeves as follows:
 - .1 pack sleeves in interior construction with mineral wool and seal both ends of sleeves with non-hardening silicone base caulking compound;
 - .2 pack sleeves in exterior walls above grade with mineral wool and seal both ends of sleeves water-tight with approved non-hardening silicone base caulking compound unless mechanical type seals have been specified;
 - .3 seal sleeves in exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified below.

- .1 Thunderline Corp. (Power Plant Supply Co.) "Link Seal" model S-316 or Metraflex Co. "Metraseal" Type ES.
 - .6 For fire-rated construction, refer to section entitled Firestopping and Smoke Seal Systems.
 - .7 Where sleeves are required in masonry work, accurately locate and mark the sleeve position, and turn the sleeves over to the trade performing the masonry work for installation.
 - .8 Terminate sleeves for piping which will be exposed so that the sleeve is flush at both ends with the wall, partition or slab surface so that the sleeve may be completely covered by an escutcheon plate, except for sleeves in waterproof floors which are to extend 4" (100 mm) above the finished surface.
 - .9 "Gang" type sleeving will be permitted only with the approval of the Consultant.
 - .10 Where sleeves are provided for future piping, cap and seal both ends of the sleeved opening to the approval of the Consultant.
- 3.5 INSTALLATION OF WATERPROOF MECHANICAL SEALS
- .1 Provide watertight link type mechanical seals in exterior wall openings.
 - .2 Assemble and install each mechanical seal in accordance with manufacturer's instructions.
 - .3 After installation, periodically check each mechanical seal installation for leakage and, if necessary, tighten link seal bolts until seal is completely watertight.
- 3.6 DUCT OPENINGS
- .1 Duct openings, air inlet and outlet openings, fire damper and similar openings will be provided in new poured concrete work, masonry, drywall and other building surfaces by trade responsible for particular construction in which opening is required.
 - .2 Size openings for fire dampers to 600 mm (24") high to suit damper arrangement with folding blade out of air stream.
 - .3 For duct openings except where fire dampers are required, pack and seal space between duct or duct insulation and duct opening as specified above for pipe openings in non-fire rated construction.
- 3.7 SLEEVE AND FORMED OPENING LOCATION DRAWINGS
- .1 Prepare and submit for review and forwarding to the concrete reinforcement detailer, drawings indicating all required sleeves, recesses and formed openings in poured concrete work. Such drawings shall be completely and accurately dimensioned and relate sleeve, recesses, and formed openings to suitable grid lines and elevation datum.
 - .2 Begin to prepare such drawings immediately upon notification of acceptance of tender and award of contract.
- 3.8 INSTALLATION OF PIPE ESCUTCHEON PLATES
- .1 Provide escutcheon plates suitably secured over all exposed piping passing through walls, floors, ceilings, partitions, furrings, and similar construction in finished areas.
 - .2 Install the plates so that they are tight against the building surface concerned, and ensure that the plates completely cover pipe sleeves and/or openings, except where waterproof sleeves extend above floors.

3.9 INSTALLATION OF FASTENING AND SECURING HARDWARE

- .1 Provide fasteners, anchors, braces and supports required to maintain installations attached to the structure or to finished floors, walls and ceilings in a secure and rigid manner, capable of withstanding the dead loads, live loads, superimposed dead loads, and any vibration of the installed products.
- .2 Use fasteners compatible with structural requirements, finishes and types of products to be connected. Do not use materials subject to electrolytic action or corrosion where conditions are liable to cause such action.
- .3 Where hangers are suspended from concrete slabs, install inserts before concrete is placed using inserts designed for the specific purpose.
- .4 Where built-in inserts are inaccessible due to subsequent installation of ducts, pipes or other installations, use anchors appropriate to the load requirements, including safety factor.
- .5 Where fastener installations are suspect, conduct on-site tests of installed fasteners, employing an independent testing laboratory acceptable to the Consultant, using properly engineered and calibrated force measuring meters.
- .6 Where the floor, wall or ceiling construction is not suitable to support the loads, provide additional framing or special fasteners to ensure that the load is properly secured to the structure that is to support the products.
- .7 Provide reinforcing or connecting supports where required to distribute the loading to the structural components.
- .8 Do not use wood plugs and hammer impact fasteners. Anchors in floor topping fills are not acceptable. Secure anchors in floors to the structure.
- .9 Where a performance requirement is specified, submit engineering calculations and written verification signed by a registered professional engineer that the installation has been inspected and is structurally sound and in accordance with design requirements.
- .10 Fastenings which cause spalling or cracking of the structure or products to which anchorage is made are not acceptable.
- .11 Obtain the Consultant's consent before using explosive actuation fastening devices. If consent is obtained, comply with CSA A166.
- .12 Space anchors within limits of load bearing or shear capacity and ensure they provide positive permanent anchorage.

3.10 INSTALLATION OF PIPE HANGERS AND SUPPORTS

- .1 Provide required pipe hangers and supports.
- .2 Provide any additional structural steel channels, angles, inserts, beam champs and similar accessories required for hanging or supporting pipe. Unless otherwise shown or specified, hang or support pipes from structure only.
- .3 For insulated pipe, size hanger or support to suit diameter of insulated pipe and install hanger or support on outside of insulation and insulation finish.
- .4 Support requirements for underground piping are as follows:

- .1 support underground pipe, unless otherwise specified, on a well compacted bed of dry, natural, undisturbed earth free from rocks or protrusions of any kind, or on compacted material as specified;
 - .2 support underground service piping penetrating building exterior walls or foundations to prevent pipe damage if minor building settlement occurs, all as per drawing detail;
 - .3 ensure bedding and supports for underground pipes are flat and true and allowances are made for pipe hubs, couplings, or other protrusions so no voids are left between pipe and bedding.
- .5 Unless otherwise shown or specified, hang and/or support horizontal pipe above ground by means of hangers and/or supports specified in Part 2 of this Section. Unless otherwise shown or specified, hangers for suspended pipe less than or equal to 25 mm (1") dia. are to be clevis type or adjustable ring type, and hangers for suspended pipe greater than or equal to 40 mm (1-½") dia. are to be adjustable clevis type.
- .6 Space hangers and supports in accordance with following:
- .1 cast iron pipe – hang or support at every joint with maximum 2.4 m (8') spacing;
 - .2 plastic pipe – conform to pipe manufacturer's recommended support spacing;
 - .3 copper and steel pipe – hang or support at spacing in accordance with following schedule:

PIPE DIA.	MAX. SPACING STEEL (meters)	MAX. SPACING COPPER (meters)
to 25 mm (1")	2.4 m (8')	1.8 m (6')
40 mm (1-½")	2.7 m (9')	2.4 m (8')
50 mm (2")	3.0 m (10')	2.7 m (9')
65 mm (2-½")	3.6 m (12')	3.0 m (10')
75 mm (3")	3.6 m (12')	3.0 m (10')
90 mm (3-½")	3.6 m (12')	3.6 m (12')
100 mm (4")	4.2 m (14')	3.6 m (12')
250 mm (10")	6.0 m (20')	
300 mm (12")	6.7 m (22')	

- .7 Where pipes change direction, either horizontally or vertically, provide a hanger or support on horizontal pipe not more than 300 mm (12") from elbow, and where pipes drop from tee branches, support tees in both directions not more than 50 mm (2") on each side of tee.
- .8 When pipes with same slope are grouped and a common hanger or support is used, space hanger or support to suit spacing requirement of smallest pipe in group and secure pipes in place on common hanger or support.
- .9 Provide roller hangers or supports for heat transfer piping greater than or equal to 150 mm (6") diameter and conveying a material 75°C (170°F) or greater to facilitate pipe movement due to expansion and contraction, and at each hanger or support tack weld a steel protection saddle to pipe to protect piping insulation.
- .10 Unless otherwise shown or specified, support vertical piping by means of supports specified in Part 2 of this Section, spaced in accordance with following:
 - .1 support vertical pipes at maximum 3 m (10') intervals or at every floor, whichever is lesser;

- .2 for sections of vertical piping with a length less than 3 m (10'), support pipe at least once;
 - .3 for vertical cast iron plain end pipe (mechanical joint type), secure riser or pipe clamp around pipe under a flange integral with pipe for vertical support purposes, or provide a length of hub and spigot pipe to facilitate proper support;
 - .4 for vertical steel pipe risers in excess of 3 m (10'), weld shear lugs to pipe to carry load;
 - .5 for vibration isolated piping risers, provide rubber-steel-rubber vibration isolation pads between riser clamps and floor.
- .11 Support piping on the roof as follows:
- .1 on new roof – supply manufactured roof supports as per Part 2 of this Section to accommodate piping involved and support spacing specified above, and hand supports to roofing trade on roof for installation as part of roofing work, then secure piping in place on supports.
- .12 Each hanger, support or securement for horizontal bare copper tubing is to be plastic coated to prevent direct contact between pipe and ferrous hanger. Each wall or floor clamp for vertical bare copper piping is to be isolated from pipe by means of strips of flexible rubber inserts. Use of painted ferrous hangers and supports, including those painted with copper coloured paint, is not acceptable. Site application of tape or other types of isolation is not acceptable.
- .13 For insulated horizontal piping less than or equal to 40 mm (1-½") diameter, provide galvanized steel insulation protection shields between insulation and hanger or support. Install shields immediately after pipe is insulated.
- .14 Do not support piping from steel deck without written consent from Consultant.

3.11 SUPPLY OF ACCESS DOORS

- .1 Supply access doors to give access to all valves, cleanouts, strainers, duct access doors, and other similar mechanical work which may need maintenance or repair but which is concealed in inaccessible construction, except as otherwise specified herein or on the drawings.
- .2 Before commencing installation of mechanical work, coordinate with other trades and prepare on a set of reflected ceiling plans and wall elevations, complete layouts of access doors. Submit these layouts for Consultant's review and show exact sizes and locations of such access doors. Locate and arrange mechanical work to suit.
- .3 Access doors will be installed by trade responsible for particular type of construction in which doors are required. Supply access doors to trade installing same at proper time.
- .4 Wherever possible, access doors to be of a standard size for each application. Confirm exact dimensions and minimum size restrictions with Consultant prior to ordering.
- .5 Group piping and ductwork to ensure the minimum number of access doors is required.
- .6 Coordinate with Electrical Contractor and General Trades Contractor to ensure access doors on project are provided by a single manufacturer, installed as part of work of General Trades Contractor and work involving both mechanical and electrical services should, where possible, be accessible from common access door. Coordinate work to ensure common location access doors are not supplied by both Mechanical Divisions and Electrical Divisions.

3.12 INSTALLATION OF VALVES

- .1 Generally, valve locations are indicated or specified on drawings or specified in Sections of the Specification where valves are specified, however, regardless of locations shown or specified, following requirements apply:

- .1 provide shut-off valves to isolate systems, at base of vertical risers, in branch take-offs at mains and risers on floors, to isolate equipment, to permit work phasing as required, and wherever else required for proper system operation and maintenance;
- .2 install shut-off valves with handles upright or horizontal, not inverted, and located for easy access;
- .3 unless otherwise specified, provide a check valve in discharge piping of each pump;
- .4 valve sizes are to be same as connecting pipe size;
- .5 valves are to be permanently identified with size, manufacturer's name, valve model or figure number and pressure rating, and wherever possible, valves are to be product of same manufacturer;
- .6 for valves in insulated piping, design of valve stem, handle and operating mechanism is to be such that insulation does not have to be cut or altered in any manner to permit valve operation.

3.13 INSTALLATION OF PRESSURE GAUGES AND THERMOMETERS

- .1 Provide pressure gauges with cocks in the following locations:
 - .1 in valved tubing across suction, suction strainer (if applicable), and discharge piping of each circulating pump;
 - .2 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, heat exchangers, main coils, etc.;
 - .3 in expansion tank(s);
 - .4 in separate domestic hot water storage tank(s);
 - .5 at top most outlet in each standpipe fire protection system riser;
 - .6 in piping at each side of a pressure reducing valve;
 - .7 in potable water service piping downstream of meter;
 - .8 wherever shown and/or specified on the Drawings or in the Specification.
- .2 Provide thermometers in following locations:
 - .1 in supply and return piping connections to main mechanical plant equipment such as boilers, chillers, cooling towers, heat exchangers, main coils, etc., unless temperature indication is supplied with equipment;
 - .2 wherever else shown and/or specified.
- .3 Conform to following installation requirements:
 - .1 for installation of thermometers in piping wells, provide a coat of metallic base heat transfer paste or grease in piping well;
 - .2 for pressure gauges in piping at equipment locations, install pressure gauge between equipment and first pipe fitting;
 - .3 locate, mount and adjust instruments so they are easily readable;
 - .4 where pressure gauges and/or thermometers are located at high level or in an area where they cannot be easily seen, provide remote reading instruments.
- .4 Locate and mount all instruments so they are easily readable.

3.14 INSTALLATION OF EQUIPMENT DRIVE GUARDS AND ACCESSORIES

- .1 Provide OSHA guards for exposed accessible rotating parts such as belt drives, couplings, fan wheels, and shaft ends on mechanical equipment.
- .2 Install belt guards to allow movement of motors for adjusting belt tension.
- .3 Provide a means to permit lubrication and use of test instruments with guards in place.
- .4 Secure guards to equipment or equipment base but do not bridge sound or vibration isolation.

- .5 Where equipment oil level gauges, oil reservoirs, grease cups, or grease gun fittings are integral with equipment but are not easily accessible for service, extend to an accessible location using aluminium or copper tubing.

3.15 SUPPLY OF MOTOR STARTERS AND ACCESSORIES

- .1 Unless otherwise noted, supply a motor starter for each item of motorized equipment which you provide.
- .2 Where three (3) phase starters are indicated and scheduled in motor control centre enclosures, supply the control centres complete with starters and bolt the assemblies to concrete housekeeping pads where shown.
- .3 Where package type equipment with integral starters, or equipment with starters integral in loose control panels supplied with the equipment (either by Mechanical Divisions or as part of the work of other Divisions) is fed from a motor control centre, provide a disconnect switch in the motor control centre in lieu of a starter. Refer to the starter schedule(s) for requirements.
- .4 Unless otherwise noted or shown on the drawings, single phase starters will be mounted adjacent to the equipment they serve and connected complete as part of the electrical work. Hand the starters to the electrical trade at the site at the proper time.
- .5 Motor starter interlocking will be done as part of the electrical work in accordance with requirements specified in Mechanical Divisions, and as outlined on the starter schedule(s). Equip each starter to be interlocked with all required contacts and control connection accessories.
- .6 Provide an identification nameplate on each motor starter or disconnect located in a motor control centre or on a motor starter panel, on each individually mounted starter which you supply, and on each disconnect which is provided by Electrical Division for motorized equipment which you supply.

3.16 IDENTIFICATION PAINTING

- .1 Identify exposed piping and ductwork in locations as follows:
 - .1 at every end of every duct run;
 - .2 adjacent to each valve, strainer, damper and similar accessory;
 - .3 at each piece of connecting equipment;
 - .4 on both sides of every pipe and duct passing through a floor, wall or partition, unless otherwise specified;
 - .5 at 20' (6 m) intervals on pipe and duct runs exceeding 20' (6 m) in length;
 - .6 on each side of special fittings and branch connections;
 - .7 at least once in each room, and at least once on pipe and duct runs less than 20' (6 m) in length.
- .2 Identify concealed ductwork in locations as follows:
 - .1 at points where pipe or ducts enter and leave rooms, shafts and similar areas;
 - .2 at maximum 20' (6 m) intervals on piping and ductwork above suspended accessible ceilings, and at least once in each room;
 - .3 at each access door location;
 - .4 at each piece of connected equipment, automatic valve, etc.
- .3 Provide an identification nameplate for equipment provided as part of this project, including items such as control valves, motorized dampers, instruments, and similar products. Secure nameplates in place, approximately at eye level if possible, with stainless steel screws unless such a practice is prohibitive, in which case use epoxy cement applied to cleaned surfaces. Locate nameplates in the most conspicuous and readable location.

- .4 Paint new natural gas piping with primer and 2 coats of yellow paint in accordance with Code requirements and requirements of Painting Section in Division 09. Identify piping at intervals as specified above.
- .5 Provide an identification nameplate for each motor starter or disconnect switch located in a motor control centre or on a motor starter panel, and on each individually mounted starter provided as part of mechanical work, and on each disconnect switch provided as part of the electrical work for motorized equipment provided as part of mechanical work.
- .6 Identification for ductwork shall consist of neatly stencilled, painted 1" (25 mm) high lettering to indicate the system the duct is associated with and the duct service, i.e., "SYSTEM ACS-1-SUPPLY", and stencilled directional arrows to indicate air flow. On insulated ductwork with a paintable finish apply the identification directly to the duct insulation. On uninsulated ducts apply the lettering to a rectangular painted white background. Identification paint colour shall be black.
- .7 Equipment identification wording shall be minimum 1" (25 mm) high stencilled lettering and shall indicate the use of the particular pieces of equipment. Abbreviations will not be permitted.
- .8 Note that use of Brady Ltd. or equal plastic coated cloth material colour coded markers with lettering, arrows, and waterproof adhesive backing will be permitted in lieu of painting and stencilling if the surface the marker is to be applied to is dry and sealed with clear lacquer, and clear lacquer is applied over the marker after installation.
- .9 For electrically traced mechanical work, identification wording is to include "ELECTRICALLY TRACED".
- .10 Tag valves and prepare a valve tag chart in accordance with following requirements:
 - .1 attach a valve tag to each new valve, except for valves located immediately at equipment they control;
 - .2 prepare a computer printed valve tag chart to list tagged valves, with, for each valve, the tag number, location, valve size, piping service, and valve attitude (normally open or normally closed);
 - .1 if an existing valve tag chart is available at site, valve tag numbering is to be an extension of existing numbering and new valve tag chart is to incorporate existing chart;
 - .2 frame and glaze one copy of chart and, unless otherwise directed, affix to a wall in each main Mechanical and/or Equipment Room;
 - .3 include a copy of valve tag chart in each copy of operating and maintenance instruction manuals;
 - .4 hand an identified CD of valve tag chart to Owner at same time O & M Manuals are submitted.
- .11 Where shut-off valves, control dampers, sensors, and similar items which will or may need maintenance and/or repair are located above accessible suspended ceilings, provide round coloured ceiling tacks in ceiling panel material, or stickers equal to Brady "Quick Dot" on ceiling grid material to indicate locations of items. Unless otherwise specified, ceiling tack or sticker colours are to be as follows:
 - .1 HVAC piping valves and equipment: yellow
 - .2 fire protection valves and equipment: red
 - .3 plumbing valves and equipment: green
 - .4 HVAC ductwork dampers and equipment: blue
 - .5 control system hardware and equipment: orange

3.17 FINISH PAINTING OF MECHANICAL WORK

- .1 Finish paint exposed mechanical work as specified and/or scheduled in accordance with requirements of painting Section in Division 09.
- .2 Touch-up paint damaged factory applied finishes on mechanical work products.

3.18 PIPE LEAKAGE TESTING

- .1 Before piping has been insulated or concealed, and before equipment, fixtures and fittings have been connected, test piping for leakage.
- .2 Tests are to be witnessed by Consultant and/or Owner's representative, and, where required, representatives of governing authorities. Give ample notice of tests in writing and verify attendance. Have completed test report sheets dated and signed by those present to confirm proper test results.
- .3 When circumstances prevent scheduled tests from taking place, give immediate and adequate notice of cancellation to all who were scheduled to attend.
- .4 Gravity Drainage and Vent Piping
 - .1 Test piping in accordance with local governing building code.
 - .2 After fixtures and fittings are set and pipes are connected to building drain or drains, turn on water into pipe, fixtures, fittings and traps in order to detect any imperfect material or workmanship. Perform a smoke test if required by local governing authorities.
- .5 Domestic Water Piping
 - .1 Test piping with cold water at a pressure of 1-½ times normal working pressure and maintain pressure for a minimum of 2 hours.
- .6 Sprinkler System Piping
 - .1 Test system piping in accordance with requirements of NFPA No. 13, "Installation of Sprinkler Systems", and in accordance with any additional requirements of governing authorities.
- .7 Heat Transfer (HVAC) System Piping
 - .1 Test piping with cold water at a pressure of 1035 kPa (150 psi) for a minimum of 2 hours.
 - .1 0 kPa to 105 kPa (0 psi to 15 psi) low pressure piping – 690 kPa (100 psi);
 - .2 110 kPa to 690 kPa (16 psi to 100 psi) medium pressure piping – 1035 kPa (150 psi);
 - .3 greater than 690 kPa (100 psi) high pressure piping – 1380 kPa (200 psi).
- .8 Natural Gas Piping
 - .1 Test piping in accordance with requirements of CAN/CSA B149.1 and any additional requirements of local governing authorities.
 - .2 After completion of the verification test, locate required tag stating results of the verification test at the point of entry of gas main into building, affixed to the pipe in a secure manner.
 - .3 Check piping joints and connections for leaks with a water/soap solution while piping is under pressure.
- .9 Following requirements apply to all testing:
 - .1 ensure piping has been properly flushed, cleaned and is clear of foreign matter prior to pressure testing;
 - .2 temporarily remove or valve off piping system specialties or equipment which may be damaged by test pressures prior to pressure testing systems, and flush piping to remove foreign matter;

- .3 when testing is carried out below highest level of the particular system, increase test pressure by the hydrostatic head of 7 kPa (1 psi) for every 600 mm (24") below the high point;
- .4 include for temporary piping connections required to properly complete tests;
- .5 piping under test pressure is to have zero pressure drop for length of test period;
- .6 make tight leaks found during tests while piping is under pressure, and if this is impossible, remove and refit piping and reapply test until satisfactory results are obtained;
- .7 where leaks occur in threaded joints in steel piping, no caulking of these joints will be allowed under any conditions;
- .8 tests are to be done in reasonably sized sections so as to minimize number of tests required;
- .9 in addition to leakage tests specified above, demonstrate proper flow throughout systems including mains, connections and equipment, as well as proper venting and drainage, and include for any necessary system adjustments to achieve proper conditions.

3.19 ELECTRICAL WIRING WORK FOR MECHANICAL WORK

- .1 Unless otherwise specified or indicated, following electrical wiring work for mechanical equipment will be done as part of the electrical work:
 - .1 "line" side power wiring to motor starters or disconnect switches in motor control centres and starters or disconnects on motor starter panels, and "load" side wiring from starters or disconnects to equipment;
 - .2 "line" side power wiring to individual wall mounted starters, and "load" side wiring from starters to equipment;
 - .3 "line" side power wiring to pre-wired power and control panels and variable frequency drives (VFD), and "load" side power wiring from the panels and VFD's to equipment;
 - .4 provision of receptacles for plug-in equipment;
 - .5 provision of disconnect switches for motors in excess of 10 m (30') from starter location, or cannot be seen from starter location, and associated power wiring;
 - .6 motor starter interlocking in excess of 24 volts;
 - .7 wiring from motor winding thermistors in motors 30 HP and larger to motor starter contacts;
 - .8 120 volt power connections to electrical receptacles integral with small ceiling exhaust fans, including wiring through light switches or speed controllers;
 - .9 120 volt wiring connections to lighting fixture/switch combinations integral with air handling units;
 - .10 120 volt wiring connections to duplex receptacles integral with air handling unit control panels.
- .2 Mechanical wiring work not listed above or specified herein or on drawings to be done as part of electrical work is to be installed in conduit and is to be done as part of mechanical work in accordance with wiring requirements specified for electrical work.

3.20 MECHANICAL PLANT PERFORMANCE AND ACCEPTANCE TESTS

- .1 After individual pieces of equipment have been tested and accepted, but prior to operating tests specified hereinafter, forward to the Consultant a letter stating that the entire mechanical plant is complete in all respects, has been checked and tested, and is ready for start-up. When the letter has been received, the Consultant will visit the site for purpose of witnessing a performance and acceptance test of the entire plant.
- .2 Include for all required labour for the performance test and any adjustments required due to the results of the test, and ensure that competent and qualified equipment manufacturer's representatives are present during the test.

- .3 When the entire mechanical plant is ready for acceptance, but before acceptance of same, subject the entire plant to a continuous run for the length of time required for the purpose of demonstrating that all apparatus, materials, and systems are in perfect working order, that all controls and operating services are properly adjusted, that all units are heating and/or cooling properly, and that the systems provide uniform temperatures inside the building regardless of outside temperatures or conditions. Make the tests under the direction of the Consultant, and if the plant is not in proper operating condition, the Owner reserves the right, if all defects are not properly rectified, to employ other parties to make the necessary alterations and put the systems in proper working order, at your expense.
- .4 Note that the testing specified above must be complete prior to issue of a Certificate of Substantial Performance.

3.21 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS

- .1 Coordinate shut-down and interruption to existing mechanical systems with School. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning. Include for costs of premium time to perform work during nights, weekends or other times outside of normal working hours, which may be necessary to comply with stipulations specified herein this Article. Services for operation of existing non-renovated areas of building are to be maintained.
- .2 Upon award of a Contract, submit a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform Owner and Consultant in writing 5 working days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent. Shutdowns of some essential services may require additional advance notification time.
- .4 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down, ensure materials and labour required to complete the work for which shut-down is required are available at site.
- .5 Pipe freezing may be used to connect new piping to existing piping without draining existing piping. Pipe freeze equipment is to be equal to "NORDIC FREEZE" equipment supplied by Mag Tool Inc. (1-800-661-9983) or Rigid Tool Co. RIGID "SuperFreeze".

3.22 EQUIPMENT BASES AND SUPPORTS

- .1 Unless otherwise specified or required, set floor mounted equipment on minimum 100 mm (4") high reinforced concrete housekeeping pads 200 mm (8") clear of equipment on each side and end, or a minimum of 200 mm (8") from centreline of equipment anchor bolts to edge of the base, whichever is larger. Conform to following requirements:
 - .1 supply dimensioned drawings and equipment base templates, and provide anchor bolts for proper setting and securing of equipment on pads;
 - .2 place anchor bolts during concrete pour and be responsible for required levelling, alignment, and grouting of equipment;
 - .3 as a minimum, use wire mesh reinforcement, however, for pads for large heavy equipment, use reinforcement as per structural drawing details.
- .2 For equipment not designed for base mounting, where required, provide welded, cleaned and prime coat painted structural steel stands or supports conforming to following requirements:
 - .1 provide stands and supports, except those for small equipment, designed by a structural engineer registered in jurisdiction of the work, and submit stamped and signed design drawings with calculations as shop drawings for review;

- .2 flange bolt steel stands to concrete housekeeping pads;
 - .3 seismically restrained stands and supports in accordance with applicable requirements.
- .3 Provide welded, cleaned and prime coat painted structural steel platforms, designed by a structural engineer registered in the jurisdiction of the work, for service access to equipment. Submit stamped and signed design drawings with calculations as shop drawings for review. Conform to following requirements:
- .1 platforms in accordance with OHSA requirements and adequately sized, braced, anchored, and, as required, seismically restrained;
 - .2 flooring equal to Fisher & Ludlow "Tru-Weld" Type 19-4, Borden type W/B (19-W-4), welded steel bar type grating;
 - .3 support legs constructed of welded Schedule 40 black steel pipe with welded steel cross-bracing, securely anchored and sway braced;
 - .4 safety guard rails, constructed from minimum 32 mm (1-1/4") dia. Schedule 40 black steel pipe, for all platforms and complete with vertical stanchions at maximum 1.2 m (48") centres, top and intermediate horizontal railing, and toe plates at floor;
 - .5 vertical ladders constructed of Schedule 40 black steel pipe, 25 mm (1") dia. for equal height rungs, 40 mm (1-1/2") for stringers, anchored to floors and walls and sway braced as required;
 - .6 ships ladders, used wherever space conditions permit, of welded steel construction, climbing at an approximate 60° angle, and complete with channel iron stringers, open grate equal height risers approximately 165 mm (6-1/2") wide and factory made by grating manufacturer, handrails, and suitable anchoring and support.

3.23 CUTTING, PATCHING AND CORE DRILLING

- .1 Unless otherwise provided by General Trades, perform cutting, patching, and core drilling of existing building required for installation of mechanical work. Perform cutting in a neat and true fashion, with proper tools and equipment to Consultant's approval. Patching is to exactly match existing finishes and be performed by tradesmen skilled in particular trade or application. Work is subject to review and acceptance by Consultant.
- .2 Criteria for cutting holes for additional services:
 - .1 cut holes through slabs only; no holes to be cut through beams;
 - .2 cut holes 150 mm (6") diameter or smaller only; obtain approval from Structural Consultant for larger holes;
 - .3 keep at least 100 mm (4") clear from beam faces;
 - .4 space at least 3 hole diameters on centre;
 - .5 for holes that are required closer than 25% of slab span from supporting beam face, use cover meter above slab to clear slab top bars;
 - .6 for holes that are required within 50% of slab span, use cover meter underside of slab to clear slab bottom bars;
 - .7 submit sleeving drawings indicating holes and their locations for Structural Consultant's review.
- .3 Do not cut or drill any existing work without approval from Owner and Consultant. Be responsible for damage done to building and services caused by cutting or drilling.
- .4 Where pipes pass through existing construction, core drill an opening. Size openings to leave 12 mm (1/2") clearance around pipes or pipe insulation.
- .5 Prior to drilling or cutting an opening, determine, in consultation with Consultant and Owner, and by use of non-destructive radar scan (magnetic scan) of slab or wall, presence of any existing services and reinforcement bars concealed behind building surface to be cut and locate openings to suit. Coring is not permitted through concrete beams or girders.

- .6 Where drilling is required in waterproof slabs, size opening to permit snug and tight installation of a pipe sleeve sized to leave 12 mm (½") clearance around pipe or pipe insulation. Provide a pipe sleeve, constructed of Schedule 40 galvanized steel pipe with a flange at one end and of a length to extend 100 mm (4") above slab, in opening. Secure flange to the underside of slab and caulk void between sleeve and slab opening with proper non-hardening silicone base caulking compound to produce a water-tight installation.
- .7 Firestop and seal openings in fire rated construction in accordance with requirements of article entitled Firestopping and Smoke Seal Materials in this Section. Do not leave openings open overnight unless approved by Owner and Consultant.

3.24 PACKING AND SEALING CORE DRILLED PIPE OPENINGS

- .1 Pack and seal the void between the pipe opening and the pipe or pipe insulation for the length of the opening as follows:
 - .1 pack openings in non-fire rated interior construction with mineral wool and seal both ends of the opening with non-hardening silicone base caulking compound to produce a water-tight seal;
 - .2 pack and seal openings in fire rated walls and slabs as specified in Section entitled Firestopping and Smoke Seal Systems;
 - .3 pack openings in exterior wall above grade with mineral wool and seal both ends of sleeves water-tight with non-hardening silicone base caulking compound unless mechanical type seals have been specified;
 - .4 seal exterior walls below grade (and any other wall where water leakage may be a problem) with link type mechanical seals as specified below.

3.25 FLASHING FOR MECHANICAL WORK PENETRATING ROOF

- .1 Perform required flashing work, including counter-flashing, for mechanical work penetrating and/or set in roof.
- .2 Perform flashing work in accordance with requirements of drawing details, and requirements specified in Division 07.

3.26 CLEANING MECHANICAL WORK

- .1 Refer to cleaning requirements specified in Division 01.
- .2 Clean mechanical work prior to application for Substantial Performance of the Work.
- .3 Include for vacuum cleaning interior of air handling units and ductwork systems.

3.27 CONNECTIONS TO OTHER EQUIPMENT

- .1 Carefully examine Contract Documents during bidding period and include for mechanical work piping and/or ductwork connections to equipment requiring such connections.

3.28 INSTALLATION OF FLEXIBLE CONNECTORS

- .1 Provide flexible connectors in piping connections to seismically restrained equipment, and wherever else shown.
- .2 Provide flexible connectors in piping connections to vibration isolated equipment.

3.29 FAN NOISE LEVELS

- .1 Submit sound power levels with fan shop drawings/product data, with levels measured to AMCA 300 and calculated to AMCA 301.

3.30 EQUIPMENT AND SYSTEM MANUFACTURER'S CERTIFICATION

- .1 When equipment/system installation is complete, but prior to start-up procedures, arrange and pay for equipment/system manufacturer's authorized representative to visit site to examine installation, and after any required corrective measures have been made, to certify in writing to Consultant that equipment/system installation is complete and in accordance with equipment/system manufacturer's instructions.

3.31 EQUIPMENT AND SYSTEM START-UP

- .1 When installation of equipment/systems is complete but prior to commissioning, perform start-up for equipment/systems as specified in mechanical work Sections in accordance with following requirements:
 - .1 submit a copy of each equipment/system manufacturer's start-up report sheet to Consultant for review, and incorporate any comments made by Consultant;
 - .2 under direct on-site supervision and involvement of equipment/system manufacturer's representative, start-up equipment/systems, make any required adjustments, document procedures, leave equipment/systems in proper operating condition, and submit to Consultant complete set of start-up documentation sheets signed by manufacturer/supplier and Contractor.

END OF SECTION

1. GENERAL

1.1 APPLICATION

- .1 This Section specifies vibration isolation product requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.2 SUBMITTALS

- .1 Submit copies of manufacturer's product data sheets for products specified in this Section. Product data sheets are to include product characteristics, limitations, dimensions, finishes, and installation recommendations.
- .2 Submit a letter from vibration isolation manufacturer to certify correct installation of products, as specified in Part 3 of this Section.

2. PRODUCTS

2.1 GENERAL

- .1 Vibration isolation products are to be in accordance with drawing schedule and details, and as specified below.
- .2 Springs are to be stable, colour coded, selected to operate at no greater than $\frac{2}{3}$ solid load, designed in accordance with Society of Automotive Engineers Handbook Supplement 9 entitled Manual on Design and Application of Helical and Spiral Springs, and with spring diameters in accordance with manufacturer's recommendations to suit static deflection and maximum equipment load.
- .3 Steel components of isolation products not exposed to the weather or moisture are to be zinc plated. Steel components of isolation products exposed to the weather or in a damp, moist environment are to be factory painted with rust inhibiting primer and 2 coats of neoprene.
- .4 Where weight of isolated equipment may change significantly due to draining or filling with a liquid, vibration isolators are to be equipped with limit stops to limit spring extensions.
- .5 Flexible piping connections to vibration isolated equipment are specified in the appropriate piping sections of the Specification.

2.2 ISOLATION PADS

- .1 Sandwich type pads, 20 mm ($\frac{3}{4}$ ") nominal thickness, selected for 3.2 mm ($\frac{1}{8}$ ") static deflection unless otherwise specified, consisting of 2 waffle type or ribbed 50 durometer neoprene pads permanently bonded to a minimum #10 gauge steel plate, and complete with rubber bushed bolt holes and equipment anchor bolts with neoprene isolation grommets.
- .2 Acceptable products are:
 - .1 Vibro-Acoustics Ltd. Type NSN;
 - .2 The VMC Group Vibration Mounting & Controls Inc. (Korfund-Dynamics) "SHEAR-FLEX PLATES";
 - .3 Kinetics Noise Control Vibron Products Group Type NGS/NGD;

.4 Mason Industries Inc. Type SW/S/SW with HG Bolt Insertion Washers;

.5 J. P. America Inc. Type JSJ.

2.3 RUBBER FLOOR ISOLATORS

.1 Captive, bridge bearing quality neoprene mount selected for a minimum 4 mm (0.15") static deflection unless otherwise specified, with an integral ductile iron housing and integral equipment anchor bolt.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type R;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type RSM;

.3 Kinetics Noise Control Vibron Products Group Type RQ;

.4 Mason Industries Inc. Type BR;

.5 J. P. America Inc. Type TRM.

2.4 SPRING FLOOR ISOLATORS

.1 Seismically rated captive spring mount isolator complete with levelling bolts, upper and lower neoprene spring cups, neoprene cushion, ductile iron housing, neoprene sound pads, and neoprene isolation grommets for securing bolts.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type SFS;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type AMSR;

.3 Kinetics Noise Control Vibron Products Group Type FLSS;

.4 Mason Industries Inc. Type SSLFH;

.5 J. P. America Inc. Type TSO-C-SC.

2.5 OPEN SPRING MOUNTS

.1 Base mount free-standing assemblies, each complete with a stable colour coded steel spring welded in place, drilled mild steel mounting plate bonded to a ribbed rubber or neoprene acoustical pad, and an external 16 mm (5/8") diameter level adjustment bolt.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type FS;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Type A;

.3 Kinetics Noise Control Vibron Products Group Type FDS;

.4 Mason Industries Inc. Type SLFH;

- .5 J. P. America Inc. Type TSO.

2.6 CLOSED SPRING MOUNTS

- .1 Base mount free-standing enclosed assemblies, each complete with stable colour coded spring(s), 2 piece cast housing, non-binding rubber horizontal stabilizers, a ribbed rubber or neoprene acoustical pad bonded to base of the closed housing, and an external level adjustment bolt.
- .2 Acceptable products are:
 - .1 Vibro-Acoustics Ltd. Type CM;
 - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Types B and C;
 - .3 Kinetics Noise Control Vibron Products Group Type FLS;
 - .4 Mason Industries Inc. Type C;
 - .5 J. P. America Inc. Type TSC.

2.7 TOTALLY RETAINED SPRING MOUNTS

- .1 Base mount free-standing enclosed and retained assemblies to limit both vertical and lateral movement of mounted equipment, each complete with stable colour coded spring(s), drilled welded steel housing and top plate, ribbed rubber or neoprene acoustical pad bonded to bottom of housing, vertical limit adjusting hardware, and a level adjustment bolt.
- .2 Acceptable products are:
 - .1 Vibro-Acoustics Ltd. Type CSR;
 - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Type MS;
 - .3 Kinetics Noise Control Vibron Products Group Type SM;
 - .4 Mason Industries Inc. Type SLRSO;
 - .5 J. P. America Inc. Type TSR.

2.8 SPRING HANGERS

- .1 Welded steel plate housing with top and bottom rod mounting holes and spring retainer, neoprene double deflection isolation element, stable colour coded spring, and heavy-duty rubber washers.
- .2 Acceptable products are:
 - .1 Vibro-Acoustics Ltd. Type SHR-SN;
 - .2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) "Spring-Flex" Series HRSA;
 - .3 Kinetics Noise Control Vibron Products Group. Type SRH;

.4 Mason Industries Inc. Type 30N;

.5 J. P. America Inc. Type TSH.

2.9 NEOPRENE HANGER ISOLATORS

.1 Neoprene double deflection rod isolators with steel housing and hanger rod bushing, selected for a minimum 4 mm (0.15") static deflection unless otherwise specified.

.2 Acceptable products are:

.1 Vibro-Acoustics Ltd. Type NH;

.2 The VMC Group Vibration Mounting & Controls (Korfund-Dynamics) Type HR;

.3 Kinetics Noise Control Vibron Products Group Type RH;

.4 Mason Industries Inc. Type HD or WHD;

.5 J. P. America Inc. Type TRH.

3 . EXECUTION

3.1 INSTALLATION OF VIBRATION ISOLATION MATERIALS

.1 Provide vibration isolation products for mechanical work in accordance with drawing schedule and details, and requirements specified herein and/or on drawings.

.2 Supply to vibration isolation product manufacturer or supplier a copy of a "reviewed" shop drawing or product data sheet for each piece of equipment to be isolated and dimensioned pipe layouts of associated piping to be isolated.

.3 Unless otherwise specified, vibration isolation products are to be product of one manufacturer.

.4 Ensure vibration isolation manufacturer coordinates material selections with equipment provided in order to ensure adherence to performance criteria. Allow for expansion and contraction when material is selected and installed.

.5 Unless otherwise indicated, install isolation materials for base mounted equipment on concrete housekeeping pad bases which extend at least over the full base and isolated area of the isolated equipment. Additional requirements are as follows:

.1 block and shim bases level so ductwork and piping connections can be made to a rigid system at proper operating level, before isolated adjustment is made, and ensure there is no physical contact between isolated equipment and building structure;

.2 steel bases are to clear the sub-base by 25 mm (1");

.6 Isolate piping larger than 25 mm (1") dia. directly connected to motorized and/or vibration isolated equipment with 25 mm (1") static deflection spring hangers at spacing intervals in accordance with following:

.1 for pipe less than or equal to 100 mm (4") dia. – first 3 points of support;

.2 for pipe 125 mm (5") to 200 mm (8") dia. – first 4 points of support;

- .3 for pipe equal to or greater than 250 mm (10") dia. – first 6 points of support;
- .7 First point of isolated piping support is to have a static deflection of twice the deflection of the isolated equipment but maximum 50 mm (2").
- .8 Secure top of spring hanger frame rigidly to structure, and do not install spring hangers in concealed locations.
- .9 Where it is impossible to use at least 2 spring hangers, provide Senior Flexonics Ltd. Style 102 (or 102-U as required) or equal, twin sphere, moulded rubber flexible connection assemblies, selected by manufacturer and suitable in all respects for intended application, and complete with required nipples and connections to provide proper vibration isolation.
- .10 Isolate designated piping risers at floor support points in accordance with drawing detail.
- .11 For control wiring connections to vibration isolated equipment ensure flexible metallic conduit with 90° bend is used for conduit 25 mm (1") dia. and smaller, and for conduit larger than 25 mm (1") dia., use Crouse Hinds EC couplings. Connections are to be long enough so that conduit will remain intact if equipment moves 300 mm (12") laterally from its installed position, and flexible enough to transmit less vibration to structure than is transmitted through vibration isolation. Coordinate these requirements with mechanical trades involved. If electrical power connections are not made in a similar manner as part of the electrical work, report this fact to Consultant.
- .12 Arrange and pay for vibration isolation product manufacturer to visit site to inspect installation of his equipment. Perform revision work required as a result of improper installation. When vibration isolation equipment manufacturer is satisfied with the installation, obtain and submit a letter stating manufacturer has inspected the installation and equipment is properly installed.

END OF SECTION

1. GENERAL

1.1 APPLICATION

- .1 This Section specifies insulation requirements common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly.

1.2 DEFINITIONS

- .1 "concealed" – means mechanical services and equipment above suspended ceilings, in non-accessible chases, in accessible pipe spaces, and furred-in spaces.
- .2 "exposed" – means exposed to normal view during normal conditions and operations.
- .3 "mineral fibre" – includes glass fibre, rock wool, and slag wool.
- .4 "domestic water" or "potable water" – means piping extended from building Municipal supply main.

1.3 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 The following work which is related to the mechanical insulation work is specified in other Sections of the Specification:
- .1 plumbing and drainage piping and equipment;
- .2 hydronic piping and/or equipment;

1.4 SUBMITTALS

- .1 Submit a product data sheet for each insulation system product.

1.5 SAMPLES

- .1 Submit to the Consultant for review, a sample of each type of insulation, in applied form. Mount the samples on a rigid plywood board. Identify each sample with the manufacturer's name and insulation type, and the proposed use of the insulation. The sample board shall be provided in shop drawing form. Accompanying the sample board shall be complete, up to date literature from the manufacturer for each product. It shall be understood that any and all insulation supplied and/or installed on the project shall be in accordance with the reviewed sample board.

1.6 QUALITY ASSURANCE

- .1 Mechanical insulation is to be applied by a licensed journeyman insulation mechanic, or by an apprentice under direct, daily, on-site supervision of a journeyman mechanic.
- .2 Do not apply insulation unless leakage tests have been satisfactorily completed.
- .3 Ensure surfaces to be insulated are clean and dry.
- .4 Ensure ambient temperature is minimum 13°C (55°F) for at least 1 day prior to application of insulation, and for duration of insulation work, and relative humidity is and will be at a level such that mildew will not form on insulation materials.
- .5 Company with sub-contract for mechanical insulation work is to be a member in good standing of Thermal Insulation Association of Canada.
- .6 Insulation materials must be stored on site in a proper and dry storage area. Any wet insulation material is to be removed from site.

1.7 VAPOUR BARRIER JACKET

- .1 Insulation specified with a vapour jacket, shall be supplied with the vapour barrier jacket factory installed. Installation of a vapour barrier jacket outside of the insulation manufacturer's factory is not acceptable and will be considered deficient work. Contractor and manufacturer shall certify in writing that vapour barrier jacketed insulation supplied and installed on the work is in accordance with this stipulation.

2. PRODUCTS

2.1 FIRE HAZARD RATINGS

- .1 All insulation system materials must meet requirements of NFPA 90A and insulation system materials inside building must have a fire hazard rating of not more than 25 for flame spread and 50 for smoke developed when tested in accordance with ULC S102, Surface Burning Characteristics of Building Materials and Assemblies.

2.2 THERMAL PERFORMANCE

- .1 Unless otherwise specified, thermal performance of insulation is to meet or exceed values given in Tables entitled Minimum Piping Insulation Thickness Heating and Hot Water Systems and Minimum Piping Insulation Thickness Cooling Systems, as stated in ANSI/ASHRAE/IES Standard 90.1 version referenced in Ontario Building Code.

2.3 PIPE INSULATION MATERIALS

- .1 Horizontal pipe insulation at hangers and supports are to be equal to Belform Insulation Ltd. "Koolphen K-Block" insulated pipe support inserts consisting of minimum 150 mm (6") long, pre-moulded, rigid, sectional phenolic foam insulation (of same thickness as adjoining insulation) with a reinforced foil and kraft paper vapour barrier jacket and a captive galvanized steel saddle.
- .2 Fire rated pre-moulded mineral wool is to be non-combustible, fire-rated, rigid, sectional, longitudinally split mineral wool or basalt pipe insulation with a reinforced vapour barrier jacket and compatible with ULC S115 and ULC-S101 firestopping. Acceptable products are:
 - .1 Roxul "Techton 1200";
 - .2 IIG (Johns Manville Inc.) MinWool-1200;
 - .3 Paroc 1200.
- .3 Pre-moulded mineral fibre is to be rigid, sectional, sleeve type insulation to ASTM C547, with a factory applied vapour barrier jacket. Acceptable products are:
 - .1 Johns Manville Inc. "Micro-Lok AP-T Plus";
 - .2 Knauf Fiber Glass "Pipe Insulation" with "ASJ-SSL" jacket;
 - .3 Manson Insulation Inc. "ALLEY K APT";
 - .4 Owens Corning "Fiberglas" Pipe Insulation.
- .4 Blanket mineral fibre is to be blanket type roll insulation to CGSB 51-GP-11M, 24 kg/m³ (1-½ lb/ft³) density, with a factory applied vapour barrier facing. Acceptable products are:
 - .1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;
 - .2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;
 - .3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;
 - .4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.

2.4 REMOVABLE/REUSABLE INSULATION COVERS

- .1 Valve, etc. covers are to be NO SWEAT reusable insulation wraps with vapour barrier jacket and self-sealing ends and longitudinal seam, with a length to suit the application and an insulation thickness equal to adjoining insulation.

2.5 DUCTWORK SYSTEM INSULATION MATERIALS

- .1 Blanket mineral fibre is to be blanket type roll form insulation to ASTM C553, 24 kg/m³ (1½ lb/ft³) density, 40 mm (1-½") thick, with a factory applied vapour barrier facing. Acceptable products are:
 - .1 Johns Manville Inc. Microlite FSK Duct Wrap Type 150;
 - .2 Knauf Fiber Glass Blanket Insulation FSK Duct Wrap Type III;
 - .3 Manson Insulation Inc. ALLEY WRAP FSK Duct Wrap Type III;
 - .4 Certainteed Corporation Softtouch FSK Duct Wrap Type 150.
- .2 Flexible foam elastomeric sheet is to be sheet form, CFC free, closed cell, self-adhering elastomeric nitrile rubber insulation with a water vapour permeability rating of 0.08 in accordance with ASTM E96 Procedure A. Acceptable products are:
 - .1 Armacell "AP/Armaflex SA";
 - .2 IK Insulation Group "K-Flex Duct Wrap", S2S.
- .3 Pre-moulded calcium silicate is to be rigid block and sheet insulation. Acceptable products are:
 - .1 Johns Manville Inc. "Thermo-12 Gold";
 - .2 Industrial Insulation Group "Thermo-12 Gold".
- .4 Flexible foam elastomeric sheet is to be sheet form, CFC free, closed cell, self-adhering elastomeric nitrile rubber insulation with a water vapour permeability rating of 0.08 in accordance with ASTM E96 Procedure A. Acceptable products are:
 - .1 Armacell "AP/Armaflex SA";
 - .2 IK Insulation Group "K-Flex Duct Wrap", S2S.

2.6 FIRE RATED DUCT WRAP

- .1 Flexible, non-combustible, blanket type mineral fibre duct wrap completely encapsulated in reinforced foil, suitable for installation with zero clearance to combustibles (for grease ducts), and ULC tested and listed (ULC Designs FRD-17 & 23 for ventilation ducts, ULC Design FRD-19 for kitchen exhaust/grease duct) to facilitate a 2 hour fire resistance rating (76 mm [3"] thick) to kitchen grease exhaust duct in accordance with requirements of NFPA-96, and/or a 1 or 2 hour fire resistance rating (38 mm [1-½"] thick) to ventilation or pressurization ductwork in accordance with requirements of ISO 6944.
- .2 Acceptable manufacturers are:
 - .1 3M Fire Barrier Duct Wrap 615;
 - .2 CL4 Inc. "CL4Fire";
 - .3 Unifrax Corp. "FyreWrap Elite 1.5";
 - .4 Morgan Thermal Ceramics "FireMaster FastWrap XL".
 - .5

2.7 INSULATING COATINGS

- .1 Equal to Robson Thermal Manufacturing Ltd. insulating coatings as follows:
 - .1 anti-condensation coating, "No Sweat-FX";
 - .2 thermal insulating coating, "ThermaLite".

2.8 INSULATION FASTENINGS

- .1 Wire – minimum #15 gauge galvanized annealed wire.

- .2 Aluminium Banding – equal to ITW Insulation Systems Canada "FABSTRAPS" minimum 12 mm (½") wide, 0.6 mm (1/16") thick aluminium strapping.
- .3 Duct Insulation Fasteners – weld-on 2 mm (3/32") diameter zinc coated steel spindles of suitable length, complete with minimum 40 mm (1-½") square plastic or zinc plated steel self-locking washers.
- .4 Tape Sealant – equal to MACtac Canada Ltd. self-adhesive insulation tapes, types PAF, FSK, ASJ, or SWV as required to match surface being sealed.
- .5 Mineral Fibre Insulation Adhesive – clear, pressure sensitive, brush consistency adhesive, suitable for a temperature range of -20°C to 82°C (-4°F to 180°F), compatible with type of material to be secured, and WHMIS classified as non-hazardous.
- .6 Flexible Elastomeric Insulation Adhesive – Armacell "Armaflex" #520 air-drying contact adhesive.
- .7 Closed Cell Foamed Glass Insulation Adhesive – Pittsburgh Corning PC88 multi-purpose 2-component adhesive.
- .8 Lagging Adhesive – white, brush consistency, ULC listed and labelled, 25/50 fire/smoke rated lagging adhesive for canvas jacket fabric, suitable for colour tinting, complete with fungicide and washable when dry.
- .9 Screws – No. 10 stainless steel sheet metal screws.

2.9 INSULATION JACKETS AND FINISHES

- .1 Canvas Jacket Material – ULC listed and labelled, 25/50 fire/smoke rated, roll form, minimum 170 g (6 oz.).
- .2 Roll Form Sheet and Fitting Covers – minimum 15 mm (1/2") thick white PVC, 25/50 fire/smoke rated tested in accordance with ULC S102, complete with installation and sealing accessories. Acceptable products are:
 - .1 Proto Corp. "LoSMOKE";
 - .2 The Sure-Fit System "SMOKE-LESS 25/50";
 - .3 Johns Manville Inc. "Zeston" 300.
- .3 Rigid Aluminium Jacket – equal to ITW Insulation Systems Canada "Lock-on" 0.406 mm (0.016") thick embossed aluminum jacket material to ASTM B209, factory cut to size and complete with polysurlyn moisture barrier and continuous modified Pittsburgh Z-Lock, butt straps with "Fabstraps" to weatherproof the end to end joints, and 2-piece epoxy coated pressed aluminum fittings with weather locking edges.

3. EXECUTION

3.1 GENERAL INSULATION APPLICATION REQUIREMENTS

- .1 Unless otherwise noted, do not insulate the following:
 - .1 factory insulated equipment and piping;
 - .2 branch domestic water piping located under counters to serve counter mounted plumbing fixtures and fittings;
 - .3 exposed chrome plated domestic water angle supplies from concealed piping to plumbing fixtures and fittings;
 - .4 manufactured expansion joints and flexible connections;
 - .5 acoustically lined ductwork and/or equipment;
 - .6 factory insulated flexible branch ductwork;
 - .7 piping unions, except for unions in "cold" category piping.

- .2 Install insulation directly over pipes and not over hangers and supports.
- .3 Do not apply insulation until leakage tests have been satisfactorily completed.
- .4 Ensure that all surfaces to be insulated are clean and dry.
- .5 No material including tapes, adhesives, etc. used as part of an insulation assembly shall be rated greater than 25/50 Article 2.1 entitled "FIRE HAZARD RATING OF INSULATION" shall be used within a "plenum" as defined in OBC.
- .6 Install work generally in accordance with TIAC "NATIONAL INSULATION STANDARDS MANUAL" except conform with manufacturer's published instructions and recommendations and the requirements specified herein this Section of the Specification.
- .7 Ensure that the ambient temperature is minimum 55°F (13°C) for at least one (1) day prior to the application of insulation, and for the duration of insulation work.
- .8 Install piping insulation continuous through pipe openings and sleeves.
- .9 Install duct insulation continuous through walls, partitions, and similar surfaces except at fire dampers.
- .10 Provide proper covering shields, sized to suit the insulated pipe, between the pipe hanger or support and the insulation for all piping not supported by roller hangers or supports.
- .11 Where roller hangers and supports are used, steel protection saddles will be supplied and installed as part of the piping work. Pack the saddle voids with fibreglass insulation.
- .12 When insulating "cold" piping and equipment, extend insulation up valve bodies and other such projections as far as possible, and protect the insulation jacketing from the action of condensation at its junction with the metal.
- .13 Insulate, vapour seal, and finish seismic restraints, braces, anchors, hanger rods, and similar hardware directly connected to "cold" piping and/or equipment, for a distance of 300 mm (12") clear of adjacent pipe or equipment finish, to match piping and/or equipment insulation.
- .14 When insulating vertical piping risers 75 mm (3") diameter and larger, use insulation support rings welded directly above lowest pipe fitting, and thereafter at 4.5 m (14.7') centres and at each valve and flange. Insulate as per Thermal Insulation Association of Canada National Insulation Standards, Figure No. 9.
- .15 Where piping and/or equipment is traced with electric heating cable, ensure cable has been tested and accepted prior to application of insulation, and ensure cable is not damaged or displaced during the application of insulation.
- .16 Where mineral fibre rigid sleeve type insulation is terminated at valves, equipment, unions, etc., neatly cover exposed end of insulation with a purpose made PVC cover on "cold" piping, and with canvas jacket material on "hot" piping.
- .17 Carefully and neatly gouge out insulation for proper fit where there is interference between weld bead, mechanical joints, etc., and insulation. Bevel away from studs and nuts to permit their removal without damage to insulation, and closely and neatly trim around extending parts of pipe saddles.
- .18 Where thermometers, gauges, and similar instruments occur in insulated piping, and where access to heat transfer piping balancing valve ports and similar items are required, create a neat, properly sized hole in insulation and provide a suitable grommet in the opening.

- .19 The final appearance and finish of exposed mechanical work depends to a large degree on the quality of the insulation application, therefore, first class workmanship will be insisted upon.
- .20 For all piping system components and for equipment or sections of equipment which require insulation but also access to permit maintenance or adjustment, design and install the insulation to permit easy removal and replacement.
- .21 For items such as "circuit balancing valves" which are supplied with insulating accessories, specified in other Sections of the Specification, incorporate the packing into the pipe insulation, but do not contravene fire hazard ratings of CAN/ULC-S102.

3.2 INSULATION FOR HORIZONTAL PIPE AT HANGERS AND SUPPORTS

- .1 At each hanger and support location for piping 50 mm (2") diameter and larger and scheduled to be insulated, except where roller hangers and/or supports are required, and unless otherwise specified, supply a factory fabricated section of phenolic foam pipe insulation with integral vapour barrier jacket and captive galvanized steel shield. Supply insulation sections to piping installers for installation as pipe is erected.

3.3 PIPE INSULATION REQUIREMENTS - MINERAL FIBRE

- .1 Except where other types of insulation are specified for portions of piping in succeeding articles in this Section, insulate the following pipe with rigid fibreglass pipe insulation of the thickness noted:
 - .1 domestic cold water piping, less than 100 mm (4") dia. – 25 mm (1") thick;
 - .2 domestic cold water piping, greater than or equal to 100 mm (4") dia. – 40 mm (1-½") thick;
 - .3 domestic hot water piping, less than 40 mm (1-½") dia. – 25 mm (1") thick;
 - .4 domestic hot water piping, greater than or equal to 40 mm (1½") dia. – 40 mm (1-½") thick;
 - .5 condensate drainage piping from fan coil unit or any other air conditioning system/unit drain pans to main vertical drain risers or to indirect drainage point – 25 mm (1") thick;
 - .6 piping indicated to be traced with electric heating cable – minimum 50 mm (2") thick;
- .2 Secure overlap flap of the sectional insulation jacket tightly in place. Cover section to section butt joints with tape sealant.
- .3 Insulate fittings with sectional pipe insulation mitred to fit tightly, and cover butt joints with tape sealant, or, alternatively, wrap fittings with blanket mineral fibre insulation to a thickness and insulating value equal to the sectional insulation, secure in place with adhesive and/or wire, and cover with PVC fitting covers.
- .4 Unless otherwise specified, insulate unions, valves, strainers, and similar piping system accessories in "cold" piping with cut and tightly fitted segments of sectional pipe insulation with joints covered with tape sealant, or, alternatively, wrap piping union, valve, strainer, etc., with blanket mineral fibre and cover with PVC covers as for paragraph above.
- .5 Terminate sectional insulation approximately 50 mm (2") from flange or coupling on each side of flange or coupling. Cover flange or coupling with a minimum 50 mm (2") thickness of blanket mineral fibre insulation wide enough to butt tightly to ends of adjacent sectional insulation. Secure blanket insulation in place and cover with a purpose made PVC coupling cover.
- .6 Take special care at concealed water rough-in piping at plumbing fixtures to ensure piping is properly insulated. If necessary due to space limitations, use 12 mm (½") thick sectional pipe insulation in lieu of 25 mm (1") thick insulation.

3.4 PIPE INSULATION REQUIREMENTS – FIRE RATED INSULATION

- .1 Where pipe (inside building and above ground) which is to be insulated as specified above penetrates fire rated construction, provide fire-rated, non-combustible sectional insulation on portion of pipe in fire barrier and for a distance of 50 mm (2") on either side of fire barrier. Insulation thickness is to be as specified, but in any case minimum 25 mm (1").

3.5 DUCTWORK INSULATION REQUIREMENTS – MINERAL FIBRE

- .1 Insulate following ductwork systems inside building and above ground with mineral fibre insulation of thickness indicated:
 - .1 outside air intake ductwork, casings and plenums from fresh air intakes to and including mixing plenums or sections, or, if mixing plenums or sections are not provided, to first heating coil, or if both mixing plenums or sections and heating coil sections are not provided, and fresh air is not tempered, then the fresh air ductwork system complete – minimum 40 mm (1-½") thick as required;
 - .2 mixed supply air or preheated supply air casings, plenums and sections to and including the fan section where not factory insulated – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;
 - .3 supply air ductwork outward from fans, except for supply ductwork exposed in area it serves – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;
 - .4 exhaust discharge ductwork for a distance of 3 m (10') downstream (back) from exhaust openings to atmosphere, including any exhaust plenums within the 3 m (10') distance – minimum 25 mm (1") thick rigid board or minimum 40 mm (1-½") thick flexible blanket as required;
 - .5 any other ductwork, casings, plenums or sections specified or detailed on drawings to be insulated – thickness as specified.
- .2 Provide rigid board type insulation for casings, plenums, and exposed rectangular ductwork. Provide blanket type insulation for round ductwork and concealed rectangular ductwork.
- .3 Liberally apply adhesive to surfaces of exposed rectangular ducts and/or casings. Accurately and neatly press insulation into adhesive with tightly fitted butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom and side surfaces. Secure and seal joints with 75 mm (3") wide tape sealant. Additional installation requirements as follows:
 - .1 at trapeze hanger locations, install insulation between duct and hanger;
 - .2 provide drywall type metal corner beads on edges of ductwork, casings and plenums in equipment rooms, service corridors, and any other area where insulation is subject to accidental damage, and secure in place with tape sealant.
- .4 Liberally apply adhesive to surfaces of concealed rectangular or oval ductwork, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Provide pin and washer insulation fasteners at 300 mm (12") centres on bottom surfaces. Secure and seal joints with 75 mm (3") tape sealant. At each trapeze type duct hanger, provide a 100 mm (4") wide full length piece of rigid mineral fibre board insulation between duct and hanger.
- .5 Accurately cut sections of insulation to fit tightly and completely around exposed and concealed round or oval ductwork. Liberally apply adhesive to surfaces of duct, and wrap insulation around duct with a top butt joint and tight section to section butt joints. Seal joints with tape sealant. At duct hanger locations install insulation between duct and hanger. At each hanger location for concealed ductwork where flexible blanket insulation is used, provide a 100 mm (4") wide full circumference strip of semi-rigid board type duct insulation between duct and hanger.
- .6 Insulation application requirements common to all types of rigid ductwork are as follows:

- .1 at duct connection flanges, insulate flanges with neatly cut strips of rigid insulation material secured with adhesive to side surfaces of flange with a top strip to cover exposed edges of the side strips, then butt the flat surface duct insulation up tight to flange insulation, or, alternatively, increase insulation thickness to depth of flange and cover top of flanges with tape sealant;
- .2 installation of fastener pins and washers is to be concurrent with duct insulation application;
- .3 cut insulation fastener pins almost flush to washer and cover with neatly cut pieces of tape sealant;
- .4 accurately and neatly cut and fit insulation at duct accessories such as damper operators (with standoff mounting) and pitot tube access covers;
- .5 prior to concealment of insulation by either construction finishes or canvas jacket material, patch vapour barrier damage by means of tape sealant.

3.6 DUCTWORK INSULATION REQUIREMENTS – FLEXIBLE ELASTOMERIC

- .1 Insulate exposed exterior ductwork (except fresh air intake ductwork) and associated plenums and/or casings outside building with minimum 40 mm (1-½") thick flexible elastomeric sheet insulation as required, applied in 2 minimum 20 mm (¾") thick layers with staggered tightly butted joints.
- .2 Install with adhesive in strict accordance with manufacturer's instructions to produce a weather-proof installation. Ensure sheet metal work joints are sealed watertight prior to applying insulation.

3.7 DUCTWORK INSULATION REQUIREMENTS – CALCIUM SILICATE

- .1 Insulate following kitchen exhaust ductwork with minimum 40 mm (1-½") thick calcium silicate block insulation:
 - .1 kitchen exhaust ductwork from exhaust hood to masonry shaft – 2 hour rating;
- .2 Secure insulation in place with adhesive and with wire on 450 mm (18") centres. Point gaps and joints with insulating cement. Where ductwork is exposed, cover insulation with wire mesh secured to wire and with edges laced together and apply a coat of finishing cement trowelled smooth. Use drywall type metal corner bead for duct edges where finishing cement is applied.

3.8 DUCT WRAP REQUIREMENTS – FIRE RATED MATERIAL

- .1 Provide blanket type fire rated duct wrap system material for following ductwork to produce fire rating indicated:
 - .1 kitchen exhaust ductwork from exhaust hood to masonry shaft – 2 hour rating;
- .2 Install duct wrap material in accordance with ULC design requirements and supplier's/manufacture's instructions.
- .3 Coordinate installation of duct wrap with installation of ductwork.
- .4 Arrange and pay for duct wrap supplier to examine completed duct wrap system at site. Submit a letter from supplier to certifying duct wrap system has been properly installed.

3.9 APPLICATION OF INSULATING COATINGS

- .1 Apply, in accordance with manufacturer's instruction, insulating coatings to following bare metal surfaces:
 - .1 paint bare metal surfaces clear of "cold" piping and/or equipment insulation for a distance of from 300 mm (12") to 600 mm (24") clear of pipe or equipment insulation, with "No Sweat-FX" anti-condensation coating;
 - .2 paint bare metal surfaces associated with mechanical systems with an operating temperature 60°C (140°F) with "ThermaLite" insulating coating.
- .2 Apply coatings with a brush. Remove any splatter or excess coating from adjacent surfaces.

3.10 INSULATION FINISH REQUIREMENTS

- .1 Unless otherwise shown and/or specified, jacket exposed mineral fibre insulation, and calcium silicate duct insulation work inside building with canvas secured in place with a full covering coat of lagging adhesive. Accurately cut canvas with scissors or a knife. Do not rip or tear canvas to size. Remove lagging adhesive splatter from adjacent uninsulated surfaces.
- .2 Jacket exposed pipe insulation work inside building with white sheet PVC and fitting covers. Install sheet PVC and fitting covers tightly in place with overlapped circumferential and longitudinal joints arranged to shed water. Seal joints to produce a neat water-tight installation. Provide slip-type expansion joints where required by manufacturer's instructions.
- .3 Apply 2 heavy coats of "PITTCOTE 404" coating with 24 hr. between coats to foamed glass insulation exposed above grade.
- .4 Apply 2 coats of Armacell "WB Armaflex" with 24 hr. between coats) to flexible elastomeric insulation outside building.

END OF SECTION

1 GENERAL

1.1 APPLICATION

- .1 This Section specifies requirements, criteria, methods and execution for mechanical demolition work that are common to one or more mechanical work Sections, and it is intended as a supplement to each Section and is to be read accordingly.

2 PRODUCTS

Not Used

3 EXECUTION

3.1 DISCONNECTION AND REMOVAL OF EXISTING MECHANICAL WORK

- .1 Where indicated on drawings, disconnect and remove existing mechanical work, including hangers, supports, insulation, etc. Disconnect at point of supply, remove obsolete connecting services and make system safe. Cut back obsolete piping behind finishes and cap water-tight unless otherwise specified.
- .2 Scope and extent of demolition or revision work is only generally indicated on drawings. Estimate scope, extent and cost of work at site during bidding period site visit(s). Claims for extra costs for demolition work not shown or specified but clearly visible or ascertainable at site during bidding period site visits will not be allowed.
- .3 If any re-design is required due to discrepancies between mechanical drawings and site conditions, notify Consultant who will issue a Site Instruction. If, in the opinion of Consultant, discrepancies between mechanical drawings and actual site conditions are of a minor nature, required modifications are to be done at no additional cost.
- .4 Where existing mechanical services extend through, or are in an area to serve items which are to remain, maintain services in operation. Include for rerouting existing services concealed behind existing finishes and which become exposed during renovation work, so as to be concealed behind new or existing finishes.
- .5 Unless otherwise specified, remove from site and dispose of existing materials which have been removed and are not to be relocated or reused.

3.2 INTERRUPTION TO AND SHUT-DOWN OF MECHANICAL SERVICES AND SYSTEMS

- .1 Co-ordinate shut-down and interruption to existing mechanical systems with school. Generally, shut-downs may be performed only between the hours of 12:00 midnight Friday until 6:00 a.m. Monday morning.
- .2 Upon award of contract, submit a list of anticipated shut-down times and their maximum duration.
- .3 Prior to each shut-down or interruption, inform Owner in writing 5 business days in advance of proposed shut-down or interruption and obtain written consent to proceed. Do not shut-down or interrupt any system or service without such written consent.

- .4 Perform work associated with shut-downs and interruptions as continuous operations to minimize shut-down time and to reinstate systems as soon as possible, and, prior to any shut-down, ensure materials and labour required to complete the work for which shut-down is required are available at site.
- .5 Pipe freezing may be used to connect new piping to existing piping without draining existing piping. Pipe freeze equipment is to be equal to "NORDIC FREEZE" equipment supplied by Mag Tool Inc. or Rigid Tool Co. RIGID "SuperFreeze".

3.3 ROOFING WORK

- .1 Where roof revisions and/or replacements are part of project, include for disconnecting, lifting, or temporarily removing mechanical equipment on roof as required to permit completion of roofing work, and for re-installing equipment when roofing work is complete.

END OF SECTION

1 GENERAL

1.1 APPLICATION

- .1 This Section specifies commissioning requirements that are common to Mechanical Divisions work Sections and it is a supplement to each Section and is to be read accordingly. When requirements of this Section contradict requirements of Divisions 00 or 01, conditions of Divisions 00 or 01 to take precedence.

1.2 COMMISSIONING AGENT INVOLVEMENT VERSUS WARRANTY OBLIGATIONS

- .1 Involvement of Commissioning Agent performing duties as described in this Section is not in any way to void or alter any Contractual warranty obligations.

1.3 SUBMITTALS

- .1 Submit to Commissioning Agent, at same time as submittal to Consultant, one copy of each shop drawing or product data sheet associated with equipment or systems to be commissioned.
- .2 Submit for review, a Commissioning Plan with schedule, commissioning procedures for commissioning events, and a copy of Commissioning Agent's commissioning data sheets for equipment/systems to be commissioned.
- .3 Submit a list of commissioning instruments and for each instrument, indicate purpose of instrument and include a recent calibration certificate.
- .4 Submit equipment and system manufacturer's start-up and test report sheets for review a minimum of 1 month prior to equipment and system start-up procedures.
- .5 After start-up and successful pre-functional performance testing and submittal of completed forms, submit, for each system or subsystem, a letter confirming pre-functional performance testing has been successfully completed and system or subsystem is ready for functional performance testing and commissioning process to commence.

1.4 DEFINITIONS

- .1 Commissioning: process of demonstrating to Owner and Consultant, for purpose of final acceptance, by means of successful and documented functional performance testing, that systems and/or subsystems are capable of being operated and maintained to perform in accordance with requirements of Contract Documents, all as further described below.
- .2 Commissioning Agent: commissioning authority who will supervise commissioning process, and who will recommend final acceptance of commissioned mechanical work.
- .3 Start-Up and Adjusting: process of equipment manufacturer's/supplier's technical personnel, with Contractor, starting and operating equipment and systems, making any required adjustments, documenting process, and submitting manufacturer's/supplier's start-up reports to confirm equipment has been properly installed and is operational as intended.

- .4 Pre-Functional Performance Testing: testing, adjusting and operating of components, equipment, systems and/or subsystems, by Contractor, after start-up but before functional performance testing, to confirm components, equipment, systems and/or subsystems operate in accordance with requirements of Contract Documents, including modes and sequences of control and monitoring, interlocks, and responses to emergency conditions, and including submittal of pre-functional performance testing documentation sheets.
- .5 Functional Performance Testing: a repeat of successful pre-functional performance testing by Contractor, in presence of Commissioning Agent and Consultant with completed Commissioning Agent's commissioning documentation sheets to document, validate and verify equipment, systems and subsystems are complete in all respects, function correctly, and are ready for acceptance.
- .6 Commissioning Documentation Sheets: prepared sheets for pre-functional performance testing and for functional performance testing supplied by Commissioning Agent for each piece of equipment/system to be commissioned, each sheet or set of sheets complete with Project name and number, date of commissioning, equipment/system involved, equipment/system name and model number, equipment tag in accordance with drawings, and, for each commissioning procedure listed, a column giving expected data in accordance with Contract Documents, a column to fill in observed data during commissioning, and space for signatures of Contractor and Commissioning Agent.
- .7 Systems Operating Manual: a manual prepared by Commissioning Agent to present an overview of building mechanical systems and equipment to be used by building maintenance personnel to assist them in daily operation of systems.
- .8 Validate: to confirm by examination and witnessing tests correctness of equipment and system operation.

1.5 COMMISSIONING AGENT

- .1 Retain services of a qualified Commissioning Agent.

1.6 QUALITY ASSURANCE

- .1 Commissioning work is to be in accordance with requirements of following:
 - .1 CSA Z320, Building Commissioning Standard and Check Sheets;
 - .2 CSA Z8001, Commissioning of Health Care Facilities;
 - .3 ASHRAE Guideline 0, The Commissioning Process;
 - .4 ASHRAE Guideline 1.1, The HVAC Commissioning Process;
 - .5 ASHRAE Guideline 1.2, The Commissioning Process for Existing HVAC&R Systems;
 - .6 ASHRAE Guideline 1.5, Commissioning Smoke Control Systems;
 - .7 Owner designated Commissioning Agent.
- .2 Commissioning Agent is to meet following qualifications:
 - .1 be a member of Professional Engineers Association in Province of the work;

- .2 be a member of Building Commissioning Association, and a Certified Commissioning Professional (CCP) as designated by Building Commissioning Association;
- .3 have a minimum of 5 years of successful documented commissioning experience on projects of similar size and complexity as this Project;
- .4 supply a qualified P. Eng. and a Building Commissioning Association Certified Commissioning Professional (CCP) or an ASHRAE Commissioning Project Management Professional (CPMP) on site to supervise commissioning process.

1.7 COMMISSIONING OBJECTIVES

- .1 Objectives of commissioning process:
 - .1 to support quality management by means of monitoring and checking installation;
 - .2 to verify equipment/system performance by means of commissioning of completed installation;
 - .3 to move completed equipment/systems from "static completion" state to "dynamic" operating state so as to transfer a complete and properly operating installation from Contractor to Owner.

1.8 TESTING EQUIPMENT

- .1 Supply instruments and test equipment required to conduct start-up, testing and commissioning procedures.

2 PRODUCTS

Not Used

3 EXECUTION

3.1 COMMISSIONING

- .1 Commission work in accordance with requirements of this Section and as required by Commissioning Agent.
- .2 Prerequisites to successful completion of commissioning:
 - .1 submittal of signed start-up and test reports;
 - .2 completion of system testing, adjusting and balancing (TAB), and acceptance of TAB reports;
 - .3 permanent electrical and control connections of equipment;
 - .4 successful completion and documentation of pre-functional performance testing;
 - .5 submittal of letters to Consultant certifying systems and subsystems have been started, tested, adjusted, successfully pre-functional performance tested, are ready for functional performance testing, and are in accordance with requirements of Contract Documents.

3.2 DEFICIENCIES LISTED DURING COMMISSIONING

- .1 Correct deficiencies listed by Consultant and Commissioning Agent during commissioning process within 15 calendar days of notification unless agreed otherwise with Consultant, and when deficiencies have been corrected, notify Consultant and Commissioning Agent immediately.

3.3 SYSTEMS TO BE COMMISSIONED

- .1 Mechanical systems to be commissioned include, but are not to be limited to, systems described below. Specific commissioning procedures are to be as directed by Commissioning Agent.
- .2 Commissioning of drainage systems includes:
 - .1 commissioning of drainage pumps and controls by means of tests recommended by manufacturer to confirm proper operation and performance;
 - .2 commissioning of equipment such as interceptors and backflow preventers.
- .3 Commissioning of fire protection systems will be considered complete upon preparation and submittal by Contractor of completion certificates required by applicable NFPA Standards, demonstration of proper system operation to local Fire Chief and any other authorities, including Owner's insurance underwriter as required, and coordination and cooperation with fire alarm system commissioning procedures, in particular smoke control systems and other such fan system control sequences.
- .4 Commissioning of water systems (all piping extended from Municipal main) includes:
 - .1 commissioning of pumps and controls;
 - .2 commissioning of water heaters;
 - .3 commissioning of piping specialties such as backflow preventers, mixing valves, and similar components;
 - .4 commissioning of trap seal primer units, including adjustment of water flows and confirmation of water flow at each connected trap;
 - .5 commissioning of plumbing fixtures.
- .5 Commissioning of natural gas system includes pressure regulating equipment. Perform commissioning in accordance with requirements of CAN/CSA B149.1, and any supplemental requirements of governing authorities.
- .6 Commissioning of heating systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".

- .7 Commissioning of cooling systems includes piping, piping specialties, equipment, and control, as well as checking and validating temperature and flow documentation contained in TAB reports. If TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
- .8 Commissioning of air handling systems includes equipment, ductwork, ductwork specialties, controls, interlocks, and checking and validating air capacities and flows in accordance with TAB reports.
- .9 Control work commissioning includes confirmation of proper operation of individual control components, and overall operation of controls in conjunction with operation of connected building systems, including heating season/cooling season testing requirements specified above.
- .10 Commissioning of BAS includes confirmation of proper operation of components, input/output points, hardware and software, and demonstration of system performing required procedures.
- .11 Commissioning of noise and vibration control equipment includes noise and vibration measurements to confirm proper operation of equipment.

3.4 COMMISSIONING PROCESS

- .1 Perform commissioning process in stages and include, but not be limited to, following:
 - .1 Stage 1: Commissioning of equipment/systems as listed in this Section, which is a prerequisite to an application for Substantial Performance of the Work and includes supervising and validating results of functional performance testing, and submittal of reviewed Systems Operating Manual.
 - .2 Stage 2: Commissioning work performed 12 months after issue of a Certificate of Substantial Performance and which includes supervision of Contractor's "fine tuning" of equipment/systems through seasonal occupancy, and any other such work to achieve optimal comfort and performance conditions.
 - .3 Stage 3: Successful completion of satisfactory equipment/system operation during 1st month after issue of a Certificate of Total Performance of the Work.
 - .4 Stage 4: Successful completion of satisfactory equipment/system operation during 3rd month after issue of a Certificate of Total Performance of the Work.
 - .5 Stage 5: Successful seasonal commissioning of building.

3.5 RESPONSIBILITIES OF COMMISSIONING AGENT

- .1 During construction phase, Commissioning Agent is to:
 - .1 review Contractor's shop drawings for commissioning related issues, and report any such issues to Consultant;
 - .2 as soon as possible after project start-up, prepare and issue a Commissioning Plan based on Contractor's construction schedule;

- .3 prior to tests, supply pre-functional performance test commissioning data sheets for equipment and systems to be commissioned to Contractor;
- .4 monitor and inspect installation on a regular basis throughout construction stages, issue reports identifying any issues which may have an impact on commissioning process, and work with project team to expeditiously resolve any problems that may arise due to site conditions;
- .5 arrange with Contractor for on-site commissioning meetings on an as-required basis, to be attended by Contractor and applicable subcontractors, Owner, and Consultant, chair meetings, and prepare and distribute meeting minutes to attendees;
- .6 witness and validate tests, identify deficiencies, and issue progress reports;
- .7 coordinate commissioning scheduling with Contractor;
- .8 review final TAB report on site with Contractor, and check 100% of TAB results for fan equipment, 30% of TAB results for duct systems outward from fan equipment, and issue a report to Consultant;
- .9 for smaller multiple items of equipment such as air terminal boxes, fan coil units, backflow preventers, and similar equipment, review completed commissioning data sheets submitted by Contractor and review data sheet information on-site with Contractor for 30% of quantity of each item of equipment;
- .10 review pre-functional performance test commissioning data sheets submitted by Contractor, then witness and supervise functional performance testing and supervise and direct commissioning process, validate commissioning procedures, witness completion of commissioning data sheets by Contractor, and sign completed data sheets;
- .11 perform a preliminary review of Contractor's O & M Manuals, before they are issued to Consultant, and issue any comments to Consultant;
- .12 coordinate, with Contractor and Owner, training and instructions by Contractor and his equipment and system manufacturers/suppliers to Owner's operating and maintenance personnel, and comment on quality of training and instructions to Consultant;
- .13 prepare and issue Systems Operation Manual to Owner prior to equipment and system training by Contractor.
- .2 During post construction phase, Commissioning Agent is to:
 - .1 prepare and issue final report on commissioning, identifying any deficiencies that remain outstanding;
 - .2 recommend any training and/or instructions to be given to Owner's operating and maintenance personnel in addition to training and instructions already given;
 - .3 after Substantial Performance of the Work, witness system checks and validate documentation by Contractor as follows:
 - .1 once during 1st month of building operation;

- .2 once during 3rd month of building operation;
- .3 once between 4th and 10th month of building operation but during a season opposite to 1st or 3rd month visits.
- .4 ensure any deficient work resulting from system checks described above are corrected;
- .5 3 months after Substantial Performance of the Work, attend a question and answer session(s) with Contractor to answer any questions and concerns related to commissioning work from Owner's operating personnel.

3.6 RESPONSIBILITIES OF CONTRACTOR

- .1 During construction phase, Contractor is to:
 - .1 prepare and submit an installation schedule which includes a time schedule for each activity with lead and lag time allowed and indicated, shop drawing and working detail drawing submissions, and major equipment factory testing and delivery dates;
 - .2 prepare and submit a commissioning schedule which is to include a time schedule coordinated with installation schedule referred to above and Commissioning Agent, and allowances for additional time for re-tests as may be required, and update schedule on a monthly basis as required;
 - .3 when requested by Commissioning Agent, arrange site commissioning meetings with Owner, Consultant, and applicable subcontractors present, to be chaired by Commissioning Agent who will also prepare and distribute meeting minutes;
 - .4 promptly correct reported deficient work, and report when corrective work is complete;
 - .5 where required by Codes and/or Specification, retain equipment manufacturers/suppliers or independent 3rd parties to certify correct installation of equipment/systems;
 - .6 under supervision of equipment manufacturers/suppliers, start-up and adjust equipment to design requirements, and submit start-up sheets which include equipment data such as manufacturer and model number, serial number where applicable, and performance parameters, all signed by equipment manufacturer/supplier and Contractor;
 - .7 complete Commissioning Agent's commissioning data sheets for multiple items of smaller equipment such as air terminal boxes, fan coil units, backflow preventers, etc., submit sheets to Commissioning Agent, accompany Commissioning Agent for an on-site check of 30% of data sheet information for each type of equipment, and perform any corrective action required as a result of site checks;
 - .8 perform system testing, adjusting and balancing and, when complete, issue a copy of final report to Commissioning Agent for review and a site check of results, and perform any corrective work required as a result of site checks by Commissioning Agent;

- .9 in accordance with updated commissioning schedule and actual progress at site, certify in writing to Consultant and Commissioning Agent that equipment and/or systems are complete, have been checked, started and adjusted, successfully pre-functional performance tested and documented, and are ready for functional performance testing and commissioning procedures, giving Consultant and Commissioning Agent a minimum of 5 working days' notice;
 - .10 perform system and subsystem functional performance testing under supervision of Commissioning Agent, and submit to Consultant and Commissioning Agent, completed and signed functional performance testing and commissioning data sheets (issued by Commissioning Agent) and also signed by Commissioning Agent.
- .2 During post construction phase, Contractor is to:
- .1 optimize system operation in accordance with building occupant's needs and comments using System Operation Manual prepared by Commissioning Agent as reference;
 - .2 complete commissioning procedures, activities, and performance verification procedures that were delayed or not concluded during construction phase;
 - .3 accompanied by Commissioning Agent, complete system checks and "fine tuning" with signed documentation as follows:
 - .1 once during 1st month of building operation;
 - .2 once during 3rd month of building operation;
 - .3 once between 4th and 10th months in a season opposite to 1st and 3rd month visits.
 - .4 correct deficiencies revealed by system checks described above, and, where required, involve equipment manufacturers/suppliers during corrective actions, and report completion of corrective work;
 - .5 3 months after Substantial Completion conduct a question and answer session(s) at building with Owner's operating and maintenance personnel, with duration of session(s) dictated by number of questions and concerns that have to be addressed.

END OF SECTION

1. GENERAL

1.1 APPLICATION

- .1 This Section specifies mechanical system testing, adjusting, and balancing requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.2 DEFINITIONS

- .1 "Agency" – means agency to perform testing, adjusting and balancing work.
- .2 "TAB" – means testing, adjusting and balancing to determine and confirm quantitative performance of equipment and systems and to regulate specified fluid flow rate and air patterns at terminal equipment, e.g., reduce fan speed, throttling, etc.
- .3 "hydronic systems" – includes heating water, chilled water, glycol-water solution, condenser water, and any similar system.
- .4 "air systems" – includes outside air, supply air, return air, exhaust air, and relief air systems.
- .5 "flow rate tolerance" – means allowable percentage variation, minus to plus, of actual flow rate values in Contract Documents.
- .6 "report forms" – means test data sheets arranged for collecting test data in logical order for submission and review, and these forms, when reviewed and accepted, should also form permanent record to be used as basis for required future testing, adjusting and balancing.
- .7 "terminal" – means point where controlled fluid enters or leaves the distribution system, and these are supply inlets on water terminals, supply outlets on air terminals, return outlets on water terminals, and exhaust or return inlets on air terminals such as registers, grilles, diffusers, louvers, and hoods.
- .8 "main" – means duct or pipe containing system's major or entire fluid flow.
- .9 "submain" – means duct or pipe containing part of the systems' capacity and serving 2 or more branch mains.
- .10 "branch main" – means duct or pipe servicing 2 or more terminals.
- .11 "branch" – means duct or pipe serving a single terminal.

1.3 QUALITY ASSURANCE

- .1 Employ services of an independent testing, adjusting, and balancing agency meeting qualifications specified below, to be single source of responsibility to test, adjust, and balance building mechanical systems to produce design objectives. Agency is to have successfully completed testing, adjusting and balancing of mechanical systems for a minimum of 5 projects similar to this Project within past 3 years, and is to be certified as an independent agency in required categories by one of following:
 - .1 AABC - Associated Air Balance Council;
 - .2 NEBB - National Environmental Balancing Bureau.
- .2 Testing, adjusting and balancing of complete mechanical systems is to be performed over entire operating range of each system in accordance with 1 of following publications:
 - .1 National Standards for a Total System Balance published by Associated Air Balance Council;

- .2 Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems published by National Environmental Balancing Bureau;
- .3 Chapter 37, Testing, Adjusting, and Balancing of ASHRAE Handbook HVAC Applications.

1.4 SUBMITTALS

- .1 Within 30 days of work commencing at site, submit name and qualifications of proposed testing and balancing agency in accordance with requirements of article entitled Quality Assurance below.
- .2 Submit sample test forms, if other than those standard forms prepared by Associated Air Balance Council (AABC) or National Environmental Balancing Bureau (NEBB), are proposed for use.
- .3 Submit a report by Agency to indicate Agency's evaluation of mechanical drawings with respect to service routing and location or lack of balancing devices. Include set of drawings used and marked-up by Agency to prepare report.
- .4 Submit a report by Agency after each site visit made by Agency during construction phase of this Project.
- .5 Submit a draft report, as specified in Part 3 of this Section.
- .6 Submit a final report, as specified in Part 3 of this Section.
- .7 Submit a testing and balancing warranty as specified in Part 3 of this Section.
- .8 Submit reports listing observations and results of post construction site visits as specified in Part 3 of this Section.

2. PRODUCTS

NOT USED

3. EXECUTION

3.1 SCOPE OF WORK

- .1 Perform total mechanical systems testing, adjusting, and balancing. Requirements include measurement and establishment of fluid quantities of mechanical systems as required to meet design specifications and comfort conditions, and recording and reporting results.
- .2 Mechanical systems to be tested, adjusted and balanced include:
 - .1 TAB of domestic water systems (all piping extended from Municipal main) is to include:
 - .1 domestic hot water recirculation piping;
 - .2 TAB of heating systems is to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during heating season, a follow-up site visit during heating season will be required to confirm proper flows and temperatures, and any required system "fine tuning".
 - .3 TAB of cooling systems is also to include piping and equipment fluid temperatures, flows and control, and if TAB is not done during cooling season, a follow-up site visit during cooling season will be required to confirm proper flows and temperatures, and any required system "fine".

- .4 TAB of air handling systems is to include equipment and ductwork air temperatures, capacities and flows.

3.2 TESTING, ADJUSTING AND BALANCING WORK

- .1 Conform to following requirements:
 - .1 as soon as possible after award of Contract, Agency is to carefully examine a white print set of mechanical drawings with respect to routing of services and location of balancing devices, and is to issue a report listing results of the evaluation;
 - .2 set of drawings examined by Agency is to be returned with evaluation report, with red line mark-ups to indicate locations of readings, and required revision work such as relocation of balancing devices and locations for additional devices;
 - .3 after review of mechanical work drawings and specification, Agency is to visit site at frequent, regular intervals during construction of mechanical systems, to observe routing of services, locations of testing and balancing devices, workmanship, and anything else that will affect testing, adjusting and balancing;
 - .4 after each site visit, Agency is to report results of site visit indicating date and time of visit, and detailed recommendations for any corrective work required to ensure proper adjusting and balancing;
 - .5 testing, adjusting and balancing is not to begin until:
 - .1 building construction work is substantially complete and doors have been installed;
 - .2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then successfully performance tested.
 - .6 mechanical systems to be tested, adjusted and balanced are to be maintained in full, normal operation during each day of testing, adjusting and balancing;
 - .7 obtain copies of reviewed shop drawings of applicable mechanical plant equipment and terminals, and temperature control diagrams and sequences;
 - .8 Agency is to walk each system from system "head end" equipment to terminal units to determine variations of installation from design, and system installation trades will accompany Agency;
 - .9 Agency is to check valves and dampers for correct and locked position, and temperature control systems for completeness of installation before starting equipment;
 - .10 wherever possible, Agency is to lock balancing devices in place at proper setting, and permanently mark settings on devices;
 - .11 for belt-driven equipment, Agency is to report to Commissioning Agent who in turn is to inform Contractor and Consultant of any situation where sheaves have to be replaced to suit testing and balancing, and replacements are to be done by Contractor at no cost;
 - .12 Agency is to leak test ductwork as specified in Section entitled HVAC Air Distribution in accordance with requirements of SMACNA "HVAC Air Duct Leak Test Manual", coordinate work with work of aforementioned Sections, provide detailed sketch(es) to Sheet Metal Contractor and Consultant identifying ductwork not in accordance with acceptable leakage values specified in aforementioned Sections, and retest corrected ductwork;
 - .13 Agency is to balance systems with due regard to objectionable noise which is to be a factor when adjusting fan speeds and performing terminal work such as adjusting air quantities, and should objectionable noise occur at design conditions, Agency is to immediately report problem and submit data, including sound readings, to permit an accurate assessment of noise problem to be made;
 - .14 Agency is to check supply air handling system mixing plenums for stratification, and where variation of mixed air temperature across coils is found to be in excess of $\pm 5\%$ of design requirements, Agency is to report problem and issue a detail sketch of plenum baffle(s) required to eliminate stratification;
 - .15 Agency is to perform testing, adjusting and balancing to within $\pm 5\%$ of design values, and make and record measurements which are within $\pm 2\%$ of actual values;

- .16 for air handling systems equipped with air filters, test and balance systems with simulated 50% loaded (dirty) filters by providing a false pressure drop;
 - .17 test, adjust and balance air conditioning systems during summer season and heating systems during winter season, including at least a period of operation at outside conditions within 2.8°C (5°F) wet bulb temperature of maximum summer design condition, and within 5.5°C (10°C) dry bulb temperature of minimum winter design condition, and take final temperature readings during seasonal operation.
- .2 Prepare reports as indicated below.
- .1 Upon completion of testing, adjusting, and balancing procedures, prepare draft reports on AABC or NEBB forms. Draft reports may be hand written, but must be complete, factual, accurate, and legible. Organize and format draft reports in same manner specified for final reports. Submit 2 complete sets of draft reports. Only 1 complete set of draft reports will be returned.
 - .2 Upon verification and approval of draft reports, prepare final reports, type written, and organized and formatted as specified below. Submit 2 complete sets of final reports. Use units of measurement (SI or Imperial) as used on Project Documents.
 - .3 Report forms are to be those standard forms prepared by the referenced standard for each respective item and system to be tested, adjusted, and balanced. Bind report forms complete with schematic systems diagrams and other data in reinforced, vinyl, 3-ring binders. Provide binding edge labels with project identification and a title descriptive of contents. Divide contents of binder into divisions listed below, separated by divider tabs:
 - .1 General Information and Summary;
 - .2 Air Systems;
 - .3 Hydronic Systems;
 - .4 Temperature Control Systems.
 - .4 Agency is to provide following minimum information, forms and data in report:
 - .1 inside cover sheet to identify Agency, Contractor, and Project, including addresses, and contact names and telephone numbers and a listing of instrumentation used for procedures along with proof of calibration;
 - .2 remainder of report is to contain appropriate forms containing as a minimum, information indicated on standard AABC or NEBB report forms prepared for each respective item and system;
 - .3 Agency is to include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "as-built" diagram indicating and identifying equipment, terminals, and accessories;
 - .4 Agency is to include report sheets indicating building comfort test readings for all rooms.
- .3 After final testing and balancing report has been submitted, Agency is to visit site with Contractor and Consultant to spot check results indicated on balancing report. Agency is to supply labour, ladders, and instruments to complete spot checks. If results of spot checks do not, on a consistent basis, agree with final report, spot check procedures will stop and Agency is to then rebalance systems involved, resubmit final report, and again perform spot checks with Contractor and Consultant.

- .4 When final report has been accepted, Contractor is to submit to Owner, in name of Owner, a certificate equal to AABC National Guaranty Certification or a NEBB Quality Assurance Program Bond, and in addition, Contractor is to submit a written extended warranty from Agency covering one full heating season and one full cooling season, during which time any balancing problems which occur, with exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by Agency and reported on to Owner, and if it is determined that problems are a result of improper testing, adjusting and balancing, they are to be immediately corrected without additional cost to Owner.
- .5 Do not begin testing, adjusting and balancing work until:
 - .1 building construction work is substantially complete;
 - .2 mechanical systems are complete in all respects, and have been checked, started, adjusted, and then performance tested in the presence of and to the satisfaction of the Consultant;
 - .3 the mechanical systems have been prepared for testing and balancing work.
- .6 All mechanical systems to be tested, adjusted and balanced must be maintained in full, normal operation during each day of testing, adjusting and balancing.
- .7 Perform testing, adjusting and balancing to within plus or minus 5% of design values, and make and record measurements using instruments with minimum accuracy of within plus or minus 2% of required values.
- .8 Wherever possible, lock all balancing devices in place at the proper setting, and permanently mark settings on all devices.
- .9 Co-operate and work with the controls contractor in the verification of the operation of all systems.

3.3 TESTING, ADJUSTING AND BALANCING REPORT

- .1 Prepare and submit to the Consultant, when the work is complete, bound, identified copies of a testing and balancing report as specified in the article entitled "SUBMITTALS" in PART 1 of this Section. Prepare the report using standard AABC, NEBB or equal forms to indicate all measurements required by the referenced balancing standard, including, but not limited to, the following:
 - .1 Cooling system c/w location of equipment (e.g. chiller, pumps), measurements at inlet and outlet of equipment;
 - .2 Air handling system c/w location of equipment and measurements at the inlet and outlet of exhaust fan.
- .2 Include for each system to be tested, adjusted and balanced, a neatly drawn, identified (system designation, plant equipment location, and area served) schematic "As-built" diagram indicating all equipment and accessories.
- .3 Prepare report sheets using the units of measurement (SI or Imperial) as used on the project construction documents.

3.4 VERIFICATION OF TESTING, ADJUSTING AND BALANCING REPORT

- .1 When the testing, adjusting and balancing report has been received, the Consultant will schedule a site visit or visits for the purpose of verifying balancing results contained in the report. In addition to spot checking equipment performance, a maximum of 30% of all terminal equipment will be checked.
- .2 The testing and balancing agency shall accompany the Consultant during report verification, and shall supply all required tools and instruments to take measurements. Instruments used shall be the same instruments used in performing the testing and balancing work.

- .3 If, during the verification procedures, testing and balancing results indicated in the report are found to differ substantially with the results of spot checks, the report will be rejected by the Consultant, and testing, adjusting and balancing procedures shall be repeated and a new report issued for review and verification.
- .4 Testing, adjusting and balancing must be complete and accepted by the Consultant prior to application for a Certificate of Substantial Performance of the Work.
- .5 Include a copy of the accepted testing and balancing report in each copy of the operating and maintenance instruction manuals.

3.5 WARRANTY

- .1 When testing, adjusting and balancing work is complete and the balancing report has been accepted, submit to the Project Manager, in the name of the Owner, an AABC National Guaranty Certification or NEBB Certificate of Conformance Certification, as applicable, and in addition, submit to the Project Manager, in the name of the Owner, a written extended warranty covering one (1) full heating season and one (1) full cooling season, during which time any balancing problems which occur in the building, with the exception of minor revision work done during scheduled site visits, will, at no cost, be investigated by your personnel and reported on to the Project Manager. If it is determined that the problems are a result of improper testing, adjusting and balancing, they shall be immediately corrected without additional cost to the Owner.

END OF SECTION

1 . GENERAL

1.1 APPLICATION

- .1 This Section specifies firestopping and smoke seal requirements that are common to mechanical work Sections of the Specification and it is a supplement to each Section and is to be read accordingly.

1.2 SUBMITTALS

- .1 At least 4 weeks prior to work commencing, submit a sample of each type of material requirements for firestop and smoke seal systems in applied form. Identify each system with manufacturer's name and type, ULC designation, and proposed use. After samples are reviewed, work is to conform to reviewed samples.
- .2 Submit a product data sheet and a WHIMIS sheet for each firestopping and smoke seal product.
- .3 Submit for review, full company name and experience of proposed firestopping and smoke seal system applicator.
- .4 Submit a letter of proper firestopping and smoke seal certification as specified in Part 3 of this Section.

1.3 QUALITY ASSURANCE

- .1 Applicator is to have a minimum of 3 years of successful experience on projects of similar size and complexity, and is to be reviewed by Consultant.
- .2 Comply with firestopping and smoke seal product manufacturer's recommendations regarding suitable environment conditions for product installation.

2 . PRODUCTS

2.1 FIRESTOPPING AND SMOKE SEAL SYSTEM MATERIALS

- .1 Asbestos-free elastomeric materials tested, listed and labelled by ULC in accordance with ULC S115 and ULC S101 for installation in ULC designated firestopping and smoke seal systems to provide a positive fire, water and smoke seal, and a fire-resistance rating (flame, hose stream and temperature) not less than fire resistance rating of surrounding fire rated construction.
- .2 Firestopping and smoke seal material system to be specifically ULC certified with designated reference number for its specific installation. As part of shop drawing submission, submit copies of firestopping drawings with ULC certificate and system number for each specific installation.
- .3 Materials are to be compatible with abutting dissimilar materials and finishes and complete with primers, damming and back-up materials, supports, and anchoring devices in accordance with firestopping manufacturer's recommendations and ULC tested assembly. Coordinate material requirements with trades supplying abutting areas of materials.

- .4 Typically, for openings of up to 250 mm (10") in diameter, provide putty pad type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibres or silicone compounds.
- .5 Typically, for openings of greater than 250 mm (10") in diameter, and for rectangular openings, provide pillow type firestop materials equivalent to Specified Technologies Inc. "SpecSeal" re-enterable, non-curing, mineral fibre core encapsulated on six sides with intumescent coating contained in a flame retardant poly bag.
- .6 Pipe insulation forming part of a fire and smoke seal assembly is specified in Section entitled Mechanical Insulation.
- .7 Supply products of a single manufacturer for use on work of this Division.
- .8 Installer to be manufacturer trained and certified on specific product. Submit copy of certificate with shop drawings.
- .9 Include for manufacturer's authorized representative to inspect and verify each installation and application. Submit test report signed and verified by system installer's authorized representative and manufacturer's representative.
- .10 Acceptable certification to also include certification by Underwriters Laboratories of Northbrook IL, using tests conforming to ULC-S115 and given cUL listing published by UL in their "Products Certified for Canada (cUL) Directory".
- .11 Acceptable manufacturers are:
 - .1 Specified Technologies Inc.;
 - .2 3M Canada Inc.;
 - .3 Tremco;
 - .4 A/D Fire Protection Systems;
 - .5 Nelson;
 - .6 Hilti Canada.

3. EXECUTION

3.1 INSTALLATION OF FIRESTOPPING AND SMOKE SEAL MATERIALS

- .1 Where work penetrates or punctures fire rated construction, provide ULC certified, listed and labelled firestopping and smoke sealing packing material systems to seal openings and voids around and within raceway and to ensure that continuity and integrity of fire separation is maintained. Openings not in immediate vicinity of working areas are to be firestopped and sealed same day as being opened.
- .2 Install firestopping and smoke seal materials for each installation in strict accordance with specific ULC certification number and manufacturer's instructions. Comply with local governing building code requirements and obtain approvals from local building inspection department. Ensure that openings through fire separations do not exceed maximum size wall opening, and maximum and minimum dimensions indicated in ULC Guide No. 40 U19 for Service Penetration Assemblies and firestopping materials.
- .3 Ensure that continuity and integrity of fire separation is maintained and conform to requirements of latest edition of ULC publication "List of Equipment and Materials, Volume II, Building Construction".
- .4 Comply with following requirements:

- .1 Examine substrates, openings, voids, adjoining construction and conditions under which firestop and smoke seal system is to be installed. Confirm compatibility of surfaces.
 - .2 Verify penetrating items are securely fixed and properly located with proper space allowance between penetrations and surfaces of openings.
 - .3 Report any unsuitable or unsatisfactory conditions to Consultant in writing, prior to commencement of work. Commencement of work will mean acceptance of conditions and surfaces.
 - .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces. Remove stains on adjacent surfaces.
 - .5 Prime substrates in accordance with product manufacturer's written instructions.
 - .6 Provide temporary forming as required and remove only after materials have gained sufficient strength and after initial curing.
 - .7 Tool or trowel exposed surfaces to a neat, smooth, and consistent finish.
 - .8 Remove excess compound promptly as work progresses and upon completion.
 - .9 At fusible link damper locations, seal perimeter of angle iron framing on both sides of wall or slab with ULC listed and labelled sealant materials to provide a positive smoke seal.
- .5 Notify Consultant when work is complete and ready for inspection, and prior to concealing or enclosing firestopping and smoke seal materials and service penetration assemblies. Arrange for final inspection of work by local governing authority inspector prior to concealing or enclosing work. Make any corrections required.
- .6 On completion of firestopping and smoke sealing installation, submit a Letter of Assurance to Consultant certifying the firestopping and smoke sealing installation has been carried out throughout the building to service penetrations and that installation has been performed in strict accordance with requirements of local governing building code, any applicable local municipal codes, ULC requirements, and manufacturer's instructions.
- .7 Manufacturer's authorized representative to inspect and verify each installation and provide a test report signed by installing trade and manufacturer's representative. Test report to list each installation and respective ULC certification and number.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets to regulatory authority for review and approval prior to submitting to Consultant. Conform to following requirements:
 - .1 submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings;
 - .2 submit complete CAD layout drawings indicating source of water supply with test flow and pressure, "head-end" equipment piping schematic, pipe routing and sizing, and zones, all signed and sealed by a qualified professional mechanical engineer registered in jurisdiction of the work as specified below;
 - .3 submit copies of all calculations, including hydraulic calculations, stamped and signed by same engineer who signs layout drawings, and a listing of all design data used in preparing the calculations, system layout and sizing, including occupancy-hazard design requirements;
 - .4 in addition to submitting shop drawings to regulatory authority as specified above, shop drawings must be approved by Owner's insurer prior to being submitted to Consultant for review.
- .2 Submit a complete sprinkler system test certificate as specified in Part 3 of this Section.
- .3 Sprinklers are to be identified on drawings and product submittals, and be specifically identified by manufacturer's listed model or series designation. Trade names and other abbreviated listings are unacceptable.

1.2 QUALITY ASSURANCE

- .1 Fire protection sprinkler system work is to be in accordance with following Codes and Standards:
 - .1 NFPA 13, Standard for the Installation of Sprinkler Systems;
 - .2 CSA B137.2, Polyvinylchloride (PVC) Injection-Moulded Gasketed Fittings for Pressure Applications;
 - .3 CSA B137.3, Rigid Polyvinylchloride (PVC) Pipe for Pressure Applications;
 - .4 ASTM A53, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless;
 - .5 ASTM A135, Standard Specification for Electric-Resistance-Welded Steel Pipe;
 - .6 ASTM A234, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service;
 - .7 ASTM A536, Standard Specification for Ductile Castings;
 - .8 ASTM A795, Standard Specification for Black and Hot-Dipped Zinc Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use;

- .9 ANSI/ASME B16.4, Grey Iron Threaded Fittings (Classes 125 and 250);
- .10 CAN/CSA B64.10, Backflow Preventers and Vacuum Breakers.
- .2 Fire protection sprinkler work is to be performed by a sprinkler company who is a member in good standing of the Canadian Automatic Sprinkler Association. Site personnel are to be licensed in jurisdiction of the work and under the continuous supervision of a foreman who is an experienced fire protection system installer and a journeyman pipe fitter licensed in jurisdiction of the work.
- .3 Check and verify dimensions and conditions at site and ensure work can be performed as indicated. Coordinate work with trades at site and accept responsibility for and cost of making adjustments to piping and/or spacing to avoid interference with other building components.
- .4 Verify working condition of existing sprinkler system equipment which has direct interface with project work and is to remain. Replace with new equipment where necessary.
- .5 System components must be ULC listed and labelled.
- .6 Grooved couplings, and fittings, valves and specialties are to be products of a single manufacturer. Grooving tools are to be of same manufacturer as grooved components.
- .7 Castings used for coupling housings, fittings, valve bodies, etc., are to be date stamped for quality assurance and traceability.

1.3 DESIGN REQUIREMENTS

- .1 Fire protection sprinkler work is to be designed in accordance with NFPA 13 and Provincial Standards, and, where required, local building and fire department requirements and standards of Owner's Insurer. If water supply flow and pressure test data is not available, conduct Municipal main water flow and pressure tests at nearest fire hydrant to obtain criteria to be used in system design. Include hydrant location and flow and pressure test data with system design calculations.
- .2 Include for a qualified mechanical professional engineer registered and licensed in the jurisdiction of the work to design the fire protection standpipe work. Refer to Section entitled Mechanical Work General Instructions for requirements regarding Contractor retained engineers.
- .3 Sprinkler /System Occupancy – Hazard Design requirements: In accordance with NFPA 13 occupancy-hazard density requirements, unless otherwise specified.

1.4 PROJECT CLOSEOUT

- .1 Provide all required closeout documents to engineer for review and record, including but not limited to, sprinkler test certificate, NFPA conformance letter stamped by a professional engineer, etc.

2 PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS

- .1 Pipe, fittings and joints are to be as follows, with exceptions as specified in Part 3 of this Section:

- .1 Schedule 40 Steel – Grooved Coupling Joints
 - .1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with grooved ends and mechanical fittings and couplings equal to Victaulic "FireLock" fittings and Victaulic Style 009N, 107H, and 107N QuickVic and 005 rigid coupling joints. Strap type outlet fittings such as Victaulic "Snap-Let" are not acceptable.
- .2 Schedule 40 Steel – Screwed and Welded Joints
 - .1 Schedule 40 mild black carbon steel, ASTM A53, Grade B. Screwed piping complete with Class 125 cast iron screwed fittings to ANSI/ASME B16.4. Welded piping complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, long sweep pattern wherever possible.
- .3 Flexible Pipe – Equal to Victaulic "VicFlex"
 - .1 Drop system is to consist of a braided type 304 stainless steel flexible tube, zinc plated steel 25 mm (1") NPT male threaded nipple for connection to branch-line piping, and a zinc plated steel reducer with a 12 mm (1/2") or 20 mm (3/4") NPT female thread for connection to sprinkler head.
 - .2 Drop is to include a cULus/FM approved Series AH2 braided hose with a bend radius to 50 mm (2") to allow for proper installation in confined spaces.
 - .3 Hose is to be listed for following number of 50 mm (2") radius 90° bends:
 - .1 4 bends at 0.79 m (31") length;
 - .2 5 bends at 0.91 m (36") length;
 - .3 8 bends at 1.2 m (48") length;
 - .4 10 bends at 1.5 m (60") length;
 - .5 12 bends at 1.8 m (72") length.
 - .4 Union joints are to be provided for ease of installation, prevention of hose torque stresses and on site changing of factory 146 mm (5.75") straight reducing nipple in reduced spaces under obstructions.
 - .5 On T-bar ceiling grid with drop in tile application, flexible drop is to attach to ceiling grid using a one-piece open gate Series AB1 bracket. Bracket is to allow installation before ceiling tile is in place.
 - .6 On T-bar ceiling grid designed for hard lid drywall application, flexible drop is to attach to ceiling grid using a one-piece open gate Series AB2 bracket. Bracket is to allow for vertical adjustment of reducer/head from below drywall, post-drywall installation.
 - .7 On hat furring channel grid with hard lid drywall application, flexible drop is to attach to ceiling grid using a one-piece open gate Series AB4 bracket. Bracket is to allow for vertical adjustment of reducer/head from below drywall, post-drywall installation.

- .8 Braided drop system is to be cULus listed for sprinkler services to 1206 kPa (175 psi).
- .4 Copper – Solder Joint
 - .1 Type "L" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints.

2.2 SPRINKLER HEADS

- .1 Sprinkler heads, unless otherwise specified, are to be as scheduled in Part 3 of this Section.
- .2 Sprinkler body is to be die-cast, with a hex-shaped wrench boss integrally cast into sprinkler body to reduce risk of damage during installation. Wrenches are to be provided by sprinkler manufacturer that directly engages wrench boss.
- .3 For locations where corrosive resistant coatings are required, body is to be coated with ULC listed and FM approved anti-corrosion VC-250 coating (silver colouring).
- .4 Recessed sprinkler heads in finished areas are to be chrome plated unless otherwise specified. Concealed sprinkler head ceiling plates are to match ceiling colour.
- .5 Where exposed pendent heads occurs in areas with suspended ceilings, they are to be complete with chrome plated escutcheon plates. Similarly, sidewall heads with concealed piping are to be complete with chrome plated escutcheon plates.
- .6 Sprinkler heads which are exposed in areas where they may be subject to damage are to be complete with wire guards, chrome plated where in finished areas.
- .7 Escutcheons and guards are to be listed, supplied, and approved for use with sprinkler by sprinkler manufacturer.
- .8 Sprinkler heads located in areas or over equipment where high ambient temperature is present are to be, unless otherwise specified, 74°C (165°F) heads. All other heads, unless otherwise specified or required, are to be 57°C (135°F) rated.
- .9 Acceptable manufacturers are:
 - .1 Victaulic Co.;
 - .2 Tyco Fire Suppression & Building Products;
 - .3 The Viking Corporation;
 - .4 The Reliable Automatic Sprinkler Co.

3 EXECUTION

3.1 MONITORING OF SYSTEMS

- .1 Daily monitor and supervise existing sprinkler system serving renovated areas to ensure that each respective system is left in proper operating condition at end of each working day. Include for but not be limited to performing following:

- .1 Under presence of Owner's representative, check each morning and evening (start and end of work) of each day, sprinkler system to ensure that it is in proper working condition;
- .2 If portions of sprinkler system is not in proper working order, provide temporary provisions subject to approval of local fire authority or local governing authority, to ensure that proper sprinkler coverage is provided and/or provide supervisory personnel to monitor areas where sprinkler system is not operational;
- .3 Document and sign off with Owner's representative signing off also, each respective daily check condition;
- .4 Ensure that work to sprinkler system does not affect portion of system serving areas outside of renovation areas.

3.2 DEMOLITION

- .1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.3 PIPING INSTALLATION REQUIREMENTS

- .1 Provide required sprinkler system piping.
- .2 Perform piping work in accordance with requirements of NFPA 13, governing regulations, and "Reviewed" shop drawings.
- .3 Piping, unless otherwise specified, is as follows:
 - .1 for piping inside building and above ground except as noted below – Schedule 40 grooved end black steel with Victaulic or equal fittings and coupling joints, or, for piping to and including 50 mm (2") diameter, screwed fittings and joints, or, for piping 65 mm (2-½") diameter and larger, welding fittings and welded joints;
 - .2 for branch piping to heads in suspended ceilings, etc. – at your option, flexible piping installed in accordance with manufacturer's instructions;
- .4 Pipe sizes, pipe routing, sprinkler head quantities and locations, and layout of work shown on drawings are to assist during tendering period. Ensure adequate head coverage, head quantities and pipe sizing as specified in Part 1 of this Section. Do not reduce size of sprinkler main or re-route main unless reviewed with and approved by Consultant.
- .5 Install grooved joints in accordance with manufacturer's latest installation instructions. Grooved ends are to be clean and free from indentations, projections and roll marks. Gaskets are to be moulded and produced by coupling manufacturer, and verified as suitable for intended service. Have factory-trained representative from mechanical joint manufacturer provide on-site training in proper use of grooving tools and installation of grooved piping products. Have factory-trained representative periodically review product installation and ensure best practices are being followed. Remove and replace any improperly installed products.
- .6 Clean pipe, fittings, couplings, flanges and similar components after erection is complete. Wire brush clean any ferrous pipe, fitting, coupling, flange, hanger, support and similar component which exhibit rust and carefully coat with suitably coloured primer.

- .7 When sprinkler work is complete, test system components and overall system(s) and submit completed test certificate and other documentation in accordance with Chapter 8 of NFPA 13.

3.4 INSTALLATION OF SPRINKLER HEADS

- .1 Provide required sprinkler heads in accordance with following schedule:

APPLICATION	SPRINKLER HEAD TYPE
Rooms/areas with a suspended ceiling	Victaulic V38/V39 or Tyco Series RFII "Royal Flush II" concealed pendent Victaulic V27 or Tyco Series TY-FRB recessed pendent Victaulic V27 or Tyco Series TY-FRB pendent with escutcheon plates
Rooms/areas without a suspended ceiling	Victaulic V27 or Tyco Series TY-FRB pendent
At non-rated windows in rated walls	Tyco Model WS horizontal and pendent vertical sidewall

- .2 Sprinkler head manufacturers indicated on schedule are for type indication purposes. Acceptable manufacturers are listed in Part 2 of this Section.
- .3 Coordinate sprinkler head locations with all drawings, including architectural reflected ceiling plan drawings, and, where applicable, electrical drawings. Coordinate sprinkler head locations in areas with suspended ceilings with the location of lighting, grilles, diffusers, and similar items recessed in or surface mounted on the ceiling as per the reflected ceiling plans. In areas with lay-in tile, centre the sprinkler head both ways in the lay-in tile wherever possible. Confirm locations prior to roughing-in.
- .4 Maintain maximum headroom in areas with no ceilings.
- .5 Provide guards for heads where they are subject to damage.
- .6 Provide high temperature heads in equipment rooms and similar areas over heat producing or generating equipment.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

- .1 Submit product data sheets for all products specified in this Section.

1.2 QUALITY ASSURANCE

- .1 Fire extinguishers are to be in accordance with following Codes and Standards:
 - .1 National Fire Code of Canada;
 - .2 NFPA 10, Standard for Portable Fire Extinguishers;
 - .3 CAN/ULC S508, Standard for the Rating and Testing of Fire Extinguishers.

2 PRODUCTS

2.1 GENERAL

- .1 Fire extinguishers are to be pressurized (stored pressure) rechargeable type, in accordance with NFPA 10, and UL and/or ULC listed and labelled for the class of fires and hazard locations for which they are specified.
- .2 Each extinguisher is to be complete with:
 - .1 manufacturer's identification label indicating extinguisher model number, rating, and operating instructions;
 - .2 anodized aluminum or chrome plated forged brass valve with positive squeeze grip on-off operation and a pull-pin safety lock;
 - .3 discharge hose with nozzle or horn and hose securing clip;
 - .4 for wall mounting extinguishers, a wall mounting bracket.

2.2 4A60B:C AND 4A80B:C RATED DRY CHEMICAL EXTINGUISHERS

- .1 Multi-purpose 4A60B:C dry chemical extinguishers are to be 125 mm (5") dia., 4.5 kg (10 lb.), each complete with a steel cylinder with a safety red baked enamel finish and a waterproof stainless steel pressure gauge.
- .2 Multi-purpose 4A80B:C dry chemical extinguishers are to be as above but 175 mm (7") dia., 9 kg (20 lb.).

2.3 WET CHEMICAL CLASS K COMMERCIAL KITCHENS

- .1 ULC listed portable wet chemical extinguisher suitable for Class K fires and commercial kitchen operation, 6 L cylinder with heavy-duty chrome plated brass valves, operator safe discharge hose, full stainless steel construction, mounting bracket.

2.4 FIRE EXTINGUISHER CABINETS

- .1 Surface Mounted: Rectangular break-glass type enclosures sized to suit the extinguishers to be housed, constructed of #18 gauge corrosion resistant steel with a baked white enamel finish, front glass panel, break-glass mechanism, and keyed alike cylinder lock.
- .2 Recessed: Rectangular cabinets sized to suit the extinguishers to be housed, with a #18 gauge corrosion resistant white enamelled steel tub, #14 gauge cleaned and prime coat painted steel door and adjustable trim assembly with rounded corners, semi-concealed piano hinge, safety glass panel, and flush stainless steel door latch.

2.5 FIRE BLANKETS

- .1 Equal to National Fire Equipment Ltd. Model #FB-6078-MC 300 mm x 400 mm (12" x 16") red enamelled #16 gauge surface mounting steel cabinet identified "FIRE BLANKET" and "PULL TAB TO REMOVE", complete with non-combustible glass fibre fire blanket pressure fit into the cabinet and equipped with pull-back release straps.

3 EXECUTION

3.1 INSTALLATION OF FIRE EXTINGUISHERS

- .1 Provide fire extinguishers of type(s) in accordance with requirements of NFPA 10.
- .2 Unless otherwise shown or specified, wall mount extinguishers using wall brackets supplied with extinguishers.
- .3 Do not install extinguishers until after wall finishing work is complete.
- .4 Be responsible for maintaining fire extinguishers until Substantial Completion of the Work.
- .5 If extinguishers are indicated adjacent to a door, locate extinguishers at the strike side of the door.

3.2 INSTALLATION OF FIRE EXTINGUISHER CABINETS

- .1 Provide wall cabinets for fire extinguishers where required.
- .2 Unless otherwise shown or specified, locate cabinets so centerline is approximately 1.2 m (4') above finished floor.
- .3 Confirm exact locations prior to installation.

3.3 INSTALLATION OF FIRE BLANKETS

- .1 Provide fire blankets in wall mounted cabinets in the Kitchen. Confirm exact locations prior to installation.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all products specified in Part 2 of this Section except for pipe, fittings, and chlorine.
- .2 Submit laboratory water purity test results indicating chlorine residual prior to application for Substantial Performance of the Work.
- .3 Submit signed test results and inspection and test log cards for each backflow preventer as specified in Part 3 of this Section.
- .4 As specified in Part 3 of this Section, submit a letter from anchor design engineer stating anchor installation has been examined at site and anchors are properly fabricated and installed.

1.2 QUALITY ASSURANCE

- .1 Domestic water piping and valves are to comply with following codes, regulations and standards (as applicable):
 - .1 applicable local codes and regulations;
 - .2 ASTM F1960, Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) Tubing;
 - .3 CAN/CSA B125.1, Plumbing Supply Fittings;
 - .4 CAN/CSA B125.3, Plumbing Fittings;
 - .5 CAN/CSA B137 Series, Thermoplastic Pressure Piping Compendium;
 - .6 CAN/ULC S102.2, Standard Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies;
 - .7 CAN/ULC S101, Fire Endurance Tests of Building Construction and Materials;
 - .8 NSF/ANSI 14, Plastics Piping System Components and Related Materials;
 - .9 NSF/ANSI 61, Drinking Water System Components – Health Effects;
 - .10 NSF/ANSI 372, Drinking Water System Components – Lead Content.

2 PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS

- .1 Hard Copper - Solder Joint
 - .1 Type "L" hard drawn seamless copper to ASTM B88, complete with copper solder type fittings to ASME/ANSI B16.18 and soldered joints using The Canada Metal Co. Ltd. "SILVABRITE 100" or equal lead-free solder for cold water pipe, and 95% tin/ 5% Antimony or "SILVABRITE 100" solder for other services.

.2 Semi-Rigid Polyethylene Tubing

- .1 Versa Fittings and Mfg. Inc. 12 mm (½") dia., high density, semi-rigid polyethylene tubing, 1380 kPa (200 psi) rated.

2.2 SHUT-OFF VALVES

.1 Ball Valves

- .1 Class 600, 4140 kPa (600 psi) WOG rated, lead-free, full port ball type valves, each complete with a forged brass body with solder ends, forged brass cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, and a removable lever handle. Valves in insulated piping are to be complete with stem extensions.

.2 Acceptable products are:

- .1 Toyo Valve Co. Fig. 5049A-LF;
.2 Milwaukee Valve Co. #UPBA485B;
.3 Kitz Corporation Code 859;
.4 Apollo Valves #77LF-200;
.5 Watts Industries (Canada) Inc. #LFFBVS-3C.

2.3 CHECK VALVES

.1 Horizontal

- .1 Lead-free, Class 125, bronze, 1380 kPa (200 psi) WOG rated horizontal swing type check valves with solder ends.
- .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 237A-LF;
 - .2 Milwaukee Valve Co. #UP1509;
 - .3 Kitz Corporation Code 823;
 - .4 Apollo Valves #61LF Series.

.2 Vertical

- .1 Equal to Kitz Corp. Code 826, lead-free, 1725 kPa (250 psi) WOG rated vertical lift check valve with soldering ends.

2.4 DRAIN VALVES

- .1 Minimum 2070 kPa (300 psi) water rated, 20 mm (¾") dia., straight pattern full port bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm (¾") dia. garden hose, and a cap and chain.
- .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 5046;
 - .2 Dahl Brothers Canada Ltd. Fig. No. 50. 430;
 - .3 Kitz Corporation Code 58CC;
 - .4 Apollo Valves #78-104-01;
 - .5 Watts Industries (Canada) Inc. #B6000.

2.5 DOMESTIC HOT WATER PIPING BALANCING VALVES

- .1 Solder or flanged end type as required, globe style, non-ferrous circuit balancing valves designed to facilitate precise flow measurement, precision flow balancing, and positive shut-off, complete with capped and valved drain connection, and valved ports for connection to a differential pressure meter.
- .2 Acceptable products are:
 - .1 S.A. Armstrong Model CBV Series;
 - .2 Tour and Andersson Model TBV Series;
 - .3 Watts Industries (Canada) Inc. Model CSM Series.

2.6 CHLORINE

- .1 Sodium hypochlorite to AWWA B300.

2.7 FLOOR DRAIN TRAP SEAL PRIMERS

.1 Primer Valve Type

- .1 Precision Plumbing Products Inc. Model P2-500 trap primer valve, constructed of brass, adjustable to high or low water pressures and complete with "O" ring seals, 12 mm (½") threaded inlet and outlet connections, and, for priming two traps from the same primer, a DU-2 dual outlet distribution unit.

.2 Primer Valve Type with Manifold

- .1 Precision Plumbing Products Inc. Model P1-500 trap primer valve constructed as specified above for the Model P2-500 primer valve, complete with a Model DU-3 or DU-4, 3 or 4 outlet distribution unit for priming 3 or 4 traps, and at Model "YS-8" supply tube with combinations of Model DU-3 and DU-4 distribution units for priming from 5 to 6 traps.

.3 Electronic Type

- .1 Precision Plumbing Products #PT Series surface wall mounting, CSA certified, 115 volt, 1-phase, 60 Hz., electronic, automatic trap priming manifolds, each sized to suit the number of drain traps or interceptors serviced, and each complete with:
 - .1 galvanized steel cabinet with door;
 - .2 20 mm (¾") dia. NPT copper pipe inlet with shut-off valve and water hammer arrestor;
 - .3 solenoid valve, an atmospheric vacuum breaker, and a discharge manifold with 12 mm (½") dia. compression type copper tube connections on 40 mm (1-½") centres with quantity to suit the number of items to be primed;
 - .4 control panel with circuit breaker, 5 ampere fuse, 24 hour timer, and manual override toggle switch.

2.8 WATER HAMMER ARRESTORS

- .1 Piston type, sealed, pressurized water hammer arrestors suitable for either horizontal or vertical installation, each complete with a hard drawn copper body, "O"-ring piston seals, an air charge, and an inlet opening equal to diameter of pipe in which arrestor is required.
- .2 Acceptable products are:
 - .1 Watts Industries (Canada) Inc.;
 - .2 Zurn #Z1705;
 - .3 Precision Plumbing Products Inc. #SC;

.4 Mifab MWH Series

2.9 BACKFLOW PREVENTERS

.1 Reduced Pressure Zone Assembly

.1 Lead-free reduced pressure zone assembly backflow preventer in accordance with CAN/CSA B64 (including supplements), each of bronze or epoxy coated cast iron bronze fitted construction depending on size, and complete with inlet strainer, inlet and outlet shut-off valves, an intermediate relief valve, ball valve type test cocks, and a proper air gap fitting.

.2 Acceptable products are:

.1 Watts Industries #LF009QT-S for 12 mm (½") size, #LF909QT-S for 20 mm to 50 mm (¾" to 2") size, and #LF909-NRS-S for 65 mm (2-½") and larger size;

.2 Zurn/Wilkins 975XL2 and 375 Series;

.3 "Apollo" Valves manufactured by Conbraco Industries Inc. Series 4ALF;

.4 Danfoss Flomatic Corp. Series RPZ.

2.10 THERMOSTATIC MIXING VALVE

.1 Equal to Lawler 310-SC1 12 mm (½") dia. or 20 mm (¾") dia. as required, each CSA B125 certified, forged brass, tamper-proof thermostatic mixing valves, adjustable for water supply between 29°C and 49°C (85°F and 120°F), sized to suit number of lavatories in grouping, and complete with a stop and check valve and a lockable handle.

2.11 AIR VENTS

.1 Equal to ITT Hoffman Specialty No. 78 cast brass, 1035 kPa (150 psi) rated, 20 mm (¾") straight water main vent valves, each tapped at the top for a 3.2 mm (1/8") safety drain connection.

2.12 DOMESTIC WATER THERMAL EXPANSION TANK

.1 Pre-charged domestic water thermal expansion tank, carbon steel outer shell construction and complete with fixed butyl rubber bladder to prevent water from contacting shell interior, top NPT stainless steel system connection, 7.6 mm to 813 mm (0.301" to 32") charging valve connection and prime painted exterior.

.2 Acceptable products are:

.1 Watts Industries (Canada) Inc. Series PLT;

.2 Amtrol Therm-X-Trol series;

3 EXECUTION

3.1 DEMOLITION

.1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.2 PIPING INSTALLATION REQUIREMENTS

- .1 Provide required domestic water piping.
- .2 Piping, unless otherwise specified, is as follows:
 - .1 for 12 mm (½") dia. trap seal primer tubing located underground or in concrete or masonry construction – semi-rigid polyethylene;
 - .2 for pipe inside building and aboveground in sizes to 100 mm (4") dia. – Type "L" hard copper with solder joints
- .3 Slope piping so it can be completely drained.
- .4 Provide cast brass dielectric type adapters/unions at connections between ferrous and copper pipe or equipment.

3.3 INSTALLATION OF SHUT-OFF AND CHECK VALVES

- .1 Refer to Part 3 of Section entitled Basic Mechanical Materials and Methods.
- .2 For shut off valves installed on solder joint copper piping up to and including 75 mm (3") diameter, provide ball type valves, and for flanged joints copper or stainless steel piping larger than 75 mm (3") diameter provide butterfly type valves.

3.4 INSTALLATION OF DRAIN VALVES

- .1 Provide a drain valve at the bottom of domestic water piping risers, at other piping low points, and wherever else shown.
- .2 Locate drain valves so they are easily accessible.

3.5 INSTALLATION OF DOMESTIC HOT WATER PIPING BALANCING VALVES

- .1 Provide balancing valves in domestic hot water recirculation piping where shown or required.
- .2 Locate each valve so it is easily accessible.

3.6 INSTALLATION OF DOMESTIC HOT WATER THERMOSTATIC MIXING VALVES

- .1 Provide a domestic hot water thermostatic mixing valve assembly.
- .2 Adjust each valve to design requirements and check and test operation. Set maximum temperature limit stops.
- .3 Identify each valve and its water temperature delivery setting with an engraved nameplate.

3.7 INSTALLATION OF TRAP SEAL PRIMERS

- .1 Provide required accessible trap seal primers to automatically maintain a water seal in floor drain traps, whether shown on drawings or not.

- .2 Provide trap primer valves to prime single or multiple (1 to 6) traps. Install trap primer valves in domestic cold water piping to frequently used plumbing fixtures. Where from 2 to 6 traps are to be primed from same primer valve, provide appropriate supply and distribution tube assemblies. Ensure primer valves are accessible.
- .3 Provide 115 volt, electronic, surface wall mounting trap primer assemblies for multiple (4 to 30) traps. Include for a 115 volt 15 ampere panel breaker and wiring in conduit from closest panelboards to primer assembly, all to wiring standards of Electrical Division. Adjust primer water flow and timing to suit number of traps served.
- .4 Ensure trap primer piping is secured to floor drain primer tapplings and not terminated through the tapping in the throat of the drain.

3.8 INSTALLATION OF WATER HAMMER ARRESTORS

- .1 Provide accessible water hammer arrestors in domestic water piping in locations as follows:
 - .1 in headers at groups of plumbing fixtures;
 - .2 at top of risers;
 - .3 at ends of long horizontal runs of piping;
 - .4 in piping connecting solenoid valves or equipment with integral solenoid valves;
 - .5 wherever else shown or required by Code.
- .2 Install each unit in a piping tee either horizontally or vertically in the path of potential water shock in accordance with manufacturer's instructions and details.

3.9 INSTALLATION OF BACKFLOW PREVENTERS

- .1 Provide a reduced pressure zone assembly backflow preventer where indicated and in each direct domestic water connection to equipment other than plumbing fixtures and fittings.
- .2 Locate each backflow preventer on floor or wall between 765 mm and maximum 1.5 m (30" and 60") above floor such that it is easily accessible for maintenance and testing. Equip each backflow preventer with an air gap fitting and pipe the reduced pressure zone water outlet to drain.
- .3 Test operation of each backflow preventer in accordance with requirements of CAN/CSA B64 by personnel certified for such testing by governing authorities, and submit signed test results and a properly and clearly identified and marked inspection and test record card for each backflow preventer.

3.10 INSTALLATION OF AIR VENTS

- .1 Provide accessible air vents in domestic water piping to prevent air binding.
- .2 Extend copper indirect drain piping from top drain connection of each vent to nearest suitable drain.
- .3 Locate exact vent locations on as-built record drawings.

3.11 INSTALLATION OF DOMESTIC WATER THERMAL EXPANSION TANK

- .1 Provide domestic water thermal expansion tanks.
- .2 Unless otherwise specified, mount at least 450 mm (18") from cold water inlet to domestic water heater.
- .3 Adjust pre-charge to match incoming water pressure after installation.
- .4 Install in accordance with manufacturer's instructions and as per local governing Codes and Regulations.

3.12 FLUSHING AND DISINFECTING PIPING

- .1 Flush and disinfect all new and/or reworked domestic water piping after leakage testing is complete.
- .2 Isolate new piping from existing piping prior to flushing and disinfecting procedures.
- .3 Flush piping until all foreign materials have been removed and flushed water is clear. Provide connections and pumps as required. Open and close valves, faucets, hose outlets, and service connections to ensure thorough flushing.
- .4 When flushing is complete, disinfect the piping with a solution of chlorine in accordance with AWWA C601.
- .5 When disinfecting is complete, submit water samples to a certified laboratory for purity testing and, when testing indicates pure water in accordance with governing standards, submit a copy of test results and fill the systems.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all products specified in this Section except pipe and fittings.
- .2 Submit a copy of plumbing inspection certificate prior to application for Substantial Performance of the Work.
- .3 Submit letters from product manufacturers/suppliers to certify correct installation of products as specified in Part 3 of this Section.

2 PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS

.1 PVC Sewer

- .1 DR35 rigid, green PVC hub and spigot pattern sewer pipe and fittings to CAN/CSA B182.2, with gasket joints assembled with pipe lubricant.
- .2 DR35 rigid, PVC sewer pipe and fittings, with solvent weld joints, all certified to CSA B182.1 and colour-coded as per local governing codes, regulations and standards.

.2 Copper - Solder Joint

- .1 Type DWV hard temper to ASTM B306, with forged copper solder type drainage fittings and 50% lead - 50% tin solder joints.

.3 Cast Iron

- .1 Class 4000 cast iron pipe, fittings, and mechanical coupling joints to CAN/CSA B70.

.4 Copper - Victaulic Coupling Joint

- .1 Type DWV hard temper to ASTM B306, with factory or site rolled grooved ends (with grooving rolls designed for copper) and Victaulic "Copper Connection" wrought copper or cast bronze fittings and Style 606 gasket type couplings.

2.2 SHUT-OFF AND CHECK VALVES

.1 Shut-off Valves

- .1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass body, blowout-proof stem, chrome plated solid brass ball, solder or screwed ends as required, and removable lever handle.
- .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 5049A or Fig. 5044A;
 - .2 Milwaukee Valve Co. #BA-155 or #BA -125;
 - .3 Kitz Corporation Code 58 or Code 59;

- .4 Victaulic Co. of Canada Ltd. Series 722;
- .5 Apollo Valves # 77-100 or # 77-200;
- .6 Watts Industries (Canada) Inc. #FBVS-3C.

.2 Check Valves

- .1 Class 125, bronze, 1725 kPa (250 psi) WOG rated vertical lift check valve with solder or screwed ends as required, and, for horizontal piping, Class 125, bronze 1380 kPa (200 psi) WOG rated swing check valves with solder or screwed ends.
- .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 231 or Fig. 236 or Fig. 237;
 - .2 Milwaukee Valve Co. #1510 or #510;
 - .3 Kitz Corporation Code 36 or Code 22 or Code 23.

2.3 CLEANOUTS

.1 Horizontal Piping

- .1 TY pipe fitting with an extra heavy brass plug screwed into the fitting.

.2 Vertical Piping

- .1 Bronze or copper cleanout tees in copper piping, each complete with a bronze ferrule, and, for cast iron piping, "BARRETT" type cast iron cleanout tees, each gas and water-tight and complete with a bolted cover.

2.4 FLOOR CLEANOUT TERMINATIONS

- .1 Factory finished cast iron terminations, each adjustable and complete with a cast iron body with neoprene sleeve, solid, gasketed, polished nickel-bronze scoriated top access cover to suit floor finish, a seal plug, and captive, vandal-proof, stainless steel securing hardware.
- .2 Acceptable products are:
 - .1 Watts Industries (Canada) Ltd. # CO-200-R-1;
 - .2 Jay R. Smith #4020-F-C Series;
 - .3 Zurn # ZN-1602-SP Series;
 - .4 Mifab # C1100-XR-1 or #C1000-R-3.
- .3 Cleanout terminations in areas with a tile or sheet vinyl floor finish are to be as above but with a square top in lieu of a round top.

2.5 FLOOR DRAINS, FUNNEL FLOOR DRAINS AND HUB DRAINS

- .1 Unless otherwise specified or indicated, floor drains are to be vandal-proof drains in accordance with drawing symbol list, each complete with a cast iron body and a trap seal primer connection. Cast iron components are to be factory finished with latex based paint coating.
- .2 Floor drains in areas with a tile or sheet vinyl floor finish are to be as above but with a square grate in lieu of a round grate.
- .3 Funnels are to be provided where indirect drainage is required.
- .4 Acceptable manufacturers are:
 - .1 Watts Industries (Canada) Ltd.;
 - .2 Jay R. Smith Manufacturing Co.;
 - .3 Zurn Industries Ltd.;
 - .4 Mifab Inc.

2.6 GREASE INTERCEPTOR (CSA APPROVED)

- .1 Grease intercepting and recovery unit, epoxy coated fabricated steel construction with one piece removable baffle assembly, code approved deep seal trap, secured and gasketed non slip cover, NH inlet and outlet, and external flow control, CSA approved product.
- .2 Acceptable products are:
 - .1 Watts Industries (Canada) Inc. WD-CSA Series;
 - .2 Jay R. Smith #P500-CSA;
 - .3 Zurn.

3 EXECUTION

3.1 DEMOLITION

- .1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.2 DRAIN AND VENT PIPING INSTALLATION REQUIREMENTS

- .1 Provide required drainage and vent piping. Pipe, unless otherwise specified, as follows:
 - .1 for underground pipe inside building and to points 1.5 m (5') outside building lines – rigid PVC sewer pipe, minimum 75 mm (3") dia.;
 - .2 for pipe inside building and aboveground in sizes less than or equal to 65 mm (2-½") dia. – type DWV copper;
 - .3 for pipe inside building and aboveground in sizes greater than or equal to 75 mm (3") dia. – Class 4000 cast iron;

- .2 Unless otherwise specified, slope horizontal drainage piping aboveground in sizes to and including 75 mm (3") dia. 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") dia. and larger 25 mm (1") in 2.4 m (8').
- .3 Install and slope underground drainage piping to inverts or slopes indicated on drawings to facilitate straight and true gradients between points shown. Verify available slopes before installing pipes.
- .4 Unless otherwise specified, slope horizontal branches of vent piping down to fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').
- .5 Extend vent stacks up through roof generally where shown but with exact locations to suit site conditions and in any case a minimum of 3 m (10') from fresh air intakes. Terminate vent stacks a minimum of 330 mm (13") above roof (including roof parapets) in vent stack covers. Where not shown on drawings, route vent piping from source to building exterior as required in order to satisfy local governing codes and authority. Coordinate vent routing with other building services and ensure there is no architectural impact.
- .6 Provide cast brass dielectric unions at connections between copper pipe and ferrous pipe or equipment.
- .7 All drainage piping located above residential units is to be Class 4000 cast iron.

3.3 INSTALLATION OF SHUT-OFF AND CHECK VALVES

- .1 Provide a shut-off valve and a check valve in discharge piping of each drainage pump.
- .2 Locate valves so they are easily accessible without the use of ladders or other such devices.

3.4 SUPPLY OF VENT STACK COVERS

- .1 Supply a properly sized vent stack cover for each vent stack penetrating roof.
- .2 Hand vent stack covers to roofing trade at site for installation and flashing into roof construction as part of roofing work. Coordinate installation to ensure proper locations. Provide waterproofing caps over vent stacks.

3.5 INSTALLATION OF CLEANOUTS

- .1 Provide cleanouts in drainage piping in locations as follows:
 - .1 in building drain or drains as close as possible to inner face of outside wall, and, if a building trap is installed, locate cleanout on downstream side of building trap;
 - .2 at or as close as practicable to the foot of each drainage stack;
 - .3 at maximum 15 m (50') intervals in horizontal pipe 100 mm (4") dia. and smaller;
 - .4 at maximum 30 m (100') intervals in horizontal pipe larger than 100 mm (4") dia.;
 - .5 in the wall at each new urinal or bank of urinals in a washroom;
 - .6 wherever else shown on drawings.

- .2 Cleanouts are to be same diameter as pipe in piping to 100 mm (4") dia., and not less than 100 mm (4") dia. in piping larger than 100 mm (4") dia.
- .3 Where cleanouts in vertical piping are concealed behind walls or partitions, install cleanouts near floor and so cover is within 25 mm (1") of the finished face of the wall or partition.

3.6 INSTALLATION OF FLOOR CLEANOUT TERMINATIONS

- .1 Where cleanouts occur in horizontal inaccessible underground piping, extend cleanout TY fitting up to floor, and provide a cleanout termination set flush with finished floor.
- .2 In waterproof floors, ensure each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit floor finish.
- .3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.
- .4 Ensure cleanout termination covers in tiled floor are square in lieu of round.

3.7 INSTALLATION OF FLOOR DRAINS, FUNNEL FLOOR DRAINS AND HUB DRAINS

- .1 Provide floor drains, funnel floor drains and hub drains.
- .2 Coordinate location of floor drains, funnel floor drains and hub drains with equipment provided by Mechanical Division and Owner's supplied equipment. Install in accordance with manufacturer's instructions.
- .3 Equip each drain with a trap.
- .4 In equipment rooms and similar areas, exactly locate floor drains to suit location of mechanical equipment and equipment indirect drainage piping. In washrooms, exactly locate floor drains to avoid interference with toilet partitions.
- .5 Confirm exact location of drains prior to roughing in. Where floor drains occur in washrooms coordinate locations with toilet partition installations.
- .6 Temporarily plug and cover floor drains during construction procedures. Remove plugs and covers during final clean-up work and when requested, demonstrate free and clear operation of each drain. Replace any damaged grates, and refinish any areas of the drain where cast iron finish has been damaged or removed, including rusted areas.

3.8 INSTALLATION OF DRAINAGE INTERCEPTOR

- .1 Provide an interceptor in drainage piping.
- .2 An extension is to be provided on interceptor to ensure proper drainage to and from interceptor
- .3 Ensure unit is easily accessible for maintenance. Confirm exact location prior to roughing-in.
- .4 Unit is to be vented with wall cleanouts as per OBC requirements

- .5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.
- .6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements. Submit a copy of the letter prior to Substantial Performance of the Work.
- .7 Include for 2 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1 GENERAL

1.01 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all equipment and associated hardware specified in this Section.
- .2 Include pump motor product data sheets and pump performance curves with shop drawing/product data sheet submission.
- .3 Submit with delivery of heater(s) a copy of the factory inspection and test report for each heater, and include a copy of each report with O & M Manual project close-out data.
- .4 Submit manufacturer/supplier installation certification letters as specified in Part 3 of this Section.
- .5 Submit, prior to Substantial Performance of the Work, start-up or test data specified in Part 3 of this Section.

2 PRODUCTS

2.01 HORIZONTAL IN-LINE CIRCULATING PUMPS

- .1 Bronze construction centrifugal pumps in accordance with drawing schedule and complete with:
 - .1 lead free cast bronze casing with flanged pipe connections;
 - .2 alloy steel shaft with integral thrust collar, copper shaft sleeve, and oil lubricated bronze sleeve bearings;
 - .3 balanced lead free cast bronze impeller;
 - .4 motor conforming to requirements of Section entitled Basic Mechanical Materials and Methods, connected to motor by means of a 4-spring coupling with guard;
 - .5 mechanical seal.
- .2 Acceptable manufactures are:
 - .1 S.A. Armstrong Ltd.;
 - .2 ITT Bell & Gossett;
 - .3 Grundfos Canada Inc.;
 - .4 Taco.

2.02 CIRCULATING PUMP AUTOMATIC CONTROL

- .1 Equal to ITT Bell & Gossett Model TC-1 115 volt, programmable, Automatic Timer Kit to control circulating pump on and off at pre-set minimum 15 minute intervals, and equipped with ON (continuous run), OFF (at all times), and TIMER (run at programmed times) modes.

2.03 ELECTRIC DOMESTIC HOT WATER TANK AND HEATER

- .1 CSA certified electric domestic hot water tank and heater with model number and performance as specified on drawings, and complete with:
 - .1 1035 kPa (150 psi) rated (working pressure) steel tank, glass lined, insulated (except for control panel area) with injected minimum R-16 foam insulation, covered with an enamelled steel jacket, and equipped with 40 mm (1-½") dia. NPS brass nipple water inlet and outlet connections, a drain valve, and sacrificial anode rods;
 - .2 removable multiple immersion heating elements, each consisting of a wire filament in a sealed stainless steel sheath;
 - .3 ASME rated temperature and pressure relief valve;
 - .4 factory pre-wired power and control panel.
- .2 Equip enamelled steel ventilated control panel with removable glass fibre insulation to cover bare area of tank, a hinged door, multiple knockouts, a ground screw, and following:
 - .1 terminal block for power wiring connections;
 - .2 magnetic contactors for heating elements;
 - .3 adjustable immersion thermostat;
 - .4 manual reset immersed high temperature limit control for each element;
 - .5 fuse block with fuses;
 - .6 element diagnostic panel with LED's for each element to monitor on-off operation of each element;
 - .7 contacts, relays and any other hardware, compatible with building automation system protocol and required to connect heater(s) to BAS in accordance with BAS control points list.
- .3 Acceptable manufacturers are:
 - .1 A.O. Smith Water Products Co.;
 - .2 John Wood (GWS Water Heating Co.);
 - .3 Rheem Canada Ltd.;
 - .4 Bradford White Canada Inc.

3 EXECUTION

3.01 DRAINAGE COORDINATION

- .1 Coordinate drain requirements of plumbing equipment provided by Mechanical Division and/or Owner with location of drains specified in Section 22 13 00.

3.02 INSTALLATION OF CIRCULATING PUMPS

- .1 Provide horizontal in-line domestic hot water circulating pumps.
- .2 Install pumps in place in vertical piping approximately 1.2 m (4') above floor in accordance with pump manufacturer's instructions.
- .3 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.
- .4 Include for 2 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.03 INSTALLATION OF CIRCULATING PUMP CONTROL

- .1 Provide a programmable timer to control circulating pump on and off at pre-set times. Mount timer and connect to pump in accordance with timer manufacturer's instructions. Programme timer in accordance with Consultant's instructions.

3.04 INSTALLATION OF POINT-OF-USE ELECTRIC DOMESTIC HOT WATER STORAGE TANK AND HEATER

- .1 Provide a domestic hot water storage tank and heater.
- .2 Install in accordance with manufacturer's instructions.
- .3 Provide a ceiling bracket (supplied by heater manufacturer) for heater mounting and rigidly secure in place.
- .4 Mount heater in a catch pan, pipe temperature/pressure relief valve outlet to drain, and pipe auxiliary catch pan to drain.
- .5 Coordinate installation with electrical trade who will connect heater with power wiring.
- .6 Check and test heater operation and, unless otherwise specified or instructed, set thermostat to produce 60°C (140°F) hot water.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

- .1 Submit product data sheets (fixture cuts) for all plumbing fixtures and fittings.

2 PRODUCTS

2.1 GENERAL RE: PLUMBING FIXTURES AND FITTINGS

- .1 Fixtures and fittings, where applicable, are to be in accordance with requirements of CAN/CSA B45 Series, General Requirements for Plumbing Fixtures, including supplements, ASME A112.1.18.1/CSA B125.1, Plumbing Supply Fittings, and CSA B125.3, Plumbing Fittings.
- .2 Barrier-free fixtures and fittings are to be in accordance with governing Code requirements.
- .3 Unless otherwise specified, vitreous china, porcelain enamelled, and acrylic finished fixtures are to be white.
- .4 Unless otherwise specified, fittings and piping exposed to view are to be chrome plated and polished.
- .5 Fittings located in areas other than private washrooms are to be vandal-proof.
- .6 Fixture carriers are to be suitable in all respects for the fixture they support and construction in which they are located.
- .7 Floor flanges for floor mounted water closets are to be cast iron or brass, secured to floor to prevent movement and complete with a wax seal and brass or stainless steel bolts, nuts, and washers. Plastic floor flanges will not be acceptable.
- .8 Proper seal to mate with fixture carrier flange and produce a water-tight installation.
- .9 Exposed traps for fixtures not equipped with integral traps, such as lavatories, are to be adjustable chrome plated cast brass "P" traps with cleanouts, minimum #17 gauge chrome plated tubular extensions, and chrome plated escutcheons, all to suit fixture type and drain connection.
- .10 Concealed traps for fixtures not equipped with integral traps, such as counter sinks, are to be adjustable cast brass with cleanout plugs, all to suit fixture type and drain connection.
- .11 Exposed supplies for fixtures which do not have supply trim/fittings with integral stops, i.e. lavatories, are to be solid chrome plated brass angle vales with screwdriver stops for public areas, wheel handle stops for private areas, flexible stainless steel risers, and stainless steel or chrome plated steel escutcheons, all arranged and sized to suit fixture.
- .12 Water piping as specified, complete with ball type shut-off valves as specified with water piping, or Dahl Bros. Canada Ltd. ¼ turn Mini Ball Valves.
- .13 All above grade drainage piping associated with waterclosets and showers are to be Class 4000 cast iron.

2.2 PLUMBING FIXTURES AND FITTINGS

.1 Plumbing fixtures and fittings are to be in accordance with the following:

.1 S-1 Shampoo Sink

- .1 Lanvain 'Odesa' Shampoo Sink. 487 mm (19.5") long, 544 mm (21.75") wide, 250 mm (10") high, constructed from porcelain, single handle faucet with spray hose, vacuum breaker, crumb cup strainer and wall bracket.
- .2 McGuire LFBV170 Supply - CONVERTIBLE™ Commercial Faucet Supply kit, consisting of (2) stop valves, (2) risers, (2) flanges (standard), Lead Free Brass body, Chrome-plated finish, 138 - 862 kPa (20 - 125 PSI) operating pressure, 4 to 60 °C (40 to 140 °F) operating temperature, Convertible loose key/triangle handle, Quarter turn ball valve, Angle stop, C.P. wrought steel deep bell wall flange (standard), C.P. prefabricated 127 mm (5") copper sweat tube extension nipple, 305 mm (12") C.P. lavatory flexible copper riser tubes (standard), 13 mm (1/2") Sweat inlet x 10 mm (3/8") O.D. outlet, 82 °C (180 °F) maximum during high-temperature system flush, AB 100 compliant, ASME A112.18.1 compliant, ASME A112.18.2-2 (risers), CSA B125.2 compliant (risers), Certified to NSF/ANSI 372, Certified to NSF/ANSI 61, UPC compliant.
- .3 McGuire 8912 P-Trap - Heavy cast brass, 38 x 38 mm (1-1/2" x 1-1/2") size, With cleanout plug, 292 mm (11-1/2") length, Neoprene gasket, Slipnuts.
- .4 Watts SI-750-TO Interceptors - epoxy coated cast aluminum, Sediment Interceptor, Hair, Plaster & Sediment Interceptor, 51 mm (2") I.P.S. threaded connections, removable stainless steel sediment basket, Gasketed cover, Stainless steel top.
- .5 Watts CA-311 Carrier - epoxy coated, Carrier, Floor Mounted, wall Plate, welded feet, universal steel hangar support plate, Heavy gauge steel offset uprights, integral mounting brackets, Plated hardware.

S-2 Stainless Steel Sink

- .6 Franke Commercial LBS6808P-1-3 Sink - Single compartment sink, 203 mm (8") centerset, Commercial sinks, with overall dimension, 508 mm (20") long, 521 mm (20-1/2") wide, 203 mm (8") high, constructed from 18 gauge Type 304 Stainless steel, Bowl dimensions are, Left bowl is 457mm (18") long and right bowl is 305mm (12") long, 406 mm (16") wide, 203 mm (8") deep, Polished to #4 satin finish, Factory installed EZ TORQUE™ fasteners, Factory applied rim seal, Center back waste location, 38 mm (1-1/2") (DN38) brass tailpiece, 89 mm (3-1/2") crumb cup strainer, Undercoated to reduce condensation and resonance, Compliances and certifications: ASME A112.19.3 compliant, CSA B45.4 compliant.
- .7 Chicago Faucets 786-GN2AFCABCP Faucet - Counter mounted, Manual, Two handles, Sink faucet, Chrome-plated finish, 203 mm (8") centerset, Lead Free ANSI/NSF 61 and ANSI/NSF 372 compliant ECAST® brass construction, -377-XTAB quatern compression cartridge, 5.7 LPM (1.5 GPM) maximum flowrate, -FC 5.7 LPM (1.5 GPM) laminar flow control insert in spout inlet, plain end outlet, Rigid/swing Gooseneck spout, 133 mm (5-1/4") spout reach, -317-PR vandal-resistant 102 mm (4") metal wrist blade handles with red & blue index, Grid drain included, 13 mm (1/2") NPSM supply inlet for 10 mm (3/8") or 13 mm (1/2") flexible riser.

- .8 McGuire LFBV170 Supply - CONVERTIBLE™ Commercial Faucet Supply kit, consisting of (2) stop valves, (2) risers, (2) flanges (standard), Lead Free Brass body, Chrome-plated finish, 138 - 862 kPa (20 - 125 PSI) operating pressure, 4 to 60 °C (40 to 140 °F) operating temperature, Convertible loose key/triangle handle, Quarter turn ball valve, Angle stop, C.P. wrought steel deep bell wall flange (standard), C.P. prefabricated 127 mm (5") copper sweat tube extension nipple, 305 mm (12") C.P. lavatory flexible copper riser tubes (standard), 13 mm (1/2") Sweat inlet x 10 mm (3/8") O.D. outlet, 82 °C (180 °F) maximum during high-temperature system flush, AB 100 compliant, ASME A112.18.1 compliant, ASME A112.18.2-2 (risers), CSA B125.2 compliant (risers), Certified to NSF/ANSI 372, Certified to NSF/ANSI 61, UPC compliant.
- .9 McGuire 8912 P-Trap - Heavy cast brass, 38 x 38 mm (1-1/2" x 1-1/2") size, With cleanout plug, 292 mm (11-1/2") length, Neoprene gasket, Slipnuts.
- .2 EW-1 Emergency Eyewash
 - .1 Guardian G1814-G3600LF-T Emergency Equipment - Wall mounted, Eye wash, constructed from, Stainless steel construction, Thermostatic mixing valve blends hot and cold water, 283 mm (11-1/8") Ø bowl size, Corrosion resistant powder coated finish, Two GS-Plus spray heads with flip top dust cover each, 13 mm (1/2") Ø IPS Chrome plated brass stay open ball valve, 13 mm (1/2") Ø NPT female inlet supply inlet, Chrome plated brass tailpiece and trap with 1-1/2" (38 mm) IPS waste connection, 32 mm (1-1/4") Ø NPT female outlet, Compliances and certifications: ANSI compliant.
 - .2 Lawler 911E/F-Unit 84909 Mixing Valve - Emergency mixing valve, Thermostatic High-low master water mixing valve, The control mechanism shall employ a liquid-filled thermostatic motor to drive the valve without additional power requirements. The control mechanism shall employ a stainless steel sliding piston control device with reverse seat closure and both fixed and variable cold water bypass.

2.3 ACCEPTABLE MANUFACTURERS

- .1 Subject to compliance with requirements, manufacturers that may be incorporated into the Work include, but are not limited to, following:
 - .1 Plumbing Brass:
 - .1 American Standard;
 - .2 Delta Commercial;
 - .3 Chicago Faucet;
 - .4 Moen Commercial.
 - .2 Stainless Steel Sinks:
 - .1 Franke Commercial;
 - .2 Novanni Commercial;
 - .3 Aristaline;

- .4 Arch Metal Ind.
- .3 Emergency Eye Wash and Emergency Showers:
 - .1 Haws;
 - .2 Speakman;
 - .3 Bradley.
- .4 Drain Fittings, Angle Supplies, and Traps:
 - .1 McGuire;
 - .2 American Standard;
 - .3 Delta Commercial;
 - .4 Zurn Industries.
- .5 Fixture Carriers:
 - .1 Watts Industries;
 - .2 Jay R. Smith;
 - .3 Zurn Industries.
- .6 Thermostatic Mixing Valves:
 - .1 Lawler;
 - .2 Delta Commercial;
 - .3 Symmons

2.4 CAULKING

- .1 General Electric Series SCS-1200 Silicone Construction Sealant or Dow Corning 780 silicone rubber sealant with primers as recommended by sealant manufacturer. Caulking colour(s) for coloured fixtures other than white, if any, will be selected by Consultant from sealant manufacturer's standard colour range.

3 EXECUTION

3.1 DEMOLITION

- .1 Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.2 INSTALLATION OF PLUMBING FIXTURES AND FITTINGS

- .1 Provide required plumbing fixtures and fittings.

- .2 Where new fixtures and fittings are to be connected to existing piping, include for required piping revisions.
- .3 Connect plumbing fixtures and fittings with piping sized in accordance with drawing schedule. Refer to manufacturer's published connection (rough-in) requirements. Where manufacturer requires piping connection larger than shown below, provide piping accordingly:

FIXTURE AND/OR FITTING	DRAIN SIZE MM (IN.)	VENT SIZE MM (IN.)	DHW SIZE MM (IN.)	DCW SIZE MM (IN.)	TEMP WATER SIZE MM (IN.)
Lavatories	32 (1-¼)	32 (1-¼)	12 (½)	12 (½)	-----
Counter Sinks	38 (1-½)	32 (1-¼)	12 (½)	12 (½)	-----
Emergency Eye Wash	32 (1-¼)	32 (1-¼)	12 (½)	12 (½)	12 (½)

- .4 Confirm exact location of plumbing fixtures and trim prior to roughing-in. Refer to architectural plan and elevation drawings.
- .5 When installation is complete, check, and test operation of each fixture and fitting. Adjust or repair as required.
- .6 For barrier-free fixtures, comply with mounting height and other requirements of governing Code(s).
- .7 Supply templates for counter mounted fixtures and trim and hand to trades who will cut the counter. Ensure openings in counter are properly located.
- .8 Install eye wash fixtures in accordance with manufacturer's instructions. Ensure exposed piping is painted.
- .9 Wall mount mixing valves for emergency fixtures approximately 1.5 m (5') above floor and secure in place. Check and confirm valve operation and temperature of tempered water supply. Provide cabinets. Identify each cabinet and hand 3 identified cabinet keys to Consultant prior to Substantial Performance of the Work.

3.3 CAULKING AT PLUMBING FIXTURES AND FITTINGS

- .1 Caulk around plumbing fixtures and fittings where they contact walls, floors, and any other building surface.
- .2 Clean areas/surfaces to be caulked and prime in accordance with sealant manufacturer's instructions. Where damage to a building surface may occur, mask surface to prevent damage and ensure a clean exact edge to the caulking bead.
- .3 Apply caulking using a gun with proper size and shape of nozzle and force sealant into joints to ensure good surface contact and a smooth and even finished bead of sealant.
- .4 If joints have been masked sealant may be tooled in a continuous stroke to obtain complete void filling. Remove masking tape immediately after tooling and before sealant begins to skin.

3.4 CLOTHES WASHER CONNECTIONS

- .1 Provide roughed-in water and drain connections for Owner supplied clothes washer consisting of:
 - .1 15 mm (½") dia. piping connection for both hot and cold water, each terminated in a Dahl "Mini-Ball" Valve with hose end and water hammer arrestor;
 - .2 50 mm (2") dia. standing waste with a height to suit the washer drain and complete with a "P" trap.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all products specified in this Section.
- .2 Supply a spare charge of limestone for acid neutralizing sump, as specified in Part 3 of this Section.
- .3 Submit a start-up and installation certification letter from supplier of acid neutralizer sump as specified in Part 3 of this Section.

2 PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS

- .1 Flame retardant PVDF grooved end pipe and fittings to ASTM F1412, Schedule 40 or Schedule 80 as required, complete with fused joints made with an electric resistance wire coil coupling assembly and an electric control unit supplied by the pipe supplier.
Acceptable products are:
 - .1 Zurn "Z9 Systems";
 - .2 Ipex Inc. "PLENUMLINE" (Smillie McAdams Summerlin Ltd.);
 - .3 Orion "Whiteline" (Watts Industries (Canada) Inc.);

2.2 CLEANOUTS

- .1 For horizontal piping, PVDF TY pipe fitting with removable, air-tight cleanout access cover.
- .2 For vertical piping, PVDF "Barrett" type cleanout tee fitting with removable, air-tight access cover.

2.3 ACID NEUTRALIZING SUMP AND SOLIDS INTERCEPTOR

- .1 Smillie McAdams Summerlin Ltd. equipment consisting of a sediment interceptor, an acid neutralizing sump with limestone chips, and an effluent monitoring and alarm panel.
- .2 Model SI- __ moulded, round, black polyethylene interceptor with MJ type inlet and outlet fittings, strainer basket locating and securing guides, removable strainer basket with handles, 3.2 mm (1/8") diameter perforations and a solids retention chamber, and a removable, gasketed black polyethylene cover with stainless steel securing hardware.
- .3 Model AN- __, moulded, round, black polyethylene sump with MJ type inlet, outlet and vent pipe connection fittings, threaded cleanout plug in piping inlet riser, a tank adapter with 20 mm (3/4") FIPS connection for installation of a monitoring system pH electrode in the effluent outlet, and a removable 12 mm (1/2") thick gasketed black polyethylene top with 300 mm (12") diameter access port and stainless steel hardware, and a maintenance instruction sign supplied loose for field installation.
- .4 Initial operating charge of limestone chips (calcium carbonate equivalent content of 90%) in 25 mm (1") to 75 mm (3") size pieces, and a complete spare charge of limestone chips.

- .5 Model 47, 115 volt, 1-phase, surface wall mounting panel with power cord and plug, pH electrode assembly with a minimum of 6 m (20') of coaxial cable with exact length of cable to suit mounting location of panel, audible and visual high and low pH alarms, and a hinged front door with viewing window.
- .6 Acceptable manufacturers are:
 - .1 Smillie McAdams Summerlin Ltd;
 - .2 Town and Country Plastics, Inc.

3 EXECUTION

3.1 PIPING INSTALLATION REQUIREMENTS

- .1 Provide required acid and corrosive resistant drainage and vent piping.
- .2 Piping is to be PVDF.
- .3 Unless otherwise specified, slope horizontal drainage piping above ground in sizes to and including 75 mm (3") diameter 25 mm (1") in 1.2 m (4'), and pipe 100 mm (4") diameter and larger 25 mm (1") in 2.4 m (8').
- .4 Install and slope underground drainage piping to inverts or slopes indicated on drawings to facilitate straight and true gradients between points shown. Verify available slopes before installing pipes.
- .5 Unless otherwise specified, slope horizontal branches of vent piping down to fixture or pipe to which they connect with a minimum pitch of 25 mm (1") in 1.2 m (4').
- .6 Ensure piping is installed in accordance with manufacturer's instructions, particularly with respect to piping joints, and piping hangers and supports.

3.2 INSTALLATION OF CLEANOUTS

- .1 Provide cleanouts in acid and corrosive resistant drainage piping in locations as follows:
 - .1 at or as close as practical to the foot of each stack;
 - .2 at maximum 15 m (50') intervals in horizontal pipe larger than 100 mm (4") dia.;
 - .3 at maximum 30 m (110') intervals in horizontal pipe larger than 100 mm (4") dia.;
 - .4 wherever else shown on drawings.
- .2 Cleanouts are to be same diameter as pipe in piping to 100 mm (4") dia. and not less than 100 mm (4") dia. in piping larger than 100 mm (4") dia.
- .3 Where cleanouts are concealed behind walls or partitions, install cleanouts near floor and so cover is within 25 mm (1") of finished face of the wall or partition.

3.3 INSTALLATION OF FLOOR CLEANOUT TERMINATIONS

- .1 Where cleanouts occur in horizontal inaccessible underground acid-resistant piping, extend cleanout TY fitting up to floor, and provide a cleanout termination set flush with the finished floor.
- .2 In waterproof floors, ensure that each cleanout termination is equipped with a flashing clamp device. Cleanout terminations are to suit the floor finish.
- .3 Where cleanout terminations occur in finished areas, confirm locations prior to rough-in and arrange piping to suit.

3.4 INSTALLATION OF ACID NEUTRALIZING SUMP AND INTERCEPTOR

- .1 Provide an acid neutralizing sump with solids interceptor. Confirm exact location prior to roughing-in.
- .2 Provide a welded, cleaned, primed, and enamel coated black structural steel angle support stand for solids interceptor. Equip stand with a steel plate top and flanged legs, and secure in place. Height of stand is to suit height of neutralizing sump inlet. Ensure there is sufficient space available above tanks to permit removal of the strainer basket and introduction of limestone.
- .3 Provide a full charge of limestone chips in sump. Supply a spare charge of limestone and store at site where directed. Ensure Owner is aware of name, address and telephone number of the limestone supplier.
- .4 Install maintenance instruction sign on neutralizing tank in an easily readable location.
- .5 Surface wall mount monitoring alarm panel and plug into adjacent receptacle. Install pH probe in neutralizing sump, and connect to pH monitor panel with coaxial cable in rigid 25 mm (1") diameter PVC conduit. Adjust panel and prove proper operation.
- .6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.
- .7 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements. Submit a copy of the letter prior to Substantial Performance.
- .8 Include for 4 hours of on-site training for 2 groups of 6 people. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data for all products specified in Part 2 of this Section except for pipe, fittings, and unions. Indicate performance criteria, conformance to appropriate reference standards, and limitations.

1.2 QUALITY ASSURANCE

- .1 Gas system work is to be in accordance with requirements of CAN/CSA B149.1, Natural Gas and Propane Installation Code, as amended by local Gas Codes.
- .2 Gas system work is to be performed only by licensed gas pipe fitters (holding Gas Technician 1 Certificate) authorized under TSSA Act.
- .3 Apply for, on TSSA forms, approval of gas system design by TSSA prior to work beginning at site and prior to ordering any equipment. Submit completed TSSA Form and copies of shop drawings/product data sheets as required to TSSA and obtain an approval certificate. Pay costs for TSSA review and approval process. If TSSA requires revisions to the system and revisions result in an extra cost, a Notice of Change will be issued by Consultant for the revision.

2 PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS

- .1 Uncoated Black Steel - Screwed Joints
 - .1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, complete with malleable cast iron screwed fittings to ANSI B2.1, and screwed joints.
- .2 Uncoated Black Steel - Welded Joints
 - .1 Schedule 40 mild black carbon steel, ASTM A53, Grade B, mill or site bevelled, complete with factory made forged steel butt welding fittings and welded joints.
- .3 Copper - Uncoated
 - .1 Type "G" seamless copper tubing to ASTM B837, hard temper with wrought copper capillary brazed joint type fittings to ASTM B.61, and brazed joints made with "Sil-Fos" or "Sil-Fos 5" brazing alloy, or, soft temper with flared brass fittings of a single 45° flare type, forged or with a machined long nut and copper to copper threaded connectors, and, where required, flared brass copper to NPS adapters.
- .4 Flexible Stainless Steel
 - .1 Flexible, CSA certified, 860 kPa (125 psi) rated, gas-tight, convoluted stainless steel tubing factory jacketed with a bright yellow PVC coating which is continuously identified. Supply tubing in coils and complete with factory attached stainless steel end fittings, and adapter unions, protective plates, and steel clamps.
 - .2 Acceptable products are:
 - .1 Tru-Flex Metal Hose LLC. "Pro-Flex";

- .2 Titeflex Corp. "Gastite";
- .3 Omega Flex Canada "TracPipe".

2.2 PIPING UNIONS

- .1 Screwed Piping
 - .1 Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).
- .2 Flanged Piping
 - .1 Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.
- .3 Copper to Steel
 - .1 Equal to Kamco Products "Copper Stopper".

2.3 SHUT-OFF VALVES

- .1 Ball Type
 - .1 CSA certified, minimum 3100 kPa (450 psi) WOG rated, 1/4 turn, full port non-lubricated brass ball valves, each complete with a Teflon PTFE seat, chrome plated solid ball, removable lever handle, and screwed ends.
 - .2 Acceptable products are:
 - .1 Neo Valves Inc. #425;
 - .2 Kitz Corp. Code 58;
 - .3 Toyo Valve Co. Fig. 5044A.
- .2 Plug or Ball Type
 - .1 CSA certified, plain face flanged, Class 125, 1380 kPa (200 psi) rated, 1/4 turn, cast iron lubricated plug valves, each wrench operated and complete with cylindrical plug with lubricant grooves, lubricant screw, and lubricant receptacle, or full port carbon steel ball valves with flanged ends.
 - .2 Acceptable products are:
 - .1 Neo Valves Inc. #1AS40114 plug valve;
 - .2 Newman Hattersley #171M plug valve;
 - .3 Kitz Corp. Code No. 150 SCTAM-FS-CGA ball valve.

- .3 Shut off valves serving natural gas emergency generators are to be provided with valve position indicator and contact to initiate trouble alarm condition at the generator control panel.

2.4 PRESSURE REGULATORS

- .1 CSA certified pressure regulators as follows:
 - .1 vented type: spring-loaded self-operated design, tight closing, selected for facility gas pressure and piping pressure loss, and connected equipment load at full firing rate plus 20% spare, and complete with:
 - .1 1035 kPa (150 psi) rated cast iron body finished with corrosive resistant epoxy enamel;
 - .2 aluminum diaphragm and spring case with Nitrile diaphragm, disc, and body o-ring;
 - .3 throttling type, high flow rate, tight shut-off relief valve selected to protect equipment downstream of regulator in coordination with regulator capacity.
 - .2 Acceptable manufacturers are:
 - .1 Maxitrol Co.;
 - .2 Fisher Controls;
 - .3 Leslie Controls Inc.;
 - .4 Lakeside Process Controls.

3 EXECUTION

3.1 DEMOLITION

- .1 Perform required gas system demolition work. Refer to demolition requirements specified in Section entitled Demolition and Revision Work.

3.2 NATURAL GAS PIPING INSTALLATION REQUIREMENTS

- .1 Provide required natural gas distribution piping and connect gas fired or operated equipment, and provide required vent piping to atmosphere, including vent piping from pressure regulators. Perform piping work in accordance with requirements of CAN/CSA B149.1, Natural Gas and Propane Installation Code, as amended by local Gas Codes.
- .2 Piping is to be as follows:
 - .1 for underground piping, coated Schedule 40 black steel, coated soft copper, or polyethylene;
 - .2 for aboveground piping, uncoated Schedule 40 black steel, hard temper or soft copper, or, if permitted, flexible stainless steel.
- .3 Install flexible stainless steel pipe in strict accordance with pipe manufacturer's instructions.

- .4 Slope gas piping in direction of flow to low points.
- .5 Ensure supports for roof mounted piping are sized (height) to accommodate roof slope and required piping slope, and to permit installation of low point dirt pockets.
- .6 Provide full pipe diameter 150 mm (6") long drip pockets at bottom of vertical risers, at piping low points, and wherever else shown and/or required.
- .7 Identify natural gas piping aboveground with 2 coats of safety yellow enamel applied over primer, and SMS Ltd. or equal coil type vinyl identification makers with arrows.
- .8 Include for mounting of a solenoid valve in the gas piping to kitchen cooking equipment.

3.3 INSTALLATION OF SHUT-OFF VALVES

- .1 Provide CSA approved ball type or lubricated plug type shut-off valves to isolate equipment, and wherever else shown.
- .2 Ensure valves are located for easy accessibility and maintenance.

3.4 INSTALLATION OF PRESSURE REGULATORS

- .1 Provide pressure regulators in gas distribution piping where indicated and/or required.
- .2 Use vented type pressure regulators for all other applications.
- .3 Install regulating stations in accordance with requirements of CAN/CSA B149.1.
- .4 Provide 6 mm (¼") diameter test ports upstream and downstream of each regulator assembly complete with a capped isolation valve.
- .5 Locate outdoor regulating stations a minimum of 300 mm (12") away from walkways, and 3 m (10') away from equipment air intakes and building openings. Provide required vent piping and terminate vents in a turn-down elbow fitting with bronze bug screen secured in place.
- .6 Locate indoor regulating stations in locations accessible without use of ladders or lifts. Combine vents where permitted and increase vent pipe size accordingly. Extend vent piping up through roof 3 m (10') away from equipment air intakes and building openings and terminated in a turn-down elbow fitting with bronze bug screen secured in place.
- .7 Indicate operating set-points, relief settings and vent arrangements for each regulating station on as-built record drawings.

END OF SECTION

1. GENERAL

1.1 RELATED WORK SPECIFIED IN OTHER SECTIONS

- .1 The following work which is related to the work of this Section is specified in other Sections of the Specification:
 - .1 supply of piping or equipment mounted temperature control components;
 - .2 domestic water piping connections to equipment;
 - .3 drainage piping connections to equipment drain pans;
 - .4 provision of heat pumps;
 - .5 provision of site applied thermal insulation for piping and equipment;
 - .6 circulating system testing, adjusting and balancing.

1.2 SUBMITTALS

- .1 Submit shop drawings for all products specified in this Section except piping and unions.
- .2 Submit certified performance curves with all pump shop drawings.
- .3 Submit with delivery of each unit a copy of factory inspection and test report, and include a copy of each report with O & M Manual project close-out data.
- .4 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.
- .5 Prior to Substantial Performance of the Work, submit a spare seal flush line filter for each pump equipped with a seal flush line.
- .6 Shop drawings for piping anchors must be prepared and stamped by a professional Structural Engineer registered in the jurisdiction of the work. Refer to requirements for Contractor retained engineers specified in Section entitled Mechanical Work General Instructions.
- .7 Submit a letter from pipe anchor design engineer to stating engineer has visited site to examine installation of pipe anchors and pipe anchor installation is in accordance with reviewed anchor shop drawing.

1.3 QUALITY ASSURANCE

- .1 Pump motors are to comply with requirements of Section entitled Basic Mechanical Materials and Methods.

2. PRODUCTS

2.1 PIPE, FITTINGS AND JOINTS

- .1 Black Steel - Screwed Joint
 - .1 Mild black carbon steel, Grade B, ASTM A53, complete with Class 125 cast iron threaded fittings to ANSI/ASME B16.4, and screwed joints.
- .2 Black Steel - Welded Joint
 - .1 Mild black carbon steel, Grade B, ASTM A53, mill or site bevelled, complete with factory made seamless carbon steel butt welding fittings to ASTM A234, Grade WPB, with long sweep pattern elbows unless otherwise specified, and welded joints.

2.2 PIPING UNIONS

- .1 Screwed Piping
 - .1 Malleable iron, ground joint, bronze or brass to iron or bronze to bronze seat screwed unions and union elbows with a minimum pressure rating of 1725 kPa (250 psi) steam at 260°C (500°F).
- .2 Flanged Piping
 - .1 Forged carbon steel slip-on type raised faced welding flange unions to ASTM A105, 150 lb. Class for steel pipe, and slip-on type 150 lb. Class bronze flanges for copper pipe.

2.3 CIRCUIT BALANCING VALVES

- .1 Tour & Andersson Series 787 threaded and Series 788 flanged for precise flow measurement, balancing, and positive shut-off with no drip seat. Each valve to be wye pattern, globe style with self-sealing EPDM measurement points, EPDM seat, and wheel handles with locking tamper-proof setting.
- .2 Circuit balancing valves shall be sized based on design water flow and manufacturer's performance data. Refer to the following circuit balancing valve schedule for sizes.

Size (in)	Nominal Flow			
	Min. (gpm)	Max. (gpm)	Min. (l/s)	Max. (l/s)
1/2	0.6	2.8	0.038	0.177
3/4	2.0	6.0	0.126	0.379
1	3.9	10.0	0.246	0.631
1-1/4	5.0	15.0	0.316	0.947
1-1/2	6.6	20.0	0.416	1.262
2	12.6	36.0	0.795	2.272
2-1/2	38.0	100.0	2.398	6.310
3	31.0	130.0	1.956	8.203
4	68.0	200.0	4.291	12.620
5	90.0	320.0	5.679	20.192
6	182.0	450.0	11.48	28.395

- .3 Acceptable manufacturer is Tour & Anderson (TA Hydronics) only.

2.4 PRESSURE RELIEF VALVES

- .1 Dresser Industries Canada Ltd., "CONSOLIDATED", ASME tested, rated and certified, cast iron, bronze fitted, 1725 kPa rated pressure relief valves, each capable of relieving the full output of the equipment it is associated with, and factory set at 105% (percent) times the system pressure at the point in the system where the pressure relief valve is installed.
- .2 Acceptable manufacturers are Dresser Industries Canada Ltd., Watts Industries, Kunkle, Spirax Sarco Canada Ltd., Singer Valve Co. Ltd., and Lonergan.

2.5 SHUT-OFF VALVES

.1 Ball Type

- .1 Class 600, 4140 kPa (600 psi) WOG rated full port ball valves, each complete with a forged brass or bronze body and cap, blowout-proof stem, solid forged brass chrome plated ball, "Teflon" or "PTFE" seat, threaded ends, and removable lever handle.
- .2 Acceptable products are:
 - .1 Toyo Valve Co. Fig. 5044A;
 - .2 Watts Industries (Canada) Inc. #FBV-3;
 - .3 Kitz Corp. Code 58;
 - .4 Victaulic Co. of Canada Ltd. Series 722;
 - .5 Apollo Valve #77-100.

.2 Butterfly Type

- .1 Cast ductile iron, lug body style, 1200 kPa (175 psi) rated butterfly valve, each complete with a neck to permit 50 mm (2") of insulation above the flange, a field replaceable EPDM seat, ductile iron disc, stainless steel shaft with EPDM seal, a lever handle for valves to and including 150 mm (6") diameter, a handwheel and gear type operator for valves larger than 150 mm (6") diameter, and each suitable for bubble-tight dead end service with valve closed and either side of connecting piping removed.
- .2 Acceptable products are:
 - .1 DeZurik of Canada Ltd., Figure No. 632;
 - .2 Victaulic Co. of Canada Ltd. Vic-300 MasterSeal or AGS Vic-300;
 - .3 Apollo Valve 143 Series;
 - .4 Watts Industries (Canada) Inc. #BF-03;
 - .5 Kitz Corp. 6112 Series;
 - .6 Toyo Valve Co. 918DESL/G2.

2.6 SWING CHECK VALVES

.1 Bronze - Screwed

.1 Class 125, 1380 kPa (200 psi) WOG rated horizontal swing check valves, each complete with a "Y" pattern bronze body, hinged brass disc, easy access screw-in cap, and screwed ends.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 236;

.2 Nibco #T-433;

.3 Kitz Corp. Code No. 22.

.2 Steel - Grooved Ends

.1 Victaulic Co. of Canada Ltd. Series 716, 779 or W715 grooved end carbon steel check valves suitable for mounting horizontally or vertically.

.3 Cast Iron - Screwed and Flanged

.1 Cast iron, bronze trim, 1380 kPa (200 psi) rated swing check valves, each complete with a bronze disc and seat, malleable iron hinge, bolted cover, and screwed or flanged ends as required.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 435A;

.2 Watts Industries (Canada) Inc. #F-511;

.3 Kitz Corp. Code No. 78.

2.7 VERTICAL LIFT CHECK VALVES

.1 Class 150, 1380 kPa (200 psi) WOG rated bronze vertical lift check valves, each complete with screwed ends and a bronze disc.

.2 Acceptable products are:

.1 Toyo Valve Co. Fig. 231;

.2 Watts Industries (Canada) Inc. #600;

.3 Kitz Corp. Code No. 36.

2.8 WAFER CHECK VALVES

.1 Threaded lug body type, full bore, ANSI Series 150, 1965 kPa (285 psi) rated at 38°C (100°F), non-slam wafer check valves, each complete with a carbon steel body, stainless steel discs, a shaft, springs, disc stop and thrust bearings constructed of type 316 stainless steel, and seat materials to suit the application. The inside diameter of the valve must equal the inside diameter of the connecting pipe.

.2 Acceptable products are:

- .1 Gulf Valve Co. "WAFER CHECK";
- .2 Watts Industries (Canada) Inc. Series ICV-125;
- .3 The Metraflex Co. Style CVXX.

2.9 DRAIN VALVES

- .1 Minimum 2070 kPa (300 psi) WOG rated, 20 mm ($\frac{3}{4}$ ") diameter straight pattern bronze ball valves, each complete with a threaded outlet suitable for coupling connection of 20 mm ($\frac{3}{4}$ ") diameter hose, and a cap and chain.
- .2 Acceptable products are:
 - .1 Toyo Valve Co. Ltd. Fig. 5046;
 - .2 Watts Industries (Canada) Inc. #B-6000-CC;
 - .3 Kitz Corp. Code No. 68AC;
 - .4 Apollo Valves #78-104-01.

2.10 AIR VENTS

- .1 Manual Air Vents
 - .1 Equal to Conbraco 27 Series, 3.2 mm ($\frac{1}{8}$ ") diameter with a key handle.
- .2 Automatic Air Vents:
 - .1 Float actuated air vents, each complete with a semi-steel body and cap, a stainless steel float assembly and seat, and a neoprene head.
 - .2 Acceptable products are:
 - .1 Spirax Sarco Ltd., Type 13 W for system working pressures to 1035 kPa (150 psi), 13 WH for system working pressures greater than 1035 kPa (150 psi);
 - .2 Armstrong International Inc. No. 1-AV.

2.11 STRAINERS

- .1 Cast iron wye shaped strainers, minimum 890 kPa (125 psi) rated and complete with a removable type 304 stainless steel screen with perforations sized to suit the application, and, for strainers 50 mm (2") diameter and larger, a blowdown pipe connection tapping.
- .2 Acceptable products are:
 - .1 Spirax Sarco Ltd. Type IF-125 screwed or Type AF-250 flanged;
 - .2 Toyo Valve Co. Ltd. Fig. 380A screwed or Fig. 381 flanged;
 - .3 Victaulic Co. of Canada Style 732 or W732 "Vic-Strainer";
 - .4 Armstrong International Inc. A1 Series;
 - .5 Watts Industries (Canada) Inc. #77SCI;
 - .6 Mueller Steam Specialty Products Model 11M screwed or Model 758 flanged.

3. EXECUTION

3.1 CONDENSER WATER PIPING INSTALLATION REQUIREMENTS

- .1 Provide all required condenser water piping.
- .2 Pipe, unless otherwise noted, shall be mild black steel, Schedule 40 for pipe to 8" (200 mm) diameter, Schedule 30 for pipe 10" to 18" (250 mm to 450 mm) diameter, and Schedule 20 for pipe 20" to 24" (500 mm to 600 mm) diameter.
- .3 Piping to and including 2" (50 mm) diameter shall be screwed. Piping 2-1/2" (65 mm) diameter and larger shall be welded.
- .4 Slope horizontal mains to provide a minimum continuous up-grade of 1" (25 mm) in 20' (6 m) to high points. Slope branch supply and return piping connections to equipment a minimum of 1" (25 mm) in 4' (1.2 m).
- .5 Provide shut-off valves in piping connections to equipment, to isolate piping risers, to isolate other sections of systems as shown, and wherever else indicated on drawings. Valves in piping to and including 50 mm (2") dia. are to be ball type. All other shut-off valves are to be ball or butterfly type unless otherwise specified. Locate valves so they are easily accessible. Wherever possible, install valves at uniform height. Provide chain operators for valves which are inaccessible for operation from floor level.
- .6 Provide an air relief vent in the high points of closed loop piping systems if the piping is not adequately vented into equipment.
- .7 Provide circuit balancing valves in piping generally where shown on the drawings but with exact locations in accordance with instructions of personnel doing system flow balancing work. Confirm locations prior to installation. Balancing valves shall be sized according to design flow. Ensure that balancing valves are a minimum of 10 pipe diameters downstream of any pump or fitting and a minimum of 5 pipe diameters upstream of any fitting.
- .8 Pipe the discharge of each liquid piping safety relief valve to drain unless otherwise shown or specified.
- .9 Check and test the operation of each liquid piping safety relief valve. Replace defective valve.
- .10 Install automatic control valves, piping wells and similar piping and/or equipment mounted control components required for automatic temperature control systems supplied as part of the work specified the Section 25 05 05. Refer to the drawing control diagrams.

3.2 INSTALLATION OF PRESSURE RELIEF VALVES

- .1 Provide factory set pressure relief valves. Pipe discharge of each water piping relief valve to drain unless otherwise shown or specified.
- .2 Confirm relief valve settings.

3.3 INSTALLATION OF AIR VENTS

- .1 Provide an air vent in piping mains at all high points, at equipment connections, and wherever else shown and/or specified. Equip each air vent with a ball type shut-off valve. Install vents in 100 mm (4") dia. and larger piping and all vents in mechanical rooms in accordance with drawing detail.

- .2 Provide 9 mm (3/8") dia. copper drain piping from each automatic air vent to nearest suitable drain and terminate so discharge is visible. Identify drain piping.

3.4 INSTALLATION OF STRAINERS

- .1 Provide strainers in piping. Locate strainers so baskets are easily accessible and removable. Clean strainer baskets during and after piping system flushing and cleaning is complete, and before water quantity balancing commences.

3.5 FLUSHING AND CLEANING PIPING

- .1 Flush and clean new piping in accordance with requirements specified in Section entitled HVAC Water Treatment.

3.6 TESTING, ADJUSTING AND BALANCING

- .1 When work is complete and equipment is operating as intended, test, adjust and balance water flows in accordance with requirements specified in Section entitled Testing, Adjusting, and Balancing.

END OF SECTION

1. GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all products specified in this Section except shop fabricated ductwork and fittings.
- .2 Include capacity, throw and terminal velocity, noise criteria, and pressure drops with grille and diffuser shop drawing/product data sheet submission.
- .3 Submit duct leakage test data prior to ductwork being covered from view.
- .4 Include the following with fan & accessories shop drawing/product data sheet submission:
 - .1 certified fan performance curves at specified operating point with flow, static pressure and HP clearly plotted;
 - .2 certified sound power data that conforms to specified levels;
 - .3 product data sheets for all accessories;
 - .4 product data sheets for fan motors.

1.2 QUALITY ASSURANCE

- .1 Grilles and diffusers are to be tested and performance certified to ANSI/ASHRAE 70, Method of Testing the Performance of Air Outlets and Air Inlets.

2. PRODUCTS

2.1 GALVANIZED STEEL DUCTWORK

- .1 Galvanized steel sheet is to be hot dipped in accordance with requirements of ASTM A653. G60 galvanizing for bare uncovered duct to be finish painted. G90 for all other galvanizing.
- .2 Rectangular
 - .1 Lock forming grade hot dip galvanized steel, ASTM A653, shop fabricated, minimum #26 gauge.

2.2 RECTANGULAR ALUMINUM DUCTWORK

- .1 Alloy 3003 Temper H14 aluminum, ASTM B209, shop or factory fabricated, water-tight, with metal gauges and fabrication in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct working pressure classification, and type 316 stainless steel support hardware.

2.3 FLEXIBLE METALLIC DUCTWORK

- .1 Bare
 - .1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-UN", ULC S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, and supplied in 3 m (10') lengths.
- .2 Insulated
 - .1 Spirally wound, semi-rigid, self-supporting corrugated aluminum duct with continuous triple lock seams, SMACNA Form "M-I", ULC S110 listed and labelled as a Class 1 Air Duct, constructed of dead soft aluminum strip, supplied in 3 m (10') lengths and factory covered with 40 mm (1-½") thick, 12 kg/m³ (0.75 lb/ft³) density fibreglass insulation with a vinyl jacket meeting 25/50 flame spread and smoke developed requirements tested in accordance with CAN/ULC S102.

2.4 FLEXIBLE CONNECTION MATERIAL

- .1 Waterproof, indoor-outdoor type flexible connection material meeting requirements of NFPA 90A, consisting of woven glass fibre fabric coated on both sides with synthetic rubber. Acceptable products are:
 - .1 Duro Dyne Canada Inc. "DUROLON";
 - .2 Dyn Air Inc. "HYPALON".
- .2 Waterproof, flameproof, high temperature flexible connection material meeting requirements of NFPA 90A, consisting of a woven glass fibre fabric coated on both sides with silicone rubber. Acceptable products are:
 - .1 Duro-Dyne Canada Inc. "THERMAFAB";
 - .2 Dyn Air Inc. "SILICON HI-T".

2.5 METAL DUCT SYSTEM JOINT SEALANT

- .1 ULC listed and labelled, premium grade, grey colour, water base, non-flammable duct sealer, brush, or gun applied, with a CAN/ULC S102 tested maximum flame spread rating of 5 and smoke developed rating of 0.
- .2 Acceptable manufacturers are:
 - .1 Johns Manville;
 - .2 Manson Insulation;
 - .3 Knauf Insulation.

2.6 ACOUSTIC LINING

- .1 Minimum 25 mm (1") thick acoustic lining material meeting 25/50 flame spread and smoke developed ratings tested in accordance with CAN/ULC S102, meeting NFPA 90A, ASTM C1071, and ASTM G21 requirements, not supporting microbial growth, flexible for round ducts, board type for rectangular ducts, consisting of a bonded fiberglass mat coated on inside (airside) face with a black fire-resistant coating.
- .2 Acceptable manufacturers are:
 - .1 Johns Manville;
 - .2 Manson Insulation;
 - .3 Knauf Insulation.

2.7 CASING AND PLENUM MATERIAL AND ACCESSORIES

- .1 Unless otherwise specified, casing and plenum material is to be same as connecting duct material.
- .2 Accessories such as access doors and drain pans are to be constructed of same material as casing and plenum and are to be in accordance with Chapter 6 of SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.8 AIR FILTERS

- .1 AAF-Canada, air filters as per the drawing schedule. All filters shall be ULC listed and labelled and rated as Class I or Class II.
- .2 Pre-filter shall have a 20-25% average efficiency when tested by the ASHRAE 52 test method. The frame shall be constructed of high strength moisture resistant "beverage" board. Two mating die-cut boxes are bonded together to form a double wall construction. The media pad support retainers shall be bonded to the media on both the air entering and leaving sides.

- .3 Final filters shall have an average efficiency of 90-95%, when tested by the ANSI/ASHRAE 52.1 test method. The Varicel filter shall have cell sides made of natural kraft pine and hardwood fibre board for high tear strength. Two mating die cut boxes shall be bonded together, forming a double wall around the perimeter of the filter. The mini-pleat media pack shall be bonded inside the double wall with a foil laminate frame on all four edges to prevent leakage and increase rigidity. The media shall be dual density micro-glass paper with a water repellent binder. The filters shall have a ULC Class II rating. The efficiency and size shall be as shown on the filter schedule.
- .4 Acceptable manufacturers are Farr, AFF-Canada and Airguard Industries.

2.9 AIR FILTER GAUGES

- .1 Dwyer Industries Inc. Series 2000 differential pressure gauge with a 0-500 Pa range, accurate to within 2% of full scale and complete with all required mounting and connection accessories. The 120 mm diameter dial shall have a zero (0) point adjustment and graduations in inches of wc.

2.10 CASING AND PLENUM MATERIAL AND ACCESSORIES

- .1 Unless otherwise specified, casing and plenum material is to be same as connecting duct material.
- .2 Accessories such as access doors and drain pans are to be constructed of same material as casing and plenum and are to be in accordance with Chapter 6 of SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.11 PLENUM ACCESS DOORS

- .1 Factory fabricated, double wall insulated access doors, sized as indicated on drawings, and constructed of same material as connecting ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit operating pressure of the system.

2.12 SPLITTER DAMPERS

- .1 Minimum #20 gauge damper blade constructed of same material as duct, reinforced as required to suit blade size, system velocity, and to prevent "chatter", and complete with operating hardware equal to DynAir Inc. #Q-50 "DYN-A-QUAD S-S" quadrant regulator with RW-50 backup washers to prevent leakage, long square bearing pin, and slide pin.

2.13 AIR TURNING VANES

- .1 For square elbows, multiple-radius turning vanes interconnected with bars, adequately reinforced to suit pressure and velocity of system, constructed of same material as duct they are associated with, and in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.14 MANUAL BALANCING (VOLUME) DAMPERS

- .1 Flanged and drilled, single or parallel blade (depending on damper size) manual balancing dampers, each constructed of same material as connecting ductwork unless otherwise specified, each designed to maintain internal free area of connecting duct, and each complete with:
 - .1 hexagonal or square shaft extension through frame;
 - .2 non-stick, non-corrosive synthetic bearings for rectangular dampers, flange stainless steel bearings for round dampers;
 - .3 blade stops for single blade dampers, designed to prevent blade from moving more than 90°;

- .4 linkage for multiple blade dampers;
- .5 locking hand quadrant damper operator with, for insulated ducts 50 mm (2") standoff mounting.
- .2 Rectangular Dampers: Nailor Industries Inc. 1800 Series, maximum size 1.2 m x 1.2 m (4' x 4') for a single damper.
- .3 Round Dampers: Nailor Industries Inc. Model 1890, maximum 600 mm (24") diameter, equipped with a minimum 200 mm (8") deep frame, and blade stiffeners where required.
- .4 Multiple Rectangular Damper Section Assembly: Rectangular assembly supplied with the dampers or site constructed, of same material as damper and designed for tight and secure mounting of individual dampers.
- .5 Acceptable manufacturers are:
 - .1 Nailor Industries Inc.;
 - .2 T.A. Morrison & Co. Inc. "TAMCO";
 - .3 NCA Manufacturing Ltd.;
 - .4 Greenheck Fan Corp.;
 - .5 Ruskin Co.

2.15 BACKDRAFT DAMPERS

- .1 Nailor Industries Inc., 1300 Series gravity type dampers each complete with a galvanized steel frame, aluminum damper blades with neoprene edges, galvanized steel linkage, and lifetime lubricated nylon bearings.
- .2 Acceptable manufacturers are Nailor Industries Inc., Greenheck Fan Corp., NCA Manufacturing Limited, Ruskin Ltd., and Air Specialties Manufacturing Ltd.
- .3 SMACNA HVAC Duct Construction Standards Metal and Flexible, to suit the pressure construction standard of the system.

2.16 FUSIBLE LINK DAMPERS

- .1 Curtain blade type, dynamic, galvanized steel (unless otherwise specified) fusible link dampers, ULC classified to CAN/ULC S112 and in accordance with NFPA 90A requirements, factory tested for closure under airflow, 1-1/2 hour or 3 hour rated as required, and complete with a constant force type 301 stainless steel closure spring, a blade lock assembly, a steel sleeve, retaining angles, and, unless otherwise specified, a 74°C (165°F) rated standard fusible link.
- .2 Fusible link dampers are to be Type "B" or Type "C" (as required) with folded curtain blade out of air stream except where damper size or location requires use of type "A" dampers with curtain blade in air stream.
- .3 Acceptable manufacturers are:
 - .1 Nailor Industries Inc.;
 - .2 Greenheck Fan Corp.;
 - .3 NCA Manufacturing Ltd.;
 - .4 Ruskin Co.;
 - .5 Price Industries (E.H. Price).

2.17 COMBINATION FIRE/SMOKE DAMPERS

- .1 Nailor Industries Series 1220, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator.
- .2 For applications where supply or return ducts terminate at a grille, at your option, provide:
 - .1 Nailor Industries 1221-OW "out of wall" high performance combination fire/smoke damper, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator accessible through the front supply/return grille, intumescent thermal insulation on all sides of sleeve.
 - .2 Nailor Industries 1221G combination fire/smoke damper for grilles, ULC listed to CAN/ULC S112 and CAN/ULC S112.1, meeting requirements of NFPA 80, 90A, 92, 101 and 105, consisting of type A, B, or C fusible link fire dampers as required and a fail-safe, opposed blade, normally closed, motor operated smoke damper complete with factory installed and tested 120 V electric actuator accessible through the front supply/return grille, grille mounting flanges. Coordinate grille size and mounting with damper requirements.
- .3 ULC 1-1/2 hour fire rated and ULC Class I leakage rated for smoke, and equipped with a 74°C (165°F) ULC classified fusible link that will cause damper to close and lock independent of actuator when duct temperature reaches maximum temperature of damper assembly.
- .4 Supply damper with factory installed sleeves of minimum 400 mm (16") length, field verified by contractor dependent on wall thickness. Caulk sleeves to ULC requirements and constructed of 20 gauge for sizes up to 2.1 m (84") wide and 18 gauge for sizes greater than 2.1 m (84") wide.
- .5 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.
- .6 Acceptable manufacturers are:
 - .1 Nailor Industries Inc.;
 - .2 Greenheck Fan Corp.;
 - .3 NCA Manufacturing Ltd.;
 - .4 Ruskin Co.;
 - .5 Price Industries (E.H. Price).

2.18 SMOKE DAMPERS

- .1 Multi-blade type, fail-safe, dynamic, galvanized steel (unless otherwise specified) smoke dampers, ULC classified to CAN/ULC S112.1, ULC Class I leakage rated for smoke, meeting requirements of NFPA 90A, 92, 101 and 105, normally closed, low pressure drop design, dynamically tested, each complete with jamb and blade seals, linkage concealed in the frame, a steel sleeve to suit the opening, and an electric actuator to automatically close damper upon receiving an external signal, and to automatically open damper when system is reset.
- .2 Dampers in ductwork other than galvanized steel are to be as specified above but constructed of type 316 stainless steel.
- .3 Acceptable manufacturers are:
 - .1 Nailor Industries Inc.;
 - .2 Greenheck Fan Corp.;
 - .3 NCA Manufacturing Ltd.;
 - .4 Ruskin Co.;

.5 Price Industries (E.H Price).

2.19 MOTORIZED DAMPERS

- .1 TAMCO Series 9000 BF low leakage/thermal break thermally insulated air foil damper capable of achieving a 6.7 cfm/sq. ft. (34 l/s/sq. m.) at – 40 °F (– 40 °C) leakage rate at 4" (1 kPa) differential pressure and bearing the AMCA certification seal for air leakage and complete with:
 - .1 0.080" (2.03 mm) thick 4" (100 mm) deep extruded aluminium insulated frame with extruded TPE thermoplastic seals on the sides of the frame. Entire frame shall be thermally broken by means of polyurethane resin pockets, complete with thermal cuts;
 - .2 extruded aluminium, broken frame damper blade internally insulated with non-CFC expanded polyurethane foam, with EPDM gasketed blade seals integrally secured to the damper blade;
 - .3 acetal copolymer (Celcon) and polycarbonate bearings with no metal-to-metal contact;
 - .4 out-of-airstream linkages and crank arms constructed of aluminium and corrosion resistant, zinc & nickel plated steel, complete with cup-point trunnion screws.
- .2 Dampers shall be sized for "flanged" installation (damper blade area to be equal to duct or plenum cross section area).
- .3 Acceptable damper manufacturer is TAMCO only.

2.20 ROOF DUCT SUPPORTS

- .1 Equal to PHP Systems Design Model PHP-D adjustable duct support assemblies sized to suit duct size, each assembly complete with injection moulded recycled plastic and carbon black bases and tubular hot dip galvanized steel framing.

2.21 ROUND TO RECTANGULAR DUCT CONNECTIONS

- .1 Equal to Flexmaster Canada Ltd. galvanized steel, flared, flanged or notched "Spin-On" round duct take-off collars with locking dampers in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

2.22 PRESSURE RELIEF DOORS

- .1 Greenheck model PRAD (positive) or VRAD (negative) pressure relief doors constructed of same material as duct or plenum they are associated with, each complete with a sealing gasket, special latches, cable assembly with spring to limit door opening to maximum 80° and factory set, field adjustable pressure relief magnet assembly.
- .2 Size access doors to match requirements of system so pressure drop through open blow-out door at required flow rate will not exceed rated pressure of duct system.
- .3 Acceptable manufacturers are:
 - .1 Greenheck Fan Corp.;
 - .2 United Enertech.

2.23 DUCT ACCESS DOORS

- .1 In accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, with sizes suitable in all respects for purpose for which they are provided, and, unless otherwise specified, constructed of same material as duct they are associated with.

2.24 DUCTWORK DRAIN POINTS

- .1 Equal to Ductmate Canada Ltd. "Moisture Drain", 20 mm (¾") diameter moisture drains with galvanized sheet metal funnel, and chrome plated brass threaded drain, nut and cap.

2.25 INSTRUMENT TEST PORTS

- .1 Equal to Duro-Dyne of Canada Ltd. #IP1 or #IP2 (to suit insulation thickness where applicable) gasketed, leakproof instrument test ports for round or rectangular ducts as required, each complete with a neoprene expansion plug and a plug securing chain.

2.26 WIRE MESH (BIRDSCREEN)

- .1 Heavy-gauge galvanized steel or aluminum mesh, 12 mm x 12 mm (½" x ½") secured in a rigid galvanized steel or aluminum framework, sized as indicated on drawings, and constructed so as to be removable.

2.27 LOUVRES

- .1 Price Industries Inc. DE439 or DE635, 100 mm (4") or 150 mm (6") deep (to suit wall thickness) factory assembled stationary, drainable, storm-proof louvres sized as indicated on drawings, each AMCA water penetration and air performance certified, constructed of welded, extruded, alloy 6063-T5 aluminum with drainable blades, mounting and securing hardware to suit the application, and 12 mm (½") mesh aluminum birdscreen in an aluminum frame.
- .2 Louvres are to be factory finished with a finish equal to PPG Industries "Duramar" fluoropolymer powder coating over primer with colour as selected from manufacturer's standard colour range.
- .3 Acceptable manufacturers are:
 - .1 Price Industries Inc.;
 - .2 The Airolite Co. LLC;
 - .3 Construction Specialties;
 - .4 Nailor Industries Inc.;
 - .5 Greenheck Fan Corp.

2.28 LOUVRE BLANK-OFF PANELS

- .1 Insulated, framed, sandwich construction panels consisting of 40 mm (1½") thick rigid insulation (meeting NFPA 90A requirements) between minimum #20 gauge galvanized sheet steel with exterior face of panels finished to match finish of exterior wall louvres.

2.29 GRILLES AND DIFFUSERS

- .1 Grilles and diffusers of type, size, capacity, finish, and arrangement as shown on drawings and in accordance with drawing schedule, each equipped with all required mounting and connection accessories to suit mounting location and application.
- .2 Acceptable manufacturers are:
 - .1 Price Industries Inc.;
 - .2 Anemostat;
 - .3 Krueger Division of Air System Components Inc.;
 - .4 Titus;
 - .5 Nailor Industries Inc.;
 - .6 Tuttle & Bailey.

3. EXECUTION

3.1 CLEANLINESS REQUIREMENTS FOR HANDLING AND INSTALLATION OF DUCTWORK

- .1 Handle and install ductwork in accordance with SMACNA's Duct Cleanliness for New Construction Guidelines at the Advanced Level.

3.2 GENERAL RE: FABRICATION AND INSTALLATION OF DUCTWORK
RDZ Project No.: 25192

- .1 Provide required ductwork, rectangular, round and/or flat oval. Where rectangular ductwork is shown, round or flat oval ductwork of equivalent cross-sectional area is acceptable.
- .2 It is to be understood that all duct dimensions shown on drawings are clear internal dimensions.
- .3 Unless otherwise specified, construct and install ductwork in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit duct pressure class designation of minimum 500 Pa (2" w.c.) positive or negative as applicable, a minimum velocity of 10 m/s (2000 fpm), and so ductwork does not "drum". Flat surfaces of rectangular ductwork are to be cross-broken. Duct system sealing is to meet ANSI/SMACNA Seal Class A requirements.
- .4 Construct ductwork so that manufacturer's gauge markings are external, and, unless otherwise specified, construct, seal and install ductwork in accordance with SMACNA HVAC Duct Construction Standards Metal and Flexible to suit the duct pressure class designation. Sealing for ductwork with a pressure class less than 0.45 kPa shall be SMACNA Seal Class "C".
- .5 Confirm routing of all ductwork at site and site measure ductwork prior to fabrication. Duct dimensions may be revised to suit site routing and building element requirements, if dimension revisions are reviewed with and approved by Consultant. Duct routing and/or dimension revisions to suit conditions at site are not grounds for a claim for an extra cost.
- .6 Refer to structural drawings. Where ductwork is to be run within or through open web steel joists, ductwork shown on mechanical drawings is schematic only and is to be altered as required to suit steel joist configuration, spacing, panel points, and cross-bridging at no additional cost.
- .7 Wherever ductwork is required at locations where sprayed fireproofing is applied to building construction, install ductwork only after fireproofing work is complete and do not compromise fire rating of sprayed fireproofing.
- .8 Install (but do not connect) duct system mounted automatic control components supplied as part of the automatic control work.
- .9 Support horizontal rectangular ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but use trapeze hangers with, unless otherwise specified, galvanized steel channels, and galvanized steel hanger rods for exposed ducts and concealed ducts wider than 500 mm (20"). Support hardware constructed of same material as duct for metal duct, and, unless otherwise specified, type 316 stainless steel for non-metal duct. Supports for "heavy" duct such as cementitious core duct is to be suitable in all respects for the application and approved by Consultant.
- .10 Support round and flat oval ducts inside building in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, but, unless otherwise specified, for both uninsulated and insulated ducts exposed in finished areas, use bands and secure at top of duct to a hanger rod, all similar to Ductmate Canada Ltd. type "BA". If duct is insulated, size strap to suit diameter of insulated duct. Unless otherwise specified, duct support hardware for metal duct is constructed of same material as duct, and for non-metal duct, type 316 stainless steel.
- .11 Factory made flanged joint system components are acceptable in rectangular duct installations. Install the components in strict accordance with the manufacturer's printed instructions and recommendations.
- .12 Where flanged duct joints are used, do not locate joints in wall or slab openings, or immediately at wall or slab openings. Do not use flanged joints for exposed uninsulated ducts in finished areas.

- .13 Where watertight horizontal ductwork is required, construct ducts without bottom longitudinal seams. Solder or weld joints of bottom and side sheets. Seal all other joints with duct sealer. Slope horizontal duct to hoods, risers, or drain points. Provide drain points. Provide watertight ductwork for:
 - .1 ductwork outside building or otherwise exposed to the elements;
 - .2 shower exhaust ducts from grilles to duct main or riser;
 - .3 fresh air intakes;
 - .4 wherever else shown.
- .14 Ductwork leakage shall not exceed the following:
 - .1 ductwork to 2" W.C. Class - one (1) percent of the total air quantity handled by the respective fans;
 - .2 ductwork exceeding 2" W.C. Class - two (2) percent of the total air quantity handled by the respective fans.
- .15 Leakage testing of ductwork shall be provided by the Testing, Adjusting and Balancing (TAB) agency in accordance with the requirements of SMACNA "HVAC Air Duct Leak Test Manual" and as specified herein. In addition, be responsible for the following:
 - .1 preparing ductwork 25' (7.5 m) and longer, for leakage testing prior to installation of external insulation including capping duct runouts and provision of tap-in for test equipment;
 - .2 Ensuring notice is given to the TAB Agency and Commissioning Consultant so that they may be present for all testing;
 - .3 resealing and/or replacement of defective ductwork;
 - .4 bearing all costs associated with retesting ductwork which has failed to pass leakage testing.
- .16 Seal all ductwork in accordance with SMACNA Seal Class "A", except for round duct with self-sealing gasketed fittings and couplings which does not require site applied sealant. Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.
- .17 Apply sealants by brush or gun to cleaned metal surfaces. Where bare ductwork is exposed apply neat uniform lines of sealant. Randomly brushed, sloppy looking sealant applications will be rejected and must be repaired or replaced with a neat application of sealant.
- .18 Clean exterior exposed (uninsulated) ducts and coat with a heavy full coverage of Bakor #410-02 black metal paint.
- .19 Where dissimilar metal ducts are to be connected, isolate ducts by means of flexible duct connection material.
- .20 Round exposed ductwork in Gymnasium is to be 2 metal gauges heavier than standard metal gauge for same size duct, and duct hangers are to be pairs of 9.5 mm ($\frac{3}{8}$ ") diameter hanger rods secured to 40 mm (1- $\frac{1}{2}$ ") wide #12 gauge galvanized steel split clamps around full circumference of duct at maximum 1.8 m (72") centres. Provide double nuts and lock washers on each hanger rod above and below each clamp.
- .21 Equip ducts with a dimension of 600 mm (24") and larger and located in mechanical equipment rooms of any kind with hanger rods equipped with double deflection neoprene rod isolation hangers properly sized for associated load. Also refer to Section entitled Seismic Control and Restraint.
- .22 In addition to SMACNA duct construction standards specified above, ductwork is to be constructed and installed to meet seismic requirements of local Building Code and ANSI/SMACNA The Seismic Restraint Manual: Guidelines for Mechanical Systems.

- .23 Provide automatic control dampers, except for dampers supplied as part of the cabinet fan assemblies. Leave each damper in satisfactory condition.
- .24 Ensure that control dampers located in aluminium ductwork are constructed of type 316 stainless steel and are non-corrosive.
- .25 Refer to Section entitled Basic Mechanical Materials and Methods for additional installation requirements.

3.3 INSTALLATION OF ALUMINUM DUCTWORK

- .1 Provide aluminum ductwork, rectangular or round.
- .2 Provide aluminium ductwork for:
 - .1 Exhaust ductwork over dishing sinks;
- .3 Wherever bare aluminum ductwork comes in contact with ferrous metal or copper, paint ferrous metal or copper surface with a heavy, 100% covering coat of zinc chromate paint, asphalt paint or otherwise isolate direct contact with the bare aluminum.
- .4 Refer to "Commentary on Aluminum Ducts" in ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, do not use drive and S cleats for joining waterproof aluminum ductwork. Use following SMACNA joining methods:
 - .1 T-21 - welded flange;
 - .2 T-22 - companion angle and gasket;
 - .3 T-24A - flanged.
- .5 Keep longitudinal joints at top surface of horizontal runs. Provide proper transverse supports to prevent deflection. Ensure duct is rigid.
- .6 When mastic is used for sealing such as sealing longitudinal joints, apply mastic to both surfaces before they are mated. When dry, apply mastic again for a water-tight seal.

3.4 INSTALLATION OF FLEXIBLE DUCTWORK

- .1 Provide maximum 3 m (10') long lengths of flexible ductwork for connections between galvanized steel duct mains and branches, and necks of ceiling grilles and diffusers. Do not install flexible ductwork through walls, even if shown on drawings.
- .2 At rectangular galvanized steel duct, accurately cut holes and provide flanged or "Spin-in" round flexible duct connection collars. Seal joints with duct sealer.
- .3 Install flexible ducts as straight as possible and support in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, and secure at each end with nylon or stainless steel gear type clamps, and seal joints. Provide long radius duct bends where they are required.
- .4 Do not penetrate fire barriers with flexible duct.

3.5 INSTALLATION OF ACOUSTIC LINING

- .1 Provide acoustic lining in ductwork in locations as follows:
 - .1 wherever shown and/or specified on drawings;
 - .2 supply ductwork downstream of air terminal boxes for a distance of 2.4 m (8') measured along duct and outward from box in all directions;
 - .3 all transfer air ducts.

- .2 Install lining in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible, however, for all installations regardless of velocity, at leading and trailing edges of duct liner sections, provide galvanized steel nosing channel in accordance with detail entitled Flexible Duct Liner Installation found in the ANSI/SMACNA manual referred to above.

3.6 INSTALLATION OF CASINGS AND PLENUMS

- .1 Provide required shop or site fabricated casings and plenums. Unless otherwise specified or shown, construct casings and plenums of same material as connecting duct system.
- .2 Construct and install casings and plenums in accordance with Chapter 6 of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible to suit systems' pressure classification. Ensure plenums and casings secured to building structure are gasketed air-tight and equipped with angle reinforcing.
- .3 Provide drain pans with accessible trapped drains for fresh air intake plenums, and wherever else shown.
- .4 In addition to SMACNA duct construction standards specified above, casings and plenums are to be constructed and installed to meet seismic requirements of local Building Code and ANSI/SMACNA - The Seismic Restraint Manual: Guidelines for Mechanical Systems.

3.7 INSTALLATION OF CASING AND PLENUM ACCESS DOORS

- .1 Provide access doors into all site or shop fabricated casings and plenums requiring access, and wherever shown.
- .2 Construct access doors to open in or out to suit positive and negative pressures of system.
- .3 Provide pitot tube openings in access doors where required for system air quantity balancing purposes.
- .4 Provide suitably sized, engraved, red-white laminated Lamacoid warning nameplates on access doors into casings and plenums where equipment is located, i.e. fans.

3.8 INSTALLATION OF ROUND TO RECTANGULAR DUCT CONNECTIONS

- .1 Cut round holes in rectangular ducts and provide round to rectangular lock-in fittings with dampers for connection of flexible round ductwork.

3.9 INSTALLATION OF SPLITTER DAMPERS

- .1 Provide splitter dampers in supply ductwork at branch duct connections off supply air mains, and wherever else shown and/or specified on drawings. Install splitter dampers so they cannot vibrate and rattle and so damper operation mechanisms are in an easily accessible and operable location. Ensure operators for dampers in insulated ducts are equipped with stand-off mounting brackets.

3.10 INSTALLATION OF TURNING VANES

- .1 Provide turning vanes in ductwork elbows where shown on drawings and wherever else required where, due to site installation routing and duct elbow radius, turning vanes are recommended in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.

3.11 INSTALLATION OF MANUAL BALANCING (VOLUME) DAMPERS

- .1 Provide manual balancing dampers as required to provide a fully balanced system, including but not limited to in all open end ductwork, in all duct mains, and wherever else shown and/or specified.
- .2 Install dampers so operating mechanism is accessible and positioned for easy operation, and so dampers cannot move or rattle. Ensure operating mechanisms for dampers in insulated ducts are complete with stand-off mounting brackets.
- .3 Where a duct for which a balancing damper is required has dimensions larger than dimensions of maximum size volume damper available, provide multiple dampers bolted together in a properly sized assembly, or bolted to a heavy-gauge black structural steel angle or channel framework which is properly sized. Seal to prevent air by-pass, and provide connecting linkage.
- .4 Confirm exact damper locations with personnel doing air quantity balancing testing work and install dampers to suit. Include for providing 5 additional dampers at no additional cost.

3.12 INSTALLATION OF BACKDRAFT DAMPERS

- .1 Provide backdraft dampers where shown.
- .2 Install and secure such that the dampers cannot move or rattle.

3.13 INSTALLATION OF FUSIBLE LINK DAMPERS

- .1 Provide fusible link dampers. Ensure damper rating (1-½ or 3 hr.) is suitable for fire barrier it is associated with.
- .2 Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.
- .3 Provide expansion clearance between damper or damper sleeve and opening in which damper is required. Ensure openings are properly sized and located, and all voids between damper sleeve and opening are properly sealed to maintain rating of fire barrier.
- .4 Where size of fire barrier opening requires use of a sectionalized fire damper assembly, provide multiple fusible link dampers (sized to CAN/ULC S112) bolted together in a properly sized assembly or bolted to a heavy-gauge black structural steel angle or channel framework.

3.14 INSTALLATION OF COMBINATION FIRE/SMOKE DAMPERS

- .1 Provide combination fire/smoke dampers. Install dampers with retaining angles on all 4 sides of each side of damper, and, where required, connect with ductwork, all in accordance with damper manufacturer's instructions and details, and Code requirements.
- .2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

3.15 INSTALLATION OF SMOKE DAMPERS

- .1 Provide smoke dampers. Install dampers with retaining angles on all 4 sides of sleeve on both sides of damper and connect with ductwork in accordance with damper manufacturer's instructions and details, and Code requirements.
- .2 Coordinate damper installation with electrical work where electrical connections to damper actuators are specified.

3.16 INSTALLATION OF FLEXIBLE CONNECTION MATERIAL

- .1 Provide a minimum of 100 mm (4") of flexible connection material where ducts, plenums, and/or easings connect to fans, and wherever else shown or specified.
- .2 Rigidly secure a minimum of 75 mm (3") of duct material (minimum #24 gauge) to each edge of flexible fabric and to fan, duct, plenum, etc., in accordance with ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible. Ensure connections to flexible fabric material are arranged and supported so as to not impose any external forces on the fabric.

3.17 INSTALLATION OF ROOF MOUNTED DUCT SUPPORTS

- .1 Supply supports for roof mounted ductwork.
- .2 Hand adjustable structural supports to roofing trade on roof for installation and flashing into roof construction as part of roofing work. Accurately mark exact locations and spacing of structural supports and supervise installation. Provide properly sized hot dip galvanized structural steel angles between structural supports and secure in place on support studs. Support ductwork on the angles and provide galvanized steel banding to secure ducts to the angles.

3.18 INSTALLATION OF PRESSURE RELIEF DOORS

- .1 Provide pressure release access doors to prevent duct system explosion or implosion as a result of a duct obstruction, i.e. closed fire damper, which prevents normal air flow through the system. Size access doors in accordance with requirements of Part 2 of this Section.
- .2 Where pressure release doors are shown in suction ducts or plenums, mount access door assembly so door swings in and latch mechanism is on the inside of duct or plenum. If latch mechanism is not accessible, provide a standard access door at latch side of the pressure release access door for maintenance purposes.
- .3 Adjust each latch mechanism by means of the adjusting pin to suit static pressure of the particular system in accordance with latch mechanism manufacturer's instructions.

3.19 INSTALLATION OF DUCT ACCESS DOORS

- .1 Provide access doors in ductwork for access to all components which will or may need maintenance and/or repair, including reheat coils. Install in accordance with requirements of ANSI/SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .2 Identify access doors provided for fusible link damper maintenance with "FLD" stencil painted or marker type red lettering and ensure doors are properly located for damper maintenance.
- .3 When requested, submit a sample of proposed duct access doors for review.
- .4 Where sectionalized fusible link dampers and/or balancing dampers are provided in large ducts, provide a plenum type access door to suit, and adequately reinforce ductwork to suit access door installed.

3.20 INSTALLATION OF INSTRUMENTS TEST PORTS

- .1 Provide instrument test ports in all main ducts at connections to fans, plenums or casings, in all larger branch duct connections to mains, and wherever else required for proper air quantity balancing and testing.
- .2 Locate test ports where recommended by personnel performing air quantity testing and balancing work.

3.21 INSTALLATION OF ACOUSTIC LINING

- .1 Provide acoustic lining to the extent shown and/or specified on the drawings.
- .2 Install lining in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.

3.22 INSTALLATION OF AIR FILTERS

- .1 Provide all required air filters, located and arranged as shown and scheduled.
- .2 Provide all required filter assembly frames and install to prevent air by-pass and to permit easy filter removal. Construct frames from the same material as the plenum, casing or duct the filters are associated.
- .3 When air handling systems are complete and ready for start-up and testing, but building finishes are not complete and cleaning is not complete, provide minimum 20% average dust spot efficient (atmospheric) temporary glass fibre media in place of permanent filters prior to fan start-up, and provide temporary media over all return air openings in dirty, dusty, incomplete areas.

- .4 Prior to application for a Certificate of Substantial Performance, and when the systems are ready for air balancing, remove temporary media and install permanent filters.
- .5 For each filter bank, supply a spare set of replacement media and turn the filters over to the Project Manager prior to application for a Certificate of Substantial Performance of the Work.

3.23 INSTALLATION OF AIR FILTER GAUGES

- .1 Provide a filter gauge for each main air handling system. For systems with pre-filters and after-filters, install the gauge across the after-filters.
- .2 Secure gauges in place on the filter section casing in an easily readable location. Adjust each gauge to suit the design pressures of the system with new fresh filters in place.

3.24 INSTALLATION OF WIRE MESH (BIRDSCREEN)

- .1 Provide framed, removable wire mesh panels over openings in ducts and/or walls where shown and/or specified on drawings. Rigidly secure in place but ensure panels are removable.
- .2 Provide wire mesh panels for open-end return air ducts in ceiling spaces whether shown on drawings or not.

3.25 INSTALLATION OF LOUVRES

- .1 Provide louvres for wall openings.
- .2 Install louvre assemblies and secure in place in accordance with manufacturer's instructions and details.
- .3 Confirm exact louvre sizes and finish prior to ordering.

3.26 INSTALLATION OF LOUVRE BLANK-OFF PANELS

- .1 Provide blank-off panels for inactive portions of exterior wall louvres.
- .2 Secure panels in place with non-ferrous hardware so they cannot move or rattle, yet are easily removable.
- .3 Confirm exact finish of panels prior to fabrication.

3.27 INSTALLATION OF GRILLES AND DIFFUSERS

- .1 Provide grilles and diffusers. Wherever possible, grilles and diffusers are to be product of same manufacturer.
- .2 Unless otherwise specified connect grilles and diffusers in accordance with requirements of SMACNA HVAC Duct Construction Standards Metal and Flexible.
- .3 Exactly locate grilles and diffusers to conform to final architectural reflected ceiling plans and detailed wall elevations, and to conform to final lighting arrangement, ceiling layout, ornamental and other wall treatment.
- .4 Equip supply diffusers having a basic 4-way or all round air pattern for operation in 1-, 2-, or 3-way pattern where indicated on drawings.
- .5 Confirm grille and diffuser finishes prior to ordering.

3.28 DUCT SYSTEMS CLEANING AND START-UP

- .1 Remove all dirt and foreign matter from the entire duct system and clean duct system terminals and the interior of supply air handling units prior to operating fans.
- .2 Prior to starting any supply air handling system provide 50 mm (2") thick glass fibre construction filters at fan equipment in place of permanent filters.
- .3 Provide cheesecloth over all duct system inlets and outlets inside the building and run the system for twenty-four hours, after which remove the cheesecloth, the construction filters, and install new permanent filters.
- .4 Include all labour for a complete site walk-through with testing and balancing personnel following the route of all duct systems to be tested, adjusted and balanced for the purpose of confirming the proper position and attitude of dampers, the location of pitot tube openings, and any other work affecting the testing and balancing procedures. Perform all corrective work required as a result of this walk-through.

3.29 TESTING, ADJUSTING AND BALANCING

- .1 Testing, adjusting and balancing of air distribution work shall be performed by a balancing contractor retained directly by the Board and is not included in the mechanical contracts.
- .2 The mechanical contractor shall co-operate with the balancing contractor and provide whatever assistance the balancing contractor may require in order to complete the work.
- .3 Prepare the systems for balancing as follows:
 - .1 check the operation of fan equipment, automatic dampers, and similar air flow control devices and ensure that they are operating properly;
 - .2 ensure that air filters are new and clean;
 - .3 ensure that any required duct leakage testing has been completed and that the duct systems are air-tight within tolerances specified in this Section.
- .4 Perform all corrective work such as fan sheave replacement and duct sealing recommended by the Balancing Personnel.

END OF SECTION

1 GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets for fans and accessories. Include following:
 - .1 certified fan performance curves at specified operating point with flow, static pressure and HP clearly plotted;
 - .2 certified sound power data that conforms to specified levels;
 - .3 product data sheets for all accessories;
 - .4 product data sheets for fan motors.
- .2 Submit with delivery of each unit a copy of the factory inspection report, and include a copy of each report with O & M Manual project close-out data.
- .3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.
- .4 Supply reviewed copies of fan/curb assembly shop drawings or product data to trade who will cut roof openings for fans, and ensure openings are properly located.
- .5 Submit a signed copy of de-stratification fan manufacturer's 5 year extended parts and labour warranty.

1.2 QUALITY ASSURANCE

- .1 Fan manufacturers, as applicable, are to be current members of the Air Movement and Control Association International Inc. (AMCA), and fans are to be rated (capacity and sound performance) and certified in accordance with requirements of following standards:
 - .1 ANSI/AMCA Standard 210, Laboratory Method of Testing Fans for Certified Aerodynamic Performance Rating;
 - .2 AMCA Standard 211, Product Rating Manual for Fan Air Performance;
 - .3 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans;
 - .4 AMCA Standard 311, Product Rating Manual for Fan Sound Performance;
 - .5 AMCA Standard 99-2408, Operating Limits for Centrifugal Fans.

2 PRODUCTS

2.1 UTILITY FANS

- .1 Centrifugal, single width and inlet, factory run tested utility fans in accordance with drawing schedule, and capable of operating over complete pressure class limits as specified in AMCA Standard 2408.
- .2 Rotatable, continuously welded heavy-gauge steel housing, braced and reinforced as required to prevent vibration or pulsation, equipped with a spun, aerodynamically designed inlet cone, and an attached welded steel bearing and motor support platform.

- .3 Riveted aluminum or welded steel wheel, statically and dynamically balanced.
- .4 For belt driven fans only, AISI C1040 or C1045 hot rolled steel shaft, accurately turned, ground, polished, and ring gauged for accuracy, and sized for a first critical speed of at least 1.43 times maximum rated speed for fan, equipped with heavy-duty, grease lubricated, ball, pillow block type bearings, selected for a minimum average AFBMA L-50 bearing life of 200,00 hours at the maximum fan RPM, and secured to bearing support platform, and an adjustable V-belt drive with OHSA guard (weather cover) in accordance with requirements of Section entitled Basic Mechanical Materials and Methods.
- .5 NEMA Premium TEFC motor conforming to requirements of Section entitled Basic Mechanical Materials and Methods.
- .6 Unless otherwise specified, the finish is to consist of rust inhibiting primer applied to cleaned and deburred metal surfaces prior to assembly, then a second coat of primer after assembly and an air dried epoxy enamel finished coat both inside and outside to a 3 mm dry film thickness.
- .7 Acceptable manufacturers are:
 - .1 Twin City Fan and Blower;
 - .2 PennBarry;
 - .3 Loren Cook Co.;
 - .4 Greenheck Fan Corp.;
 - .5 Carnes Company Inc.

2.2 CENTRIFUGAL INLINE FANS

- .1 Centrifugal, ULC listed, factory run tested rectangular inline fans in accordance with drawing schedule.
- .2 Heavy-gauge galvanized steel housing with removable side panels to permit removal of power assembly without disturbing duct connections, universal mounting brackets and hardware including spring vibration isolators to accommodate horizontal or vertical mounting as required, a flanged inlet panel with inlet venturi, a flanged outlet panel, both with duct connection collars, and galvanized steel wire grid fan inlet/outlet guard(s).
- .3 Non-overloading aluminium wheel with backward inclined blades with matching inlet venturi, statically and dynamically balanced as an assembly.
- .4 For belt-drive fans only, hot rolled steel shaft, accurately turned, ground, and polished, and sized for a first critical speed of at least 1.25 times maximum rated speed for fan, and heavy-duty, self-aligning pillow block type bearings selected for an AFBMA L-50 minimum average life in excess of 500,000 hours and equipped with lubrication line and fitting, and an adjustable V-belt drive with guard conforming to requirements of Section entitled Basic Mechanical Materials and Methods.
- .5 TEFC motor conforming to requirements specified in Section entitled Basic Mechanical Materials and Methods, mounted out of the airstream, complete with a cover, and factory pre-wired to a NEMA 4 disconnect switch.

- .6 For fans as scheduled, factory supplied accessories as follows:
 - .1 for fans as scheduled, housing insulation (lining), consisting of neoprene spray coated glass fibre semi-rigid insulation meeting NFPA 90A requirements and 25/50 flame spread/smoke developed ratings when tested in accordance with CAN/ULC S102, permanently secured in place with no exposed edges;
 - .2 for fans as scheduled, a galvanized steel filter box with frame suitable for 25 mm (2") thick disposable panel type filters;
- .7 Acceptable manufacturers are:
 - .1 Twin City Fan and Blower;
 - .2 PennBarry;
 - .3 Loren Cook Co.;
 - .4 Greenheck Fan Corp.;
 - .5 Carnes Company Inc.

3 EXECUTION

3.1 INSTALLATION OF UTILITY FANS

- .1 Provide utility fans.
- .2 Secure each fan in place, level, and plumb, on vibration isolation on a roof curb as indicated.
- .3 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.
- .4 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.
- .5 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

3.2 INSTALLATION OF CENTRIFUGAL INLINE FANS

- .1 Provide inline centrifugal fans.
- .2 Secure each fan in place from structure with vibration isolation, independent of connecting ductwork and in accordance with fan manufacturer's instructions.
- .3 Ensure duct connections are made using flexible connection material.
- .4 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification requirements.
- .5 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.

- .6 Include for a 4 hour on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

1. GENERAL

1.1 SUBMITTALS

- .1 Submit shop drawings/product data sheets for all make-up air units. Include following:
 - .1 certified fan performance curves;
 - .2 certified sound power data;
 - .3 computer generated psychrometric chart for each cooling coil;
 - .4 hardware for section-to-section site connections;
 - .5 dimensioned layouts, including dimensioned curb layouts as applicable;
 - .6 product data for fan motors.
- .2 Submit with delivery of each unit a copy of the factory inspection and fire test report as specified in Part 2 of this Section, and include a copy of each report with O & M Manual project close-out data.
- .3 Submit a site inspection and start-up report from manufacturer's representative as specified in Part 3 of this Section.
- .4 Submit spare air filters as specified in Part 2 of this Section.

1.2 QUALITY ASSURANCE

- .1 Make-up air units and installation are to be in accordance with requirements of following:
 - .1 all applicable Provincial Codes and Standards;
 - .2 CAN/CSA B149, Natural Gas and Propane Installation Codes;
 - .3 CSA or ETL listed and labelled electrical components.
- .2 Unit installation tradesmen are to be journeyman and licensed gas fitters.

1.3 WARRANTY

- .1 The warranty period shall commence at the date of initial start up and shall continue for a period of one (1) year not to exceed eighteen (18) months from shipment. Manufacturer's warranty shall include parts only.
- .2 Manufacturer shall furnish a factory trained service technician to perform the unit start-up assistance to the installing contractor with licensed gas personnel. Factory technician to provide copy of start-up log to owner and to demonstrate operation and maintenance to owner's representative.

2. PRODUCTS

2.1 GAS FIRED MAKE UP AIR UNIT (MUA)

- .1 Engineered Air factory assembled make up air units in configuration as indicated on drawings and drawing schedules. Units shall include all specified components installed at the factory. Field fabrication of units and their components will not be accepted.
- .2 Units shall consist of filter sections, supply air fan section, high efficiency indirect gas heating section, motorized dampers, control panel, temperature sensors, and all other components required for a complete packaged installation.

.3 Casing:

- .1 Unit casing shall be of minimum 18 gauge satin coat galvanized sheet metal complete with 22ga internal solid liner. Surfaces shall be cleaned with a degreasing solvent to remove oil and metal oxides and primed with a two part acid based etching primer. Finish coat shall be an electrostatically applied enamel, to all exposed surfaces. All unprotected metal and welds shall be factory coated.
- .2 All walls, roofs and floors shall be of formed construction, with at least two breaks at each joint. Joints shall be secured by sheet metal screws or pop rivets. Wall and floor joints shall be broken in and roof joints broken out (exposed) for rigidity. All joints shall be caulked with a water resistant sealant.
- .3 Casings shall be supported on 75mm (3") minimum structural steel channel supports, designed and welded for low deflections. Integral lifting lugs shall be provided for hoisting.
- .4 Air handling units shall be weatherproofed and equipped for installation outdoors. This shall include the prevention of infiltration of rain and snow into the unit, and louvres on air intakes and hoods on exhaust openings with 1" (25mm) galvanized inlet screens; rain gutters over all access doors; all joints caulked with a water resistant sealant; roof joints turned up 2" (50mm) with three break interlocking design; outer wall panels extend a minimum of 1/4 inch (6mm) below the floor panel; drain trap(s) for field installation. Provide draining louvres at fresh air intake designed to prevent penetration of moisture.
- .5 Units mounted on roof curbs shall incorporate a welded floor-to-base construction. Floors are of three break upstanding design with welded corners and free of penetrations. Unit underside joints are caulked and tarred.
- .6 Provide full perimeter roof mounting curb of heavy gauge sheet metal, minimum of 24 inches (610 mm) high, and complete with wood nailer, neoprene sealing strip, and fully welded "Z" bar with 1" (25mm) upturn on inner perimeter, to provide a complete seal against the elements. External insulation of the roof mounting curb shall be provided by the Roofing Subcontractor.

.4 Access Doors:

- .1 Provide hinged access doors. Doors shall be fully lined with closed cell, automotive bulb gasket and lever lock roller type or Ventlock handles, operable from both sides. Removal of screwed wall panels will not be acceptable.
- .2 Hinged access doors to areas of negative pressure shall open out, and to areas of positive pressure shall open in. In sections that doors open inward, provide a door handle on the interior of the unit as well.

.5 Insulation:

- .1 All units shall be internally insulated with 2" thick 1 ½ lb/ft³ density, neoprene coated fibre glass thermal insulation, secured to metal panels with a fire retardant adhesive and welded steel pins at 16" (400mm) o/c. All longitudinal insulation joints and butt ends shall be covered by a sheet metal break to prevent erosion of exposed edges. Drain pans and all floor areas shall be insulated on the underside.

.6 Filters:

- .1 Filter sections shall be provided with adequately sized access doors to allow easy removal of filters.
- .2 2" (50 mm) Extended Media (Pleated) Disposable Filters: Filters shall be extended surface pleated complete with 100% synthetic media that does not support microbial growth. Frame shall be a high wet strength beverage board with a cross member design that increases filter rigidity and prevent breaching. Frame shall be recyclable. Filters shall have an expanded metal support grid bonded to the air-exiting side of the filter to maintain pleat uniformity and prevent fluttering. Metal support grid shall be recyclable. The filters shall be MERV 8 per ASHRAE 52.2. and rated U.L. 900 Class II. A permanent re-usable metal enclosing frame shall be provided for side loaded applications.
- .3 Each filter shall be equipped with a Dwyer Series 2000 magnehelic gauge.

.7 Fan Sections:

- .1 Centrifugal fans shall be rated in accordance with AMCA Standard Test Code, Bulletin 210. Fan manufacturer shall be a member of AMCA. All fans and fan assemblies shall be dynamically balanced during factory test run. Fan shafts shall be selected for stable operation at least 20% below the first critical RPM. Fan shafts shall be provided with a rust inhibiting coating.
- .2 Single low pressure forward curved fans of 18" (457 mm) diameter or smaller shall be equipped with greaseable pillow block bearings supported on a rigid structural steel frame.
- .3 Single low pressure forward curved fans of 20" (508 mm) diameter or larger shall be equipped with greaseable pillow block bearings supported on a rigid structural steel frame.
- .4 Backward inclined fans with airfoil or flat blade design shall be equipped with greaseable self-aligning ball or roller type pillow block bearings.
- .5 Air foil fans shall be equipped with greaseable, self aligning ball type pillow block bearings. The ratio of blast area to nominal outlet area for double width fans shall be 75% or greater.
- .6 Drives shall be adjustable on fans with motors 5 HP (3.73 kw) or smaller. On fans with larger motors, fixed drives shall be provided. All drives shall be provided with a rust inhibiting coating. The air balancer shall provide for drive changes (if required) during the air balance procedure.

- .7 Motor, fan bearings and drive assembly shall be located inside the fan plenum to minimize bearing wear and to allow for internal vibration isolation of the fan-motor assembly, where required. Motor mounting shall be adjustable to allow for variations in belt tension.
 - .8 Fan-motor assemblies shall be provided with vibration isolators. Isolators shall be bolted to steel channel welded to unit floor which is welded to the structural frame of the unit. The isolators shall be vertical spring type isolators with levelling bolts, bridge bearing waffled pads with minimum 1" (25mm) static deflection designed to achieve high isolation efficiency. Fans shall be attached to the discharge panel by a heavy glass fabric, neoprene impregnated, with a double locking fabric to metal connection.
 - .9 Fan motors shall be rated for fan duty, open drip proof, high efficiency (equal to CSA 390 M 1985) T-frame, and 575 Volt, 3 Phase, 60 Cycle
- .8 Indirect Gas Fired Auxiliary Heat:
- .1 Heating units shall have an indirect natural gas heating section that is C-ETL, approved for both sea level and high-altitude areas. The entire assembly shall be approved and labelled by a nationally recognized certification agency.
 - .2 Operating natural gas pressure at unit(s) manifold shall be 7" w.c.
 - .3 Gas fired units shall be approved for operation in -40°F locations.
 - .4 Heat exchanger shall be a primary drum and multi-tube secondary assembly constructed of titanium stainless steel with multi-plane metal turbulators and shall be of a floating stress relieved design. Heat exchanger shall be provided with condensate drain connection. The heat exchanger casing shall have 1" (25mm) of insulation between the outer cabinet and inner liner. Blower assemblies close coupled to duct furnace type heat exchanger are not acceptable.
 - .5 Units with optional high efficiency heat exchanger shall be tested and certified to ANSI standards to provide a minimum of 81% efficiency throughout the entire operating range as required by ASHRAE 90.1. The manufacturer shall be routinely engaged in the manufacture of this type of high efficiency equipment.
 - .6 The burner assembly shall be a blow through positive pressure type with an intermittent pilot ignition system to provide a high seasonal efficiency. Flame surveillance shall be with a solid state programmed flame relay c/w flame rod. The burner and gas train shall be in a cabinet enclosure. Insulation in the burner section shall be covered by a heat reflective galvanized steel liner. Atmospheric burners, or burners requiring power assisted venting are not acceptable.
 - .7 Unit discharge air control shall include 15:1 turndown (HT burner). The high turndown burner minimum input shall be capable of controlling at 6.7% of its rated input without on-off cycling. Manufacturer shall provide a factory test proving indirect gas fired burner capable of 15:1 turndown ratio while maintaining minimum 81% efficiency throughout the range.

- .8 Installation and venting provisions must be in accordance with C.G.A. Standard B149.1, ANSI Z223.1-NFPA54, and local authorities having jurisdiction.
- .9 Controls Panel:
 - .1 Air handling units shall be factory wired and tested, and shall be certified by ETL, with C.S.A. approved components.
 - .2 Wiring shall be in accordance with the Canadian Electrical Code, Part 1, and pertinent sections of Part 2 of the Code pertaining to specific equipment type and purpose.
 - .3 All electrical circuits shall undergo a dielectric strength test (CSA C22.2-0) and shall be factory tested and checked as to proper function.
 - .4 Pre-wired air handling units shall bear an approved bilingual label with all the necessary identification marks, electrical data, and any cautions as required by the Canadian Electrical Code, Part 2.
 - .5 Provide a system of motor control, including all necessary terminal blocks, motor contacts, motor overload protection, grounding lugs, control transformers, auxiliary contacts and terminals for the connection of external control devices or relays.
 - .6 Manufacturer supplied discharge air controller capable of controlling cooling, and heating automatically. Controller shall prioritize heat pump heating during heating season. Controller shall modulate fuel and combustion air to maintain minimum heat pump coil entering conditions for year round heat pump operation above 5°F (-15°C) ambient. Controller shall modulate auxiliary gas heating section only as needed to maintain discharge air temperature. Efficiency of gas fired section shall increase from high to low fire. Controller shall be ETL certified.
 - .7 A non-fused disconnect shall be factory mounted on the surface of the unit.
- .10 Acceptable manufacturers of air handling unit are:
 - .1 Engineered Air;
 - .2 Haakon;
 - .3 Ventrol;
 - .4 Greenheck.

3. EXECUTION

3.1 INSTALLATION OF GAS FIRED MAKE UP AIR UNIT

- .1 Provide outdoor gas fired make up air unit on roof.
- .2 Provide required rigging and hoisting/moving equipment required to move units to required locations. Perform rigging/hoisting/moving in accordance with unit manufacturer's directions and details.
- .3 Locate curbs on roof where required for installation and flashing into roof construction as part of roofing work of Division 07. Secure units in place, level, and plumb, on gasketing material.
- .4 Remove fan base hold-down clamps and other shipping restraints and protective packaging.
- .5 Carefully coordinate installation of each unit with other trades making connections to unit, in particular, control connections.
- .6 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system start-up requirements.
- .7 Refer to Section entitled Basic Mechanical Materials and Methods for equipment/system manufacturer certification. Submit a copy of the letter prior to Substantial Performance.
- .8 Include for a one half day on-site operation demonstration and training session. Training is to be a full review of all components including but not limited to a full operation and maintenance demonstration, with abnormal events.

END OF SECTION

PROJECT NAME: Halton Catholic District School Board
Notre Dame Catholic Secondary School
Cosmetology & Culinary Arts Interior Renovations

RDZ PROJECT NUMBER: 25192

Following Supplementary Controls Bid Form is submitted by:

.....

(Bidding Company)

.....

(Street Address or P. O. Box No.)

.....

(City, Province and Postal Code)

Dated and which is an integral part of Bid Form.

In accordance with Instructions to Bidders, we provide the Supplementary Controls Bid Form. We understand that the information provided to be considered an integral part of Bid Form and is to be completed in full.

Where instructions are not provided, submit Supplementary Controls Bid Form by time of Bid closing, via e-mail addressed to:

RDZ Engineers Ltd.
Attention: Giovanni Rea
e-mail: Giovanni@rdzeng.ca

Supplementary Bid Form Signature:

.....

(Signature of Authorized Representative)

.....

(Print Name)

.....

(Title)

LIST OF MANUFACTURERS/SUPPLIERS

We submit, herein, typed or neatly printed, the names of the manufacturers upon whose products our Bid Price is based and which we will supply. If no name is indicated, or if name identified is not listed in issued documents, or if more than one name is indicated for a particular product, we will if requested, provide the base specified manufacturer's product. Where products are named in the specifications with only one (1) manufacturer/supplier, or are not listed herein, we are also prepared to provide the base specified named product. We will provide Canadian manufactured products if costs and quality are similar.

We understand that the first manufacturer specified for any product is the manufacturer upon whose product the design is based, and that the other manufacturers specified for a particular product are manufacturers acceptable to the Owner and whose product produces equivalent quality, performance and size. We further understand if we indicate a manufacturer other than the manufacturer whose product is the basis of the design, we are responsible for ensuring that the product supplied is equivalent in quality, performance and size to the base design product, and that any additional costs incurred as a result of use of such products will be borne by us. Acceptance of non-base specified manufacturers with respect to their equivalency shall be as sole discretion of Consultant.

We also acknowledge that failure to submit this list as specified or failure to submit within time defined may result in provision of base specified manufacturer's product, at discretion of Consultant.

SECTION	PRODUCT	MANUFACTURER/SUPPLIER & CATALOGUE NUMBER
25 05 05	Temperature Sensors	
25 05 05	Control Valves	
25 05 05	Control Valve Actuators	
25 05 05	Control Dampers	
25 05 05	Control Damper Actuators	
25 05 05	VOC sensor	

END OF SECTION

1. GENERAL

1.1 SHOP DRAWINGS

- .1 Submit shop drawings for the following:
 - .1 all control system components;
 - .2 identified schematic control diagrams with component catalogue numbers and typed operational sequences for all systems;
 - .3 drawings of each system showing all connected devices, all wiring, all connections, all data (connected and calculated) point addresses and operator notations;
 - .4 complete sequences of operation of the BAS systems in both flow chart and program format;
 - .5 technical specification data sheets for each system component;
 - .6 descriptive data and sequence of operation of all operating, user, and application software including a complete Operator's Manual and Programmer's Manual tailored to the job.

1.2 SUBMITTALS

- .1 Submit the following to the Consultant for review:
 - .1 a sample standard control damper section with linkage, operator, and certified air flow and leakage characteristics;
 - .2 a sample, coloured, system flow diagram;
 - .3 an identified sample of each type of thermostat and room temperature sensor to be used.

1.3 WARRANTY

- .1 Equipment and Materials:
 - .1 All equipment and materials supplied by the Contractor shall be provided with a minimum three (3) year warranty against defects of design or manufacturing.
 - .2 All equipment and materials found to be defective during the warranty period shall be repaired or replaced by the Contractor at no cost to the Owner.
 - .3 The Contractor shall provide approved temporary replacement equipment and materials such that the system remains fully functional as designed and commissioned during repair or replacement activities and at NO cost to the Owner.
 - .4 The Contractor must designate warranties on manufactured equipment and materials to the Owner on the date of final acceptance and include them in the training manual.
- .2 Workmanship:
 - .1 The Work shall be provided with a three (3) year warranty by the Contractor against faults or failures of any element of the system as a result of the workmanship of the Contractor and its Subcontractors.
 - .2 The Contractor shall remedy all such faults or failures such that the system remains fully functional as designed and commissioned during remediation work periods and at NO cost to the Owner.
- .3 A signed letter in the maintenance and operations manuals outlining warranty dates shall be included.

1.4 EQUIPMENT AND MATERIALS

- .1 Provide Canadian manufactured products wherever possible and where required quality and performance is obtainable. Unless otherwise specified, all materials and apparatus shall be new and shall comply with applicable Canadian Standards Association (CSA) Standards and/or Underwriters Laboratories of Canada (ULC) Standards and the requirements of the authorities having jurisdiction. Unless otherwise specified, similar products i.e.: all valves, all control components, all vibration isolation, etc., shall be the product of one (1) manufacturer.

- .2 Materials and equipment scheduled and/or specified, have been selected to establish a performance and quality standard, and, in some instances, a dimensional standard. In most cases, base specified manufacturers are stated for material and equipment, specified by manufacturer's name and model number. Unless otherwise noted, the Bid Price may be based on materials and equipment supplied by any of the manufacturers named as acceptable for the particular material or equipment. If acceptable manufacturers are not stated for a particular material or piece of equipment, base the Bid Price on material supplied by the base specified manufacturers.
- .3 If materials or equipment supplied by a manufacturer named as acceptable are used in lieu of the manufacturer specified, be responsible for ensuring that the substituted material or equipment is equivalent in quality, performance and operating characteristics (including energy consumption if applicable) to the specified materials or equipment, and, it shall be understood that any additional costs, and changes to associated or adjacent work resulting from provision of materials supplied by a manufacturer other than the specified manufacturer is included in the Bid Price. In addition, in equipment spaces where equipment named as acceptable is used in lieu of specified equipment and the dimensions of such equipment differs from the specified equipment, prepare and submit for review, accurately dimensioned layouts of rooms affected.
- .4 In addition to the manufacturers specified or named as acceptable, other manufacturers of materials or equipment may be proposed to the Consultant for acceptance, listing in each case a corresponding credit for each alternative proposed, however, the Bid Price must be based on equipment or materials specified or named as acceptable. Certify in writing to the Consultant that the proposed alternative meets all space, power, design, energy consumption, and all other requirements of the specified or acceptable material or equipment. In addition, it shall be understood that there will be no increase in the contract Price by reason of any changes to associated equipment, mechanical and/or electrical, required by acceptance of proposed alternatives. The Consultant has sole discretion in accepting any such proposed alternative material or equipment.
- .5 Where products you intend to provide are proposed as "an equal" and/or "or approved equal", to specified products, certify in writing that the proposed product to be used in lieu of specified product, at least meets space, power, design, energy consumption, noise criteria and other requirements of the specified product and thus shall be equivalent to or better than the specified product. When requested by the Consultant, provide full design detail drawings and specifications of proposed products. Acceptance of these "or equal" and/or "or approved equal" products shall be at the sole discretion of the Consultant. The Consultant's decision shall be final and shall not require explanation. There shall be no increase in the contract Price due to the Consultant's rejection of a proposed equivalent product.
- .6 Only base specified products, specified acceptable products or equipment listed as alternate will be considered for acceptance by the School Board. No proposed substitutions will be accepted.
- .7 Indicate in Form of Supplementary Controls Tender, names of manufacturers for proposed products to be supplied, and which were based specified or scheduled with a manufacturer's name. Names of proposed manufacturers on list must be one of names stated as acceptable for particular products, unless prior approval from Owner has been given for use of products by other manufacturers. Submit to Consultant for review as directed.

1.5 APPROVED CONTROL SYSTEM MANUFACTURERS

- .1 The existing building automation system is by Siemens Building Technologies Inc. No substitutes or alternates are allowed.

2. PRODUCTS

2.1 CONDUITS

- .1 Service Areas
 - .1 Nylon Metallic Tubing (NMT) - Grey
 - .2 Electrical Metallic Tubing (EMT) - Rigid
 - .3 Liquidtight
- .2 Public Areas
 - .1 Wiremold - Colour: Match existing surfaces and wall box.
- .3 Fittings: Suitable for the type of conduit.

2.2 WIRING

- .1 All control cabling shall be FT6, plenum rated and yellow jacket in colour.
- .2 All network wiring between controllers shall be FT6, and plenum rated.
- .3 Power wiring sizing as per code requirement.

2.3 DAMPER ACTUATORS

- .1 Actuators to be 24V only and operate on a 0-10VDC or 2-10VDC signal.
- .2 Two-position (on/off) actuator are not acceptable.
- .3 Each actuator shall be "fail safe" and complete with external adjustable stops to limit the length of stroke in either direction. Operators shall be mounted on adjustable brackets. Operating arms shall have double yoke linkages and double set screws for fastening to the damper shaft. Damper operators shall be selected to operate maximum damper loads of 20 sq. ft. (1.9 sq.m). Where damper sizes exceed this area rating, multiple damper operators shall be provided.
- .4 Damper actuators shall be spring return to fail safe position.
- .5 Damper actuators associated with air handling units shall operate on a 0-10 VDC signal only.
- .6 Damper actuators exposed to the exterior elements shall be provided with a Belimo ZS-100 Series Weather Shield, or equivalent, weatherproof enclosure.
- .7 Belimo MFT actuators are not acceptable.
- .8 Acceptable actuator manufacturers are Siemens Building Technologies and Belimo.

2.4 AUTOMATIC CONTROL VALVES AND OPERATORS

- .1 Actuators to be 24V only and operate on a 0-10VDC or 2-10VDC signal.
- .2 All valve actuators shall be spring return to fail safe position.

- .3 Unless otherwise indicated control valves shall be fully modulating type with equal percentage characteristics. Two-position (On/Off) control valves are not acceptable.
- .4 Automatic control valves for air handling systems and heat exchanger to be globe style valves.
- .5 Automatic 3-way control valves to be globe style valves.
- .6 Automatic 2-way control valves to be ball style valves.
- .7 Each automatic control valve must provide the design output and flow rates at pressure drops compatible with equipment selected, must be suitable for the particular system working pressure, and shall be fitted with a position indicator and "fail-safe" operator capable of tight shut-off against the differentials imposed by the system.
- .8 Heating valves shall be normally open unless otherwise noted. Cooling valves shall be normally closed unless otherwise noted.
- .9 Butterfly type control valves with motorized gear operators will be acceptable where shown and/or specified on the drawings.
- .10 Belimo MFT actuators are not acceptable.
- .11 Acceptable valve and actuator manufacturers are Siemens Building Technologies and Belimo.

2.5 FIELD DEVICES

- .1 Damper Status Switches:
 - .1 Lever operated switches secured to damper frames, rated 5.0 amp, 120/1/60 Hz. AC full load, ULC listed and CSA approved, and activated by damper blade movement.
- .2 Temperature Sensors:
 - .1 Temperature sensors shall be factory calibrated, resistant temperature type (RTD) of 100, 1000 or 3000 ohm platinum or 5000 ohm Balco with $\pm 0.5^{\circ}\text{C}$. accuracy over a range of 0°C to 100°C .
 - .2 Temperature sensors utilized for measuring duct temperatures shall incorporate an averaging style temperature element (RTD) of sufficient length to ensure a proper average of the variation across the full cross section of the duct. Thermistor type sensors are not acceptable.
 - .3 Temperature sensors utilized for measurement of fluid temperatures shall incorporate a separate well of a material suitable for the service.
 - .4 Water service - brass.
 - .5 Where temperature sensors are specified to measure outdoor ambient temperature, they shall be installed so as not to be affected by exhaust air or reverse flow of warm air through supply units.
 - .6 Room temperature sensors controlled by the Building Automation System (BAS) complete with hard plastic exterior with no display or adjustments capabilities. RJ-11 jack on sensor is not required.
- .3 Water Flow Sensors:
 - .1 Water flow analog sensors shall be provided complete with flow element and shall be an all solid state precision industrial type with stainless-steel meter body, maximum error of no more than 0.5% of span, and 4 to 20 ma output. Sensor shall be rated for 1725 kPa minimum and installed in strict accordance to the manufacturer's instructions complete with three-valve manifold for calibration and maintenance.
- .4 Water Flow Switches:
 - .1 Water flow switches shall have a paddle actuated, snap acting SPDT switch rated at 16 amp 120/1/60 Hz. AC full load.

- .5 Air Proving Switches:
 - .1 Air proving switches shall utilize a differential pressure activated, diaphragm actuated, snap acting SPDT switch rated at 9.8 amp 120/1/60 Hz. AC full load.
- .6 Electronic Humidity Sensors:
 - .1 Humidity sensors shall be capacitance type, suitable for operating ranges of 10 to 90% RH with a sensor accuracy shall be $\pm 2\%$ over a range of 10 to 90% RH.
- .7 Air Flow Sensors:
 - .1 Flow measuring arrays shall be electronic thermal type mounted in an extruded aluminum strut with a 4-20 mA transmitter producing a non-linear output signal based on an 18-24 VDC supply to the unit. Each unit shall be supplied with a polynomial equation by the manufacturer for use in relating the output signal with duct velocity. Provide the required number of sensors in each array at the locations indicated on drawings to produce an accuracy of $\pm 3\%$ of full scale flow. Response time 100 ms, repeatability $\pm 1/2\%$ FS, operating range - 40°C to 65°C.
- .8 Current Sensing Relays:
 - .1 Current sensing relays used for proof-of-loading for fans and pumps shall be suitable for 2 to 200 amp and shall have adjustable trip thresholds of $\pm 2\%$ of range. Each relay shall be provided with an LED to allow ready observation of the relay status.
 - .2 All current sensing relays serving supply and return fans shall display amperage readings (AI) to the BAS and not an On/Off Signal (DI).
 - .3 Current sensing relays serving exhaust fans shall be On/Off (DI) signals.
- .9 Freezestat:
 - .1 Two pole manual reset type freezestat, each complete with 6 m of capillary tubing.
- .10 Differential Pressure Switch:
 - .1 Setra Systems Model 264 differential pressure transducer, capable of providing a 4 –20 mA output signal, temperature compensated to 0.033% FS/°F (0.033% FS/°C) thermal error over a temperature range of 0°F to 150°F (-18°C to 65°C), utilizing a tensioned stainless steel diaphragm and an insulated stainless steel electrode enclosed in a fire-retardant glass filled polyester casing and complete with brass pressure fitting ports for differential pressure measurement and a screwed terminal strip for electrical output signals.
- .11 Carbon Dioxide Sensor:
 - .1 Siemens Model QPA2000 (or equal) wall mounted and Model QPM duct mounted, maintenance free, non dispersive infrared carbon dioxide sensor capable of monitoring concentration of CO₂.
 - .1 Method: I.R.;
 - .2 Gas: Carbon Dioxide;
 - .3 Range: 0-2000 PPM;
 - .4 Power Source: 24 VAC;
 - .5 Output Signal: 0-10 VDC;
- .12 Photo Sensor:
 - .1 Greystone model PSR-1 sensor, CSA approved, light sensitive resistor, mounted on a weatherproof enclosure. The unit shall produce a 4-20mA output signal, coupled with a transmitter.
- .13 Occupancy Sensor:
 - .1 WattStopper model CB-100 passive infrared occupancy sensor, CSA approved device to provide automatic control of HVAC equipment with the following components:

- .1 Gasketed, watertight enclosure capable of preventing moisture and dust from entering the sensor;
- .2 Temperature compensated, dual element sensor and multi-element Fresnel lens;
- .3 Single pole, double throw isolated relay with normally open, normally closed, and common outputs rated for 1 Amp at 24 VDC for use with HVAC control, data logging and other control options;
- .4 DIP switch controlled digital time delay setting, adjustable from 15 seconds to 10 minutes;
- .5 Mounting hardware concealed under a removable cover to prevent tampering of adjustments and hardware.

2.6 RELAYS

- .1 All start/stop equipment must have a pilot relay between the controller and the controlled equipment to prevent damage to the electronic equipment.
- .2 All relays used for motors, electric heat, and corridor lighting shall be a load rated RIB relay (20 amp minimum) or an approved equivalent. Relays shall have a led pilot light.
- .3 All pilot relays shall be plug in socket mounted style. Relays to have an LED light to show when it is energized.
- .4 Ice cube relays:
 - .1 Used for pilot relays only.
- .5 RIB relays with Hand-Off-Auto selector switch shall not be used.

2.7 IDENTIFICATION

- .1 Panels:
 - .1 Engraved, laminated, black-white Lamacoid nameplates, sized to suit wording requirements and complete with bevelled edges and stainless steel securing screws.
 - .2 Each DCP shall have a list of all points either directly or indirectly controlled by the DCP inserted in a plastic pocket or folder inside the panel door of the DCP.
- .2 End Devices:
 - .1 Label shall be yellow or orange background, sized to suit wording requirements.
 - .2 Within concealed space:
 - .1 Affix a label on the end device and t-bar grid or access door below the end device.
- .3 In exposed room
 - .1 Affix a label on the end device.
- .4 Wiring:
 - .1 Each wire shall be labelled with its point descriptor at the point where it attaches to the panel and end device.
 - .2 Any terminal blocks used will have all wires labelled or a terminal block wiring diagram fastened to the door.
- .5 Provide wiring diagrams for each panel and install plastic laminated copy inside each panel or provide folder inside cabinet door with wiring diagrams.
- .6 Label all junction boxes "BAS" on the exterior of the cover plate.
- .7 For all transformers, label the junction box indicating the power circuit it is fed from.

- .8 A sample of each type of control component identification, as specified above, shall be submitted to the Consultant for approval prior to installation.

3. EXECUTION

3.1 GENERAL RE: INSTALLATION OF CONTROLS AND INSTRUMENTATION

- .1 Provide complete systems of control and instrumentation to control and supervise operation of the new environmental systems.
- .2 The control systems shall be installed by the control component manufacturer or under direct supervision of the control component manufacturer.
- .3 The control systems generally shall be as outlined on the control diagrams on the drawings and shall have all the elements and perform all the sequences therein indicated or implied.
- .4 The control diagrams show only the principal items of equipment controlling the systems. Supplement each control system with multiple-pole relays, transformers, sensors, etc., as required to enable each system to perform as specified and to permit proper operation and supervision of same.
- .5 All relays shall be grouped together in a hinged electrical cabinet and rated for their operation needs.
- .6 Current transducers shall be installed for all status points where noted. Amperage input from the variable speed drives shall not be used.
- .7 All freezestats and safeties shall be accessible with a 1829 mm (6') ladder. Contractor to contact YCDSB prior to installation if the freezestat cannot be installed in an accessible location.

3.2 INSTALLATION OF CONTROL DAMPER OPERATORS

- .1 Provide all required automatic control damper operators.
- .2 Provision of dampers in air handlers and in ductwork will be done by Mechanical Division. Inspect each damper assembly and ensure that it is properly mounted, accessible for damper operator installation, complete, damage free and provides satisfactory operation. Report defects in writing to Consultant. Installation of your work shall constitute acceptance of dampers being satisfactory.
- .3 Locate damper motors so they are accessible from outside ducts, plenums and equipment casings wherever possible. Where sequence operation is indicated, or where multiple operators drive a series of dampers, provide equipment pilot positioners to couple their action.
- .4 Unless otherwise indicated, provide one (1) controller per function or system. Equip controllers with a separate shut-off so they may be serviced without interruption of other system components.
- .5 Bracket mount controllers on ducts or plenums out clear of the insulation and ensure that they are vibration free.

3.3 INSTALLATION OF AUTOMATIC CONTROL VALVES AND OPERATORS

- .1 Unless otherwise noted, supply all required automatic control valves.

- .2 Mounting of valves in piping, unless otherwise noted, will be done as part of the piping work specified in preceding Sections of this Division of the Specification. Make the valves available at the site, at the locations where they are required, and ensure that each valve is properly mounted.
- .3 Provide an operator from each valve, connect complete, check and test operation, and adjust as required.

3.4 INSTALLATION OF FREEZESTATS

- .1 Provide freezestats as follows:
 - .1 For air handling units with hot water heating coils, install freezestat downstream of the heating coil.
 - .2 For air handling units with glycol heating coils, install freezestat in the supply air ductwork after the supply fan.
 - .3 For air handling units with gas fired heating, install freezestat in the supply air ductwork after the supply fan and inside the building.
- .2 Wire freezestats to shut down the respective fan or fans and close associated dampers and modulate associated coil control valves to normal position upon activation.
- .3 Provide a high limit temperature control in each plenum or section housing heating coil(s) to prevent the normally open heating valve from overheating the plenum and setting off the firestats. This control shall be operable when the fans are shut-down.
- .4 Provide local temperature indication (averaging sensor tubing - not thermometers) on each section or plenum housing a coil.
- .5 For all supply systems with no recirculation, arrange controls so that the outdoor air and exhaust air dampers are fully open before the fans can start.
- .6 All freezestats shall be accessible with a 1829 mm (6') ladder. Contractor to contact YCDSB prior to installation if the freezestat cannot be installed in an accessible location.
- .7 Refer to the drawings for other specific requirements and control sequences.

3.5 INSTALLATION OF CONTROL WIRING

- .1 The controls contractor shall provide all required control wiring work for control systems including power wiring connections to equipment and panels.
- .2 120 volt power wiring shall be extended from junction boxes to each DDCC, MEC and ASC. Power serving DDCCs, MECs and ASCs must be on a dedicated circuit.
- .3 All control wiring shall be in conduit in accordance with the standards and requirements of Electrical Division except for horizontal control wiring above the ceiling grids of classrooms which may be in FT6 plenum rated cable. FT6 plenum rated cable in classroom ceilings must be tied up and secured off of ceiling tiles. The controls contractor shall provide all required boxes, connectors, and other wiring accessories. All vertical drops to temperature sensors and valves must be in conduit.
- .4 Where plenum rated cable is used and where plenum rated cable passes through walls on any kind, the cable shall be installed in a conduit sleeve complete with bushings at both ends of the conduit.

- .5 All control wiring in mechanical rooms shall be in conduit with final three (3) feet to all devices in seal-tight flexible conduit. Control wiring penetrations of devices in mechanical rooms shall be provided such that water damage of equipment cannot occur through conduit openings. Top penetrations of controls cabinets will not be accepted.
- .6 All control wiring exposed in finished areas (e.g. corridors, classrooms, etc.) shall be installed in wiremold (colour to match surrounding area).
- .7 All control wiring inside of RTU's or AHU's will be in EMT conduit with final two (2) to three (3) feet to all end devices in NMT or liquid tight including plnuem whip on damper actuators. No exceptions.
- .8 BX sheathing shall not be used.
- .9 Use flexible conduit where conduits run across flexible duct connectors.
- .10 All control wiring in corridors shall be in cable trays or conduits provided by Div. 26.
- .11 Control wiring shall be in EMT conduit with bushing at both ends where control wiring penetrates through walls. For wiring passing through fire separations, both ends of the conduit shall be fire stopped.
- .12 Control wiring not in conduit shall be installed and neatly secured to the existing structure. Loosely hung wiring and wiring secured to non-structural objects will not be accepted. Wiring shall run parallel to building lines. Multiple wires shall be grouped together.
- .13 All wiring between panels and end devices shall be continuous, terminations/splicing/joints are not acceptable.

3.6 CONTROL WORK TESTING

- .1 Arrange for the automatic control systems to be adjusted, calibrated, set and tested by a qualified member of the control component manufacturer's personnel, after which obtain from the manufacturer and forward to the Consultant a letter stating that the control systems have been adjusted, calibrated, set and tested and are in perfect operating condition.
- .2 In addition, arrange for the control system manufacturer to supply at the site, qualified control system technicians to make adjustments to control systems to suit air and water balancing and testing.
- .3 Arrange for the control system supplier to completely train a minimum of two (2) designated Owner's representatives in operation and maintenance of the system. Include all costs for such training in your Tender Price.

3.7 "AS-BUILT" DRAWINGS AND OPERATOR MANUALS

- .1 The record drawings for this project will be prepared on a CAD system utilizing AutoCAD Release 2011 Software.
- .2 On completion of the Contract Work, the Contractor shall provide a set of CAD produced reproducible contract drawings and associated diskettes of relevant approved, "As-built" controls documentation. This documentation must identify and show all controls work for each phase or project.
- .3 "As-built" documentation shall also include the following as a minimum:
 - .1 schematic outline of the BAS for quick reference of overall system scope;
 - .2 adequate record of the Work as installed, including its exact location and the wiring and route;
 - .3 system hardware specification manual, which provides a functional description of all hardware components;
 - .4 system operator's manual which provides concise instructions for the operation of the system and an explanation and recovery route for all system alarms;
 - .5 system engineering manual which provides all of the information, for system set up, definition and application;
 - .6 system data manual which provides the applications data programmed into the system;
 - .7 system servicing and maintenance manuals for central unit components including:
 - .1 video monitor;
 - .2 printer;
 - .3 digital control panels (DCP);
 - .4 application specific controllers (ASC);
 - .5 field devices (sensor, switches).
 - .8 all data specified in the shop drawings section in its final "As-built" form;
 - .9 system software documentation;
 - .10 list of equipment supplied, including its make, model number, name of local suppliers, and quantity;
 - .11 all manuals will be constructed in the following manner:
 - .1 3-ring binders complete with index pages indexing tabs and cover identification at front and side;
 - .2 size of the manuals will be 8-1/2" x 11" (215 mm x 280 mm) extension type catalogue binders bound with heavy weight yellow fabric hot stamped in black lettering front and spine;
 - .3 each spine shall be lettered with full identification of the project, the front face of each binder shall contain the following:
 - .1 full identification title of the Project and Project No.;
 - .2 full identification title of the Consultant;
 - .3 full identification title of the Contractor;
 - .4 should there be more than one (1) volume for each type of application, then each volume will be so identified;
 - .5 a detailed description and configuration of these manuals will be submitted to the Engineer for approval.

3.8 OPERATOR TRAINING

- .1 The Contractor shall provide training programs for the Owner's personnel. Training will be co-ordinated with the Halton Catholic District School Board's Plant Services Department. The Owner will assign the personnel to participate in these training programs prior to commencing with work and during the start-up of the system. This training shall allow the Owner's operator(s) to understand the operation and programs of the BAS including the Operator Workstation and its controllers.
- .2 The Operator training program phase shall be divided into two (2) parts namely project inception and completion. During the inception stage the Contractor shall review the systems and familiarize the Owner with required operating functions in order that the Owner is prepared to operate the system. During the start-up of the system and upon completion of the project, the Contractor shall provide training. The Contractor shall supply an Engineer or Certified Engineering Technologist for these workshop days. The Contractor shall also supply a working prototype of the BAS for each workshop day.
- .3 The training program shall include the following:
 - .1 system configuration of the environmental control system;
 - .2 treatment units operation concepts;
 - .3 system data reading;
 - .4 equipment operation and software commands;
 - .5 operator monitoring and control intervention;
 - .6 calibration of data acquisition devices;
 - .7 preventive maintenance;
 - .8 trouble shooting of the environmental control system;
 - .9 programming.
- .4 A training program for the Owner's maintenance personnel shall be provided. This training shall allow the maintenance personnel to understand the basic operations of the BAS and also the basic commands both on the Operator Workstation, Standalone Digital Control Panels and Application Specific Controllers. The training program shall review the basic maintenance requirements for the BAS. The Contractor shall be responsible for delivering the maintenance training session. In the allowed time, the training program shall consist of the basic maintenance needs of all this equipment.
- .5 Notwithstanding the above, the contractor will provide a minimum of forty hours of training to be used at the discretion of the Halton Catholic District School Board in however way they deem fit.
- .6 All documentation related to the training program, including training manual and quick reference "cheat sheets", shall be submitted in three (3) copies.

3.9 CONTROLS CONTRACTOR'S RESPONSIBILITIES

- .1 The Controls Contractor shall comply with applicable responsibilities specified below:
 - .1 provide start-up, test procedures and O & M manual;
 - .2 provide a print-out of all points connected to the BAS;
 - .3 provide a detailed consolidate wiring diagram showing the interface of the BAS controls with packaged controls;
 - .4 responsible for component and point-to-point testing;
 - .5 responsible for sensor calibration and actuator adjustment;
 - .6 provide calibration procedure for each analog sensor;
 - .7 operate systems during testing;
 - .8 provide training and instruction;
 - .9 responsible for the acceptance test for a 21 day period;
 - .10 set-up trend logs and group logs which shall be stored on hard disk;

.11 re-visit site during the first year of operation to review BAS performance.

END OF SECTION